NAVMAN

Jupiter GPS receiver module

Development kit: Guide

(TU10-D007 series)

Related products

Jupiter 11 (low power)
• Development kit TU10-D007-051
Jupiter 11 (standard 5 V)
• Development kit TU10-D007-061
Jupiter 11 DR (dead-reckoning)
• Development kit TU10-D007-101

Jupiter 12 (standard)
• Development kit TU10-D007-351
Jupiter 12 DR (dead-reckoning)
• DR Development kit TU10-D007-352
Jupiter T (timing)
• Development kit TU10-D007-121

Jupiter Pico (standard)
• Development kit TU10-D007-361
Jupiter Pico T (timing)
• Development kit TU10-D007-362

Related documents

Jupiter 11
• Product brief LA010038
• Data sheet LA010049

Jupiter 12
• Product brief LA010040
• Data sheet LA010065

Jupiter T
• Product brief LA010039
• Data sheet LA010050

Jupiter Pico (and Pico T)
• Product brief LA010041
• Data sheet (Pico) LA010066
• Data sheet (Pico T) LA010093A

Jupiter series (11/12/Pico)
• Development kit: Quick start guide
  LA010088
• DR receiver: Gyro application note
  LA010090
• Designer's guide MN002000
• Labmon application note LA010103

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1.0 Introduction

This document describes the configuration settings for the GPS receiver development unit supplied with the TU10-D007 series GPS development kits. It also provides information about related power and I/O interface requirements. (See Figure 1-1 for connection and switch locations.)

The TU10-D007 series GPS development units are designed to work with all standard models of Jupiter series (11/12/Pico) receivers and are backward compatible with earlier Jupiter models. The units can also be used for the Jupiter Timing series and DR receivers:

   • Jupiter T and Jupiter Pico T

   • Jupiter (11/12/Pico) DR

Note: The Jupiter (11/12/Pico) timing receivers, and Jupiter Pico receivers, have a different electrical and mechanical configuration from other Jupiter series receivers. To enable use of the Jupiter Timing (and Pico) receivers with the TU10-D007 series GPS development units, an adaptor board is provided.

For additional information on the Jupiter-T, refer to the Jupiter T data sheet LA010050. See section 3.0 of this document for switch settings and other configuration parameters.

The Navman GPS development unit comes from the factory pre-configured with your selected Jupiter receiver model (see Table 5-1, at the end of this document, for model part-numbers). However, it might be necessary to re-configure the unit if an older receiver is to be used, or if the receiver is exchanged for a different model.

In addition to hardware, the GPS development kit contains Labmon (DOS based software for communicating with the Jupiter receiver). For details on using Labmon software, refer to Labmon application note LA010103.

Note: Before supplying power to the development unit, please review the configuration settings and operation described in this document for optimum performance of the Jupiter GPS receiver. (See Figure 3-1)
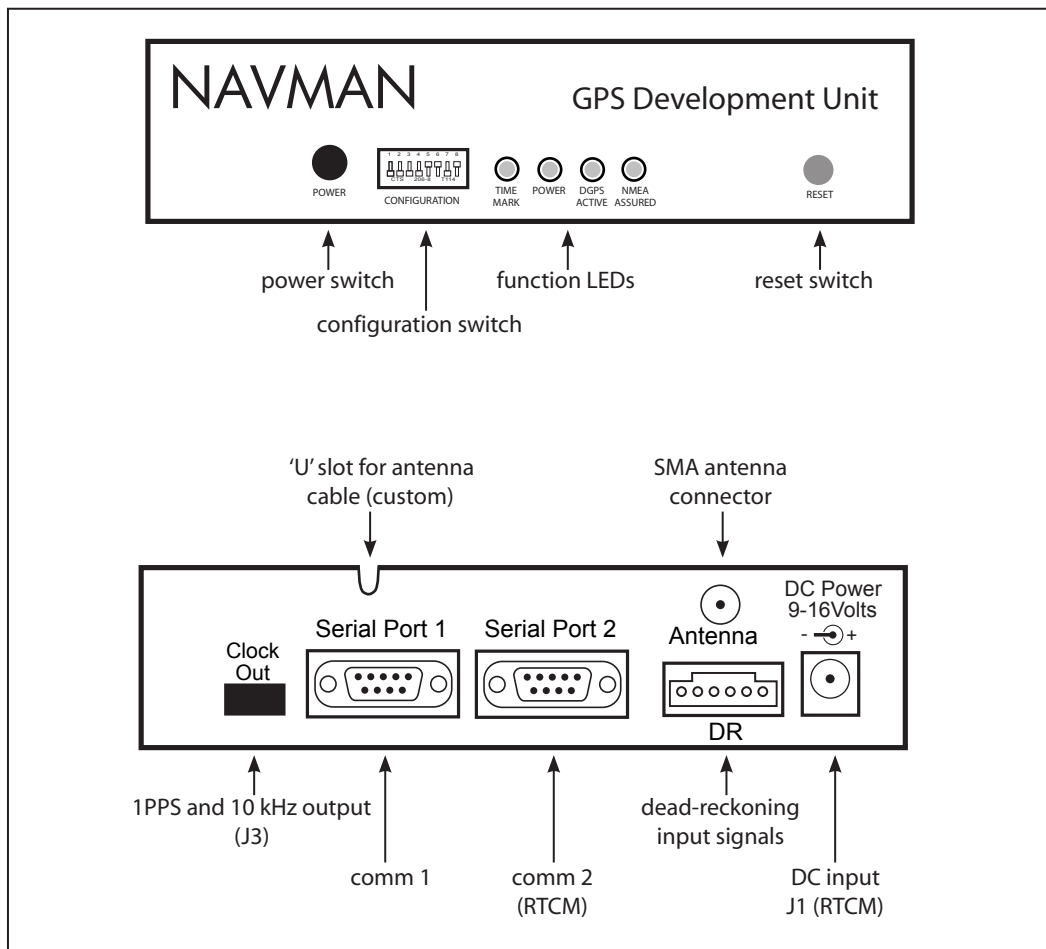
Figure 1-1 Front and back panels of the Jupiter series development unit (showing functional switches and connector locations)

2.0 Development kit

This section describes how to configure the Navman GPS development unit and Jupiter series receiver, and how to set up the test equipment.

2.1 Equipment supplied

This kit should contain the following items (see Figure 2-1):

1. Jupiter GPS development 'unit' (model dependant upon functional requirements of the GPS receiver). Includes all associated hardware: power supply regulators, TTL to RS-232 conversion IC's, two analogue interface connectors, one for the GPS timing signals and one for the Dead-Reckoning (DR)/vehicle signal inputs (additional hardware is included for the DR receiver).

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

3. serial interface cable

4. power adaptor for 240/120 VAC operation

5. power adaptor for 12 VDC vehicle operation

6. CD containing Jupiter GPS receiver data sheet, development kit quick start guide, operating software (Labmon), and other information on using GPS receivers

2.2 Equipment required

The following equipment is also required to test the Jupiter GPS receiver.

• IBM compatible PC computer

• minimum one serial port

• minimum 640 KB RAM

• (software) DOS version 3.0 or higher, or Windows® OS

2.3 Description of components

2.3.1 Development unit

The Navman GPS receiver development unit features dual RS-232 level serial data I/O ports, selectable bias voltages for active GPS antennas, port configurations, message protocols, and flexible internal 'keep-alive' backup power modes for both the Static Random Access Memory (SRAM) and the low power time source.

The unit also includes the necessary circuitry to convert the receiver's Complimentary Metal Oxide Semiconductor (CMOS) level output to RS-232 level, serial data I/O. The two serial data ports are RS-232, 9- pin D-sub-miniature connectors.
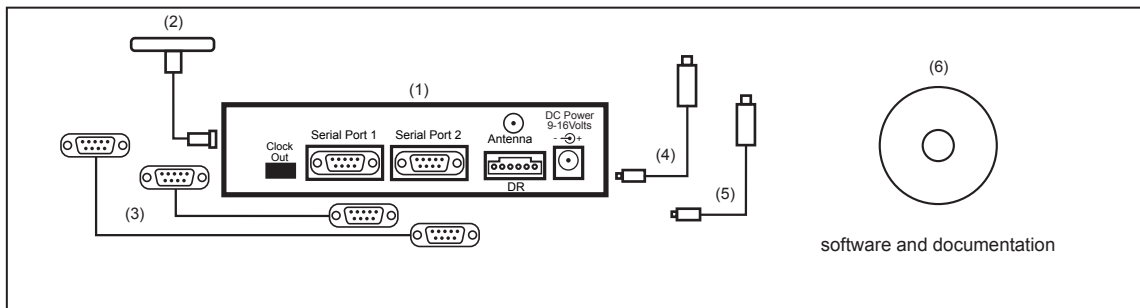
Figure 2-1 GPS development kit components

Note: before supplying power to the development unit, please review the configuration settings and operation described in this document for optimum performance of the Jupiter GPS receiver (see Figure 3-1).

2.3.1.1 Host serial port

The host serial port, labelled Serial Port 1, is used to send and receive both binary and National Marine Electronics Association (NMEA 0183) initialisation and configuration data messages.

2.3.1.2 Auxiliary serial port

The Auxiliary serial port, labelled Serial Port 2, is dedicated to the reception of RTCM SC-104 Differential GPS (DGPS) correction messages. No data is output from the receiver through the Auxiliary port.

2.3.1.3 Auxiliary test connector

An auxiliary output connector, labelled Clock Out, on the development unit allows the OEM processor to access the 1 pulse-per-second (1 PPS) time mark and 10 kHz time mark signals. The signals available at the auxiliary test connector are buffered CMOS level outputs driven by a 74LS04 CMOS inverting buffer device.

2.3.1.4 DC power regulation

The development unit also includes the necessary circuitry to regulate the DC power input and to provide the necessary supply voltages to the receiver. The unit's board contains jumper blocks which allow the OEM to insert a current measuring device in line with the primary and battery backup power lines to the receiver to monitor power usage under various conditions. To isolate the receiver from the development unit, an electronic bus switch is used. This switch is controlled externally by a configuration switch on the front panel of the unit. The bus switch also provides control over the bus voltage level. A jumper block is provided to select the interface voltage level to be used. Four front panel LEDs provide the development unit's basic status indicators.

2.3.1.5 On/off switch and reset switch

A push-button on/off switch is provided on the front panel of the development unit to control primary power to the Jupiter board. Also provided on the unit's front panel is a push-button reset switch to generate a receiver system hardware reset.

There is a provision to supply external backup power to the SRAM and RTC devices after primary power has been removed from the board. This feature provides the receiver with a 'hot start' capability by maintaining last position, current time, and satellite ephemeris data in SRAM.

The supply of an external backup voltage to the SRAM and RTC is accomplished by properly configuring a jumper block and a configuration switch. This external backup power is maintained to the SRAM and RTC unless it is disabled using a configuration switch, or by removing the JB5/JB6 jumper inside the development unit (see Figure

3-2), or by removing the +12 VDC power to the unit.

2.3.2 DC power supply

DC power for the development unit is provided by either an AC/DC converter or automobile adapter. The AC/DC converter operates from a nominal 120/240 VAC input and provides a 12 VDC at 500 mA out. For mobile operation, an automotive adapter intended for use in 12 V vehicles is provided.

2.3.3 Interface cables

A ribbon cable is provided to interface between the development unit and the customer's PC, and between the development unit and a DGPS receiver. These cables are terminated at both ends with female connectors to match the male connectors on the development unit and the PC.

2.3.4 Active antenna

A magnetic-mount active antenna is supplied with the receiver development kit, along with an RF cable (RG-316) already terminated with the proper connector for the antenna. The nominal measured attenuation of the cable with connector is approximately 3 dB. The supplied active antenna should be biased at +5 VDC, but a different active antenna with a bias of either +3, +5 or +12 VDC may be used. Switches located on the front panel of the development unit are used to select the proper bias.
Caution: ensure antenna power switches are properly set before connecting the antenna. An antenna designed for +5 VDC operation will be damaged if connected to a +12 VDC source.

2.4 Positioning the RF antenna.

Test equipment should be located so that the GPS antenna has a clear view of the sky for optimal reception of the satellite signals.

Note: GPS signals may be severely attenuated or totally obscured by roofs, solid walls, dense foliage, or even coated glass (found in many office structures). The development 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.

2.5 Connecting an RTCM differential source

The development unit, PC and the RTCM SC-104 differential correction source are connected

as shown in Figure 2-3. 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. In this case, data is only logged when Labmon is invoked with file names as command line arguments (refer to Labmon application note LA010103). Logging and subsequent review of the RTCM correction data often resolves performance or compatibility issues.

Normally, the development unit should be set up as shown in Figure 2-3 with only the RTCM correction source connected to the receiver. If the RTCM cable is not connected to the receiver's auxiliary port, DGPS operation will not be possible.

Note: The development unit may be connected to either the COM1, COM2, COM3, or COM4 serial ports and the RTCM differential correction data source connected either directly to the receiver's auxiliary I/O port, to one of the remaining serial ports of the PC, or to both using an OEM-supplied three-connector serial cable.

2.6 Operating the development unit's GPS receiver.

To operate the Jupiter receiver, press the on/off switch on the front panel of the development unit once. When power is applied to the receiver, the power LED illuminates and the time mark LED flashes at a 1 Hz rate to indicate the receiver is operating.

When the NMEA protocol for the host port is selected, the NMEA assured LED illuminates. When data is received by the auxiliary port, the DGPS active LED illuminates. The DGPS active LED does not indicate the integrity of the RTCM SC-104 data or the receiver mode. Press the on/off switch again to remove primary DC power from the receiver. This switch does not remove backup power from the receiver.

The power LED on the front panel of the development unit should indicate off before changing the configuration switch settings. The receiver operating settings will not change after re-configuration until the receiver is restarted by pressing the on/off switch or reset switch.
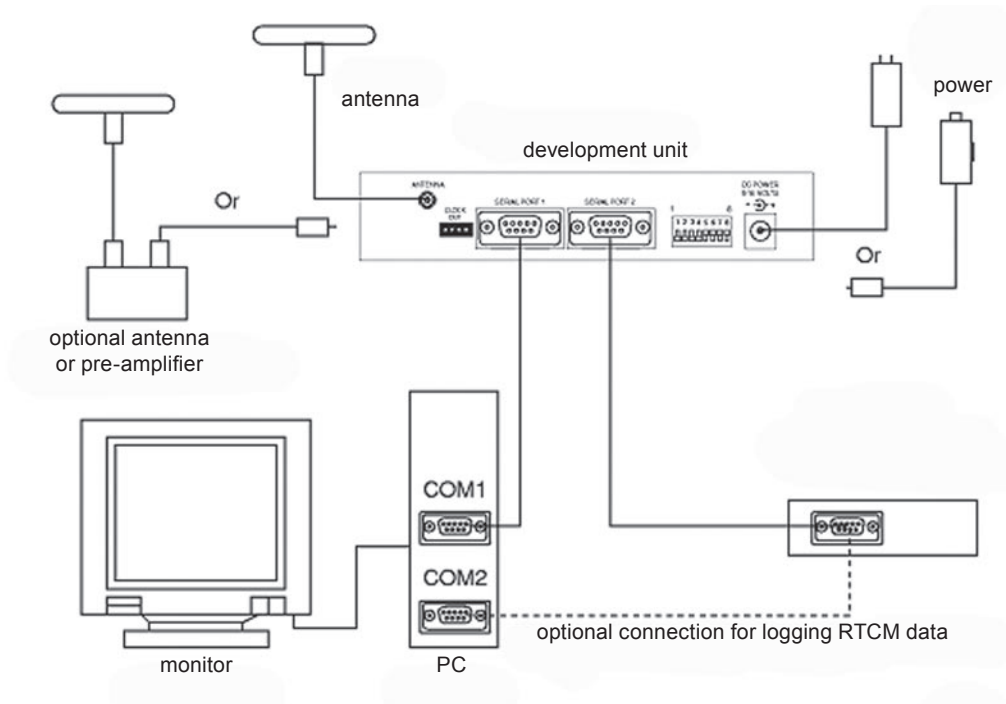

Figure 2-2 Development unit test equipment

3.0 Jupiter series receivers

Note: It is not necessary to open the development unit unless changing the GPS receiver to a different model. Most combinations of I/O and antenna selections can be made from the front panel configuration switch (labelled U10 on the PC board). Figure 3-2 illustrates the board and major components inside the development unit.

3.1 Configuration switch settings
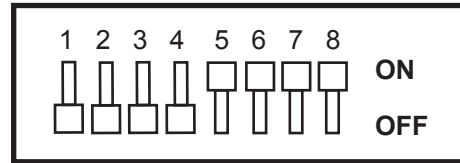
Figure 3-1 Configuration switches
(typical settings)
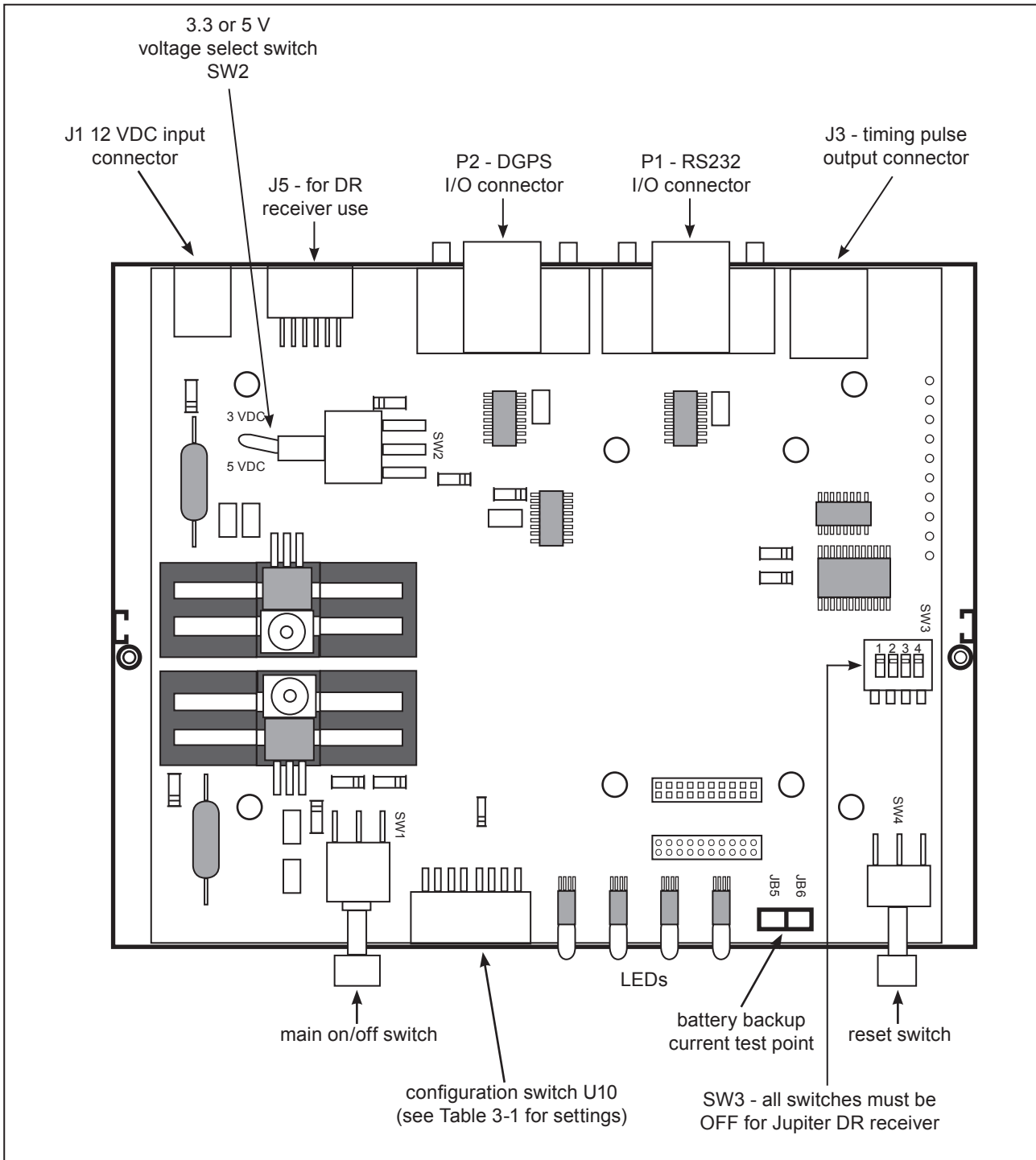
Figure 3-2 Development unit DC power arrangement and I/O configuration switch selections

Config. switch	Jupiter standard	
	ON	OFF
1	Reserved (GPIO1)	
2	NMEA protocol selected (GPIO2)	EPROM/SRAM configured protocol
3	ROM default selected (GPIO3)	(default position) EPROM/SRAM settings
4	Reserved (GPIO4)	
5	RTC backup (enabled)	RTC backup (disabled)
6	Antenna pre-amp supply 5 V or 12 V selection (see note 1)	Antenna pre-amp supply 3.3 V selection
7	Antenna pre-amp supply 5 V selection	Antenna pre-amp supply 12 V selection
8	Antenna pre-amp on	No antenna pre-amp supply
Note 1: When switch 6 is on, voltage is determined by position of switch 7. Note 2: Switches 1 to 4 are disabled when using DR (see document section 3.1.1).		

Table 3-1 Jupiter GPS receiver I/O configuration switch settings

3.1.1 Configuration switches 1 to 4

Switches 1 to 4 are connected to pins 6 to 9 of the receivers' 20-pin connector. These pins are General Purpose Input Output (GPIO) terminals, programmed for specific functions depending on what the receiver is being used for (see Table 3-1).

Note: If using a Jupiter DR GPS receiver in the development unit, switches 1 to 4 must be disabled via the unit's internal gang switch SW3, see Figure 4-2. (See Figure 3-2 for location of SW3.)

3.1.2 Configuration switch 5

Switch 5 is used for supplying backup power for the Real Time Clock (RTC). When set to 'ON', this switch will keep power applied to the receivers' SRAM and RTC even when main power to the receiver is turned off (see Table 3-2).

3.1.3 Configuration switches 6 to 8

Switches 6 to 8 are used for supplying DC voltages to the GPS antenna. There are three options for powering an active GPS antenna: 3.3, 5, and 12 V. Switch 6 selects 3.3 V in the 'OFF' position and 5 V or 12 V in the 'ON' position. Switch 7 selects 12 V in the 'OFF' position and 5 V in the 'ON' position. Switch 8 is the main 'ON/OFF' selection for the antenna pre-amp (See Table 3-2).

3.2 Voltage select switch SW2

SW2 selects 3 V or 5 V supply to the receiver, but will not alter the 3 V backup supply voltage. SW2 must be in the 3 V position for all Pico receivers.
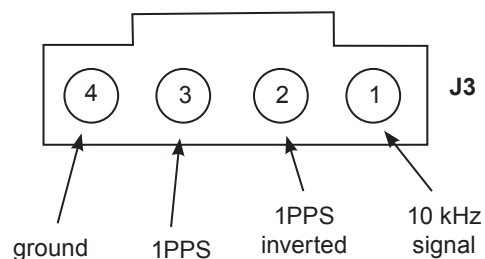
3.3 Connectors

3.3.1 J1 connector

J1 is the main DC power input connector. The Jupiter GPS development unit will accept voltages from 9 to 16 VDC. The middle pin on J1 is polarised negative and the outer shell is positive. The kit includes both an AC adaptor and a vehicle 12 V power cord.

3.3.2 J3 connector

J3 is the time mark (1PPS) and 10 kHz output connector (see Figure 3-2 for location of J3). The pin-out connections are shown in Figure 3-3.

Figure 3-3 Time mark signal output connector
(viewed from rear of unit)

A mating connector for J3 is supplied with the unit. A mating connector for J5 (DR Interface) is also included with the unit

Note: Additional connectors are available from Molex, (J3) part number 70400 series 'G'. (J5, DR Interface) part number JST-PHR-6 (also requires crimp connectors: JST-SPH 002T-P0.5S).

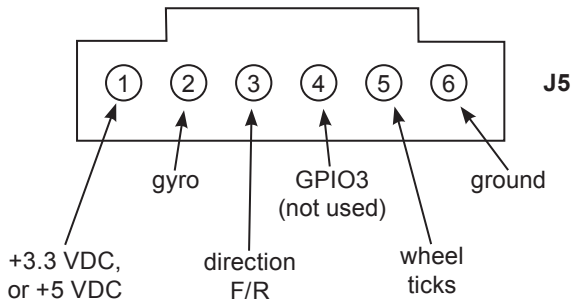### 3.3.3 Selection of links for 10 kHz output

Selection of links between JB13 & 14, or JB14 & 15 affects 10 kHz output as follows:

• Link JB13 & 14: 10 kHz output NORMAL

• Link JB14 & 15: 10 kHz output INVERTED

4.0 Jupiter DR (dead-reckoning) operation

4.1 DR interface connector (J5)

The Jupiter GPS development unit has a connector (J5), for external inputs for DR operation (see Figure 4-1).

Figure 4-1 Dead-reckoning interface connector
(viewed from rear of unit)

This connector is used for signals transmitted by:

1) an angular rate sensor (gyro)

2) a wheel ticks counter

3) a forward/reverse indicator.

These signals are present on many late model vehicles and may be used to assist the GPS receiver in determining position accuracy during loss of signal conditions.

4.1.1 DC power supply: J5 pin 1

J5 pin 1 has a 3.3 or 5 VDC supply if needed for other external circuitry.

4.1.2 Heading rate gyro input: J5 pin 2

Table 4-1 details the gyro requirements. It is important to ensure that the rate gyro signals have the following characteristics:

• range: 0 to 5 V

• output (no gyro rotation): 2.5 V

• 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 degrees/second or less

The gyro should be mounted so 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.

4.1.3 Backup sensor: J5 pin 3

Input from a signal that is normally at +5 V (pulled up on the board), but falls to 0 V when the vehicle is in reverse gear. Use of this signal is optional; if it is not used, the effect of occasional backing by the vehicle will not significantly degrade navigation performance. To ensure minimum current in 'keep alive' mode, be sure this input is not pulled up external to the board.

4.1.4 Speed pulses: J5 pin 5

The input to this pin is a pulse train generated in the vehicle. The pulse frequency is proportional to the vehicle velocity. These pulses, or wheel ticks, are generated in most vehicles by the Automatic Braking System (ABS), the transmission, or the drive shaft. System design must restrict the pulses between 0 and 5 V. The receiver periodically senses the state of pin J1-9 using a timed process. Detection limits for speed pulses are the following:

• minimum detectable rate: 1 PPS

• maximum detectable rate: 800 PPS
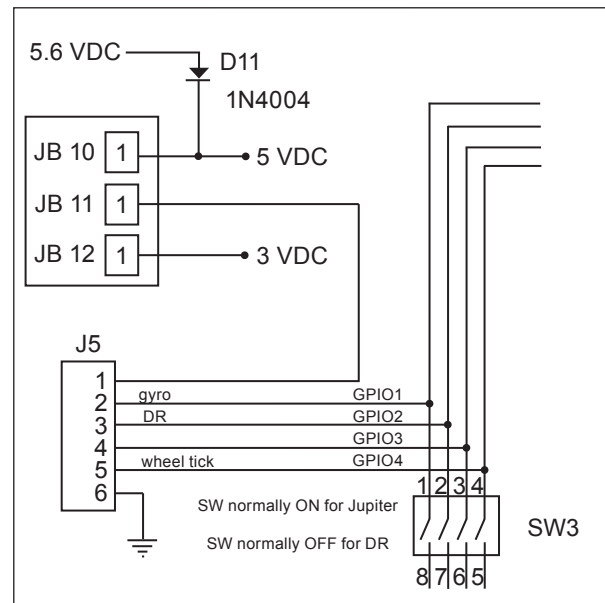
Figure 4-2 J5 (DR) connections and jumper settings for DC voltage
(for use with a gyro or other equipment)

Jumper blocks JB10, 11 and 12 are available inside the unit for use with an external gyro or other equipment that requires a regulated 3.3 or 5.0 VDC supply. J5, pin 1 may be set for zero, 3.3 V, or 5.0 V. Connect JB10 and JB11 for 5 V, connect JB11 and JB 12 for 3.3 V.

Characteristic	Symbol	Condition	Minimum	Typical	Maximum	Units
Supply voltage	Vcc		+4.75	5.0	+5.25	VDC
Output voltage	Vout	@rate limits	>0.0		5.0	VDC
Operating temp			−40	+23	+85	°C
Start up time					1	s
Angular velocity**			−100 −60		+100 +60	deg/s
Resolution				0.05		deg/s
CW/CCW assymmetry					0.1	deg/s
Bias*	ω_o	Angular rate = 0 deg/s Temp = 23°C	−1	0	+1	deg/s
Bias change due to temp variation		Angular rate = 0 deg/s			±0.30	(deg/s)/°C
Bias noise		Constant temp (1 min)			<±0.25	deg/s
Scale factor*	SF	Temp = 23°C	−0.10	0	+0.10	
Scale factor change due to temp variation					±0.001	1/°C
Scale factor noise		Constant temp (1 min)			<±0.0005	
Response					±100	deg/s^2
Linearity					±0.5	% full scale

* Bias and scale factor are defined as: $\omega_{measured} = \omega_{true}(1+SF) + \omega_o$
•• Dynamic ranges for the particular gyroscopes can vary within the limits specified.

Table 4-1 Gyro requirements

5.0 Jupiter Timing receivers

This section pertains to use of the Navman Jupiter T and Pico T timing receivers.

An adaptor board is provided for operation of the Jupiter timing receivers in the Jupiter series development units. Figure 5-1 shows a Pico T receiver plugged into an adaptor board, permitting use of the pin-out provided in the Jupiter series development units.

Please refer to the data sheets on the CD provided with the Jupiter (11/12/Pico) series GPS receiver development kit, for information on the Jupiter T and Pico T receivers.

When using a Jupiter timing receiver in the development unit, please note the following:

Jupiter T
The configuration switches are non-operational (except for battery backup). GPS antenna = 5 V from main supply.

Pico T
The configuration switches are as per standard Jupiter receivers. SW2 voltage select switch in 3 V position.

Note: If a grounded passive antenna is to be used (or an antenna other than the antenna supplied with the development kit), care must be taken to prevent the 5 V from being shorted through the antenna connection.

Figure 3-3 shows the connector (J3) pin out for the 1PPS and 10 kHz timing signals. The 10 kHz signal is coherent with the 1PPS and the leading edges may be selected to be either positive or negative going when selected by jumpers JB13, 14 and 15 (see Figure 5-1 for location of these jumpers).

Note: The 1PPS signal on J3 pin 2 is buffered (and inverted) and J3 pin 3 is direct from the receiver. The 1PPS and 10 kHz pulses are TTL/CMOS level signals, exercise care in connecting these to signals to other devices.
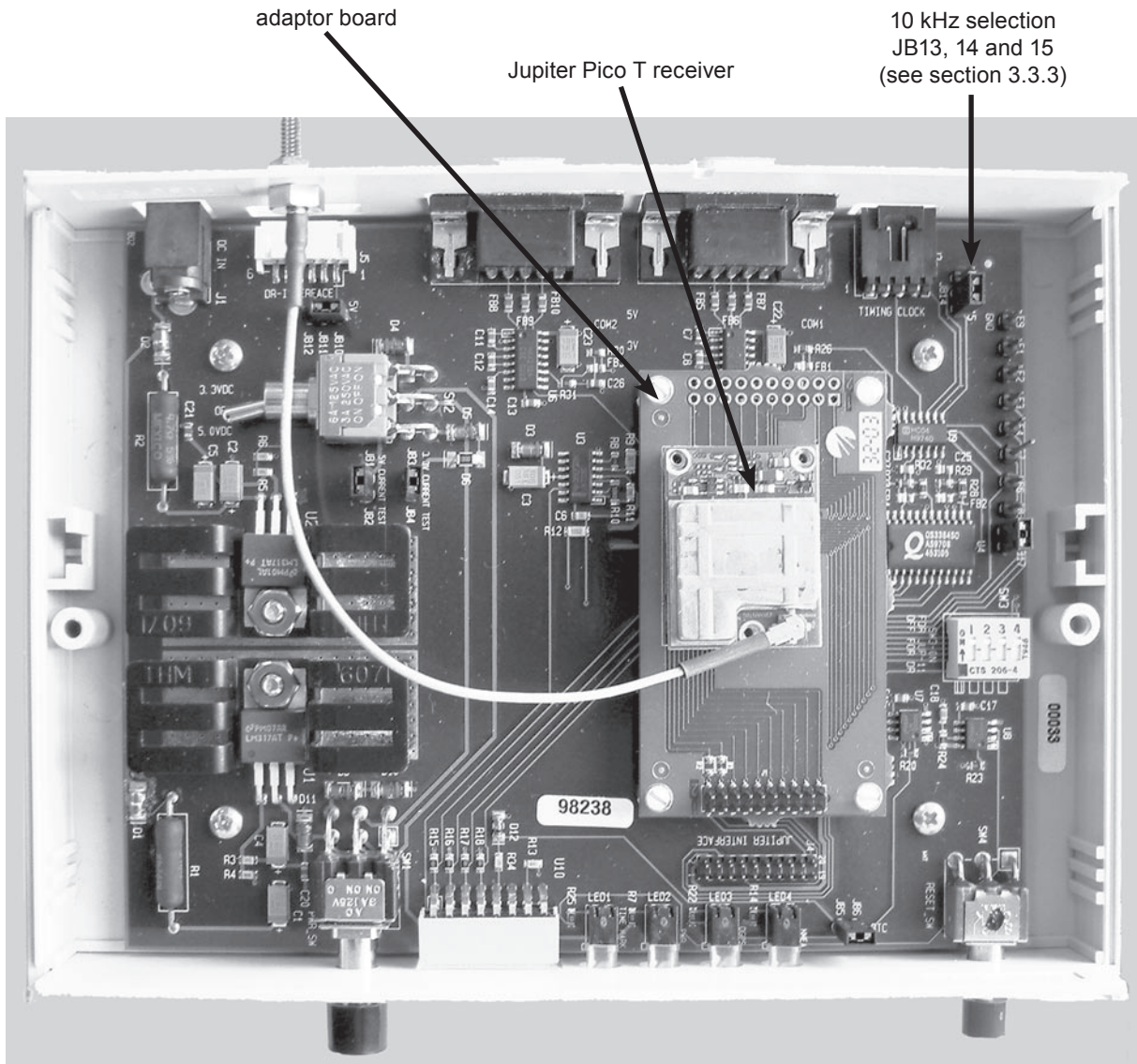
Figure 5-1 Development unit with a Jupiter Pico T receiver fitted on an adaptor board

Part Number	Description
TU10-D007-051	Development kit with Jupiter 11 LP - low power 3.3 V
TU10-D007-061	Development kit with Jupiter 11 standard - 5 V
TU10-D007-101	Development kit with Jupiter 11 DR - 3.3 V, includes gyro
TU10-D007-351	Development kit with Jupiter 12 module TU35-D410-021
TU10-D007-352	Development kit with Jupiter 12 DR module TU35-D420-021
TU10-D007-121	Development kit with Jupiter T module TU60-D120-031
TU10-D007-361	Development kit with Jupiter Pico module TU36-D100-001
TU10-D007-362	Development kit with Jupiter Pico T module TU36-D400-001
TU10-D007-363	Development kit with Jupiter Pico DR module TU36-D120-001

Table 5-1 Jupiter series development kit ordering information

6.0 Acronyms used in this document

1PPS: One Pulse Per Second
DGPS: Differential Global Positioning System
GPIO: General Purpose Input Output
GPS: Global Positioning System
NMEA: National Marine Electronics Association
RTC: Real Time Clock
RTCM: Radio Technical Commission for Maritime services

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