

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

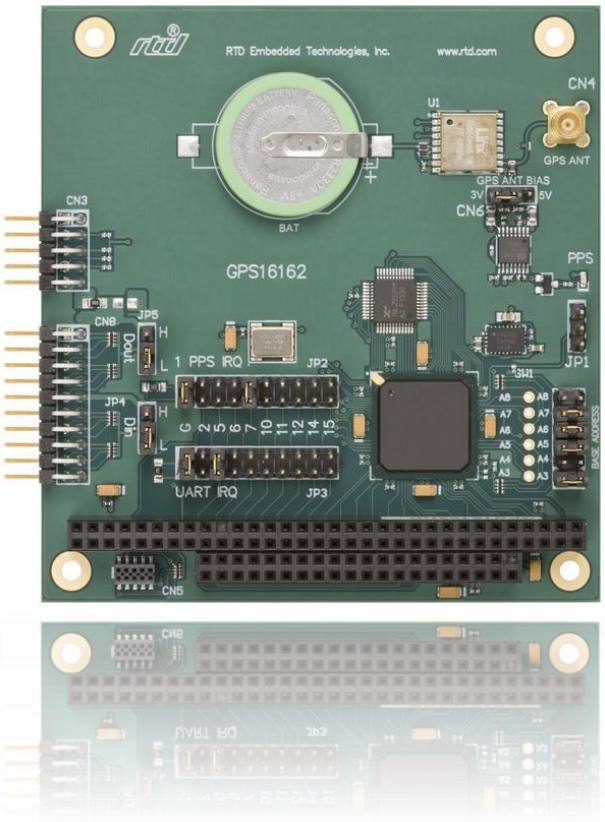
Visit our website - *Click HERE*

GPS16162HR

PC/104 GPS Module

User's Manual

BDM-610020114 Rev. C



RTD Embedded Technologies, Inc.
AS9100 and ISO 9001 Certified

RTD Embedded Technologies, Inc.
103 Innovation Boulevard
State College, PA 16803 USA
Telephone: 814-234-8087
Fax: 814-234-5218

www.rtd.com

sales@rtd.com
techsupport@rtd.com







Revision History

Rev A	Initial Release
Rev B	Corrected information in Table 14 Corrected CN8 reference in Figure 2 Added CN6 jumper information Added JP1 jumper information Added section GPS Battery Updated board picture
Rev C	Updated RTD trademark text Section 2.2: Added power consumption and +5V input supply current Section 3.2: Updated Figure 1 (board dimensions) to show location of JP7 Section 3.3. Updated Figure 2 to show location of JP7 Section 3.3.2: Documented JP7 functionality Section 4.2: Updated IDAN 3D drawing to show connector locations Section 4.3.1: Added pin orientation to IDAN connector diagram Section 5.1: Added COCOM limits

Advanced Analog I/O, Advanced Digital I/O, aAIO, aDIO, a2DIO, Autonomous SmartCal, "Catch the Express", cpuModule, dspFramework, dspModule, eBuild, expressMate, ExpressPlatform, "MIL Value for COTS prices", multiPort, PlatformBus, and PC/104EZ are trademarks, and "Accessing the Analog World", dataModule, IDAN, HiDAN, HiDANplus, RTD, the RTD logo, and StackNET are registered trademarks of RTD Embedded Technologies, Inc. (formerly Real Time Devices, Inc.). PS/2 is a trademark of International Business Machines Inc. PCI, PCI Express, and PCIe are trademarks of PCI-SIG. PC/104, PC/104-Plus, PCI-104, PCIe/104, PCI/104-Express and 104 are trademarks of the PC/104 Consortium. All other trademarks appearing in this document are the property of their respective owners.

Failure to follow the instructions found in this manual may result in damage to the product described in this manual, or other components of the system. The procedure set forth in this manual shall only be performed by persons qualified to service electronic equipment. Contents and specifications within this manual are given without warranty, and are subject to change without notice. RTD Embedded Technologies, Inc. shall not be liable for errors or omissions in this manual, or for any loss, damage, or injury in connection with the use of this manual.

Copyright © 2017 by RTD Embedded Technologies, Inc. All rights reserved.

Table of Contents

1 Introduction 7

1.1 Product Overview ... 7

1.2 Board Features ... 7

1.3 Ordering Information ... 8

1.4 Contact Information ... 8
- 1.4.1 Sales Support 8
- 1.4.2 Technical Support 8

2 Specifications 9

2.1 Operating Conditions ... 9

2.2 Electrical Characteristics ... 9

3 Board Connection 10

3.1 Board Handling Precautions ... 10

3.2 Physical Characteristics ... 10

3.3 Connectors and Jumpers ... 11
- 3.3.1 External I/O Connectors 11
  - CN8: Digital I/O Connector 11
  - CN3: GPS Utility Connector 12
- 3.3.2 Jumpers 12
  - CN6: GPS Antenna Bias 12
  - JP1: 1 PPS on Carrier Detect 12
  - JP2: 1 PPS Interrupt Jumper 12
  - JP3: GPS Interrupt Jumper 12
  - JP4 & JP5: Digital I/O Jumpers 13
  - JP6: Base Address Jumpers 13
  - JP7: Battery Jumper 15
- 3.3.3 LED Indicators 15
  - D3 (PPS) 15

3.4 Steps for Installing ... 16

4 IDAN Connections 17

4.1 Module Handling Precautions ... 17

4.2 Physical Characteristics ... 17

4.3 Connectors ... 18
- 4.3.1 External I/O Connectors 18
  - Utility Connector - 9-pin “D” Female Connector 18
  - Digital I/O Connector - 25-pin “D” Female Connector 18
  - GPS Antenna - SMA Female Connector 19

4.4 Steps for Installing ... 20

5 Functional Description 21
- 5.1.1 Linx RXM-GNSS-TM GPS Receiver 21
  - GPS module interface 22
  - GPS Antenna 22
  - GPS Battery 22
  - COCOM Limits 22
- 5.1.2 Digital I/O 22
- 5.1.3 Interrupts 22

6 Register Address Space 23

6.1 General Board Control ... 23
- 6.1.1 UART I/O (GPS BASE + 0 to GPS BASE + 7) 23
- 6.1.2 GPS Status (GPS BASE + 401h) 23
- 6.1.3 Digital I/O 24

6.1.4 RTD ISA ID 24
6.2 GPS6160 Compatibility 25
7 Troubleshooting 26
7.1 Common Problems and Solutions 26
8 Additional Information 27
8.1 PC/104 Specifications 27
8.2 Linx RXM-GNSS-TM 27
9 Limited Warranty 28

Table of Figures

Figure 1: Board Dimensions 10
Figure 2: Board Connections 11
Figure 3: Example 104™Stack 16
Figure 4: IDAN Dimensions 17
Figure 5: Example IDAN System 20
Figure 6: GPS1612 Block Diagram 21

Table of Tables

Table 1: Ordering Options 8
Table 2: Operating Conditions 9
Table 3: Electrical Characteristics 9
Table 4: CN8 Digital I/O Pin Assignments 11
Table 5: CN3 GPS Utility Pin Assignments 12
Table 6: JP3 Settings 12
Table 7: JP1 Settings 12
Table 8: IDAN- GPS16162 9-Pin "D" Connector 18
Table 9: IDAN- GPS16162 25-Pin "D" Connector 18
Table 10: Register Map 23
Table 11: GPS STATUS (GPS BASE + 401h) 23
Table 12: Digital I/O Data (GPS BASE + 404h) 24
Table 13: Digital I/O Data (GPS BASE + 405h) 24
Table 14: Digital I/O Direction (GPS BASE + 406h) 24
Table 15: Digital I/O Direction (GPS BASE + 407h) 24
Table 16: RTD ID DATA READ Indexes 24
Table 17: Digital I/O Data (GPS BASE + 400h) 25
Table 18: Digital I/O Data (GPS BASE + 400h) 25
Table 19: Troubleshooting 26

1 Introduction

1.1 Product Overview

The GPS16162 is designed to provide global positioning system (GPS) for PC/104 based systems. Included on the GPS16162 is a Linx RXM-GNSS-TM GPS Receiver module.

The GPS16162 has a UART chip that permits communication with either serial port on the GPS receiver module over the PC/104 bus without using other serial ports in the PC/104 system. The GPS supports National Marine Electronics Association (NMEA-0183 ver. 4.10) messages

1.2 Board Features

- PC/104 stackable bus structure
- Linx RXM-GNSS-TM GPS engine
  - L1 1575.42MHz, C/A code
  - 33-channel satellite tracking
  - Position accuracy: 2.5m
  - Time accuracy of ±11ns
  - 1Hz update rate (configurable up to 10Hz)
  - Tracking sensitivity down to -164 dBm
  - Protocol: NMEA-0183 ver 4.10
  - Constellation System Support:
    - GPS
    - GLONASS
    - GALILEO
    - QZSS
  - DGPS support:
    - (SBAS) Satellite-Based Augmentation System
    - (RTCM) Radio Technical Commission for Maritime Services
    - (WAAS) Wide-Area Augmentation System
    - (EGNOS) European Geo-Stationary Navigation System
    - (MSAS) MTSAT Satellite-Based Augmentation System
    - (GAGAN) GPS-Aided Geo-Augmented Navigation
- Supports +3.3V/+5V active and passive antennas
- OSX/MCX antenna jack
- Standard 16C550 UART Interface
  - Compatible with all modern operating systems.
  - Jumper-selectable Base Address and IRQ
  - Jumper-selectable 1 PPS on carrier-detect
  - TX and RX only, no flow control or handshaking required
- IRQ Jumper for 1 PPS
- Digital I/O
  - 16 bit-programmable Digital I/O
- GPS Utility Connector
  - 1 PPS
- Status LEDs
  - 1 PPS
- PC/104 compliant

1.3 Ordering Information

The GPS16162 is available in the following options:

Table 1: Ordering Options

Part Number	Description
GPS16162	PC/104 GPS Module
IDAN-GPS16162	PC/104 GPS Module in IDAN enclosure

The Intelligent Data Acquisition Node (IDAN®) building block can be used in just about any combination with other IDAN building blocks to create a simple but rugged 104™ stack. This module can also be incorporated in a custom-built RTD HiDAN® or HiDANplus® High Reliability Intelligent Data Acquisition Node. Contact RTD sales for more information on our high reliability systems.

1.4 Contact Information

1.4.1 Sales Support

For sales inquiries, you can contact RTD Embedded Technologies sales via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: sales@rtd.com

1.4.2 Technical Support

If you are having problems with your system, please try the steps in the Troubleshooting section of this manual.

For help with this product, or any other product made by RTD, you can contact RTD Embedded Technologies technical support via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: techsupport@rtd.com

2 Specifications

2.1 Operating Conditions

Table 2: Operating Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
V_{cc5}	5V Supply Voltage		4.75	5.25	V
V_{cc3}	3.3V Supply Voltage		n/a	n/a	V
V_{cc12}	12V Supply Voltage		n/a	n/a	V
T_a	Operating Temperature		-40	+85	C
T_s	Storage Temperature		-55	+125	C
RH	Relative Humidity	Non-Condensing	0	90%	%
MTBF	Mean Time Before Failure	Telcordia Issue 2 30°C, Ground benign, controlled		TBD	Hours

2.2 Electrical Characteristics

Table 3: Electrical Characteristics

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
P	Power Consumption	V_{cc5} = 5.0V		0.7		W
I_{cc}	5V Input Supply Current	Active		140		mA
Digital I/O						
V_{IH}	Input High Voltage	CN7	2.0		5.5	V
V_{IL}	Input Low Voltage	CN7	-0		0.8	V
V_{OH}	Output High Voltage	I_O = -4mA CN7	2.4		3.3	V
V_{OL}	Output Low Voltage	I_O = 8mA CN7	0		0.4	V
	5V Output	CN7			200	mA
	Pull-up/Pull-down				10K	Ω

3 Board Connection

3.1 Board Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your board in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the board at the edges, and do not touch the components or connectors. Handle the board in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

3.2 Physical Characteristics

STEP model is available upon request; contact RTD Tech Support for more information.

- Weight: Approximately 80 g (0.18 lbs.)
- Dimensions: 90.17 mm L x 95.89 mm W (3.550 in L x 3.775 in W)

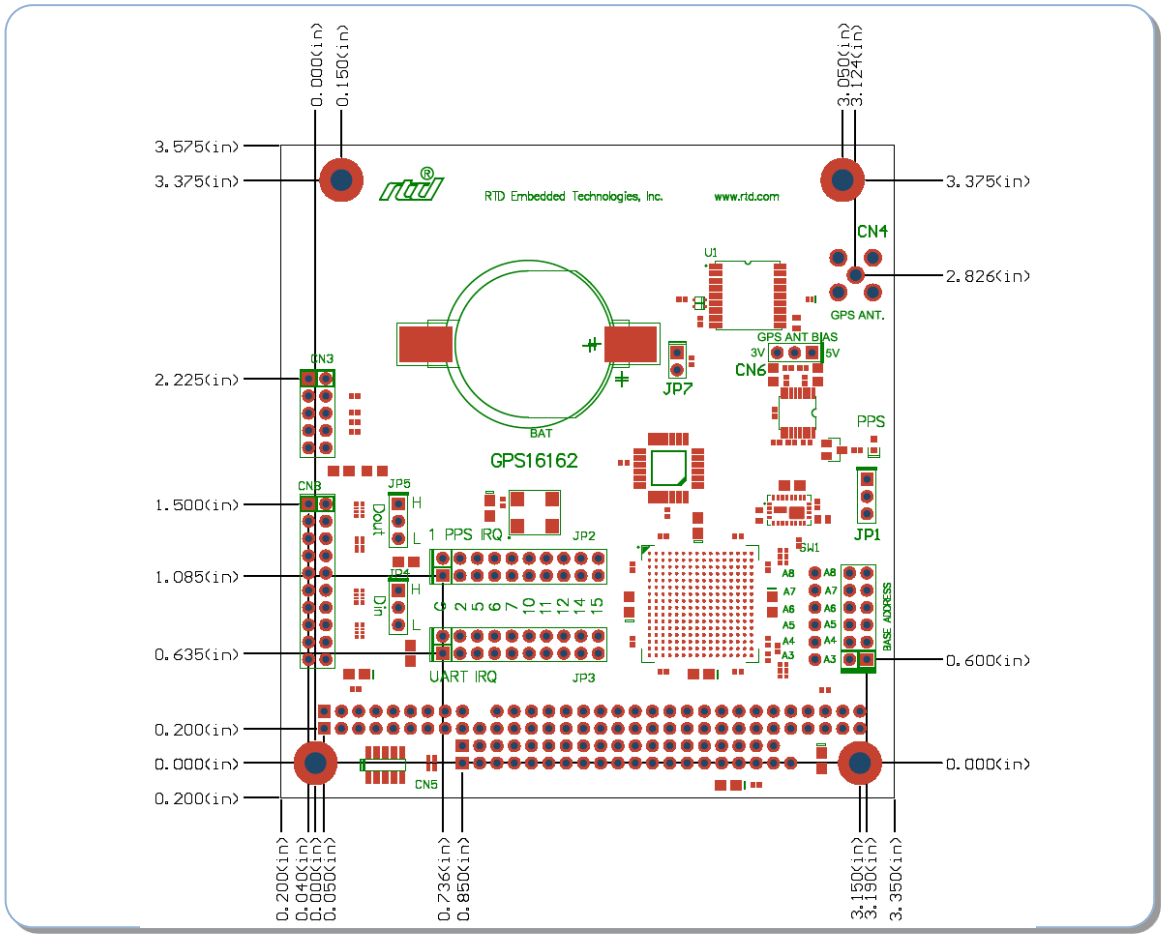


Figure 1: Board Dimensions

3.3 Connectors and Jumpers

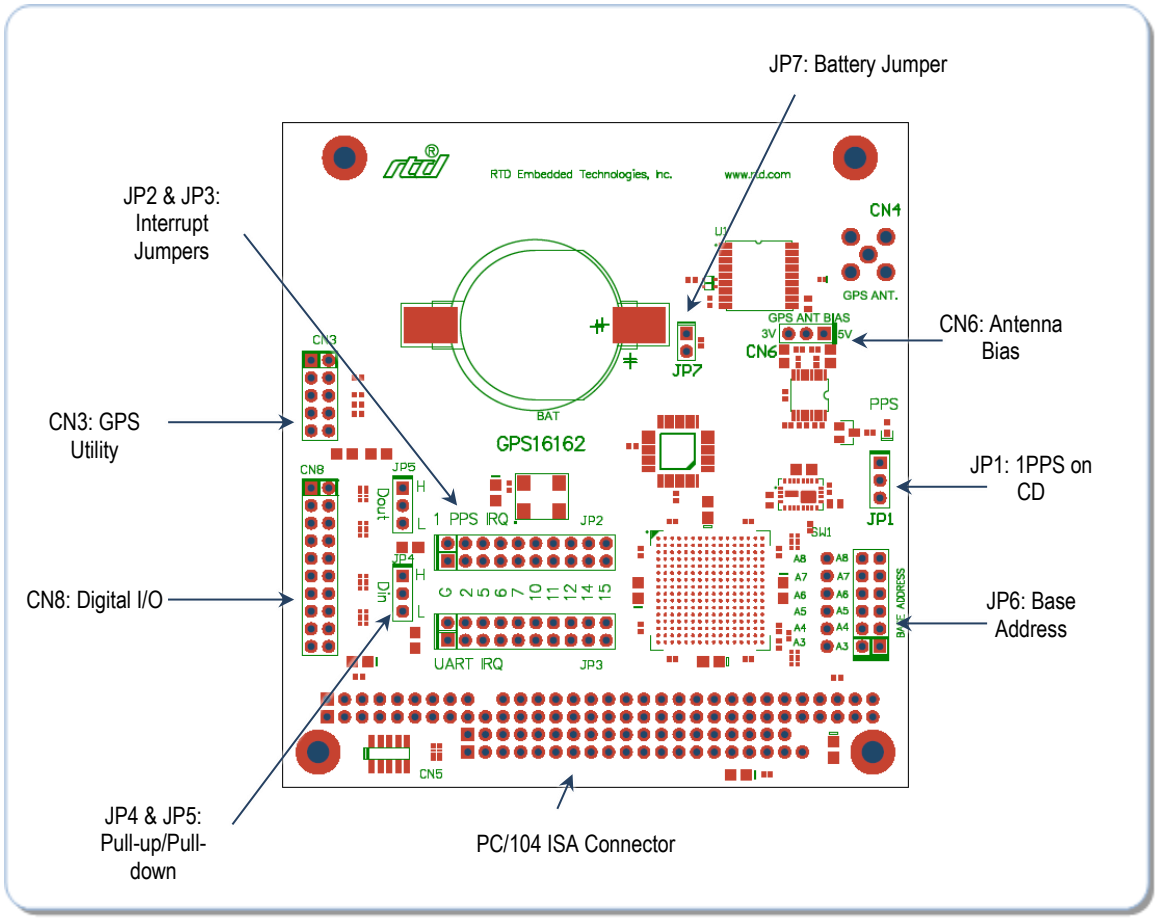


Figure 2: Board Connections

3.3.1 External I/O Connectors

CN8: Digital I/O Connector

The GPS16162 offers 16 bit-programmable digital I/O lines. These can be pulled high or low through 10KΩ resistors using JP4 to control bits 0 – 7 and JP5 to control bits 8 – 15

Table 4: CN8 Digital I/O Pin Assignments

DIO0	2	1	GND
DIO2	4	3	DIO1
DIO4	6	5	DIO3
DIO6	8	7	DIO5
+5V	10	9	DIO7
DIO8	12	11	GND
DIO10	14	13	DIO9
DIO12	16	15	DIO11
DIO14	18	17	DIO13
+5V	20	19	DIO15

CN3: GPS Utility Connector

The GPS16162 provides 1 PPS delayed through the EPLD (7.5ns max). The pin out of the external connector CN3 is shown below.

Table 5: CN3 GPS Utility Pin Assignments

Reserved	2	1	+5V
1PPS	4	3	GND
Reserved	6	5	GND
Reserved	8	7	Reserved
GND	10	9	GND

Note: CN5 is factory use only.

3.3.2 JUMPERS

CN6: GPS Antenna Bias

CN6 is used to select the antenna bias level. The available bias levels are shown in table below.

Table 6: JP3 Settings

Setting	Description	Notes
1 – 2	5V Bias Antenna	
2 – 3	3.3V Bias Antenna	Factory default
Open	Passive Antenna	

JP1: 1 PPS on Carrier Detect

JP1 is used to connect/disconnect the 1 PPS signal from GPS UART carrier detect. The options are shown in the table below.

Table 7: JP1 Settings

Setting	Description	Notes
1 – 2	1PPS is connected to the UART CD	Factory default
2 – 3	1PPS is disconnected from UART CD	

JP2: 1 PPS Interrupt Jumper

The IRQ selection jumpers allow you to set the IRQ used by the 1 PPS signal from the GPS of the GPS16162. The GPS16162 can be configured for any one of the following IRQs: 2, 5, 6, 7, 10, 11, 12, 14, or 15. The IRQ can be set by closing the appropriately labeled jumper on the board.

Default Setting: G Jumper closed

JP3: GPS Interrupt Jumper

The IRQ selection jumpers allow you to set the IRQ used by the serial port UART of the GPS16162. The GPS16162 can be configured for any one of the following IRQs: 2, 5, 6, 7, 10, 11, 12, 14, or 15. The IRQ can be set by closing the appropriately labeled jumper on the board.

The UART's carrier detect signal, which is driven by the GPS 1 PPS, can be an interrupt source.

Default Setting: IRQ 5 and G Jumper closed

Note: Typically IRQs cannot be shared; although there are some special cases (see "The G Jumper" later in this document). In general, the IRQ you select should not be used by any other devices in your system.

Reserved IRQs

Some of the IRQ choices on the GPS16162 may already be used by your CPU's onboard peripherals. Some commonly-used IRQs are:

- IRQ 2/9 is used by some VGA controllers.
- IRQ 5 or 7 may be used by the CPU's parallel port. Check your CPU's configuration to avoid a conflict.
- IRQ 12 is used by the PS/2 mouse. To use this IRQ, you will need to remove the PS/2 mouse from the system. Some CPUs also require a BIOS setting to disable the PS/2 mouse controller.
- IRQ 14 is used by the primary IDE controller. To use this IRQ, you will need to disable the primary IDE controller.
- IRQ 15 is used by the secondary IDE controller. To use this IRQ, you will need to disable the secondary IDE controller.

The G Jumper

The GPS16162 supports shared interrupts as defined by the PC/104 specification. This sharing is accomplished via the G jumper, which is located adjacent to the IRQ jumpers. The G jumper installs a 1KΩ resistor to pull the signal to the low state, allowing an interrupt to drive the signal high. To share interrupts, configure the devices for the same IRQ, then close the G jumper on one (and only one) of the devices.

When using interrupt sharing, consider the following guidelines:

- An interrupt can only be shared if all devices on the IRQ support it. If you have two sharing and one non-sharing device on the same IRQ, it will not work.
- To share interrupts, the system's drivers and operating system must support it. The Interrupt Service routines must be written to check all devices on an IRQ when the interrupt is detected. Many popular operating systems do not support interrupt sharing for ISA devices.

Note: If you are not sharing interrupts, make sure you leave the GPS16162's G jumper closed!

JP4 & JP5: Digital I/O Jumpers

JP4 controls a 10K Ohm pull up/down on DIO bits 1-8 and JP5 controls a 10K Ohm pull up/down on DIO bits 9 -16.

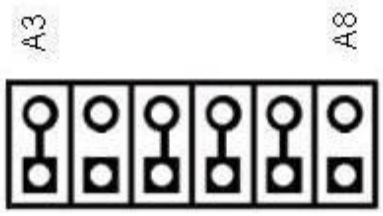
Table 8 JP4 & JP5 Operation

Jumper	Description	Default Factory Settings
JP4	1-2 – Pull-up 2-3 – Pull-down No connect - Neither	2-3 –Pull-down
JP5	1-2 – Pull-up 2-3 – Pull-down No connect - Neither	2-3 – Pull-down

JP6: Base Address Jumpers

The base address selection jumpers (A3 through A8) allow you to set the base address of the first UART that connects to the GPS module. Any software that accesses the board will do so through reads and writes to the I/O address set by the jumpers. To function properly, the I/O address the software is expecting must match the base address set by the jumpers.

As shown in the figure below, A3 is located at the left end of the jumper block, while A8 is located at the right end:



The table on the following pages shows the possible base address settings for the GPS16162. All base addresses are in hexadecimal. An 'X' indicates a closed jumper, while an empty cell indicates an open jumper.

Base Address (Hexadecimal)	Jumpers					
	A8	A7	A6	A5	A4	A3
200						
208						X
210					X	
218					X	X
220				X		
228				X		X
230				X	X	
238				X	X	X
240			X			
248			X			X
250			X		X	
258			X		X	X
260			X	X		
268			X	X		X
270			X	X	X	
278			X	X	X	X
280		X				
288		X				X
290		X			X	
298		X			X	X
2A0		X		X		
2A8		X		X		X
2B0		X		X	X	
2B8		X		X	X	X
2C0		X	X			
2C8		X	X			X
2D0		X	X		X	
2D8		X	X		X	X
2E0		X	X	X		
2E8		**X**	**X**	**X**		**X**
2F0		X	X	X	X	
2F8		X	X	X	X	X
300	X					
308	X					X
310	X				X	
318	X				X	X
320	X			X		
328	X			X		X
330	X			X	X	
338	X			X	X	X
340	X		X			
348	X		X			X
350	X		X		X	
358	X		X		X	X
360	X		X	X		
368	X		X	X		X
370	X		X	X	X	
378	X		X	X	X	X
380	X	X				
388	X	X				X
390	X	X			X	
398	X	X			X	X

Base Address (Hexadecimal)	Jumpers					
	A8	A7	A6	A5	A4	A3
3A0	X	X		X		
3A8	X	X		X		X
3B0	X	X		X	X	
3B8	X	X		X	X	X
3C0	X	X	X			
3C8	X	X	X			X
3D0	X	X	X		X	
3D8	X	X	X		X	X
3E0	X	X	X	X		
3E8	**X**	**X**	**X**	**X**		**X**
3F0	X	X	X	X	X	
3F8	X	X	X	X	X	X

By default, the GPS16162 comes configured with a base address of 0x2E8 for the GPS UART.

When selecting a base address for the GPS16162, please observe the following guidelines:

- Every device in your PC/104 system must have a unique base address! When selecting a base address for the GPS16162, make certain that it does not conflict with any other devices.
- Base addresses 0x3F8 and 0x2F8 are typically used by serial ports COM1 and COM2, respectively. If you wish to use one of those base addresses, you will need to disable any conflicting serial port.
- Some operating systems expect UART devices to be located at the standard serial port base addresses (0x3F8, 0x2F8, 0x3E8, and 0x2E8). Setting your GPS16162 to one of these addresses can make system setup and configuration easier.

JP7: Battery Jumper

Removing JP7 will disconnect the battery from the GPS module. JP7 should remain closed for normal operation.

3.3.3 LED INDICATORS

D3 (PPS)

GPS 1 Pulse Per Second (1 PPS)

3.4 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the PC/104 system or stack.
3. Select and install stand-offs to properly position the module on the stack.
4. Remove the module from its anti-static bag.
5. Check that pins of the bus connector are properly positioned.
6. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
7. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
8. Gently and evenly press the module onto the PC/104 stack.
9. If any boards are to be stacked above this module, install them.
10. Attach any necessary cables to the PC/104 stack.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

NOTE: When using under Windows, the GPS may be incorrectly detected as a Serial Mouse, causing erratic mouse cursor behavior. This issue has been documented by Microsoft. For more information, refer to Microsoft Knowledge Base Article 283063.

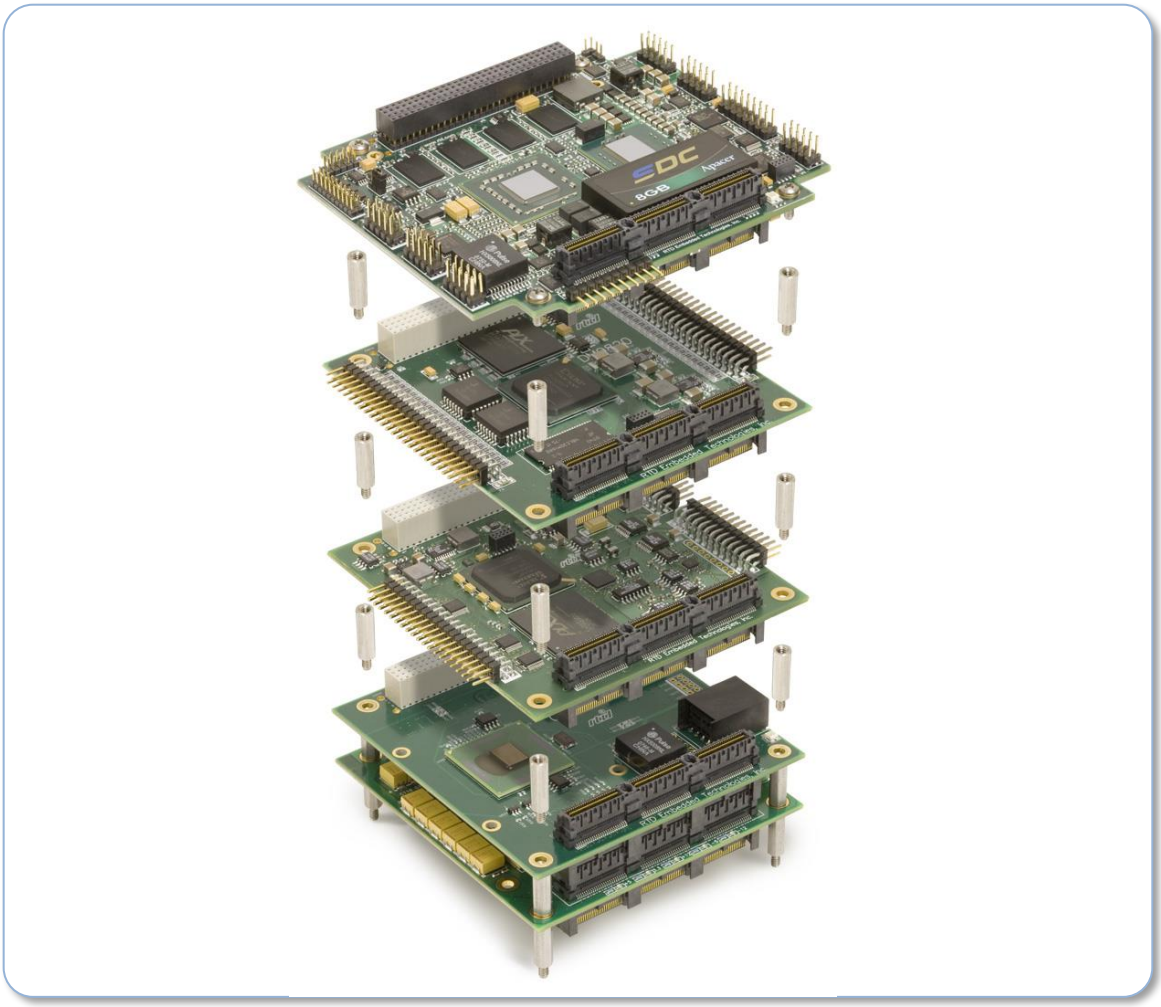


Figure 3: Example 104™ Stack

4 IDAN Connections

4.1 Module Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your module in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the module by the aluminum enclosure, and do not touch the components or connectors. Handle the module in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

4.2 Physical Characteristics

- Weight: Approximately 0.21 Kg (0.46 lbs.)
- Dimensions: 152 mm L x 130 mm W x 17 mm H (5.98 in L x 5.12 in W x 0.67 in H)

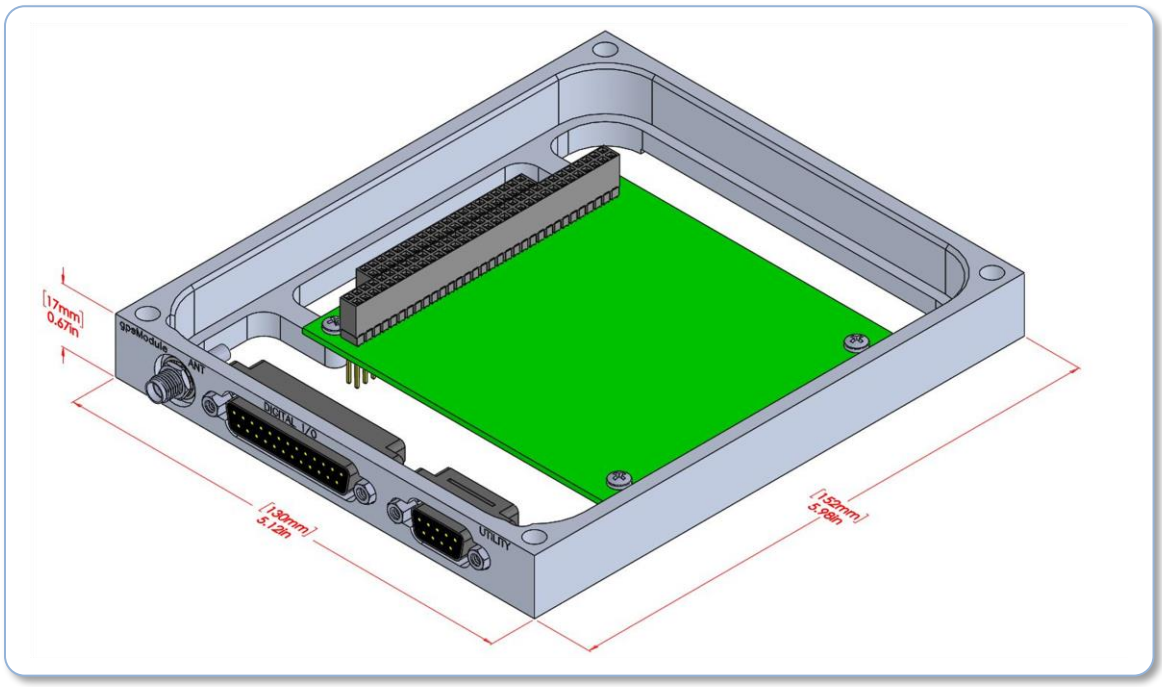
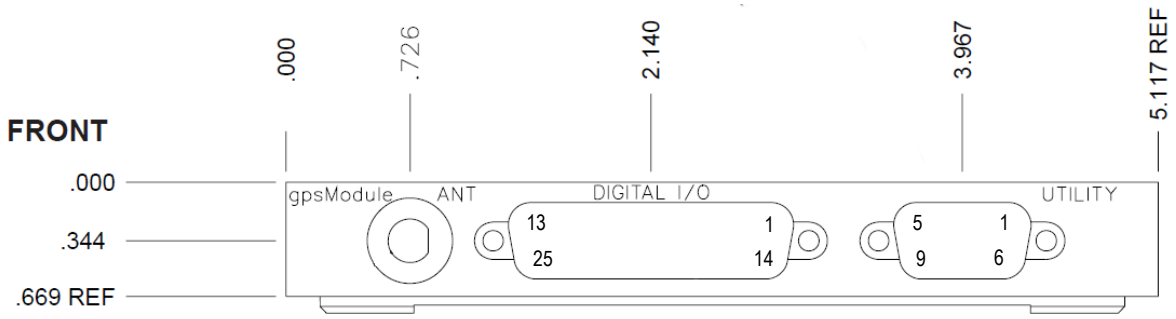


Figure 4: IDAN Dimensions

4.3 Connectors

4.3.1 External I/O Connectors



Utility Connector - 9-pin "D" Female Connector

Connector Part #: Amp 1658610-4 **Example Mating Connector:** Amp 1658608-4

Table 8: IDAN- GPS16162 9-Pin "D" Connector

IDAN Pin#	Signal	GPS16162 Pin #	
1	+5V	CN3	1
2	GND	CN3	3
3	GND	CN3	5
4	*Reserved*		
5	GND	CN3	9
6	*Reserved*		
7	1 PPS	CN3	4
8	*Reserved*		
9	*Reserved*		

Digital I/O Connector - 25-pin "D" Female Connector

Connector Part #: VALCON DF-25S-CN **Example Mating Connector:** Amp 1658608-2

Table 9: IDAN- GPS16162 25-Pin "D" Connector

IDAN Pin#	Signal	GPS16162 Pin #	
1	GND	CN8	1
2	DIO1	CN8	3
3	DIO3	CN8	5
4	DIO5	CN8	7
5	DIO7	CN8	9
6	GND	CN8	11
7	DIO9	CN8	13
8	DIO11	CN8	15
9	DIO13	CN8	17
10	DIO15	CN8	19
11	*Reserved*		
12	*Reserved*		
13	*Reserved*		
14	DIO0	CN8	2
15	DIO2	CN8	4
16	DIO4	CN8	6
17	DIO6	CN8	8

18	+5V	CN8	10
19	DIO8	CN8	12
20	DIO10	CN8	14
21	DIO12	CN8	16
22	DIO14	CN8	18
23	+5V	CN8	20
24	*Reserved*		
25	*Reserved*		

GPS Antenna - SMA Female Connector

Connector Part #: SPC Technology 8589-0853 **Example Mating Connector:** Amp 901-9877-RFX

4.4 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the IDAN system.
3. Remove the module from its anti-static bag.
4. Check that pins of the bus connector are properly positioned.
5. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
6. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
7. Gently and evenly press the module onto the IDAN system.
8. If any boards are to be stacked above this module, install them.
9. Finish assembling the IDAN stack by installing screws of an appropriate length.
10. Attach any necessary cables to the IDAN system.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

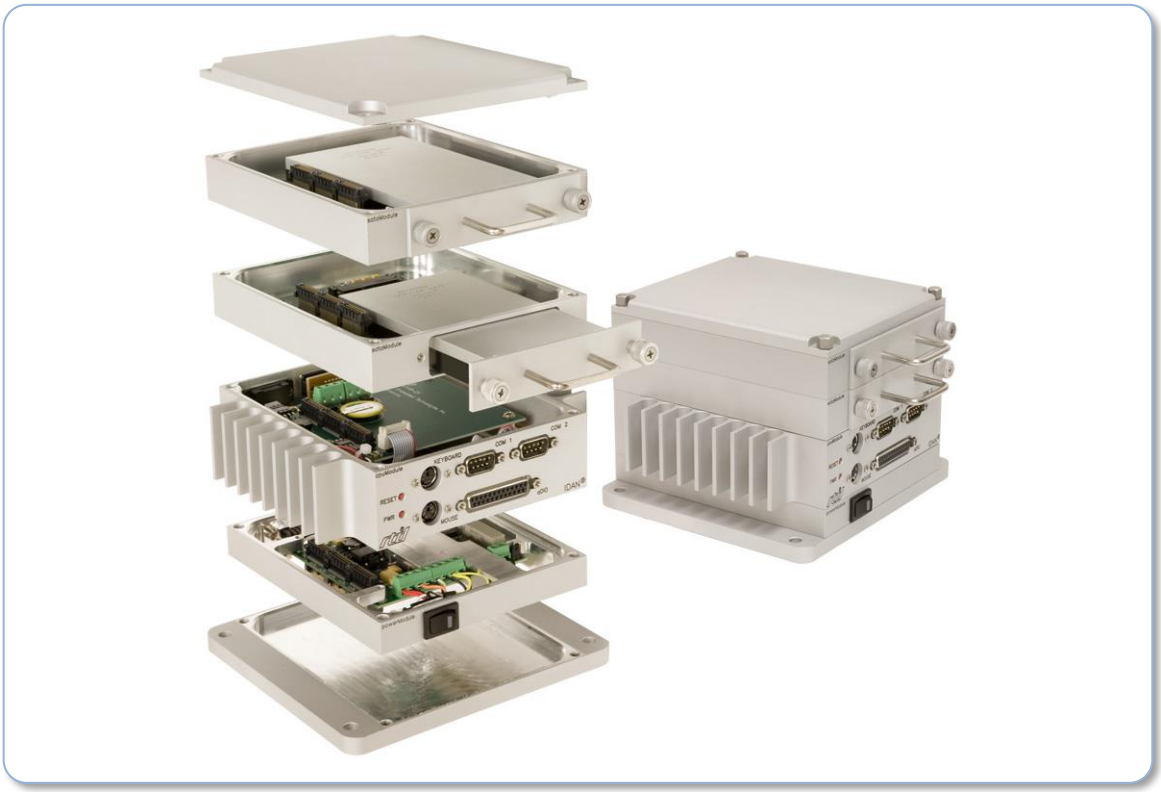


Figure 5: Example IDAN System

5 Functional Description

5.1 Block Diagram

The Figure below shows the functional block diagram of the GPS16162. The various parts of the block diagram are discussed in the following sections.

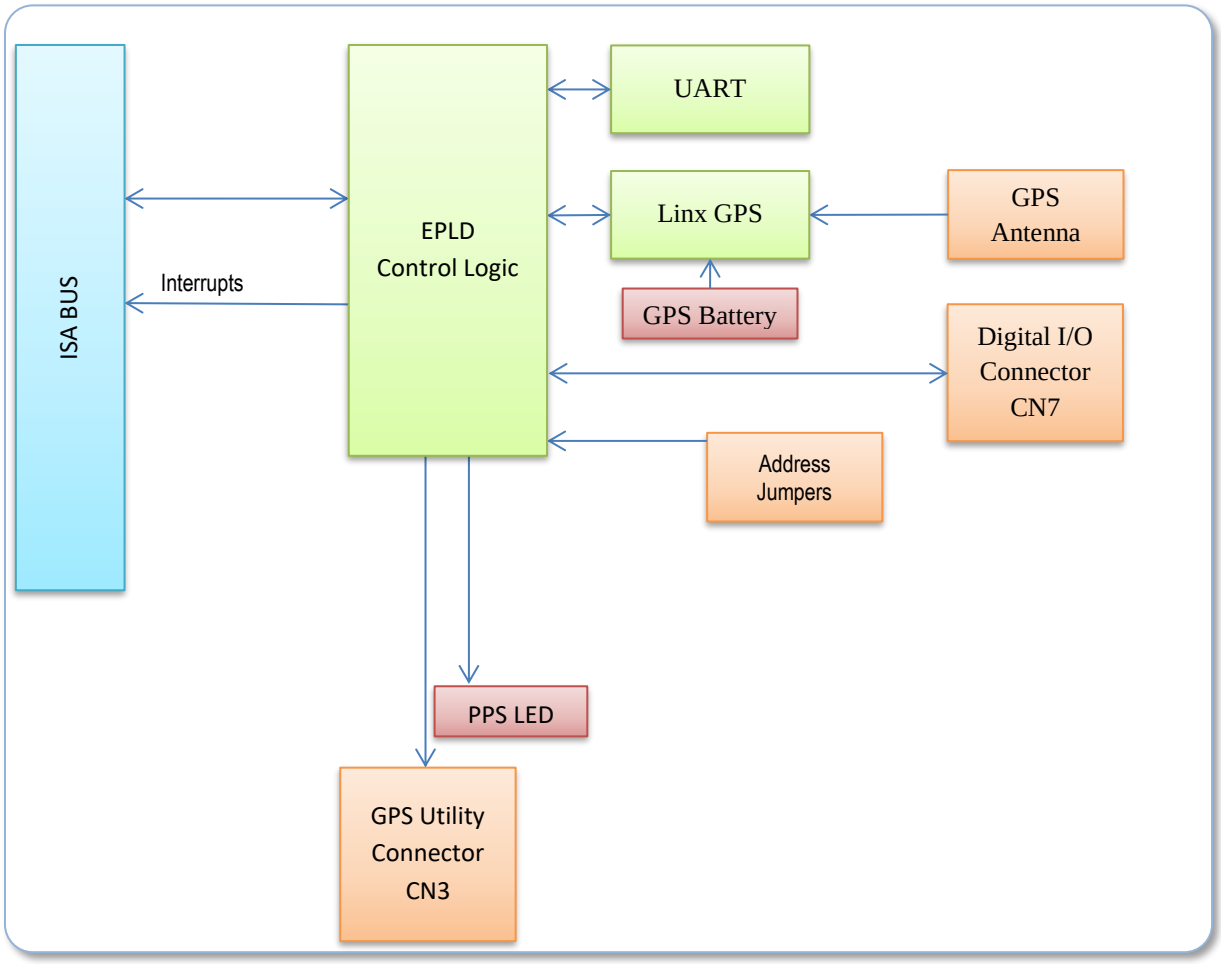


Figure 6: GPS1612 Block Diagram

5.1.1 LINX RXM-GNSS-TM GPS RECEIVER

Integrated on the GPS16162 is a Linx RXM-GNSS-TX, a low power fast-fix 33-channel GPS receiver. This GPS receiver is especially designed for portable and mobile applications. The Linx RXM-GNSS-TM provides NMEA-0183 version 4.10 data and a 1 PPS signal.

A complete list of NMEA Messages and command messages is available from the manufacturer's website at www.linxtechnologies.com.

GPS module interface

The RXM-GNSS-TM GPS is connected to the host computer through a dedicated ISA serial port. The default configuration for the serial ports is:

- 9600 Baud
- 8 Data bits
- No parity
- 1 Stop bit
- No Flow Control

GPS Antenna

Most GPS antennas are "active" which means they have a low noise amplifier (LNA) built into the antenna that requires a power source for the GPS module. While the GPS16162 will work with a passive antenna, better performance will be achieved with an active antenna. The GPS35165 provides +3.3V/+5V for active GPS antennas.

GPS Battery

The GPS16162 supplies a battery for Linx RXM-GNSS-TX. This provides backup power that keeps SRAM memory and the RTC running when the boards is powered down. This enables the module to have a faster Time To First Fix when it is powered on. This also allow the module to remember the configuration settings when powered down.

COCOM Limits

The GPS module can operate at altitudes up to 50,000m, but tracking is disabled when both altitude (18,000m) and speed (515 m/s) limits are exceeded. However, the module has an acquisition altitude limit of 10,000m. So, it cannot be powered on and acquire a position above 10,000m, but it will continue tracking if a position is acquired below 10,000m and then the module goes higher.

5.1.2 DIGITAL I/O

The GPS16162 has 16 bit-programmable digital I/O bits. RTD's driver software exports functions to use the digital I/O and the operation is covered in Digital I/O on 24. JP4 controls a 10K Ohm pull up/down on DIO bits 1-8 and JP5 controls a 10K Ohm pull up/down on DIO bits 9 - 16.

5.1.3 INTERRUPTS

The GPS16162 uses one ISA interrupt for the GPS UART and another for the 1 PPS. However, it will not actually generate interrupts unless the Interrupt Enable register has been properly programmed.

Since the GPS16162 has 16C550 UARTs, it supports all of the standard serial port interrupt events. These events include:

- Received data available
- Transmit buffer empty
- Line Status Register change
- Modem Status Register change

6 Register Address Space

6.1 General Board Control

The I/O map of the GPS16162 occupies a group of eight bytes of host PC I/O space. This window is freely selectable by the user by jumpers on the base address header. After setting the base address (GPS Base) you have access to the internal resources of the GPS16162 control logic.

Table 10: Register Map

ADDRESS (hex)	REGISTER	DIRECTION	COMMENTS
GPS BASE + 0	TXD	Read	Standard 16C550 UART Registers
	RXD	Write	
	BAUD div. Low	Read/Write	
GPS BASE + 1	BAUD div. Low	Read/Write	
	IRQ enable	Read/Write	
GPS BASE + 2	IRQ ID	Read/Write	
GPS BASE + 3	Line control	Read/Write	
GPS BASE + 4	Modem control	Read/Write	
GPS BASE + 5	Line status	Read	
GPS BASE + 6	Modem status	Read	
GPS BASE + 400h	Digital I/O	Read/Write	GPS6160 compatibility DIO
GPS BASE + 401h	GPS Status	Read/Write	Configuration registers
GPS BASE + 402h	*Reserved*		
GPS BASE + 403h	*Reserved*		
GPS BASE + 404h	Digital I/O	Read/Write	Digital I/O bits 0-7
GPS BASE + 405h	Digital I/O	Read/Write	Digital I/O bits 8-15
GPS BASE + 406h	Digital I/O Direction	Read/Write	Digital I/O direction bits 0-7
GPS BASE + 407h	Digital I/O Direction	Read/Write	Digital I/O direction bits 8-15
GPS BASE + 800h	RTD ID Data	Read	Read next RTD ID Character
GPS BASE + 801h	RTD ID Data	Read	Read next RTD ID Character
GPS BASE + 802h	Reset RTD ID	Read	Reset RTD ID counter

6.1.1 UART I/O (GPS BASE + 0 TO GPS BASE + 7)

These are the UART registers for the GPS module. These resources are not described in detail, since they are mapped as a standard PC serial port. For more details on the EXAR 16C550 UART chip programming please download the component specific data from the website: http://www.exar.com.

6.1.2 GPS STATUS (GPS BASE + 401H)

Table 11: GPS STATUS (GPS BASE + 401h)
Default: 0x00

BIT	FUNCTION	DIRECTION	COMMENTS
Bit 0	*Reserved*		
Bit 1	*Reserved*		
Bit 2	*Reserved*		
Bit 3	/EN_INT	Read/Write	0 = GPS interrupts enabled 1 = Disabled
Bit 4	*Reserved*		
Bit 5	*Reserved*		
Bit 6	1PPS/DIO 0	Read/Write	0 = DIO 0 1 = 1PPS
Bit 7	1 PPS	Read	1 PPS from GPS

Note: To output 1 PPS out DIO0, DIO0 direction needs set to an output.

6.1.3 DIGITAL I/O

GPS16162 allows bit programmable direction for all digital I/O bits. GPS6160 compatibility is described later. Note the digital I/O registers are accessed at 404h – 407h above the GPS COM port. These addresses are used to interface to the digital I/O port. The 16 bits each have a direction bit. If the direction bit is set to output, a value written to the data bit is provided on the connector. A read will result in the value on the connector pin (i.e. the output value). If the direction is set to input, a value written to the data bit is ignored and a read will result in the value on the connector pin.

Table 12: Digital I/O Data (GPS BASE + 404h)
Default: 0x00

BIT	FUNCTION	DIRECTION
Bit 0	DIO0	CN8 Pin 2
Bit 1	DIO1	CN8 Pin 3
Bit 2	DIO2	CN8 Pin 4
Bit 3	DIO3	CN8 Pin 5
Bit 4	DIO4	CN8 Pin 6
Bit 5	DIO5	CN8 Pin 7
Bit 6	DIO6	CN8 Pin 8
Bit 7	DIO7	CN8 Pin 9

Table 13: Digital I/O Data (GPS BASE + 405h)
Default: 0x00

BIT	FUNCTION	DIRECTION
Bit 0	DIO8	CN8 Pin 12
Bit 1	DIO9	CN8 Pin 13
Bit 2	DIO10	CN8 Pin 14
Bit 3	DIO11	CN8 Pin 15
Bit 4	DIO12	CN8 Pin 16
Bit 5	DIO13	CN8 Pin 17
Bit 6	DIO14	CN8 Pin 18
Bit 7	DIO15	CN8 Pin 19

Table 14: Digital I/O Direction (GPS BASE + 406h)
Default: 0xFF

BIT	FUNCTION	DIRECTION
Bit 0	DIO0	0 = INPUT 1 = OUTPUT
Bit 1	DIO1	0 = INPUT 1 = OUTPUT
Bit 2	DIO2	0 = INPUT 1 = OUTPUT
Bit 3	DIO3	0 = INPUT 1 = OUTPUT
Bit 4	DIO4	0 = INPUT 1 = OUTPUT
Bit 5	DIO5	0 = INPUT 1 = OUTPUT
Bit 6	DIO6	0 = INPUT 1 = OUTPUT
Bit 7	DIO7	0 = INPUT 1 = OUTPUT

Table 15: Digital I/O Direction (GPS BASE + 407h)
Default: 0x00

BIT	FUNCTION	DIRECTION
Bit 0	DIO8	0 = INPUT 1 = OUTPUT
Bit 1	DIO9	0 = INPUT 1 = OUTPUT
Bit 2	DIO10	0 = INPUT 1 = OUTPUT
Bit 3	DIO11	0 = INPUT 1 = OUTPUT
Bit 4	DIO12	0 = INPUT 1 = OUTPUT
Bit 5	DIO13	0 = INPUT 1 = OUTPUT
Bit 6	DIO14	0 = INPUT 1 = OUTPUT
Bit 7	DIO15	0 = INPUT 1 = OUTPUT

6.1.4 RTD ISA ID

RTD ID is a method to identify a board on the ISA bus. There are two 8-bit registers mapped at **BA + 800h** and **BA + 801h**. The registers can be read as two 8-bit or one 16-bit. An internal pointer is auto-incremented with every read to either address so the data read will step through each index as indicated below. The pointer is set to zero at reset and can be reset to zero by a read to **BA + 802h**.

Table 16: RTD ID DATA READ Indexes

Index	Data	8-Bit Read	16-Bit Read
0	Device ID	62h	6162h
1	Device ID	61h	—
2	RTD Vendor ID	35h	1435h
3	RTD Vendor ID	14h	—
4	EPLD Revision	Revision LSD	Revision
5	EPLD Revision	Revision MSD	—
6–9	Reserved	Ignore	Ignore
10	Board Name String	G	GP
11	Board Name String	P	—
12	Board Name String	S	S1

Table 16: RTD ID DATA READ Indexes

Index	Data	8-Bit Read	16-Bit Read
13	Board Name String	1	—
14	Board Name String	6	61
15	Board Name String	1	—
16		6	62
17		2	—
18	Board Name String	<nul>	<nul><nul>
19	Board Name String	<nul>	—
20–255	Unused	FFh	FFFFh

6.2 GPS6160 Compatibility

This register is intended only for GPS6160 compatibility. This address is used to interface to the digital I/O port of the GPS16162. Writing to this address will transfer the data to the output port, while reading from this address will return the data from the digital inputs. This register is compatible with the GPS6160 module. Note the default direction of the 16 digital I/O bits is bits 0 - 7 are outputs and 8 - 15 are inputs. Note: If you change the direction registers from the default, then this register will not operate properly.

Table 17: Digital I/O Data (GPS BASE + 400h) Write

BIT	FUNCTION	DIRECTION
Bit 0	Output 0	CN8 Pin 2
Bit 1	Output 1	CN8 Pin 3
Bit 2	Output 2	CN8 Pin 4
Bit 3	Output 3	CN8 Pin 5
Bit 4	Output 4	CN8 Pin 6
Bit 5	Output 5	CN8 Pin 7
Bit 6	Output 6	CN8 Pin 8
Bit 7	Output 7	CN8 Pin 9

Table 18: Digital I/O Data (GPS BASE + 400h) Read

BIT	FUNCTION	DIRECTION
Bit 0	Input 0	CN8 Pin 12
Bit 1	Input 1	CN8 Pin 13
Bit 2	Input 2	CN8 Pin 14
Bit 3	Input 3	CN8 Pin 15
Bit 4	Input 4	CN8 Pin 16
Bit 5	Input 5	CN8 Pin 17
Bit 6	Input 6	CN8 Pin 18
Bit 7	Input 7	CN8 Pin 19

7 Troubleshooting

If you are having problems with your system, please try the following initial steps:

- **Simplify the System** – Remove modules one at a time from your system to see if there is a specific module that is causing a problem. Perform you troubleshooting with the least number of modules in the system possible.

- **Swap Components** – Try replacing parts in the system one at a time with similar parts to determine if a part is faulty or if a type of part is configured incorrectly.

If problems persist, or you have questions about configuring this product, contact RTD Embedded Technologies via the following methods:

Phone: +1-814-234-8087
E-Mail: techsupport@rtd.com

Be sure to check the RTD web site (http://www.rtd.com) frequently for product updates, including newer versions of the board manual and application software.

7.1 Common Problems and Solutions

Table 19 lists some of the common problems you may encounter while using your GPS16162 and suggests possible solutions.

If you are having problems with your GPS module, review this table before contacting RTD Technical Support.

Table 19: Troubleshooting

Problem	Possible Cause
Erratic mouse cursor behavior under Windows	The GPS16162 may have been detected as a serial mouse. Refer to Microsoft Knowledge Base Article 283063 for more information.

8 Additional Information

8.1 PC/104 Specifications

A copy of the latest PC/104 specifications can be found on the webpage for the PC/104 Embedded Consortium:

www.pc104.org

8.2 Linx RXM-GNSS-TM

For a downloadable datasheet of RXM-GNSS-TM visit Linx's webpage:

www.linxtechnologies.com

9 Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, Inc. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for a Return Material Authorization (RMA) number.

This limited warranty does not extend to any products which have been damaged as a result of accident, misuse, abuse (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, “acts of God” or other contingencies beyond the control of RTD Embedded Technologies), or as a result of service or modification by anyone other than RTD Embedded Technologies. Except as expressly set forth above, no other warranties are expressed or implied, including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose, and RTD Embedded Technologies expressly disclaims all warranties not stated herein. All implied warranties, including implied warranties for merchantability and fitness for a particular purpose, are limited to the duration of this warranty. In the event the product is not free from defects as warranted above, the purchaser's sole remedy shall be repair or replacement as provided above. Under no circumstances will RTD Embedded Technologies be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use the product.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

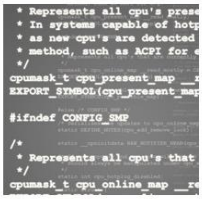
This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

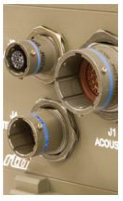
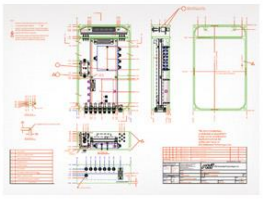
RTD Embedded Technologies, Inc.
103 Innovation Boulevard
State College, PA 16803 USA
Telephone: 814-234-8087
Fax: 814-234-5218

www.rtd.com

sales@rtd.com
techsupport@rtd.com






Copyright 2017 by RTD Embedded Technologies, Inc. All rights reserved.

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP