Trimble GeoExplorer Series GPS Receivers

Components

The Trimble GeoExplorer GPS receivers are shipped by DCL with the following components:

- GPS Receiver
- Antenna
- Data/Power Cable
- Serial Clip
- Support Module
- USB Cable
- GPS 12V Vehicle Power Adapter

RS-232 Extension Cable

Installation

The Trimble GeoExplorer Series Guide should be referred to for more details for the steps outlined below.

- Attach the Serial Clip

- Connect to External Power Source by connecting the supplied vehicle power adapter to the power port on the serial clip and connecting to the cigarette lighter socket on the ROMDAS Power Distribution Box.
- Connect to the Laptop. If you are using the serial connection instead of Bluetooth to connect the GEO Explorer to the Notebook computer the supplied Null Modem cable should be connected from the serial (COM) port on the serial clip to the serial port of the ROMDAS Notebook.

The supplied external antenna should be connected to the It is common to run the antenna through an open window, although it is better to drill a small hole in the vehicle and pass the cable through the hole. This will minimise the potential for damage to the cable.

Setting up the Receiver

The GeoExplorer series receivers can be connected to the ROMDAS computer by either

- Serial cable via the Trimble Serial Clip
- Bluetooth if the GPS Unit[1] and Notebook computer are both Bluetooth enabled.

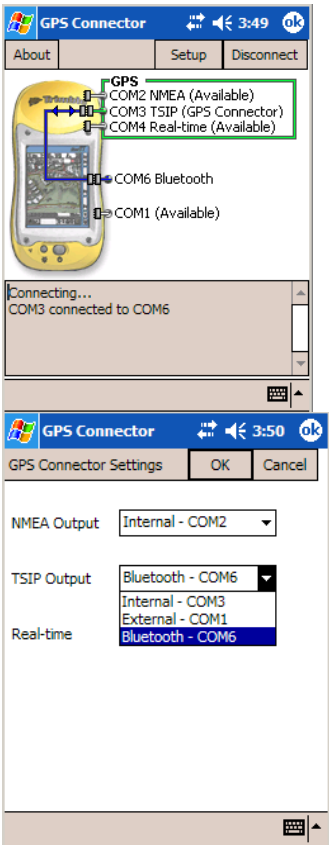
[1] The GPS receiver is shipped with the integrated Blue tooth radio deactivated. You may only activate the Bluetooth radio if GeoExplorer series GPS units have been granted Bluetooth approval in the country where the unit will be used. For more information visit the Trimble website at www.trimble.com/geo_bluetooth.html

Both of the above methods will require the setting up of the GPS Connecter Software (which is pre-installed on all GeoExplorer series units) to redirect the internal comports to the external device.

To open GPS Connecter , tap

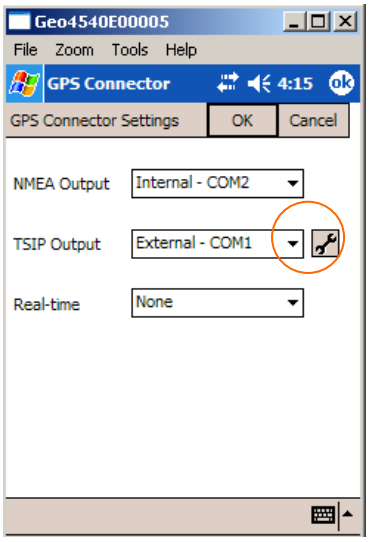
| Settings | Connections |GPS Connector

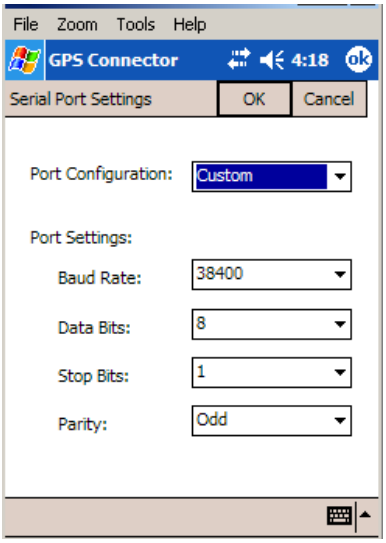
The Internal Com3 TSIP output port needs to be redirected to either the external Com 1 port on the Serial Clip or to the Bluetooth virtual serial port.



The Bluetooth serial port will need to be configured before trying to connect to the port. Please refer to the GeoExplorer manual for details on enabling and setting up a Bluetooth connection.

When selecting the external Comport the setup menu needs to be selected. The **Port Configuration** needs to be set to Custom and the **Port Settings** set to 34800,8,1,O





Trimble PRO XR/XRS GPS Receiver

Components

The Trimble PRO XR/XRS Pathfinder GPS receivers contain the following components:

- GPS Receiver
- Antenna
- Data/Power Cable
- GPS 12V Power Supply
- RS-232 Extension Cable

Installation

- Connect the antenna to the receiver on the BNC connector
- Connect the Laptop RS-232 plug to the Data Receiver (DB9 plug) on the data / power cable (Trimble Part no. 30231-00) which should be attached to Port B on the GPS receiver. The yellow TSC1 Data logger does not need to be used when using ROMDAS in TSIP mode.

The receiver needs to be positioned so that the antenna can have a clear view of the sky. It is common to run the antenna through an open window, although it is better to drill a small hole in the vehicle and pass the cable through the hole. This will minimise the potential for damage to the cable.

Once the cable has been positioned, the double-sided Velcro should be affixed to the GPS receiver and the vehicle to keep the receiver out of the way. Ideally, the status lights should be in view.

Setting up the Receiver

The receiver may need to be configured before first use with either

- The TSC1 Data logger
- Or the Trimble Pathfinder Controller software

Connected to Port B of GPS receiver.

To configure with Trimble TSC1

data logger. When the TSC1 software is started the screen to the right is shown. It is necessary to set the communications port to the appropriate value given the connections for the computer. The default is COM1.

For use with ROMDAS select:

Configuration|Com Options

The **Protocols** should be set to **TSIP**. This enables the data to be logged using the ROMDAS TSIP option allowing direct control of the receiver from the ROMDAS software.

Trimble Pocket Pathfinder GPS Receiver[2]

Components

The Trimble Pocket Pathfinder (PF) GPS receiver contains the following components:

- GPS Receiver
- Aerial
- Communications and Power Cable[3]
- GPS 12V Power Supply
- RS-232 Extension Cable
- Adhesive Velcro
- PathFinder Pocket Reference Manual

Installation

- Connect the aerial to the receiver
- Connect the **GREY** RS-232 plug to the RS-232 socket on the receiver. This plug is labelled GPS and has the black power plug coming from it. **UNDER NO CIRCUMSTANCES CAN THIS END OF THE CABLE BE CONNECTED TO THE COMPUTER. THE COMPUTER WILL BE DAMAGED**.

[2] See DCL report on Accuracy of Trimble Pocket Pathfinder GPS Receiver
[3] Cable pin connections

- Connect the power plug to the GPS power box socket
- Connect the 12 v cigarette lighter on the power box to a 12 v supply.

Example of Installation of Receiver and Connection of GPS Cable

The receiver needs to be positioned so that the aerial can have a clear view of the sky. It is common to run the antenna through an open window, although it is better to drill a small hole in the vehicle and pass the cable through the hole. This will minimise the potential for damage to the cable.

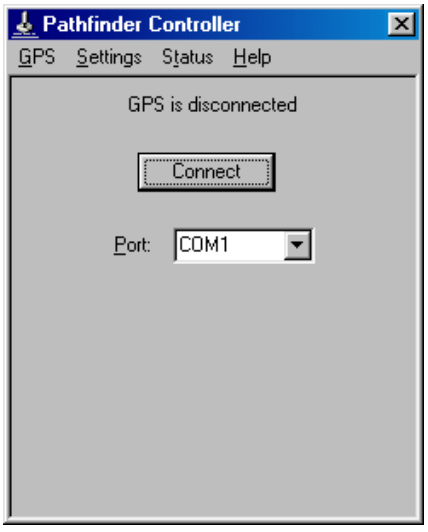
Once the cable has been positioned, the double sided velcro should be affixed to the GPS receiver and the vehicle to keep the receiver out of the way. Ideally, the light should be in view.

The RS-232 cable should be connected to the computer, using the extension cable if necessary.

Setting up the Receiver

The PathFinder Pocket can be configured and tested using the GPS PathFinder Controller software. It can be found on the ROMDAS CD under[4]:

Software Extras|GPS|Trimble PocketPathfinder Control



When the software is started the screen to the right is shown (v 1.3). It is necessary to set the communications port to the appropriate value given the connections for the computer. The default is COM1.

For use with ROMDAS select:

Settings|Port B Settings

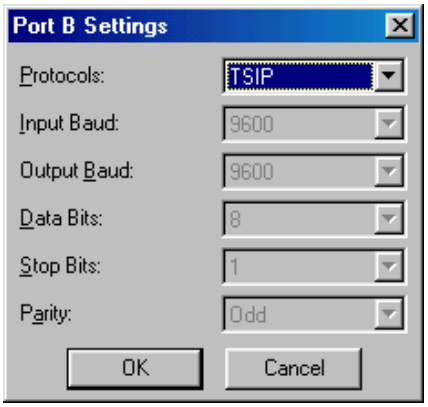
The **Protocols** should be set to **TSIP** (see bottom, right). This enables the data to be logged using the PF Tools option of ROMDAS.

The following options are available under the **Settings|GPS Settings** menu:

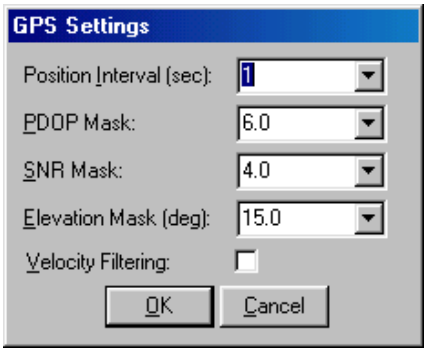
- **Position Interval:** Specifies the frequency at which positions are stored. This needs

[4] Updates are available from www.trimble.com/gis.

to be set equal to or less than the "GPS Data Sampling Frequency" setting in the ROMDAS GPS Setup menu. The default value of 1 should therefore not be changed except in exceptional circumstances.



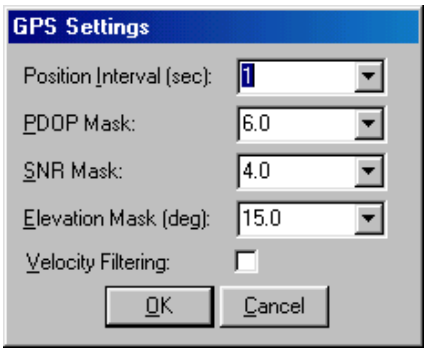
- **PDOP Mask:** Position Dilution of Precision (PDOP) is a measure of the satellite geometry. The lower the PDOP value, the more accurate the GPS positions. The PDOP mask is set to esure that only data of the required accuracy is collected. If the PDOP exceeds the configured mask the reciever stops logging positions. The recommended PDOP mask is 6.



Optional Settings

The **Settings** menu contains a number of additional options for setting up the Pocket Pathfinder. These should be modified with care.

The following options are available under the **Settings|GPS Settings** menu:



- **Position Interval:** Specifies the frequency at which positions are stored. This needs to be set equal to or less than the "GPS Data Sampling Frequency" setting in the ROMDAS GPS Setup menu. The default value of 1 should therefore not be changed except in exceptional circumstances.

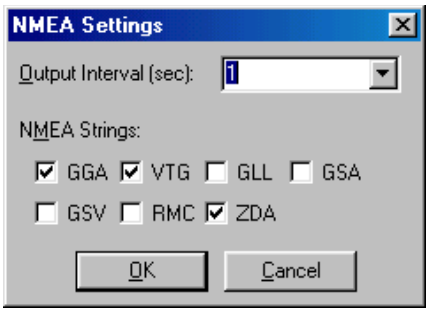
- **PDOP Mask:** Position Dilution of Precision (PDOP) is a measure of the satellite geometry. The lower the PDOP value, the more accurate the GPS positions. The PDOP mask is set to esure that only data of the required accuracy is collected. If the PDOP exceeds the configured mask the reciever stops logging positions. The recommended PDOP mask is 6.

- **SNR Mask:** Signal-to-Noise Ratio is a measure of the strength of the satellite signal relative to the background noise. Accuracy degrades as the signal strength decreases. You can configure the SNR mask on

your datalogger to log only GPS positions below a certain SNR value.

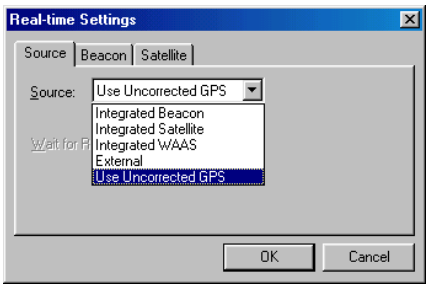
Note: PDOP and SNR act in opposite directions: greater accuracy is achieved with low PDOP and high SNR.

- **Elevation Mask:** This option is critical if you are wanting to differentially correct your data with a local base station. If it is set too low your reciever may use satillites which are are not visible to, or usable by , the base station, making it impossible to correct the data you have logged. If the elevation mask is set too high, it will unnecessarily reduce satellite availability. It should be set higher the further away you are from the base station.



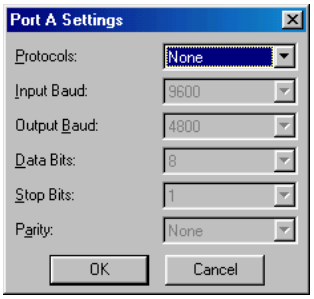
The following options are available under the **Settings|NMEA Settings** menu:

- **Output Interval (sec):** Specifies the frequency at which positions are stored. Needs to be set equal to or less than the "GPS Data Sampling Frequency" setting in the ROMDAS GPS Setup menu.
- **NMEA Sentences:** The Pocket Pathfinder can output the following NMEA strings:
  - GPGGA
  - GPGSA
  - GPVTG
  - GPRMC
  - GPZDA



The **Settings|Real-time Settings** are used for real-time differential corrections. When selected, the screen to the right is given which lists the real time correction options.

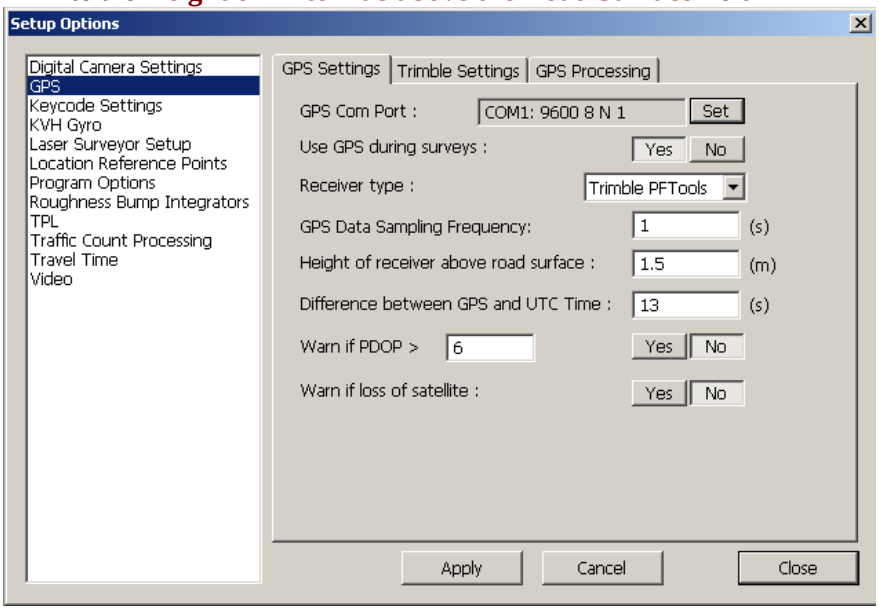
The **Settings|Port A** settings refer to the settings for the Real Time Differential correction port. These are only applicable if you have the optional Real Time source splitter cable and have set up for one of the Real Time options above.

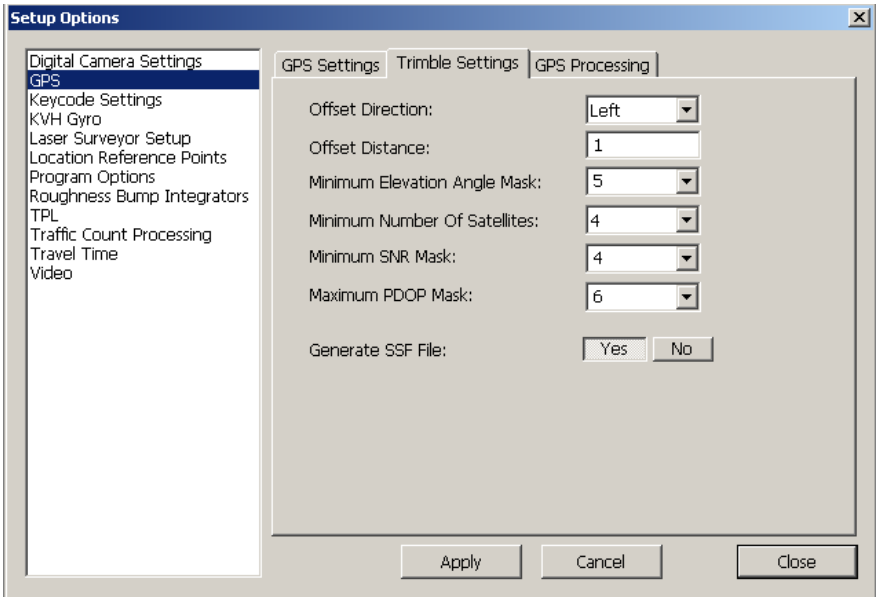


Setting up ROMDAS

- Select **Setup|Options|GPS Settings**
- Select the appropriate COM Port
- Set the Receiver Type to Trimble PFTools

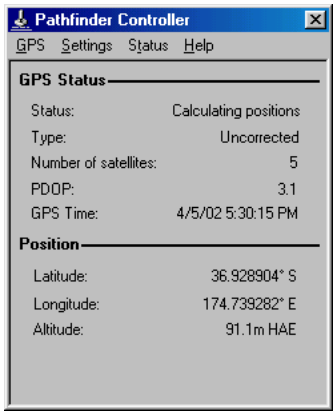
- Measure height of Antennae above the road surface and enter value into the **Height of Antennae above the Road Surface** field





Testing

The PathFinder Controller software can be used to test the GPS reciver by using the **GPS|Connect** option. The data to the right will be displayed.



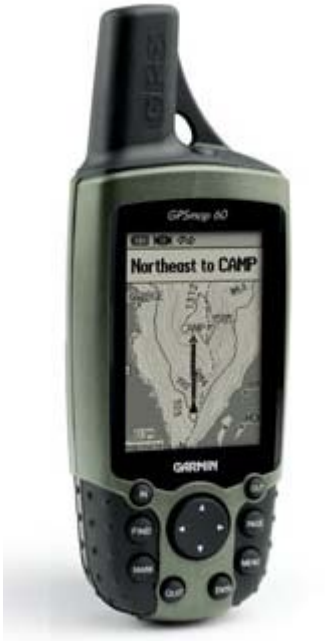
Please note if your reciever has not been used for a while or was last used in another part of the world it will not have the current almanac data and may take up to 30 mins until it can initialise and get a GPS fix.

GARMIN GPS MAP60 Receiver

Components

The GARMIN GPS MAP 60 receiver contains the following components:

- GPS Receiver
- External antenna GA 27 low profile antenna with 8' cable and magnetic/suction mount to attach to roof of ROMDAS vehicle - P/N 010-10052-03
- A combined Cigarette Lighter Adapter and PC interface cable to supply power in vehicle and interface to ROMDAS data collection computer RS232 port - P/N 010-10165-00



Installation

- Connect the antenna to the receiver
- Open the rubber plug at the rear of the receiver
- Connect the power and communications cable to the plug
- Connect the 12V cigarette lighter to the Power Distribution box.

The receiver needs to be positioned so that the antenna can have a clear view of the sky. There are two options for this:

- The GARMIN mounting kit can be used to hold the antenna against the inside of the window.
- Alternatively, run the antenna through an open window and use the magnetic mount to hold it on the roof. It is better to drill a small hole in the vehicle and pass the cable through the hole. This will minimise the potential for damage to the cable.

Once the cable has been positioned, the double-sided Velcro should be affixed to the GPS receiver and the vehicle to keep the receiver out of the way. Ideally, the screen should be in view. Alternatively, a custom car-mount kit is available to hold the receiver.

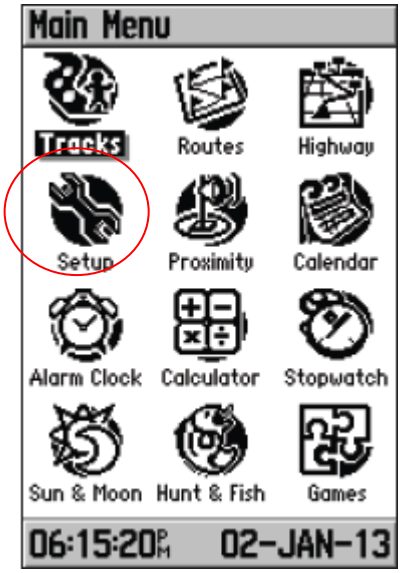
The RS-232 cable should be connected to the computer, using the extension cable if necessary.

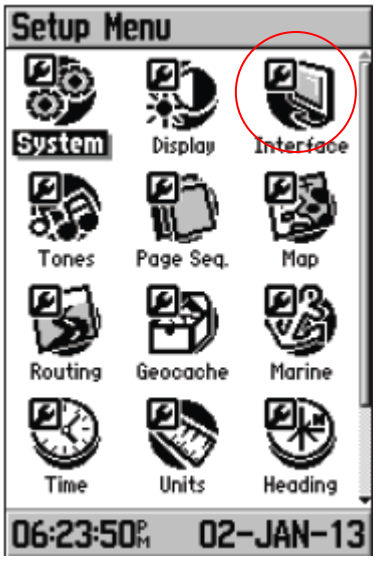
Setting up the Receiver

When you turn the GARMIN GPS receiver on a welcome page will appear for a few seconds while the unit conducts a self-test.

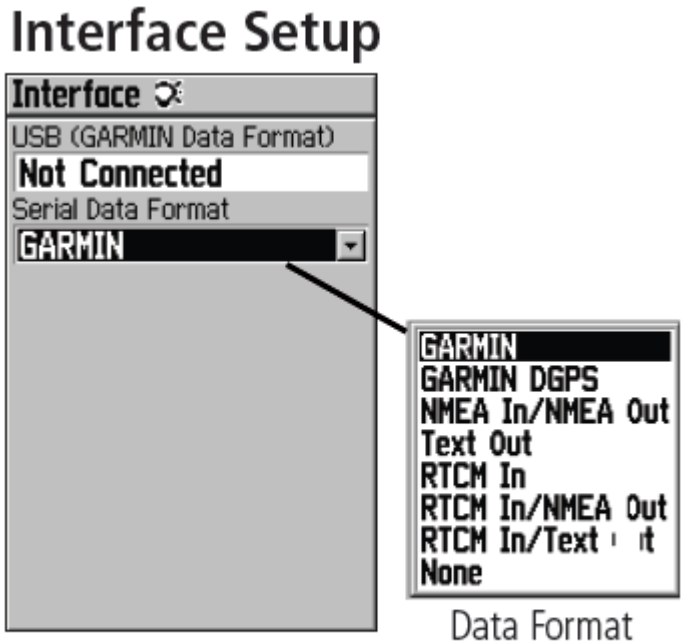
The only option that need to be set to get the GARMIN working with ROMDAS are in the **Interface** Menu on the **Setup Menu** Page

To set up for ROMDAS we need to select the **Main Menu** Page.





Using the up and down arrow keys and **Enter** key select **Setup Menu** and then **Interface**.

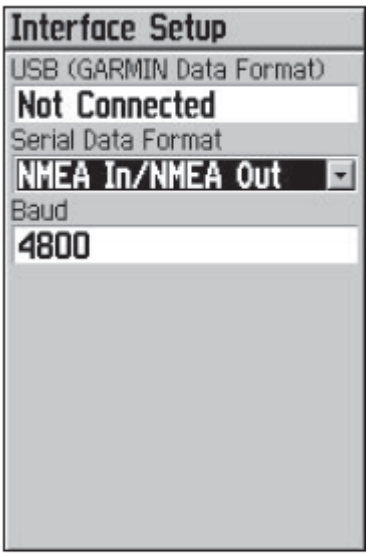


Interface Setup Page

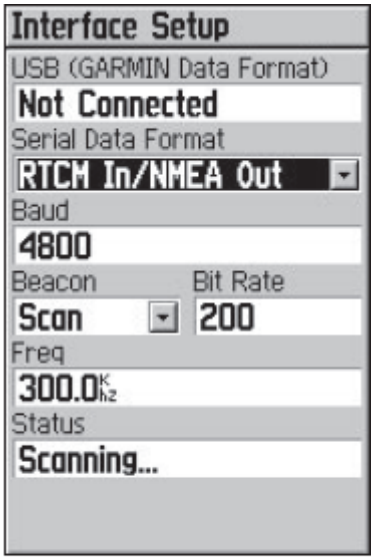
Data Format Options

The INTERFACE page lets you specify the Serial Data formats for connecting to external devices. There are eight options:

Any of the two options with **NMEA Out** as the output will work with ROMDAS.



Data Format Page for: NMEA In/NMEA Out



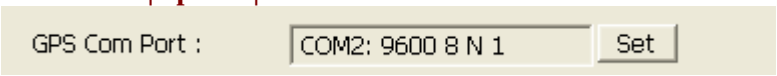
Data Format Page for RTCM In/NMEA Out

ROMDAS recognises any of the **NMEA 183 version** formats.

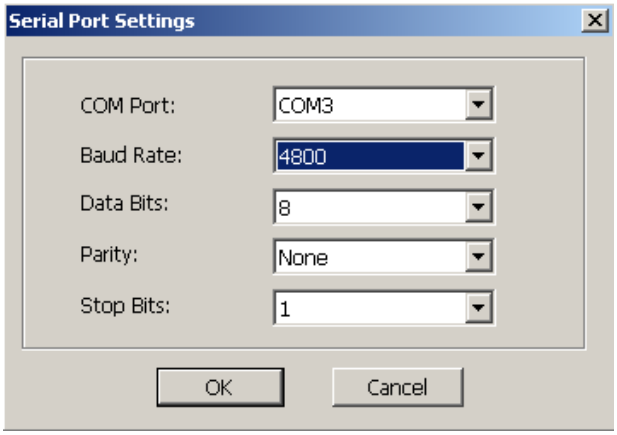
Setting up ROMDAS

The **baud rate** on the GARMIN defaults to 4800 while the ROMDAS default is 9600. All other COM port settings are not setable on the GARMIN and should remain at the defaults in ROMDAS.

- Select **Tools|Options|GPS**



- The **Set** button next to the **GPS Com Port** edit box will bring up the dialog below
- Check that the settings are as shown below (with COM Port set to the appropriate port)



Testing

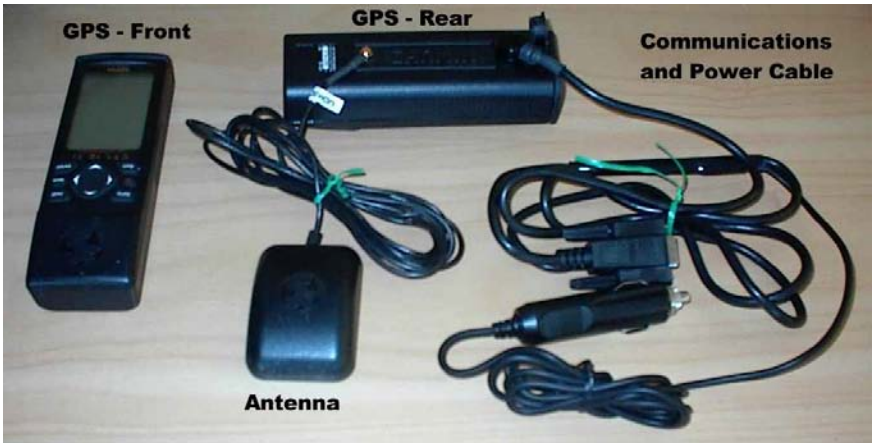
The unit should be tested as described in Section 3.14 of ROMDAS Manual.

GARMIN 12XL GPS Receiver

Components

The GARMIN 12XL GPS receiver contains the following components:

- GPS Receiver
- External antenna GA 27 low profile antenna with 8' cable and magnetic/suction mount to attach to roof of ROMDAS vehicle - P/N 010-10052-03
- A combined Cigarette Lighter Adapter and PC interface cable to supply power in vehicle and interface to ROMDAS data collection computer RS232 port - P/N 010-10165-00



Installation

- Connect the antenna to the receiver
- Open the rubber plug at the rear of the receiver
- Connect the power and communications cable to the plug
- Connect the 12V cigarette lighter on the power box to a 12V supply.

The receiver needs to be positioned so that the antenna can have a clear view of the sky. There are two options for this:

- The GARMIN mounting kit can be used to hold the antenna against the inside of the window.
- Alternatively, run the antenna through an open window and use the magnetic mount to hold it on the roof. It is better to drill a small hole in the vehicle and pass the cable through the hole. This will minimise the potential for damage to the cable.

Once the cable has been positioned, the double-sided Velcro should be affixed to the GPS receiver and the vehicle to keep the receiver out of the way. Ideally, the screen should be in view. Alternatively, a custom car-mount kit is available to hold the receiver (see to the right)

The RS-232 cable should be connected to the computer, using the extension cable if necessary.

Setting up the Receiver

When you turn the GARMIN GPS receiver on a welcome page will appear for a few seconds while the unit conducts a self-test, followed by various other of the five primary pages depending on satellite availability.

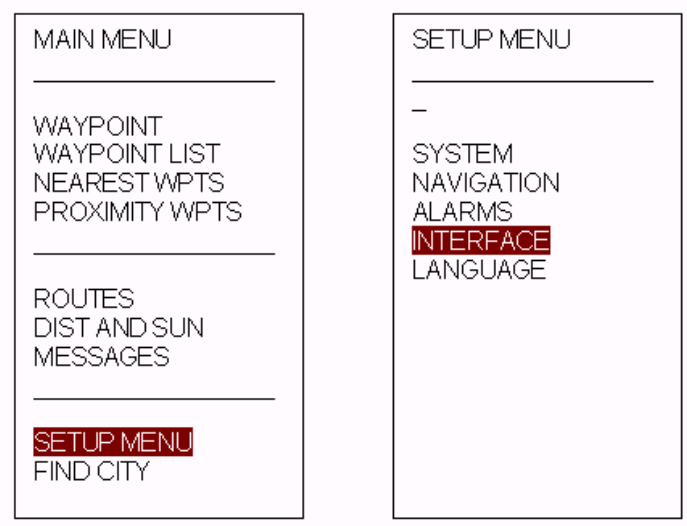
The output baud rate of the GARMIN needs to be set to match the ROMDAS GPS COM port baud rate setting in the ROMDAS Setup Options (see below).

The GARMIN's five primary pages are:

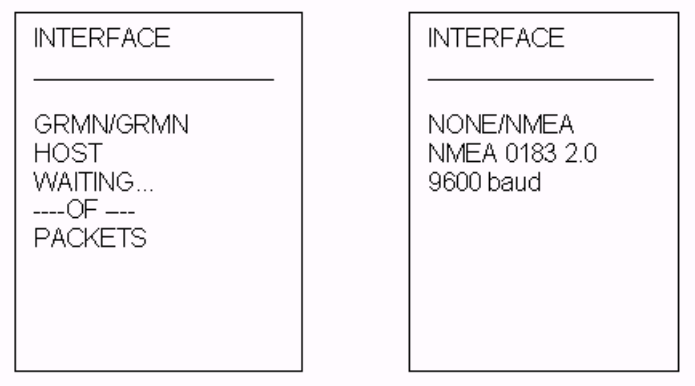
- Satellite Page
- Position Page
- Map Page
- Navigation Page
- Main Menu Page

You can scroll between these pages using either the **PAGE** or the **QUIT** keys.

To set up for ROMDAS we need to select the **Main Menu** Page.



Using the up and down arrow keys and **Enter** key select **Setup Menu** and then **Interface**.



The INTERFACE page lets you specify the formats for connecting to external devices. There are six options:

- GRMN / GRMN (default)
- None / None
- RTCM / None
- RTCM / NMEA
- NMEA / NMEA
- None / NMEA

Each option lists - **Input Option / Output Options**.

Any of the last three options with **NMEA** as the output will work with ROMDAS.

When one of the NMEA output options is selected you will then need to set the NMEA format The following NMEA formats are supported by the GARMIN 12XL:

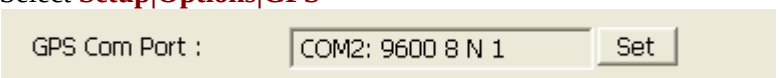
- NMEA 180
- NMEA 182
- NMEA 183 version 1.5
- NMEA 183 version 2.0

ROMDAS only recognises the **NMEA 183 version 2.0** format. The following NMEA 0183 version 2.0 sentences are output by the GARMIN 12XL: GPGGA, GPRMC, GPGSV, GPRMB, GPRMC, GPRTE, and GPWPL.

Setting up ROMDAS

The **baud rate** on the GARMIN defaults to 4800 while the ROMDAS default is 9600. All other COM port settings are not setable on the GARMIN and should remain at the defaults in ROMDAS.

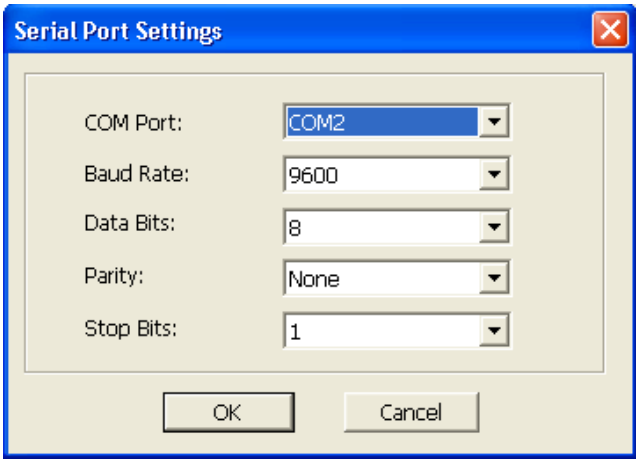
- Select **Setup|Options|GPS**



- The **Set** button next to the **GPS Com Port** edit box will bring up the

dialog below

- Check that the settings are as shown below



First Fix

If there has been memory loss or the receiver has been moved over 1000km with the power off the unit will typically take 3 –5 minutes to acquire its first position in Autolocate mode (the default). **YOU MUST BE STATIONARY FOR THIS TO WORK.** You can speed up this process by using the **Select Country from List** option from the **Initialisation Prompt**.

When the unit is turned on and the **WELCOME** page is replaced by the **SATELLITE** page, the **Initialisation Prompt** may automatically appear if the receiver needs initialization. If the **Initialisation Prompt** has not appeared from the **Satellite** page press the **Enter** key.

From the **Initialisation Prompt** choose **1. SELECT COUNTRY FROM LIST** and select the appropriate country.

If the **Initialisation Prompt** ever appears after you have initialized the receiver (due to the antenna's view of satellites being obstructed) select the **3. NO RE-INIT** option with the arrow keypad and press **ENTER**

Testing

The unit should be tested as described in Section 3.14.

KVH Heading Gyroscope

Components

The KVH heading gyroscope has the following components:

- Gyroscope
- Base Plate
- Communications Cable
- Mounting Screws
- Reference Manual

Installation

A suitable position needs to be found in the vehicle for the gyroscope. Since the gyroscope does not require any operator intervention once installed, it may be installed in an area with limited accessibility such as under a seat. The gyroscope output is proportional to temperature and therefore the gyroscope should be mounted in an area that has a relatively constant temperature. Therefore avoid areas of direct sunlight, heaters or air-condition outlets etc. The gyroscope should not be removed from the base plate provided as this acts as a heat sink unless it is bolted directly to a metal surface of at least 0.05 m^2.

The gyroscope should be mounted as parallel as possible to the normal horizontal axis of the vehicle *i.e.* as level as possible. It should be installed with the directional arrow pointing forward in the direction of travel. It should not be mounted within 300 mm of any strong magnetic field or in areas of high vibration.

Once a suitable position has been established the following is done:

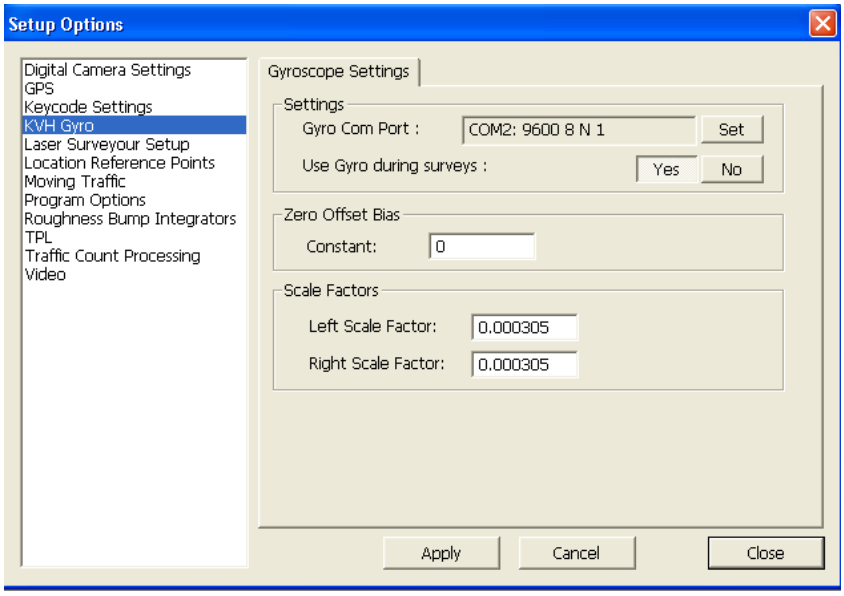
- Attach the gyroscope to the mounting plate
- Connect the gyroscope cable and tighten the two screws on the cable housing to the gyroscope
- Position the mounting plate as described above
- Ensure that the arrow adjacent to the cable connection is pointing to the front of the vehicle
- Mark the position of the four corner holes in the mounting plate on

the vehicle floor

- Remove the mounting plate and gyroscope
- Drill holes in the vehicle corresponding to the corner holes
- Install the mounting plate and gyroscope
- Run the gyroscope cable to the data collection computer

Setting Up the Gyroscope

- Select **Setup|Options|Heading Gyroscope|Gyrocope Settings**
- Enter the Gyroscope COM port number
- Confirm the settings are for 9600 8 N 1
- Set the **Use Gyro Positioning Instrument in Surveys** to **Yes**. You will need to enter the password if this is the first time activated and the software is not in Testmode.



When any gyroscope is stationary there will be a bias drift which is a function of temperature. At a fixed temperature it can be in the range of 2 to 4 degrees/h. The calibration consists of establishing a bias correction factor for this drift.

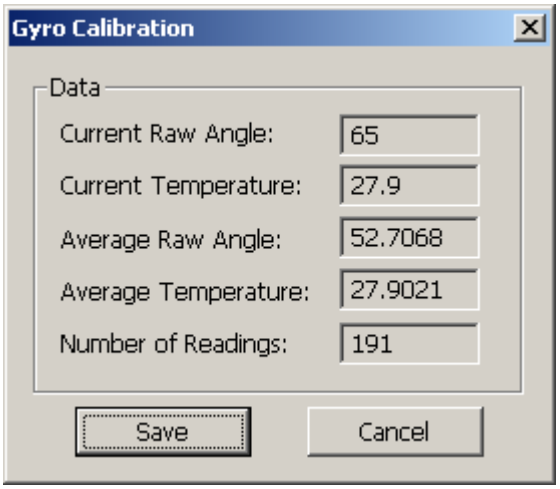
- Ensure that the gyroscope is at the typical operating temperature for the survey vehicle. It should powered up for at least 5 minutes to stabilize the temperature
- Select **Setup|Calibrate|Calibrate Gyroscope|Gyro Autobias**
- With the gyroscope stationary, run an autobias test for 30 seconds

Record the bias correction factor and the temperature

The 'Test Gyroscope' option is used to test the gyroscope.

- Ensure that the vehicle is stationary and on a level surface
- Connect the power to the gyroscope and the gyroscope to the data logging computer
- Select **Setup|Test Instruments|Test Gyroscope**
- Select **Start** to commence the gyroscope test.

The display will be as shown below. With the gyroscope motionless, the rate should be < 0.2 degrees/second and the angle < 0.5 degrees. If either of these criteria are not met, run the gyroscope autobias calibration as described above.

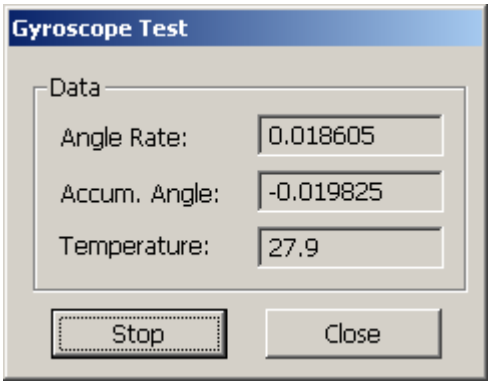


Testing the Gyroscope

Once the calibration is done the gyroscope should be tested.

- Ensure that the vehicle is stationary and on a level surface
- Connect the power to the gyroscope and the gyroscope to the data logging computer
- Select **Setup|Test Instruments|Test Gyroscope**
- Select **Start** to commence the gyroscope test.

The display will be as shown below. With the gyroscope motionless, the rate should be < 0.2 degrees/second and the angle < 0.5 degrees. If either of these criteria are not met, run the gyroscope autobias calibration as described above.



1.1 Installing the Gyroscope

Instructions

Detailed instructions on installing the gyroscope are given in Appendix F

Components

The gyroscope data are used to estimate the GPS co-ordinates of the vehicle when there is a loss of satellite lock. The gyroscope outputs the heading change (in degrees) and this is used with a Kalman filtering approach to establish the position.

The following components are supplied with the gyroscope:

- Gyroscope
- Gyroscope cable
- Mounting plate
- 4 x self-tapping screws for mounting plate to vehicle
- 4 x screws and washers for gyroscope to mounting plate

Positioning the Gyroscope

The following should be considered when positioning the gyroscope:

- It must be mounted at least 300 mm away from any magnetic source—the further the better
- It must be mounted as parallel as possible to the normal horizontal axis of the vehicle
- It must not be exposed to direct sunlight
- It must be kept dry

It is recommended that it be mounted in either the boot (trunk) of the vehicle or under a seat.

The gyroscope's internal circuitry generates a nominal amount of heat that must be conducted away to maintain an operating temperature within specified levels. The base plate of the gyro should be in full contact with a metal surface of at least 0.043 m^2. The supplied mounting plate meets these criteria.

Installing the Gyroscope

Once a suitable position has been established the following is done:

- Attach the gyroscope to the mounting plate
- Connect the gyroscope cable
- Position the mounting plate as described above
- Ensure that the arrow adjacent to the cable connection is pointing to the front of the vehicle. It **must** be within 5 degrees of the direction of travel
- Mark the position of the four corner holes in the mounting plate
- Remove the mounting plate and gyroscope

- Drill holes in the vehicle corresponding to the corner holes
- Install the mounting plate and gyroscope
- Run the gyroscope cable to the data collection computer

1.2 Gyroscope Calibration

Frequency

Before every survey or when the gyroscope has been installed/re-installed in a vehicle.

Equipment Required

The gyroscope should be installed in the survey vehicle.

Calibration

When any gyroscope is stationary there will be a bias drift which is a function of temperature. At a fixed temperature it can be in the range of 2 – 4 degrees/h. The calibration consists of establishing a bias correction factor for this drift.

- Ensure that the gyroscope is at the typical operating temperature for the survey vehicle.
- Select **Calibrate|Calibrate Gyroscope|Gyro Autobias**
- With the gyroscope stationary, run an autobias test for 30 seconds
- Record the bias correction factor

Test Gyroscope

The 'Test Gyroscope' option is used to test the ROMDAS GPS gyroscope that is used for heading corrections when there is loss of satellite lock.

- Place the gyroscope on a level surface
- Connect the power to the gyroscope and the gyroscope to the data logging computer
- Start the gyro test.

The display will be as shown below. With the gyroscope motionless, the Angle Rate should be < 0.2 degrees/second. If not, run a bias correction test as described in Section 5.6.