

GBR 23

beacon receiver

owner's
manual
and
reference
guide



GARMIN International, Inc.

1200 East 151st Street, Olathe, Kansas 66062, U.S.A.

Tel. 913/397.8200 or 800/800.1020

Fax 913/397.8282

GARMIN (Europe) Ltd.

Unit 5, The Quadrangle, Abbey Park Industrial Estate, Romsey, SO51 9AQ, U.K.

Tel. 44/1794.519944

Fax 44/1794.519222

GARMIN (Asia) Corporation

No. 68, Jangshu 2nd Rd., Shijr, Taipei County, Taiwan

Tel. 886/02.2642.8999

Fax 886/02.2642.9099

All rights reserved. Except as expressly provided herein, no part of this manual may be reproduced, copied, transmitted, disseminated, downloaded or stored in any storage medium, for any purpose without prior written consent of GARMIN Corporation. GARMIN Corporation hereby grants permission to download a single copy of this manual onto a hard drive or other electronic storage medium to be viewed for personal use, provided that such electronic or printed copy of this manual contains the complete text of this copyright notice and provided further that any unauthorized commercial distribution of this manual is strictly prohibited.

Information in this manual is subject to change without notice. GARMIN Corporation reserves the right to change or improve its products and to make changes in the content without obligation to notify any person or organization of such changes. Visit the GARMIN website for current updates and supplemental information concerning the use and operation of this and other GARMIN products.

Website address: www.garmin.com

GARMIN and GBR 23 are registered trademarks of GARMIN Corporation and may not be used without the express permission of GARMIN Corporation.

GARMIN Corporation warrants this product to be free from defects in materials and manufacture for one year from the date of purchase. GARMIN will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor. The customer is, however, responsible for any transportation costs. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL GARMIN BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

To obtain warranty service, contact your GARMIN dealer or call the GARMIN Customer Service department (913-397-8200) for a returned merchandise tracking number. The unit should be securely packaged with the tracking number clearly marked on the outside of the package and sent freight prepaid and insured to a GARMIN warranty service station. A copy of the original sales receipt is required as the proof of purchase for warranty repairs. GARMIN retains the exclusive right to repair or replace the unit or software or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

Limited Warranty



The GARMIN GBR 23 has no user-serviceable parts. Should you ever encounter a problem with your receiver, please contact your GARMIN dealer or the GARMIN Customer Service department (913-397-8200 or 800-800-1020) for repairs. Any attempt to open the case to change or modify the unit in any way will void your warranty and may result in permanent damage to the equipment.

Cautions

All differential beacon receivers decode correction data determined at the beacon transmitter site via a GPS receiver(s). The GPS system is operated by the government of the United States which is solely responsible for their accuracy and maintenance. The DGPS beacon transmitters are operated by the U.S. Coast Guard (or similar government agency in other countries) which is responsible for their accuracy and maintenance. The Global Positioning System and the Differential Global Positioning System are under development and are subject to changes which could affect accuracy and performance of all DGPS equipment. Although a DGPS system is a precision electronic NAVigation AID (NAVAID), any NAVAID can be misused or misinterpreted, and therefore become unsafe. Use the DGPS system at your own risk. To reduce this risk, carefully review and understand all aspects of this Owner's Manual and carefully compare indications from your GPS receiver to all available navigation sources including the information from other NAVAIDs, visual sightings, charts, etc. For safety, always resolve any discrepancies before continuing navigation.

NOTE: This device complies with Part 15 of the FCC rules. Operation of this device is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Table of Contents

Introduction

Limited Warranty.....1
Cautions2
Table of Contents3
Product Registration4

Overview

Capabilities & Package Contents.....5

Installation

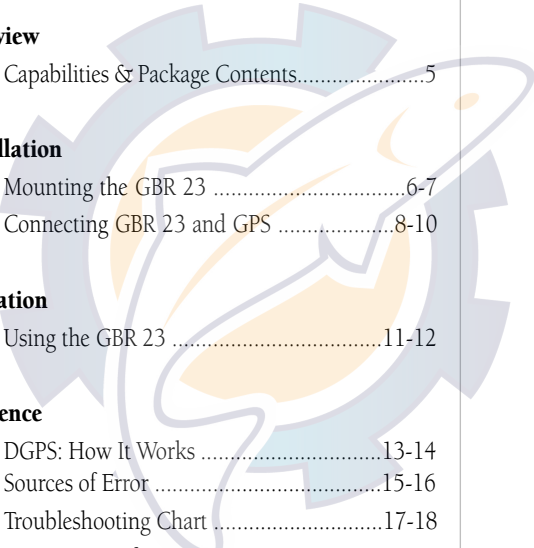
Mounting the GBR 236-7
Connecting GBR 23 and GPS8-10

Operation

Using the GBR 2311-12

Reference

DGPS: How It Works13-14
Sources of Error15-16
Troubleshooting Chart17-18
GBR 23 Specifications19
Index20



Product Registration

Customer Service Product Registration

Help us better support you by completing our on-line registration today! Have the serial number of your GBR 23 handy and connect to our website (www.garmin.com). Look for the Product Registration link on the Home page.

If you have previously registered a GARMIN product purchase using a mail-in registration card, we invite you to reregister using our NEW on-line system. Many services provided by our new product registration system are now being automated and reregistering your purchase ensures you the best possible support from GARMIN.



Why should you register your GARMIN GPS unit:

- Notification of Product Updates
- Notification of New Products
- Lost or Stolen unit tracking

Serial Number

Use this area to record the serial number (8-digit number located on the bottom of the unit) in case it is lost, stolen, or needs service. Be sure to keep your original sales receipt in a safe place or attach a photocopy inside the manual.

Serial Number:

* *



The GARMIN GBR 23 has no user serviceable parts. Should you ever encounter a problem with your unit, please contact your GARMIN dealer or GARMIN Customer Service (913-397-8200 or 800-800-1020) for repairs.

Repairs should only be made by an authorized GARMIN service center. Unauthorized repairs or modifications could void your warranty and authority to operate this device under FCC Part 15 regulations. See page 1 of this manual for further service details.

Capabilities

The GBR 23 offers a host of powerful capabilities to enhance the performance and accuracy of your GPS receiver:

- **Performance**— The single channel receiver has high-sensitivity automatic and manual tuning throughout the beacon broadcast band.
- **Ease of Use**— Once installed, operation is controlled using your GARMIN GPS unit. The unit may also be allowed to operate autonomously.
- **Convenience**— May be remotely mounted in an out-of-the-way location. Receiver status information is displayed directly on the GARMIN GPS unit.
- **Low Power Consumption**— Draws approximately 95 milliamps during normal operation.
- **Accuracy**— 1-5 (2DRMS) meters when used with a GARMIN 12 channel GPS.

Package Contents

Your GARMIN GBR 23 package includes:

- GBR 23 unit
- 30' Power/Data Cable
- Owner's Manual & Reference Guide
- Beacon Reference Card

If any parts are missing or broken, please contact your GARMIN dealer immediately.

Capabilities & Package Contents

The GBR 23 may be used with a variety of GARMIN GPS receivers. The list below identifies most, but not all, compatible models. If your GPS receiver is not listed, you may check with your GARMIN dealer or contact GARMIN product support at 1-800-800-1020 to verify compatibility.

- GPS III/II+/III/III+/III Pilot
- GPS eMap/eTrex/NavTalk
- GPS StreetPilot/ColorMap
- GPS 12/12XL/12CX/12Map
- GPS 38/40
- GPS 45/45XL/48
- GPS 50/75
- GPS 65
- GPS 89/90/92/95
- GPS 120/125
- GPSCOM 170/190
- GPSMAP 130/135/180/185
- GPSMAP 162/168
- GPSMAP 175/195/295
- GPSMAP 210/220/215/225
- GPSMAP 230/235

Mounting the Receiver

Mounting the GBR 23

Please read through these instructions thoroughly before attempting installation. Make sure you completely understand these instructions before you begin. When in doubt, seek professional assistance.

The following additional items are needed or optional to complete the installation of your GBR 23:

- **Antenna mount**— Since antenna mounting locations and methods vary, you will need to obtain an antenna mount to install the GBR 23. The receiver base fits a standard 1-inch, 14 threads per inch mount. Check with your GARMIN dealer or a marine supply company for this item.
- **On/Off switch (optional)**— Power to the receiver may be controlled by an on/off switch, such as an accessory switch on the control console. Check with your GARMIN dealer or a marine/electric supply company for this item.
- **Fuse or circuit breaker (optional)**— It is recommended to install a 2-6 Amp slow response fuse or circuit breaker to protect the circuit that the GBR 23 will be attached to.
- **GARMIN 60' Power/Data Cable**— For cable installation lengths greater than 30'.(010-10284-00)

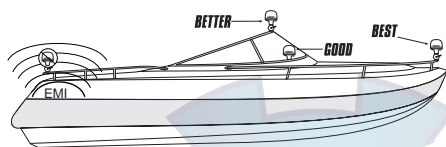
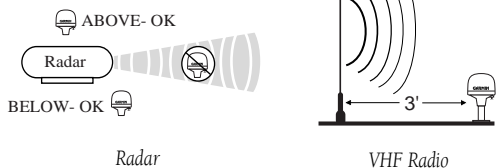


Note: As a general rule, mount the receiver at least three feet from all other antennas and the vessel's electrical system components (alternator/ignition system).

It is recommended that the system be temporarily hooked up with the wiring and unit placement approximating at the desired final installation. Then, check operation with potential local interfering equipment turned on and off. For example, other electronic equipment, fan motors, engine ignition, alternators, generators, radars and VHF radio transmissions can be sources of interference.

Position the receiver so that the clearest possible view of the horizon in all directions is obtained. Avoid mounting the antenna next to large areas of conductive material (metal, aluminum, etc.) as this may cause poor signal reception. The GBR 23 is supplied with a 30 feet power/data cable. When routing the wiring to the GBR 23, avoid routing the cable near the vessel's alternator or ignition system components or parallel to other power lines.

Three common sources of interference for DGPS units are:



EMI (Electromagnetic Interference) from engine components

If a problem is found, try altering the location of the unit or wiring. Often moving the antenna a few feet away from the source of interference will solve the problem. When a suitable configuration is found, a permanent installation should be made. Select the mounting location according to your preferences. Keep in mind that from this mounting location cables will be routed to the antenna and to the GPS unit.

1. Once a suitable mounting location has been determined and tested, secure the antenna mount at the desired mounting location.
2. Make sure the GBR 23 is aligned properly to avoid thread damage. Thread the GBR 23 onto the antenna mount and hand tighten clockwise until snug (Fig. 1). Do not overtighten.
3. Align the notches on the power/data cable and GBR 23 connector and push it connector in until it seats. Turn the locking ring clockwise until the power/data cable is firmly locked into position.
4. Route the power/data cable from the GBR 23 to the GPS unit. Excess cable may be shortened or coiled together and secured in an inconspicuous location. If additional cable is needed you may use GARMIN's optional 60' cable (010-10284-00) or similar 24 AWG shielded wiring. The entire length of the power/data cable should not exceed 200' (60.9m).

Mounting the Receiver



When routing the power/data cable, try to avoid:

- Sharp edges which may cut the cable
- Routing the cable parallel to other power lines
- Excessively twisting, straining or bending the cable

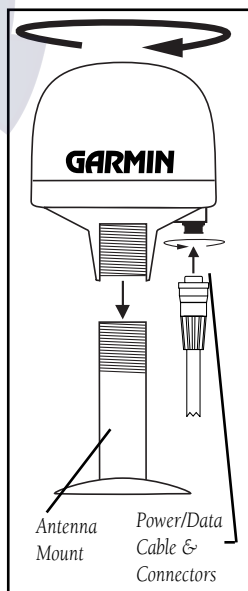


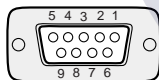
Figure 1: Mounting the GBR 23

Connecting the GBR 23



You may also output corrected NMEA data from a GARMIN GPS/DGPS combination to a PC or another NMEA device (autopilot, radar, chartplotter, etc.). GARMIN GPS units can support NMEA data output for up to three devices (the GBR 23 counts as one). Most NMEA device configurations only require that the GROUND (-) and the DATA OUT (+) wires from the GPS (which are also connected to the GROUND (-) and DATA IN (+) wires of the GBR 23) to be connected. Please refer to the instructions or manufacturer of the NMEA device for correct wiring procedures.

PC Connections



Connect the harness leads from the GPS to a 9-pin serial connector:

Data Out From GPS - Pin 2
Data In From GPS - Pin 3*
Ground From GPS - Pin 5

* When wiring a GARMIN GPS/DGPS combination, connecting the DATA OUT from the PC (pin 3) to the DATA IN of the GPS will disable the DGPS (since the GPS only allows for one input). If you need to upload/download data between the GPS and PC, it is advisable to install a switch which toggles the input to the GPS between the DGPS or PC.

The final step in installing the GBR 23 is to connect the receiver's DATA IN, DATA OUT and GROUND lines to your GPS unit. The GBR 23 is designed to transmit/receive data at 4800 baud or BPS (bits per second), which is suitable for use with all differential-ready GARMIN GPS receivers and select products made by other manufacturers.

For reliable communication, it is essential that the GBR 23 and the GPS unit share the same ground. This ground connection acts as the (current) Return line. It is recommended to wire the unit to its own circuit to avoid interference from other electronics.

Some non-GARMIN GPS units may have a separate data line labeled "RETURN", "DATA GROUND" or "DATA -". If one of these lines exist, connect the BLACK wire from the power/data cable to it.

1. You may reference Figure 3 for the following wiring: Connect the BLUE (Data Out) wire from the GBR 23's power/data cable to the DATA INPUT line of the GPS unit.
2. Connect the BROWN (Data In) wire to the DATA OUTPUT line of the GPS unit.
3. Connect the BLACK (-) wire to the GROUND wire of the GPS unit. If the BLACK wire is already connected to the same ground terminal as the GPS unit, no additional connection is required (unless a separate RETURN line is provided by the GPS unit).
4. Connect the RED (+) wire from the power/data cable to a 8-35 vDC power source. It is advisable to use a slow response fuse or circuit breaker in the range of 2A to 6A to protect the circuit.
5. If a remote power switch is being installed, see Figure 2. This will allow the GBR 23 to remain connected to a power source, but manually powered on and off. If the receiver is being wired to a circuit which is already switched, (with the GPS for example) connect the WHITE wire to ground or the same location as the BLACK wire. When the BLACK and WHITE wires are combined, the GBR 23 will turn on/off when power is applied/removed to the RED (+) and BLACK (-) wires.

Auto-Tuning

Without external commands, the GBR 23 will automatically scan frequencies between 283.5-325.0 kHz @ 0.5kHz steps for 100 and 200 bps stations only. To use 25 & 50 bps, you will need to manually tune the beacon via the GPS receiver or other source. For non-GARMIN receivers which do not supply a valid tuning interface (pg. 11-12) to the GBR 23, it is not necessary to connect to the DATA IN (BROWN) wire of the GBR 23. The GBR 23 should tune into a DGPS station within about 10 minutes. The unit will store the last used frequency in non-volatile memory and default to that frequency on next use. If you lose DGPS signal, the unit will attempt to reconnect to the last frequency and if necessary, tune to another station.

Connecting GBR and GPS

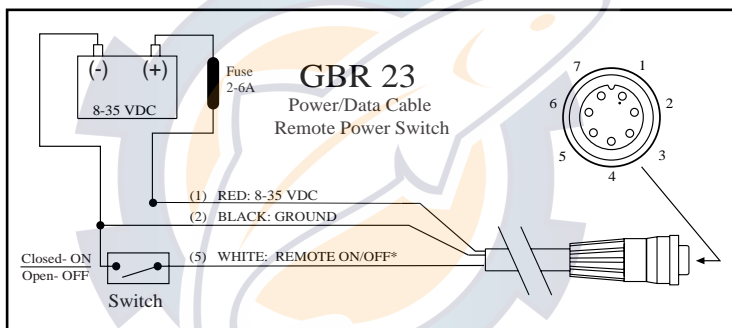


Figure 2: Wiring a Remote Power Switch For the GBR 23

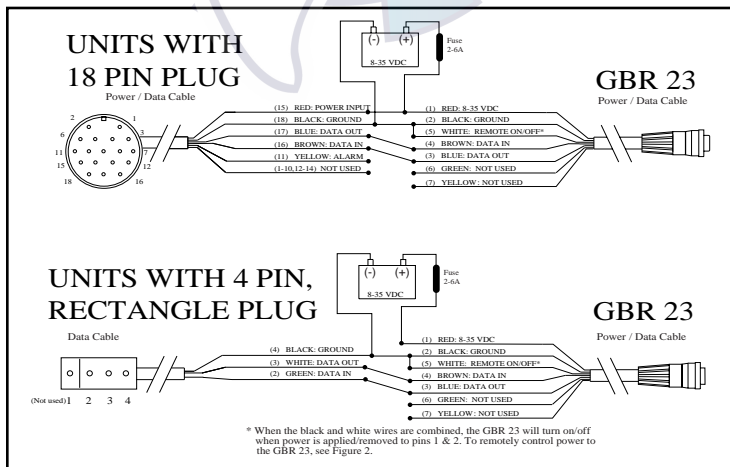


Figure 3: Sample Wiring to GARMIN GPS Units

Connecting GBR and GPS

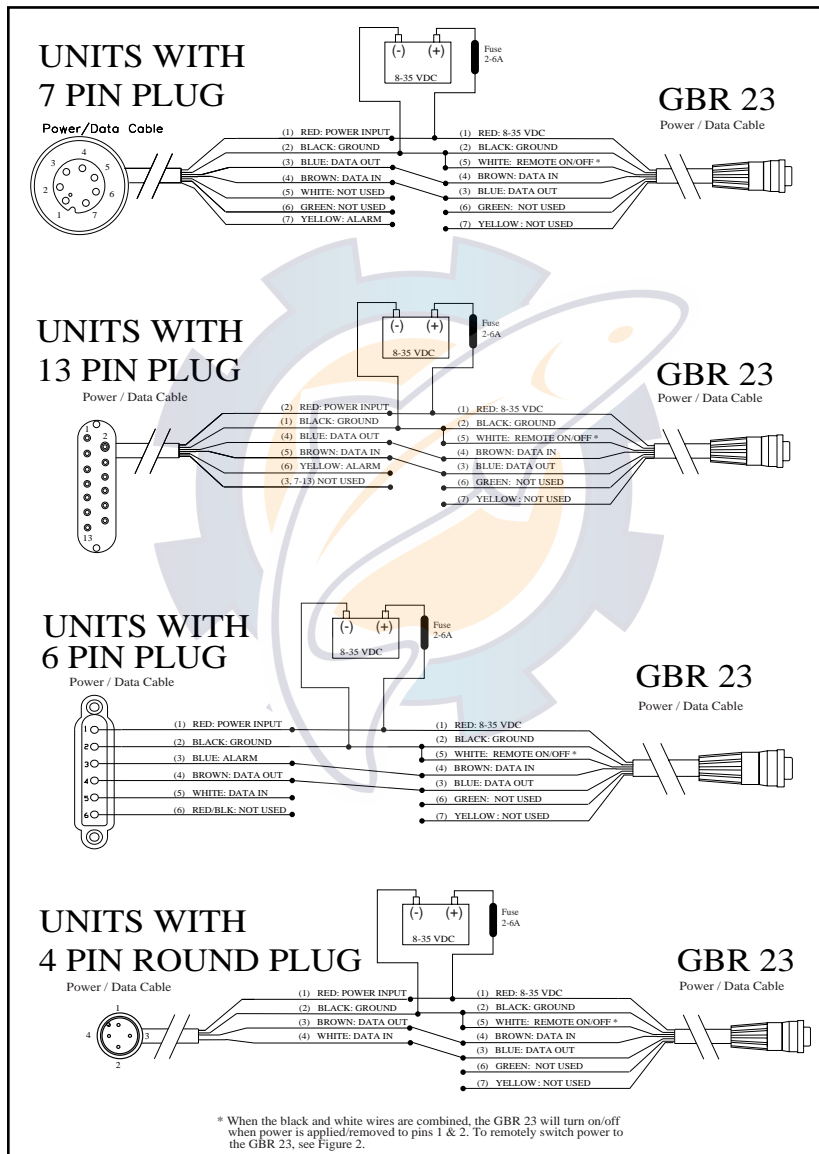


Figure 3 (cont.): Sample Wiring to GARMIN GPS Units

Using the GBR 23

When using the GBR 23, tuning may be either done automatically or controlled by the GPS unit. Your GARMIN GPS unit provides a Beacon Receiver Setup Page and, in some cases, Beacon Log Page for this purpose.

The operating instructions provided below are generalized to cover several different GARMIN models and may not exactly match your display. For additional information on operating your GPS unit with the GBR 23, refer to the owner's manual for your GPS unit. Screen examples from various model GARMIN units are provided on the following pages.

1. Apply power on to the GBR 23.
2. Turn the GPS unit on.
3. From the Interface Setup Page, select an RTCM input. If a baud rate selection is also provided, specify 4800. On GARMIN GPS units, RTCM input/NMEA 0183 output should be selected. The baud rate will be set to 4800. If additional devices, such as an autopilot or plotter, are connected to the GPS unit, they must be set to work with NMEA 0183 as well.

On some newer model GARMIN GPS receivers, you may set the interface to "Garmin Bcn Rcvr". This is a scan option, separate from the GBR 23 scan, which will automatically scan for a DGPS frequency and bit rate. Please refer to your GPS owner's manual for using this function. If this setting is used, you may skip step 4.

4. From the Interface Setup Page, enter the "Tuned To:" frequency and the "Bit Rate" for the nearest DGPS beacon transmitter. (Refer to the Beacon Reference Card for this information.)
5. Once the frequency and bit rate have been entered, "Tuning" will be displayed at the bottom of the page.
6. If the beacon signal is received by the GBR 23, the "SNR" field will display a signal-to-noise ratio and "Receiving" will appear on the page. The SNR scale ranges from zero (no reception) to 31 (best reception).

Using the GBR 23

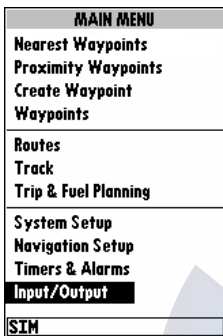
INTERFACE
RTCM/NMEA
NMEA 0183 2.0
4800 baud
BEACON RECUR
FREQ: ____ KHz
RATE: 100bps
DIST __%
SNR __dB
No Status

From the Interface Page, select 'RTCM/NMEA' and 'NMEA 0183 2.0' to properly communicate with the GBR 23.

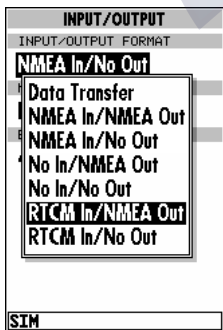
INTERFACE
RTCM/NMEA
NMEA 0183 2.0
4800 baud
BEACON RECUR
FREQ: 304.0KHz
RATE: 100bps
DIST __%
SNR __dB
Tuning

Use the Beacon Receiver Setup Page to enter the beacon operating frequency and bit rate for the nearest DGPS beacon site. This information is automatically transferred to the GBR 23.

Using the GBR 23



The Main Menu Page on the GPSMAP 130/135/175/180/185/230/235. Select 'Input/Output' to make the desired interface settings.



From the Input/Output Settings Page, select 'RTCM In/NMEA Out' to properly interface with the GBR 23.

7. If the beacon signal is received, but no DGPS correction data is included, the message "No Data" will appear at the bottom of the page. If no beacon signal is received, the "SNR" field will remain blank, "No Status" will appear at the bottom of the page.
8. To select another beacon transmitter, enter a new frequency and bit rate.
9. Some Garmin units have a list of the last five beacon frequencies used on the Beacon Log Page. As an alternative to reentering frequency and bit rate information each time you use the GBR 23, you may select a beacon from this list. (NOTE: The Beacon Receiver Setup Page will automatically default to the last beacon transmitter used each time the GPS unit is turned on.)

10. Select the Satellite Status Page. A "D" will appear at the bottom of the signal strength bar for each satellite with a corresponding differential correction or "3D Differential" will be displayed at the top of the satellite page. This page is useful for determining the quality of differential coverage available. (Remember, the more satellites with corresponding differential corrections, the more accurate your position will be.) Some models will show a distance from the DGPS transmitter only if this information is contained in the DGPS signal.

Additional manual tuning for the GBR 23

If your GPS does not support a tuning interface for the GBR 23 and you wish to manually tune it, transmit the following tuning sentence, based on NMEA 0183 ASCII (pg. 19), through a PC terminal program or other compatible source to the DATA IN of the GBR 23:

\$PSLIB,<1>,<2><CR><LF>

<1> Beacon tune frequency 0.0 (Auto), 283.5-325kHz in 0.5 kHz steps.

<2> Beacon bit rate 0 (Auto), 25, 50, 100, 200

<CR><LF> Carriage Return, Line Feed

Example: \$PSLIB,305.0,200<CR><LF>

DGPS: How It Works

Differential GPS (DGPS) is a technique used to improve the accuracy of the Global Positioning System. DGPS reduces the effects of atmospheric variations and can improve position accuracy to better than 5 meters.

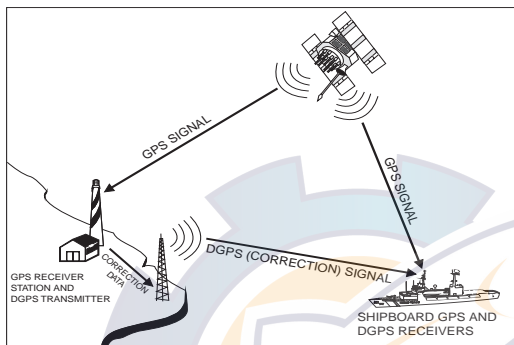


Figure 4: The DGPS System

A DGPS system consists of the following:

- DGPS Beacon Transmitter and GPS Receiver at a known location
- Shipboard DGPS Beacon Receiver
- Shipboard GPS Receiver (DGPS capable)
- GPS Satellites

The DGPS Beacon Transmitter is placed at a known location (i.e., the exact position of the site has been previously determined). At the beacon transmitter site, the GPS satellites are monitored using a GPS receiver. This receiver is equipped to calculate corrections for each satellite received. The correction is the difference between the distance to the satellite (from the beacon site) as measured by the GPS receiver, and the actual distance to the satellite based on the known location of the beacon site. These corrections are communicated to the users GPS set through the DGPS Beacon Station and the GBR 23. The users GPS set then uses the corrections to remove errors from its measurements.

DGPS: How It Works

INPUT/OUTPUT	
INPUT/OUTPUT FORMAT	
RTCM In/NMEA Out	
NMEA FORMAT	
0 bps (auto)	2.0
25 bps	
50 bps	
100 bps	R TUNE TO
200 bps	R BIT RATE
100 bps	
STATUS	SNR
No Status	--- d _B
SIM	

After entering the beacon's operating frequency, set the bit rate as indicated on the Beacon Reference Card. Beacon information is also available from the other sources listed on the card.

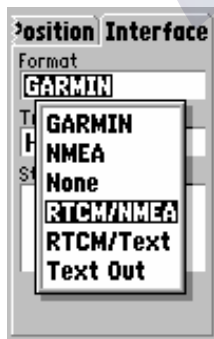
Serial Time	Interface
Serial Data Format	
GARMIN DGPS	
Baud	
4800	
Beacon	Freq Bit Rate
Scan	300.0 kHz 200
Status	
Scanning...	
SNR	Distance
--- d _B	--- m

Select GARMIN DGPS when using the GBR 23 with GARMIN GPS units.

DGPS: How It Works



The Main Menu Page on the GPS III/III+/12Map/ Navtalk. Select 'Setup' to make the desired interface settings.



From the Interface Page, select 'RTCM/NMEA' to properly interface with the GBR 23.

Satellites received by the shipboard GPS receiver, but not by the GPS receiver at the beacon transmitter site, will not have corresponding corrections. When four or more satellites received by the shipboard GPS receiver have corresponding corrections, the result is a highly accurate position reading. The more satellites with corrections, the more accurate the position.

The GBR 23 receives RTCM-SC-104 format signals from ground based DGPS Beacon Stations operating in the 283.5 kHz to 325.0 kHz frequency band, with MSK modulation and data rates of 25,50,100, or 200 bits per second. These stations are typically operated by government agencies such as the U.S. Coast Guard.

Generally, the closest DGPS station will provide the most accurate correction data. Individual stations vary and the user may wish to verify the suitability of the signal for the intended application with the station operator. The station power is normally set to provide a usable range somewhere near 300 km. Other factors such as local interference, lightning, time of day and season, if the path to the station is over ground or water, and antenna selection or installation affect the usable signal range.

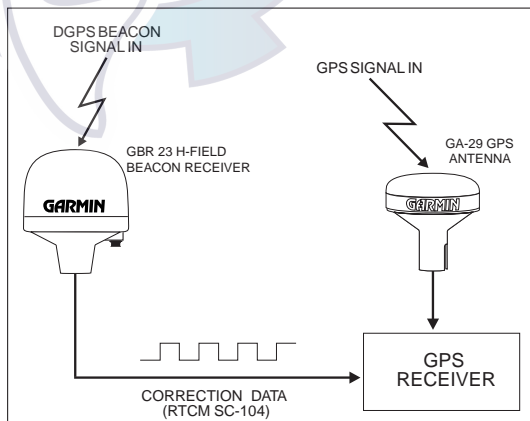


Figure 5: Shipboard DGPS System

Sources of Error

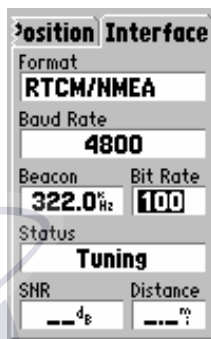
Using a DGPS Beacon Receiver with your existing GPS Receiver can provide substantial improvements in accuracy; however, there may be occasions when the best possible accuracy will not occur. Several factors can contribute to a degraded DGPS accuracy.

Loss of DGPS Beacon Signal— Obviously, the lack of DGPS correction data will result in reduced accuracy. Accuracy will be the same as if no beacon receiver was being used. Several conditions can cause a loss of the beacon signal:

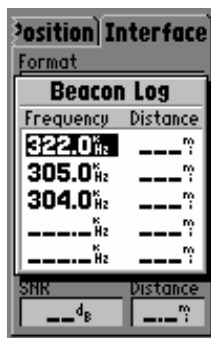
- Poor data between DGPS receiver and the GPS receiver can result in intermittent or nonexistent correction data.
- The range of a DGPS beacon transmitter (see the accompanying Beacon Reference Card) is typically a few hundred miles, or less. Beyond this range, the beacon signal cannot be reliably received.
- Interference to the beacon signal can be experienced during periods of thunderstorm activity. Other sources of static interference, such as alternator motors, ignition systems and VHF, can also affect signal reception. Alternator/ignition interference can be minimized through proper shielding of the ship's wiring, by using an EMI/RFI filter, and by mounting the beacon receiver's antenna away from these sources of interference.

Multipath— Multipath error occurs when the GPS signal is reflected before it reaches the GPS receiver. The reflected signal takes slightly longer to reach the GPS receiver than a non-reflected signal. This added time delay results in position error. (The distance to each satellite is calculated based upon the time it takes the GPS signal to reach the GPS receiver.) Multipath error can be minimized by mounting the GPS antenna at a location which minimizes the potential for reflected signals. Generally, the GPS antenna should be mounted on a large, flat horizontal surface and away from any vertical structure (cabin walls, large mast, etc.) which could reflect the GPS signal.

Sources of Error



After entering the beacon's operating frequency, set the bit rate as indicated on the Beacon Reference Card. Beacon information is also available from the other sources listed on the card.



The Beacon Log Page lists the last five beacon frequencies used. As an alternative to retyping the frequency and bit rate each time, you may select a beacon from this list.

Sources of Error

Number of Satellites Visible— As previously stated, the number of satellites available can affect position accuracy. To apply the corrections provided for the satellites received at the beacon transmitter station, the same satellites (at least in part) must be received by your GPS receiver. And, certainly, if there aren't enough satellites to determine a GPS position, there aren't enough satellites to calculate a DGPS position.

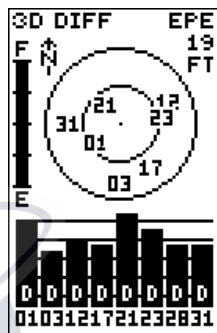
Atmospheric Conditions— Differences in the ionosphere and/or troposphere between the DGPS broadcast station and the DGPS receiver can result in decreased position accuracy. Although this does not cause significant error, the amount of error can increase as you get further away from the DGPS broadcast station.

Satellite Geometry— A minimum of 4 satellites are required to determine a 3D position. At times, additional satellites are required due to their placement with respect to each other. This relative placement is referred to as "satellite geometry". Ideal satellite geometry exists when the satellites are located at wide angles with respect to each other. When satellites are located in a line, satellite geometry is considered poor.

This same requirement applies to DGPS. If corrections are available for four different satellites, but they are all located in the same general area or in a line, the DGPS corrections will be minimal. However, if the same four satellites are placed farther apart, in several very different directions from our position, the corrections will have a much greater effect and the position accuracy will be greatly improved.

Problem	Possible Cause
1) “Check Wiring” displayed on GPS unit	Power switch/wiring faulty. Fuse/breaker blown (if used). GBR 23 not wired properly with GPS unit. Check wiring. If the BROWN (Data In) wire is not used (Auto-tuning), this message may be displayed. If the receiver status screen displays the GPS is receiving differential corrects, no action is needed.
2) “No DGPS Position” displayed on GPS unit	Not enough data is available to compute a DGPS position. Please refer to Troubleshooting problems 5 and 6.
3) “No RTCM Input” displayed on GPS unit	Beacon receiver is improperly connected or baud rates do not match. Please refer to Troubleshooting problems 5 and 6.
4) “RTCM Input Failed” displayed on GPS unit	Intermittent connection between GBR 23 and GPS unit. Check wiring. Interference from ship’s electrical system, other electronic items, thunderstorm activity, or another source is preventing signal lock-on. Also refer to Troubleshooting problems 5 and 6.
5) GPS interface status screen displays “No data” or “No Signal”	Wrong frequency or bit rate selected on GPS unit. Beacon transmitter not transmitting correction data.

Troubleshooting Chart

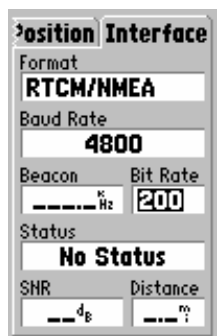


The receiver status indication at the top left of the Satellite Status Page will indicate '3D Diff' or '2D Diff' when differential corrections are available. A 'D' appears at the bottom of the signal strength bar for each satellite with a corresponding differential correction.

Troubleshooting Chart



If the 'No Differential GPS Position' message is displayed on your GPS receiver, correction data may not be available. This may be due to a missing or weak beacon signal, not enough GPS satellites or bad wiring connection between the GBR 23 and GPS.



If either 'No Status', 'None', or 'Check Wiring' messages appear (depending upon model of GPS) see Troubleshooting problem number 7.

Problem	Possible Cause
6) GPS interface status screen displays "None" or "No Status"	<p>GBR 23 not wired properly with GPS unit. Check wiring.</p> <p>No power to GBR 23. See Troubleshooting problem 1.</p> <p>Possible damage to the with DGPS antenna.</p> <p>Baud rates do not match.</p> <p>Beacon transmitter out of range. Try a different station.</p>
7) Beacon signal weak or not received.	<p>Interference from ship's electrical system, thunderstorm activity, or another source is inhibiting signal lock on.</p> <p>Also refer to Troubleshooting problems 5 and 6.</p>
8) Accuracy not as expected	<p>Poor satellite geometry coverage exists.</p> <p>Interference to GPS antenna and/or beacon antenna exists.</p> <p>Portable antenna being used on GPS unit. Use remote antenna.</p> <p>Multipath signals being received by GPS unit.</p> <p>Too far from DGPS transmitter or not tuned to closest station.</p>
9) Distance from DGPS station is blank or zero on GPS unit	<p>The distance reading to the beacon is dependent upon reception of the RTCM message transmitted from the DGPS broadcast site. This message is infrequently broadcast and may vary from station to station.</p>

Physical

Size:	4.6" W x 5.3" H (117mm x 135mm)
Weight:	23.9 ounces (0.678 kg)
Operating Range:	-68°F to +158°F (-20°C to +70°C)
Waterproof:	-1 meter submersion for 30 minutes IPX7 rating for IEC529
Mount Thread Size:	1" diameter at 14 threads/inch

Power

Voltage:	8 - 35 vDC using supplied power/data cable. Surge and reverse polarity protected for up to 80 vDC.
Current Drain:	95 mA @ 12 vDc

Signal Processing

Frequency Range:	283.5 - 325.0 kHz @ 0.5kHz
Data Rates:	200/100/50/25 BPS
Auto Tuning:	All 200 & 100 BPS Channels
Minimum Signal:	10 μ V

Data Processing

Demodulation:	MSK (Minimum Shift Keying)
MSK Bit Rates:	25, 50, 100, 200 bps

Interfaces

Input:	RS-232 or NMEA 0183, 4800 baud
Input Sentences:	Binary \$PSLIB \$-MSK
Output:	RS-232 4800 baud
Output Sentence:	RTCM SC-104 (6 of 8 bit format)

GBR 23 Specifications



Complete information concerning NMEA & RTCM formats and sentences is available for purchase at:

National Marine Electronics Association (NMEA)
PO Box 3435
New Bern, NC 28564-3435
USA
252-638-2626
252-638-4885 FAX.
www.nmea.org

Radio Technical Commission For Maritime Services (RTCM)
1800 Diagonal Road, Suite 600
Alexandria, VA 22314-2480,
USA
703-684-4481 (Info Only)
703-836-4229 FAX
www.rtcn.org

Index

A

Antenna mount.....6, 7
Auto-tuning.....9, 11-12

B

Baud rate.....8, 11-12
Beacon Log Page.....12
Beacon Range.....14
Beacon Reference Card.....5,11
Beacon Receiver Setup Page.....11-12
Beacon System.....13-16

C

Capabilities.....5
Cautions.....2
Compatibility.....5
Connections, Wiring.....8-10
Contents, Package.....5

D

DGPS System.....13-14

E

Error, Sources of.....15-16

F

Frequencies.....11-12, 14

I

Installation.....6-10
Interface Setup Page.....11-12
Interference.....6-7, 15-16

M

Mounting the Receiver.....6-7
Manual tuning.....11-12

N

NMEA.....8, 12, 19

O

On/Off Switch.....6, 8-9
Operation.....9, 11-12

P

Package Contents.....5
PC Connection.....8
Power/Data Cable.....5-10

R

Registration.....4
RTCM-SC-104 format.....14

S

Satellite Status Page.....13
Serial Number.....4
Sources of Error.....15-16
Sources of Interference.....6-7
Specifications.....19

T

Table of Contents.....3
Troubleshooting.....17-18
Tuning.....9, 11-12

W

Warranty Information.....1
Wiring Connections.....8-10





© 2000 GARMIN Corporation

GARMIN International, Inc.
1200 East 151st Street, Olathe, Kansas 66062, U.S.A.

GARMIN (Europe) Ltd.
Unit 5, The Quadrangle, Abbey Park Industrial Estate, Romsey, SO51 9AQ, U.K.

GARMIN (Asia) Corporation
No. 68, Jangshu 2nd Rd., Shijr, Taipei County, Taiwan

www.garmin.com

Part Number 190-00195-00 Rev. A