TOPCON

GB-1000

Operator's Manual

TOPCON
POSITIONING SYSTEMS

GB-1000
Operator's Manual

Part Number 31-050402-01
Rev B

Topcon only sells GPS products into Precision Markets.
Please go to www.topcongps.com for detailed market information.

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Preface

Thank you for purchasing a TOPCON GNSS Receiver GB-1000.

This instruction manual explains how to operate, inspect and adjust the GB-1000, and other pertinent matters.

In order to use the GB-1000 efficiently and safely, please read "Handling and Safety Precautions" on page B-1 before use, and then use it as prescribed. Also, please make sure that this manual is always near at hand.

User Information

1. This product is for professional use only!

   The user is required to be a qualified surveyor or have a good knowledge of surveying, in order to understand the user and safety instructions, before operating, inspecting or adjusting.
2. Wear the required protectors (safety shoes, helmet, etc.) when operating.

Exceptions from Responsibility

1. The user of this product is expected to follow all operating instructions and make periodic checks of the product's performance.
2. The manufacturer, or its representatives, assumes no responsibility for results of a faulty or intentional usage or misuse including any direct, indirect, consequential damage, and loss of profits.

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   The manufacturer, or its representatives, assumes no responsibility for fire, accident, or any act by a third party, and/or usage under other usual conditions.
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5. The manufacturer, or its representatives, assumes no responsibility for any damage, or loss of profits caused by usage, except for explained in the user manual.
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Regulatory Information

The following section provides information on this product's compliance with government regulations.

Community of Europe Compliance

We Topcon Corporation declare EC Conformity for the following product:

Product Identification:

Brand: Topcon

Model/Type: GB-1000, GEODETIC RECEIVER

Model Number: 01-830401

Manufacturer:

Name: Topcon Positioning Systems

Address: 5758 W. Las Positas Blvd., Pleasanton, CA 94588

Country: USA

Tel: 925-460-1300 Fax: 925-460-1336

Standards used:

EN 55024:1998, EN 55022/1997 class A

EN60950:2000

Means of Conformity:

The product is in conformity with Directive 89/336/EEC based on test results using harmonized standards in accordance with Article 10 (1) of the Directive.

Manual Conventions

This manual uses the following conventions:

Example	Description
ENT	Press the ENT (enter) key.

TIP

Supplementary information that can help you configure, maintain, or set up a system.

NOTICE

Supplementary information that can have an affect on system operation, system performance, measurements, or personal safety.

CAUTION

Notification that an action has the potential to adversely affect system operation, system performance, data integrity, personal health.

WARNING

Notification that an action *will* result in system damage, loss of data, loss of warranty, or personal injury.

Notes:

Introduction

Topcon Positioning System's GB-1000 (Figure 1-1) is a dual-frequency, GPS+ receiver built to be the most advanced receiver for the surveying market. The GB-1000 can receive and process both L1 and L2 signals, improving the accuracy of your survey points and positions. The dual-frequency and GPS+ features of GB-1000 combine to provide the only real time kinematic (RTK) system accurate for short and long baselines. Several other features, including multipath mitigation and co-op tracking, provide under-canopy and low signal strength reception. The receiver provides the functionality, accuracy, availability, and integrity needed for fast and easy data collection.

Figure 1-1. GB-1000 Receiver

The GB-1000 is a multi-function, multi-purpose receiver intended for precision markets. Precision markets means markets for equipment, subsystems, components and software for surveying, construction, commercial mapping, civil engineering, precision agriculture and land-based construction and agriculture machine control, photogrammetry mapping, hydrographic and any use reasonably related to the foregoing.

GPS Surveying

Table 1-1 describes the methods of surveying and typical situations for each method that the GB-1000 performs.

Table 1-1. Observation Methods with the GB-1000

Surveying Method	Appropriate Situations
Static surveying	When a long baseline and/or high accuracy are required.
Rapid static surveying	When high accuracy is required within a short range and in a short occupation time.
Stop & Go kinematic surveying	When the observation of multiple points within a relatively short range is required in a short occupation time.
Continuous kinematic surveying	Dynamic topographical surveying.
Real time kinematic surveying	Stakeout, topographical surveying, and other situations that require the observation of multiple points in real time.

Post-Processing Surveying

Post-processing surveying involves recording observation data to the GB-1000's built-in memory, downloading the observation data into a computer using data download software (such as, Topcon Link), and analyzing the data using post-processing software to obtain precise baseline vector information (such as, Topcon Tools).

Surveying methods that work best for post-processing are:

- Static surveying
- Rapid static surveying
- Stop & Go kinematic surveying
- Continuous kinematic surveying

Remember that the method of observation, observation time, etc., differ for each surveying method.

Guidelines for Post-Processing Surveying

While conducting a survey for post-processing, remember to follow these guidelines:

- Receivers that post-process must do so simultaneously.
- Receivers that post-process must do so in the same or common epoch intervals.

Static Surveying

Static surveying is the most precise surveying method. With static surveying, the antenna is fixed at a point by means of a tripod or some other anchoring device. Using at least two receivers, one at a known point and the other at an unknown point, observation is conducted simultaneously, the same epoch intervals, and with at least four common satellites.

While static surveying is the most precise surveying method, it also requires the longest observation time. Observation time is generally about one hour; data acquisition intervals are 30 seconds. However, observation time will vary with observation conditions and the baseline distance.

While static surveying can be performed with single or dual frequency data, single frequency baselines are generally limited to 10km with single frequency receivers. Dual-frequency surveying will allow for baseline greater than 10km and eliminate any related ionospheric effects. For

these longer baseline measurements, dual-frequency data options are necessary.

Static surveying requires simultaneous observation by at least two receivers. To increase the efficiency of the work, survey multiple observation points using multiple receivers to conduct the survey. With post-processing software, you can simultaneously analyze and process the observation data obtained using multiple receivers.

Compared to the other surveying methods, static surveying requires a longer observation time. By the same token, however, it enables such analysis-related problems as cycle slip and multi-path to be solved and a high precision of accuracy to be obtained.

Rapid Static Surveying

Rapid static surveying is essentially the same as static surveying, except that observation can be carried out in a shorter time period and requires GPS dual-frequency receivers.

Generally, rapid static surveying is effective within a range of 10 km, observation time is about 20 minutes, and data acquisition intervals are 15 seconds. However, the effective baseline distance and observation time will vary with the number of satellites tracked, the DOP, the existence or absence of cycle slip or multi-path, other observation conditions, and with environmental conditions.

Thanks to its short observation time, rapid static surveying increases work efficiency. On the other hand, the quantity of observation data obtained is small, so the precision and reliability of the data are lower than with static surveying.

To increase the precision of the data obtained, use occupation planning software to confirm the number of satellites and that the time period for DOP, and other conditions, is good; conduct thorough preparations for the observation.

Kinematic Surveying

With kinematic surveying, the reference station conducts static surveying, just as with the static surveying method; however, the rover station observes while moving. There are two types of kinematic surveying: Stop & Go and Continuous.

Like static surveying, kinematic surveying requires that at least two receivers receive signals simultaneously from the same four or more satellites. One of the receivers serves as the reference station. As with static surveying, this station conducts static observation with a fixed antenna using a tripod or some other anchoring device. The other receiver is a rover; it conducts observation by way of an antenna that is held, affixed to a pole or other similar attachment, and moved. As with the other surveying methods, observation can be conducted simultaneously using multiple rovers and a shared reference station.

With Stop & Go kinematic surveying, extremely short static observation (Stop) and a moving observation (Go) are repeated, making it possible to survey from numerous observation points. As this surveying method requires continuous data, ensure that the static observation and moving/rover observation continuously tracks satellites and records continuous observation data. Accordingly, conduct the observation to prevent cycle slip. With kinematic surveying, static observation time is extremely short: generally, one minute of static observation is conducted in epoch intervals of five seconds (12 epochs). The longer the static observation time, the greater will be the precision of the data obtained. The analytical results obtained from this method correspond to the static observation site.

Continuous kinematic surveying is a non-stop surveying method and is used for obtaining the consecutive, precise loci of a moving body, etc. With this method, analytical results are obtained for each epoch interval.

Real Time Kinematic (RTK) Surveying

Real time kinematic (RTK) surveying is a method that returns analytical results obtained in real time, and requires a special controller for scanning and saving the results.

With RTK surveying, as with post-processing kinematic surveying, one receiver serves as the reference station and conducts observation with its antenna anchored using a tripod or some other device; while the other receiver functions as a rover and conducts observation using an antenna affixed to a pole and moved to observation points.

Unlike post-processing kinematic surveying, the reference station and rover are linked using radio telemetry or other communication system. The modem transmits the correction data of the carrier phase data, etc. obtained through observation at the reference station. The rover, based on this transmitted data and on its own observation data, immediately conducts baseline analysis inside the receiver and outputs the results.

In order to conduct RTK surveying, a controller must be initialized for carrying out the resolution of ambiguities. The GB-1000 is equipped with on-the-fly (OTF) technology, so, even while it is moving, initialization can be carried out.

Generally, OTF initialization requires dual-frequency data and at least five satellites. Initialization ends within one minute.

Getting Acquainted

The GB-1000 is a receiver configured for surveying, with upgrade options that enable it for dual-frequency and GPS/GLONASS reception. A graphic LCD and operating keys enable any user to easily operate it, conduct various kinds of surveying, check operating conditions, and more.

The GB-1000 can be built with internal memory for recording survey data, and recorded data can be downloaded using the USB, ethernet, or RS232C port. A compact flash card slot allows data to be easily copied from the built-in memory and read on a computer.

Figure 1-2 shows the system configurations possible for the GB-1000 receiver.

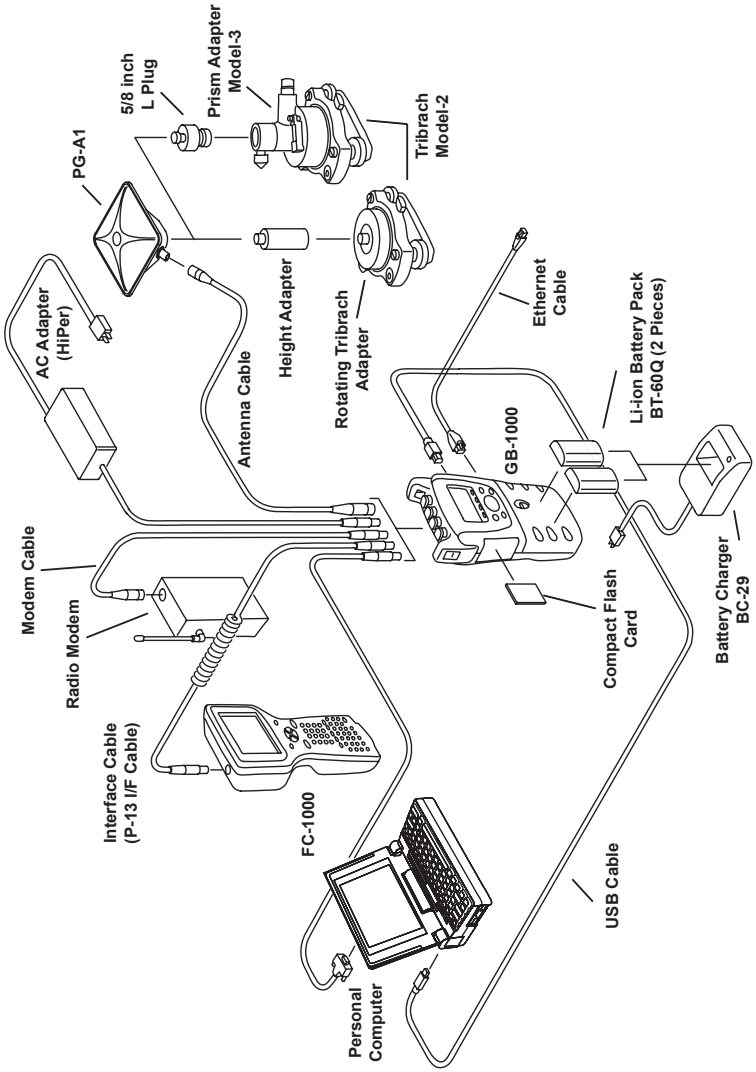


Figure 1-2. GB-1000 System Configuration

GB-1000 Receiver

The main firmware options include the following:

- Dual-frequency – Enables reception of dual frequencies.
- GLONASS – Enables reception of signals from GLONASS satellites.
- RTK – Enables RTK processing (for the measuring interval, select either 1 Hz, 5 Hz, 10 Hz, or 20 Hz).
- AMR (Advanced Multipath Rejection) – Reduces multipath errors.
- Memory – Enables the use of the internal memory, up to 128 MB.

The GB-1000 receiver has a front panel for displaying information and controlling various receiver functions. The lever provides access to the battery compartment. The CF card slot provides allows data to be saved to a compact flash card (Figure 1-3).

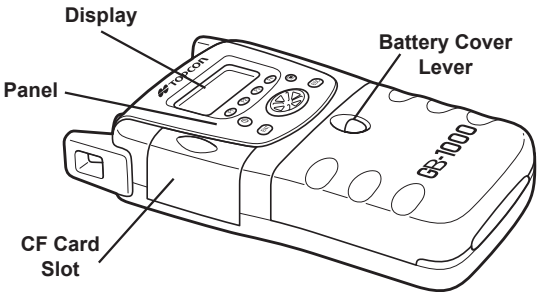


Figure 1-3. GB-1000 Front

Holes for the carrying strap are located above the panel. The two batteries reside in the lower half of the front of the receiver (Figure 1-4).

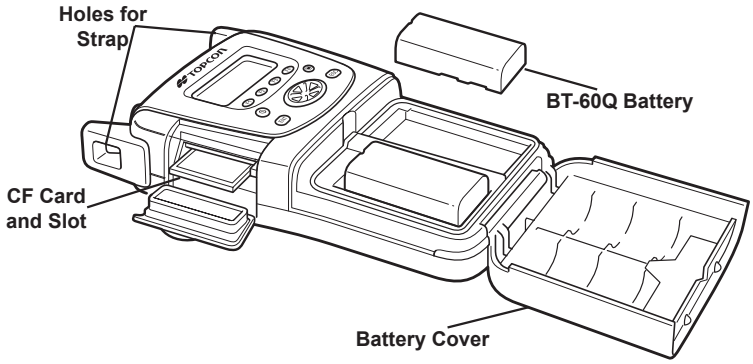


Figure 1-4. GB-1000 Strap Holes, Batteries, and Open CF Card Slot

The top of the receiver has ports for the antenna, power connection, and connection to external components. The USB and Ethernet ports are located on the right side of the receiver. A hook on the back side allows the receiver to be attached to a tripod (Figure 1-5).

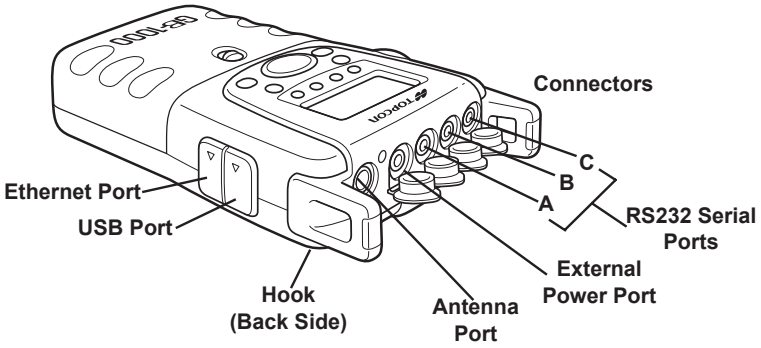


Figure 1-5. GB-1000 Ports and Connectors

Front Panel

The front panel (Figure 1-6) has eight operating keys, and a cursor key used for selecting parameters and navigating menus.

- Power key – Turns the receiver power on and off.
- Enter key – Applies settings and numerical values.
- Escape key – In the menu mode, returns to the previous screen; as well as, exits from the various setting modes.
- Menu key – Initiates the menu mode.
- Function keys – Performs the operations seen in the bottom row of certain menu screens.
- Cursor key – This 4-directional key selects parameters, setting values, menu options, etc.

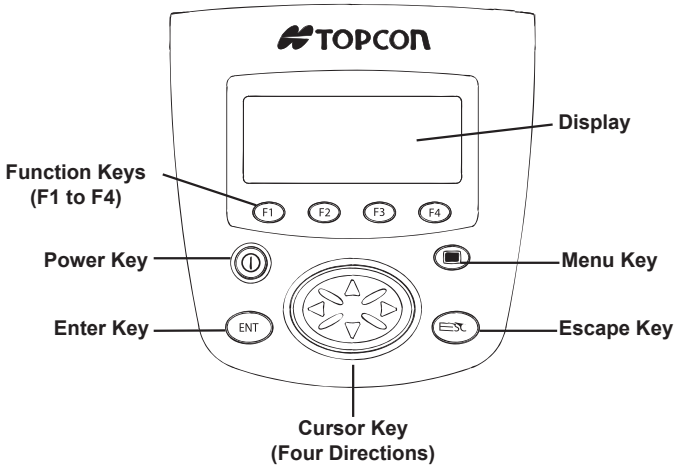


Figure 1-6. GB-1000 Front Panel

Display

The GB-1000 receiver's display (Figure 1-7) uses a 20-character x 4-row dot matrix to display menu items and other information. At the upper right are status icons that indicate the current state of the GB-1000. The bottom row shows the operations that can be performed using with the function keys. These operations change with the measuring mode.

- Contrast adjustment – In the setting mode, the display's contrast can be adjusted. See "Adjusting Display Contrast" on page 3-62.
- Automatic heater – The display has a built-in automatic heater. When the ambient temperature falls to 0°C, the heater automatically turns on, maintaining the liquid crystals display speed and clarity. The operation of the automatic heater can be turned on and off. See "Adjusting the Display's Heater" on page 3-65.
- The displays lighting – The liquid crystal display's lighting (back light) can be turned on and off. See "Adjusting Display Lighting" on page 3-63.

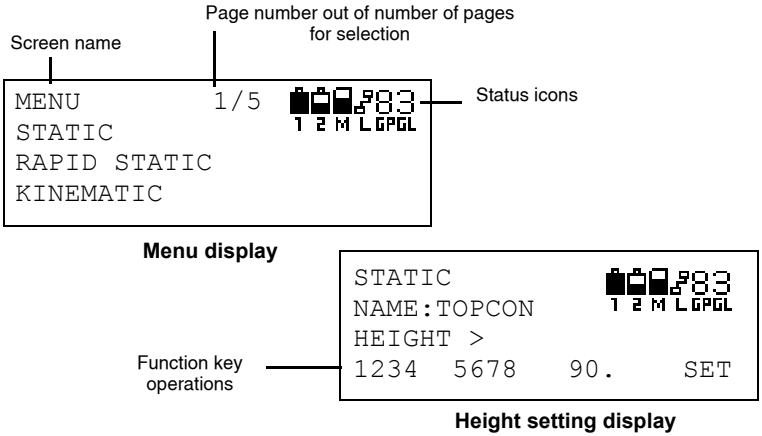


Figure 1-7. Display Examples

PG-A1 Antenna

The PG-A1 antenna (Figure 1-8) is a precision dual-frequency, dual-constellation antenna featuring precision micro center technology and an integrated ground plane to help eliminate errors caused by multipath. The PG-A1 was designed to accompany the Topcon modular receivers such as the GB-1000.

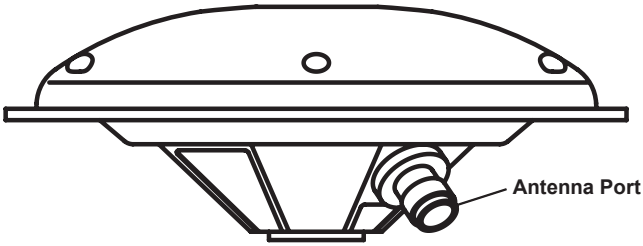


Figure 1-8. PG-A1 Antenna

Optional Accessories

- Tribrach adaptor 2-30 – Used with the Tribrach-20 and the horizontal spacer to secure the antenna to the tripod.
- Tribrach-20 – Used to secure the Tribrach adaptor 2-30 to the tripod.
- FC-1000 or FC-100 data collector – Used as a controller for the GB-1000. Requires application software.
- Data collector bracket – Used to secure the data collector to the GPS RTK pole.
- AC adaptor – Power supply with SAE connector for the GB-1000.
- Extension cable (2 m) – A cable to extend the power cable
- Data cable – A cable to connect the GB-1000 to a computer (Dsub 9-pin connector).
- Cigarette lighter cable – A cable that connects from the cigarette lighter in an automobile to the power cable and used to power the GB-1000.

- Cable with clip connectors (alligator clips) – A cable that connects from a general-purpose battery to the power cable and used to power the GB-1000.

Storage Precautions

1. Always clean the instrument after use.

   Wipe off dust with a cleaning brush, then wipe off dirt with a soft cloth.
2. Store in a location with a temperature of -30° - +60°C, and no exposure to direct sunlight.
3. Use a clean cloth, moistened with a neutral detergent or water, to clean the receiver. Never use an abrasive cleaner, ether, thinner benzene, or other solvents.
4. Always make sure the instrument is completely dry before storing. Dry the receiver with a soft, clean cloth.
5. Check each part of the tripod after extended use. Parts (screws or clamps) may work free over time.

Notes:

Setup and Connections

This chapter describes powering the GB-1000, and setting up and connecting the various components in preparation for observations.

Connecting and Charging the Batteries

The GB-1000 is equipped with two replaceable, rechargeable batteries. Observation can continue even when removing one of the batteries. Moreover, if using the AC adaptor, the batteries can be recharged while still in the GB-1000.

Using the BT-60Q Batteries

NOTICE *NOTICE*

Before shipping, the factory attaches an insulated sheet to the battery contacts. Remove this sheet before use.

A slight current flows inside the GB-1000 even when power is off. Therefore, if storing the GB-1000 for a long time with the batteries installed, the batteries will run down and the GB-1000 may become inoperable. Remove the batteries if storing the GB-1000 for two weeks or more.

Figure 2-1 on page 2-2 illustrate steps one through three for inserting the BT-60Q batteries.

1. Open the battery cover using the lever.
2. Insert the batteries, sliding them in the direction of the arrow shown in Figure 2-1.
3. Press the arrow on the battery cover, closing the cover.

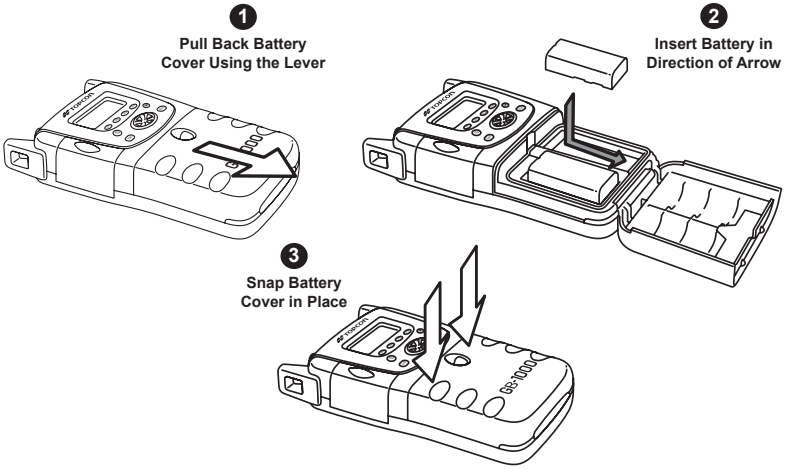


Figure 2-1. Inserting the Rechargeable BT-60Q Batteries

When two batteries are installed, the battery with the lower voltage will be used first. The status icons display the battery currently in use and its remaining capacity.

Charging the BT-60Q Batteries

When charging the BT-60Q batteries, remember the following precautions:

- Charge the batteries at a room temperature of +10°C to +40°C (+50°F to +104°F).
- To maintain the life of the batteries, observe the specified charging time to the extent possible.
- The batteries discharge even when not used, so be sure to charge them before using them.

- When the batteries are not used for a long time, completely charge them once every 15 days, and keep them in a place with a temperature no greater than 30°C. Should a battery completely discharge, its performance will decline and fully charging it will become impossible.
- During charging, the charger may become hot.
- Recharging a battery immediately after charging it may cause it to deteriorate.
- Do not conduct one charging immediately after another. This could cause the battery and/or the charger to deteriorate. If successive charging is necessary, let the charger rest for about 30 minutes before proceeding.

1. Place a BT-60Q battery in the BC-29 charger as see in Figure 2-2.
2. Plug the charger's power cord into a socket. Charging will commence and will last about 3 hours.

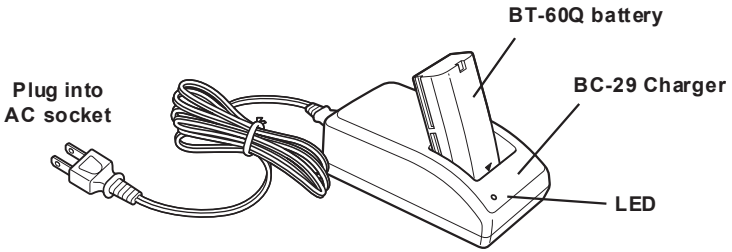


Figure 2-2. BT-60Q Battery in Charger

The LED indicator on the charger indicates the following, depending on the state of the battery:

- Steady red – fast charging under way
- Steady green – charging complete
- Blinking red – charging error
- No light – backup charging (charging by a small current prior to fast charging)

Charging with the AC Adaptor

The AC Adaptor supports charging-on-the-run for the receiver.

- With the adapter plugged into an AC outlet and the batteries installed, the batteries will also be charged.
- Without the batteries, the adapter is simply an AC adaptor.

Connect the AC Adaptor (p/n 22-034101-01) connector to the external power port on the GB-1000 (Figure 2-3).

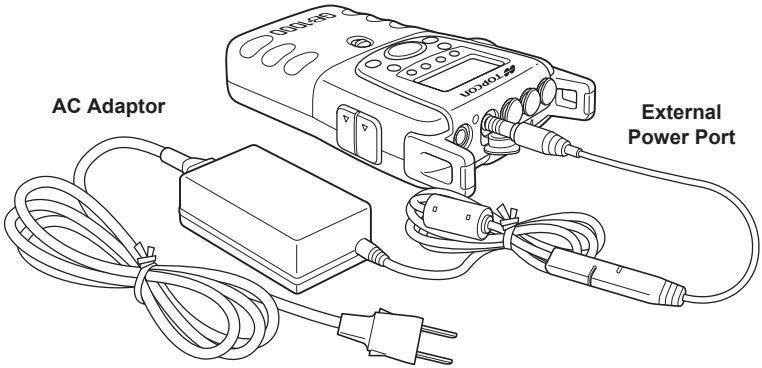


Figure 2-3. Charging the GB-1000 with the AC Adapter

Charging status varies depending on the state of the batteries and power switch.

- If the AC adaptor is connected when the GB-1000 is turned off, charging-on-the-run will begin once the receiver is turned on. Charging status (the percentage to which charging has taken place) can be checked using the status icons (the alternating display of the battery icons and the AC cord icon). When charging completes, only the AC cord icon alone displays.
- If the AC adaptor is connected when the power is on, charging-on-the-run will begin immediately. Check the status icon to confirm the charging status (Figure 2-4 on page 2-5).

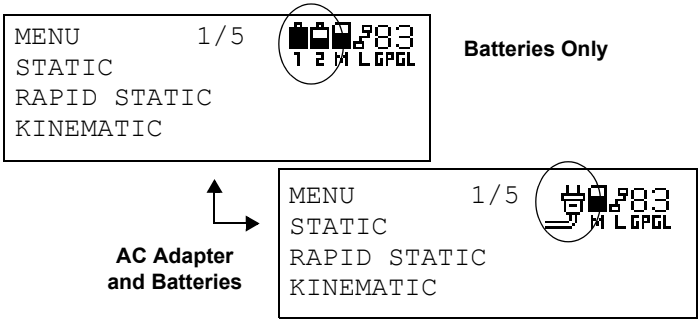


Figure 2-4. Display – Charging Status with GB-1000 Turned On

- With power turned off and the AC adaptor attached, the status icons blink between the batteries only and the AC adapter (Figure 2-5). When charging completes, power automatically switches off. If the power key is pressed during charging, power turns back on.

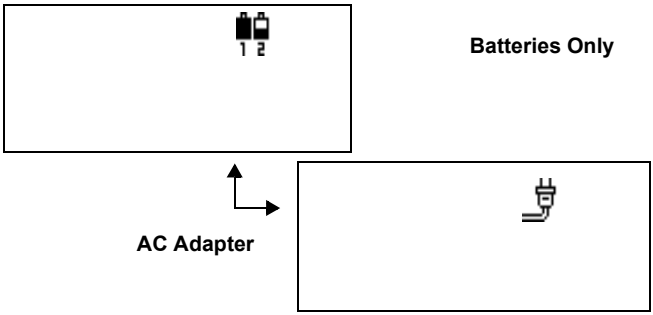


Figure 2-5. Display – Charging Status with GB-1000 Turned Off

- If no batteries are installed, the battery status icons blink for two seconds (Figure 2-6), then power switches off.

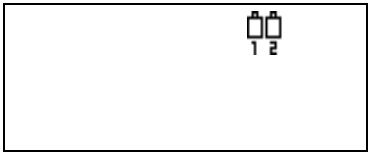


Figure 2-6. Display – Battery/Power Status without Batteries

Battery Charging Order and Precautions

When both batteries are installed, the battery with the smaller remaining capacity is charges first.

- When powering the GB-1000 from a car battery, the car battery may not supply a sufficient voltage charge. To ensure proper battery charging, use the AC adaptor.
- Conduct charging at room temperature +10°C to +40°C (+50°F to +104°F).
- Outdoor temperatures may exceed the recommended range. Check the ambient outdoor temperature before using the AC adaptor (or a car battery, etc.).
- To charge over-discharged batteries, conduct preliminary charging first. During preliminary charging, the status icons displayed in Figure 2-7 alternate. When preliminary charging completes, the screen for regular charging displays.

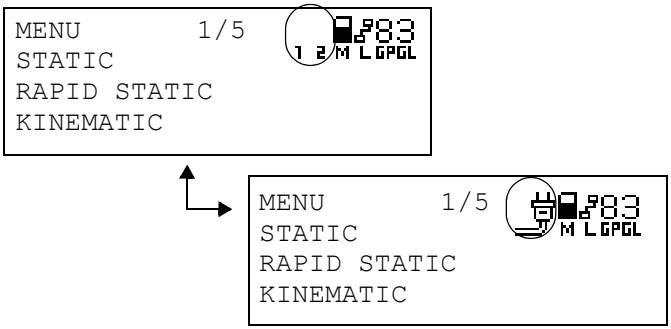


Figure 2-7. Display – Charging Over-discharged Batteries

Icons Displayed for Bad Batteries

If, when the batteries are being charged with the AC adapter, an abnormality related to voltage or to the charging situation occurs, the battery status icons will indicate that something is wrong with the battery. Abnormal situation include the life of the battery, battery deterioration, the receiver is unable to detect the battery, or some other cause.

The figures on the following pages illustrate example displays for an abnormality with battery two.

- Run charge under way with bad battery (Figure 2-8):

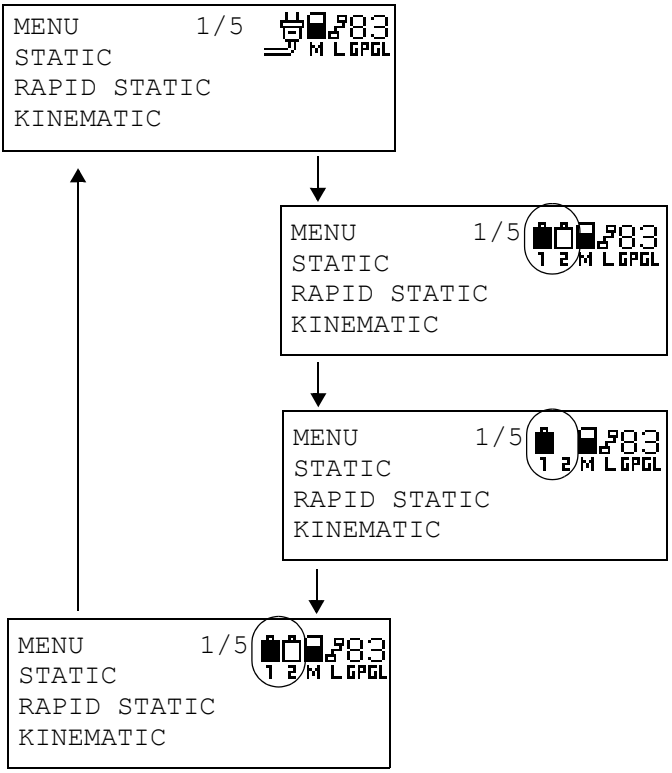


Figure 2-8. Display – Charging with a Bad Battery

- Completion of run charge with bad battery (Figure 2-9):

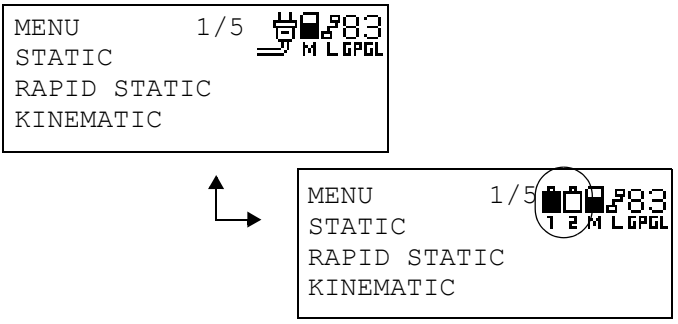


Figure 2-9. Display – Charge Complete with a Bad Battery

- Power is off and AC adapter connected with bad battery (Figure 2-10):

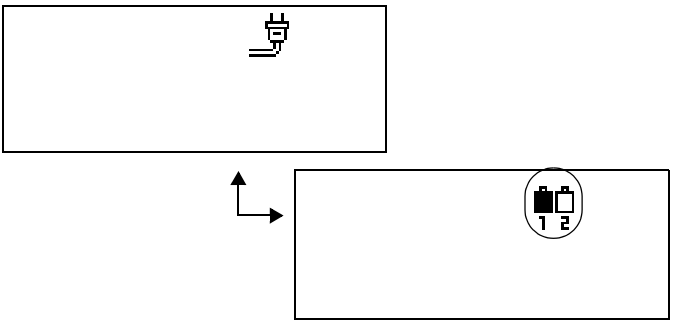


Figure 2-10. Display – Power Off, AC Adapter Connected, and a Bad Battery

When the display shows a bad battery icon, switch the batteries.

- If the abnormality display occurs for the same battery, and if that battery is replaced and the abnormality display ceases, the problem is probably battery deterioration (or some other battery deficiency).
- If the abnormality display occurs for both the battery icons, or if the abnormality display occurs even after a battery is replaced, the problem may lie with the GB-1000. In this case, please contact Topcon or your local distributor.

Connecting the USB Cable

Connect the USB cable to the GB-1000's USB port (Figure 2-11).

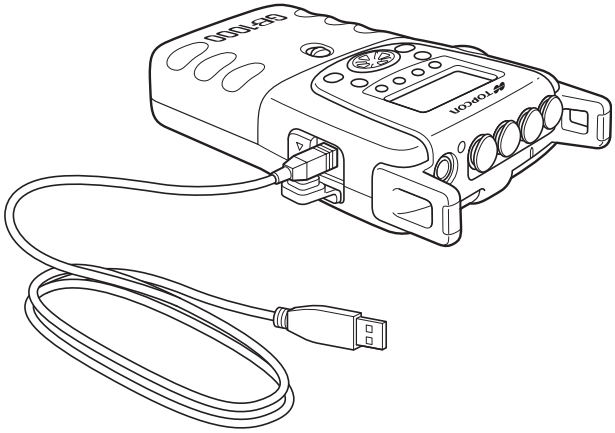


Figure 2-11. Connecting the USB Cable

NOTICE *NOTICE*

The USB port is not waterproof with an attached cable.

Connecting the LAN Cable

Connect the network cable to the GB-1000 receiver's LAN/Ethernet connector (Figure 2-12).

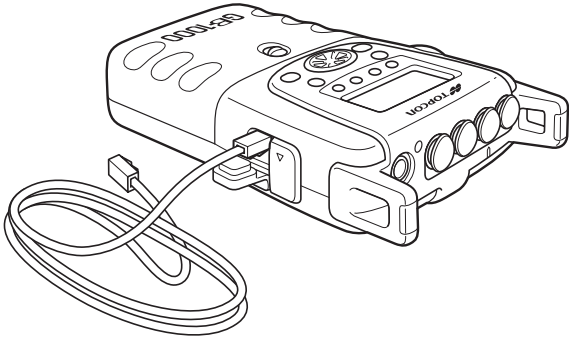


Figure 2-12. Connecting the LAN/Ethernet Cable

NOTICE *NOTICE*

The Ethernet port is not waterproof with an attached cable.

Connecting the Serial Cables

Connect the serial (RS-232C) cables for the data collector, computer, modem, etc., to the GB-1000's serial ports. The receiver has three serial ports: A, B and C. Each serial port corresponds to a specific external device (Figure 2-13):

- Port A – Data collector
- Port B – Computer
- Port C – Modem

Above each port is a colored mark: yellow for port A, green for port B, and white for port C. The red mark indicates the power port.

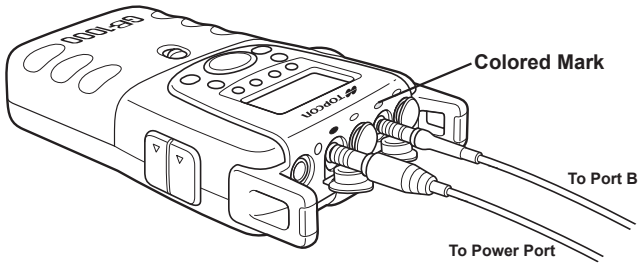


Figure 2-13. Connecting Serial Cables

TIP

Attach colored stickers to the cables that correspond to the colored mark above the receiver's serial ports.

The GB-1000's rubber caps function to maintain water proofing and are a little tight. When complete water proofing is required, be sure to push the caps all the way in.

Attaching the Strap

The strap for the GB-1000 provides an easy solution for carrying the receiver around the jobsite while performing surveys. Figure 2-14 illustrates the following steps:

1. Thread the strap through the strap holes.
2. Fold one end of the strap onto the velcro tape in the middle of the cover.
3. Fold the other end of the strap onto the velcro tape on the first end.
4. Firmly press the pieces of velcro tape together and snap the cover shut.

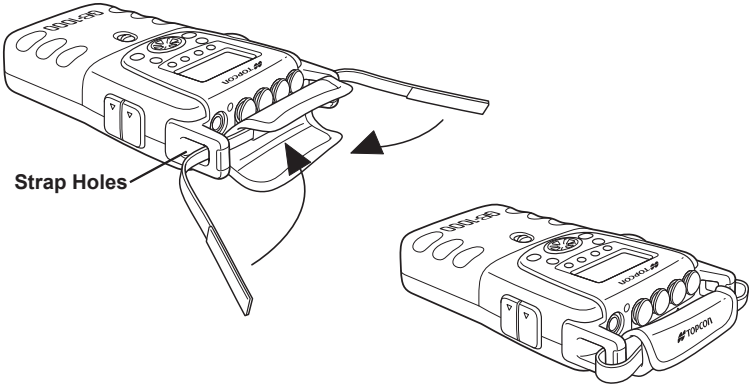


Figure 2-14. Attaching the Strap

NOTICE *NOTICE*

If the belt is not securely attached, the GB-1000 could fall and become damaged.

Handling the Compact Flash (CF) Card

The GB-1000 comes equipped with a Compact Flash card slot used to copy files from the internal memory to a compact flash (CF) card for use in a computer. Any compact flash (CF) card used with the GB-1000 must be compatible with Type I 3.3V. Figure 2-15 illustrates inserting and removing a CF card.

1. Open the cover of the CF card slot.
2. Insert the CF card with its label side upwards.
3. Close the cover of the CF card slot.
4. To remove the CF card, press the eject button located at the right of the slot.

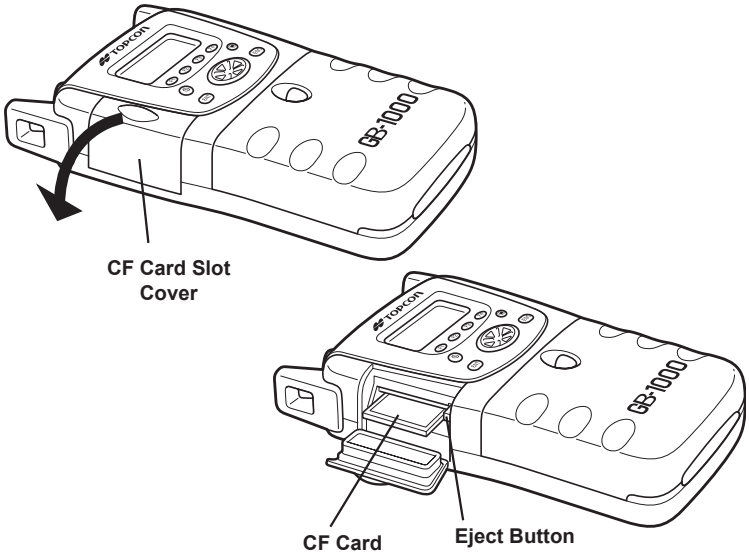


Figure 2-15. Inserting and Removing the Compact Flash Card

CAUTION

When the receiver is accessing the CF card avoid the following to prevent data loss and damage to the CF card:

– Do not remove the CF card.

– Do not remove the batteries.

– Do not shake or jolt the GB-1000.

The temperature range for using a commercially available CF card is 0-60° C. If using a CF card at a temperature of less than 0° C, use one equipped to compensate for low-temperature operation.

Status Icons

The status icons (Figure 2-16) provide basic information about the operational state of the GB-1000 receiver. The icons display in the upper right corner of the LCD panel.

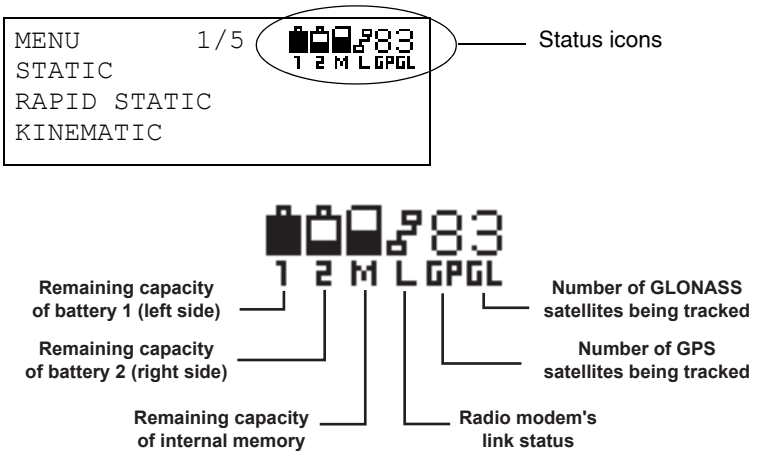


Figure 2-16. Display – Status Icons

Table 2-1 describes the status icons in more detail.

Table 2-1. Status Icons

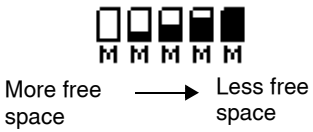
Status icon	Meaning	Explanation
	Remaining capacity of battery 1 (left side)	The remaining capacity of the battery on the left is indicated at 4 levels:  During charging-on-the-run, the charging status displays. If the battery is not installed, only the number of the battery displays.
	Remaining capacity of battery 2 (right side)	The remaining capacity of the battery on the right is indicated at four levels:  During charging-on-the-run, the charging status displays. If the battery is not installed, only the number of the battery displays.
	Remaining internal memory	The free space of the internal memory (the proportion to the total space) is indicated at five levels: 
	Radio modems link status	The radio modem's signal-receiving status is indicated with two icons: 

Table 2-1. Status Icons (Continued)

Status icon	Meaning	Explanation
8 GP	Number of GPS satellites being tracked	This display indicates the number of GPS satellites being tracked.
3 GL	Number of GLONASS satellites being tracked	This display indicates the number of GLONASS satellites being tracked.

NOTICE *NOTICE*

The icons for remaining battery capacity provide an estimate. At low temperatures, a small remaining capacity may be indicated prematurely.

Antenna Setup

The standard antenna for the GB-1000 is the PG-A1 antenna (Figure 2-17) for precise geodetic use. The PG-A1 is a light, compact, and fully waterproof antenna designed to be used for both static and kinematic surveying.

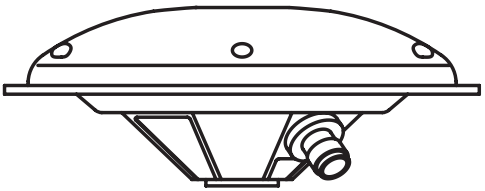


Figure 2-17. PG-A1 Antenna

When installing the antenna on a tripod, use the base, Tribrach adaptor 2-30 and horizontal spacer as described in the procedures below.

Antenna on Tripod

For the tripod (Figure 2-18), use the TOPCON Precision Wood Tripod or an expandable metal tripod.

1. Place the Tribrach-20 on the tripod and tighten the tripod screw, securing the base in place.
2. Place the Tribrach adaptor 2-30 on the base and tighten the bases locking screw.
3. Insert the horizontal spacer 1 into the PG-A1 antenna, then place the horizontal spacer 1 into the Tribrach adaptor 2-30.

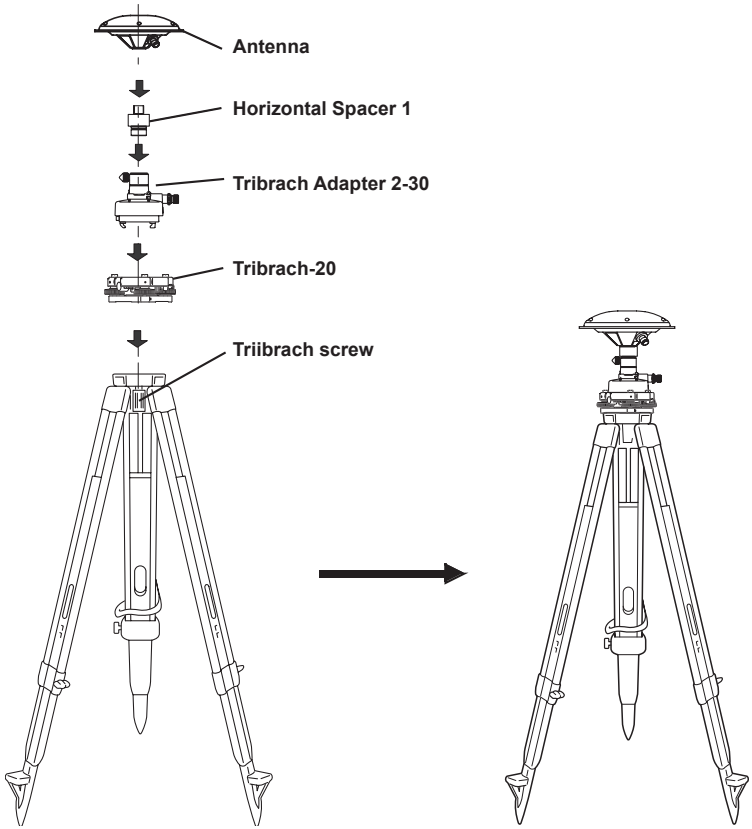


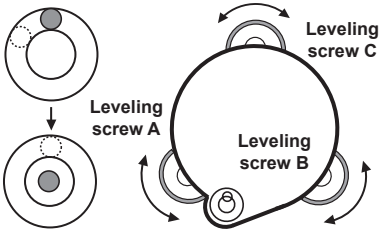
Figure 2-18. Antenna Setup on Tripod

Use the following reference to level the tripod.

1. Set Up the Tripod
Extend the extension legs to suitable lengths and tighten the leg-screws.

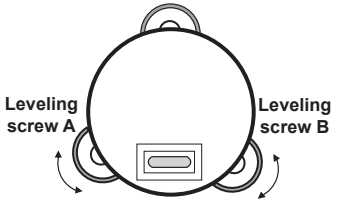
2. Attach the Antenna to the Tripod
Place the antenna on the tripod head and slide the antenna by loosening the tripod screw. If the plumb bob is positioned over the center of the point, slightly tighten the tripod screw.

3. Roughly Level the Antenna Using the Circular Level
Turn leveling screws A and B to move the bubble in the circular level. The bubble is now located on a line perpendicular to a line running through the center of leveling screws A and B

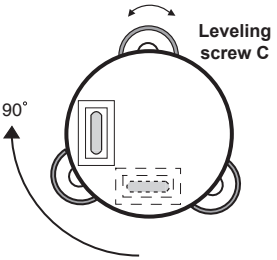


Turn leveling screw C to center the bubble in the circular level.

4. Center Using the Plate Level
Rotate the instrument horizontally using the Horizontal motion/clamp screw and place the plate level parallel with the line connecting leveling screws A and B. Turn leveling screws A and B to bring the bubble to the center of the plate level.

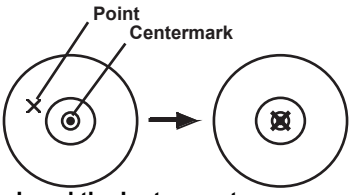


Rotate the instrument 90° (100g) around its vertical axis and turn leveling screw C to center the bubble once more.



Repeat step 4 for each 90° (100g) rotation of the instrument and check that the bubble correctly centers at all four points.

5. Center Using the Optical Plummet Telescope
Adjust the eyepiece of the optical plummet telescope to your eyesight. Slide the instrument by loosening the tripod screw, place the point on the center mark, and then tighten the tripod screw. Slide the instrument carefully to prevent any dislocation of the bubble.



6. Level the Instrument
Level the instrument as in step 4: Rotate the instrument, checking that the bubble is in the center of the plate level, regardless of telescope direction, then tighten the tripod screw to lock in position.

Antenna on RTK Pole

For the RTK pole (Figure 2-19), be sure to use one that is lightweight and mobile.

1. Screw the PG-A1 antenna onto the RTK poles 5/8-inch screw.
2. Release the lock, adjust the poles length, and fasten the lock again.

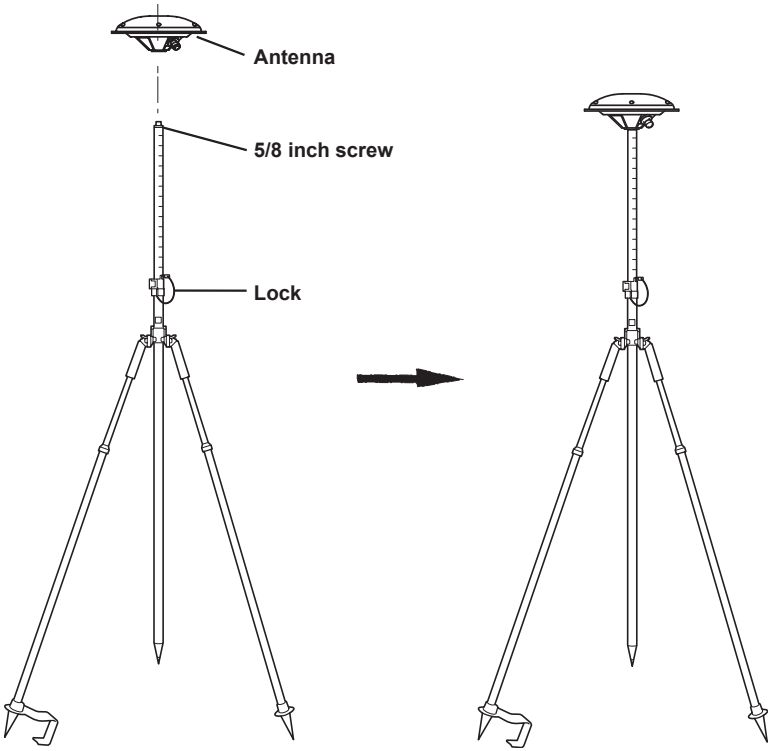


Figure 2-19. Antenna Setup on RTK Pole

Measuring Antenna Height

To accurately convert an observation taken at the antenna's position to a point on the ground, the antenna's height must be measured accurately. Inaccurate measurement of the antenna height will affect the vertical direction of the observation, and may affect the horizontal direction of the observation.

To measure the antenna height accurately:

- For the reference station antenna, measure the vertical height between the observation point marker and the antenna reference point (ARP) or the slant height between the observation point marker and the antenna height measuring position (Figure 2-20).
- For the rover antenna, measure the vertical height between the tip of the RTK pole and the ARP.

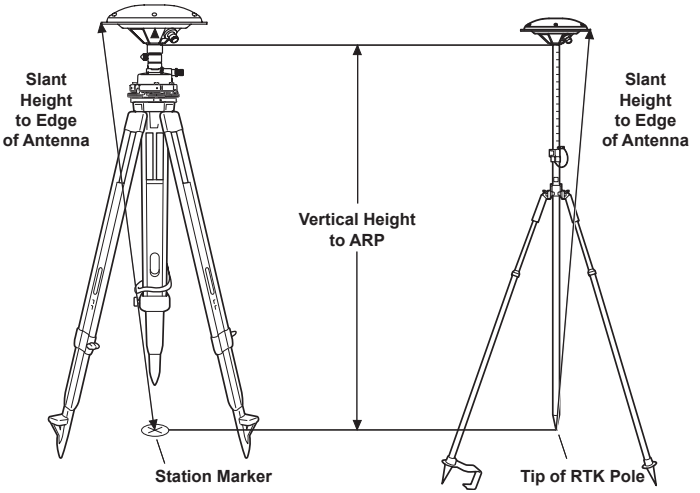


Figure 2-20. Measure Antenna Height

The actual point surveyed by the antenna is at the electrical phase center of the antenna, which is different from the ARP position. To calculate an accurate antenna height, add the offset (antenna constant) up to the phase center.

Antenna Offsets

Figure 2-21 shows the antenna height measuring position and antenna offsets for the PG-A1 antenna. L1 and L2 represent the antenna offsets for the L1 band and the L2 band, respectively.

The antenna height measuring position is the lower part of metal brim.

The following are antenna constants for the PG-A1:

- Electrical phase center from antenna reference point (ARP):

  a(L1)=54.3mm

  a(L2)=60.5mm

- Electrical phase center from antenna height measuring position:

  b(L1)=26.8mm

  b(L2)=33mm

- Antenna height measuring position from antenna reference point (ARP):

  c=27.5mm

- Distance between antenna center and measuring position:

  d=89.7mm

Normally, use b(L1) for the antenna offsets.

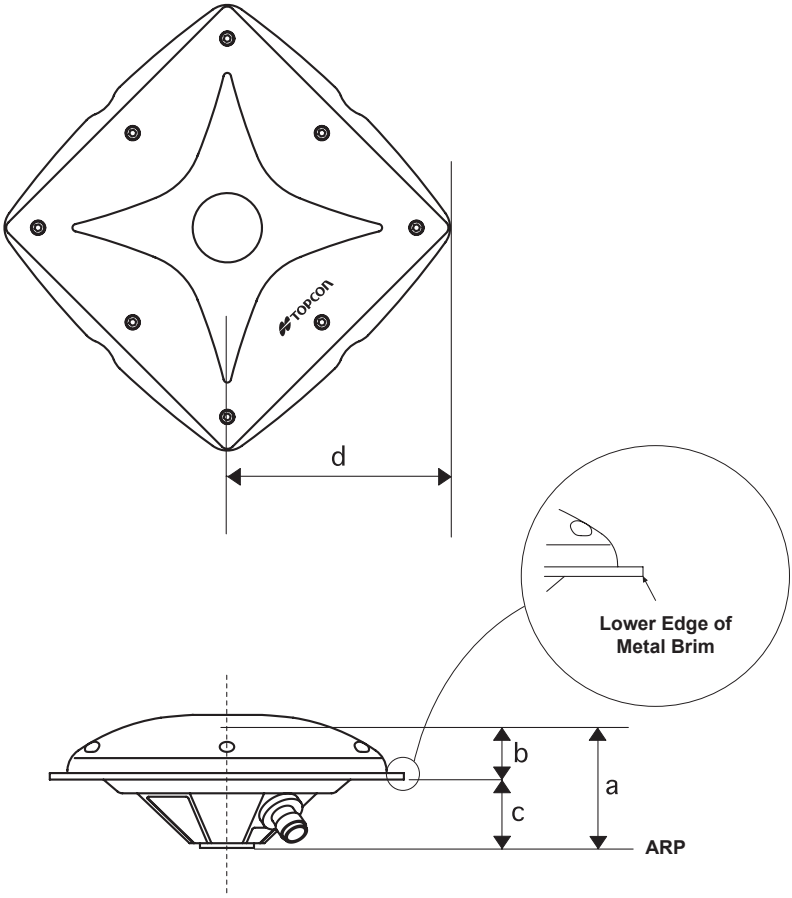


Figure 2-21. Measure Antenna Offset

Connecting the Antenna

Use the antenna cable to connect the GB-1000 and antenna.

1. Connect the cable to the GB-1000's antenna port (Figure 2-22).
2. Connect the cable to the PG-A1's antenna port (Figure 2-22).

Once connected, use the tripod hook on the back of the receiver to attach it securely to the tripod.

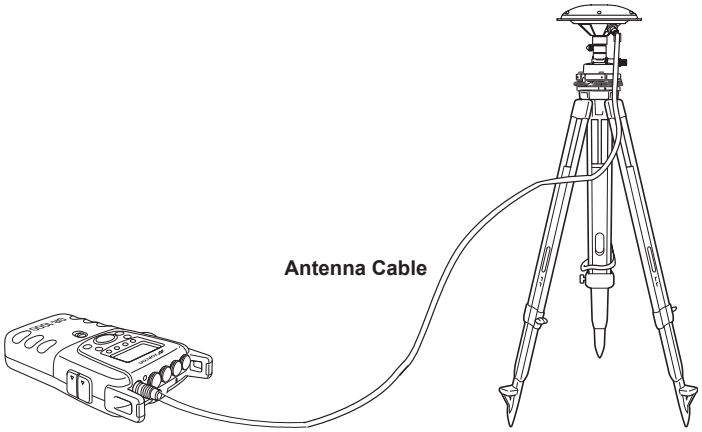


Figure 2-22. Connect GB-1000 and Antenna

Collecting Almanacs

Each satellite broadcasts a message (almanac) which gives the approximate orbit for itself and all other satellites. If the receiver has an almanac, you can considerably reduce the time needed to search for and lock on to satellite signals.

The receiver regularly updates the almanac and stores the most recent almanac in its Non-Volatile Random Access Memory (NVRAM).

You will need to collect or update the almanac:

- If the receiver has been off for a long time.
- If the last known receiver position, stored in the NVRAM, is different from the present position by several hundred kilometers.
- After loading a new OAF.
- After loading new firmware.
- After clearing the NVRAM.
- Before surveying.

1. Set up the receiver in a location with a clear view of the sky.
2. Turn on the receiver.
3. Wait for about 15 minutes while the receiver collects almanac data from the satellites.

NOTICE *NOTICE*

If 15 minutes have passed and the receiver does not lock on to satellites, you may need to clear the NVRAM. See "Resetting the NVRAM" on page 3-68 for this procedure.

Operation

This chapter describes operating the various buttons and menus of the GB-1000. The GB-1000 has the following user-interface components (Figure 3-1):

- Display – displays various menus and messages.
- Function keys – used to select screen options.
- Power key – turns the GB-1000 on and off.
- Menu key – displays the main menu.
- Enter key – applies parameters, selections, and settings.
- Escape key – returns to the previous screen or the main menu.
- Cursor key – navigates through the menus and selections.

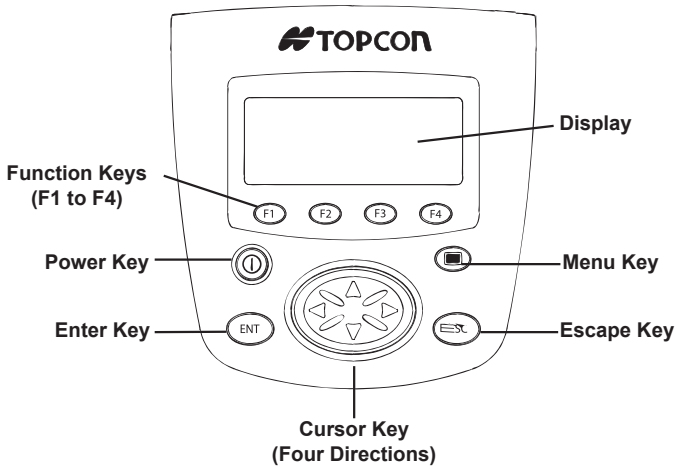


Figure 3-1. GB-1000

Turning Power On/Off and Sleep Mode

The GB-1000 uses either two rechargeable batteries or a power cord connected to an outlet for power.

Turning Power On

To turn on the GB-1000, press the power key.

The GB-1000 flash-screen briefly displays, then the main Menu displays (Figure 3-2).

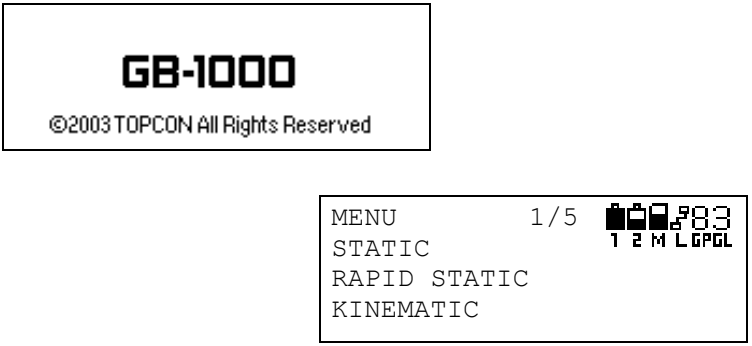


Figure 3-2. Initial Display and Menu Screen

Turning Power Off

To turn off the GB-1000, press the power key until the screen goes dark (for two or more seconds). A beep sounds several times indicating the receiver is powering off.

Sleep Mode

Sleep mode is an energy-saving standby mode in which the GB-1000 conserves energy. Any signal input to a serial port form an external device will cause the GB-1000 receiver to leave sleep mode.

1. Press the **menu** key (Figure 3-3), initiating the MENU mode.

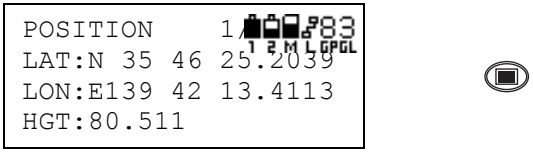


Figure 3-3. Current Display and Menu Key

2. In MENU mode, press the **down cursor key** (Figure 3-4) until SLEEP MODE displays on menu page 5/5.

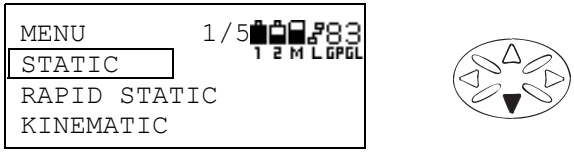


Figure 3-4. Use Cursor Key to Navigate Menu

3. With SLEEP MODE selected, press the **ENT** key (Figure 3-5).

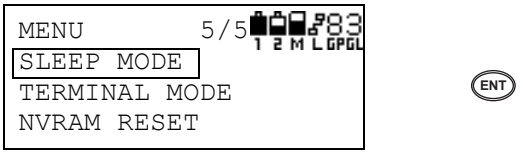


Figure 3-5. Press Enter to Select Sleep Mode

4. On the SLEEP MODE screen, press the **F1** (CHG) key (Figure 3-6) to change the sleep mode setting.

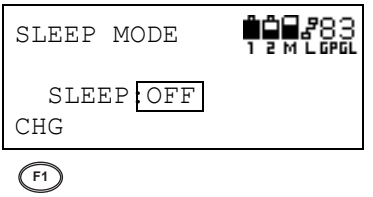


Figure 3-6. Press F1 to Change Sleep Mode Setting

5. Press the **left/right cursor key** or **F2/F3** (-/+) to select ON, then press **F4** (SET) to apply the setting (Figure 3-7).

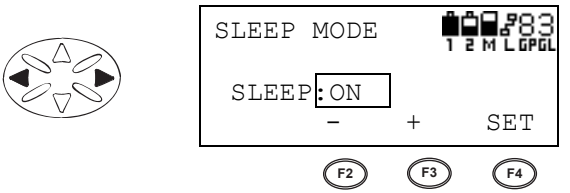


Figure 3-7. Select "On" and Press F4 to Set

Sleep mode commences (Figure 3-8).

Figure 3-8. GB-1000 in Sleep Mode

During sleep mode, the remaining battery capacity icons continuously update.

In sleep mode, the GB-1000 has about 100 hours of sleep time available—with two fully charged batteries installed. When beginning observation, check the remaining battery capacity to ensure battery power is available for the duration of the job.

Leaving Sleep Mode

To take the GB-1000 out sleep mode, do one of the following:

- Input a signal from an external device connected to one of serial ports. The screen returns to the main menu.
- Press **F1** and **F4** at the same time until a beep sounds, then release these keys. The screen returns to the main menu.

In sleep mode, no key operation other than the simultaneous pressing of F1 (EXIT) and F4 (EXIT) has any effect

NOTICE

Before turning the power off or conducting some other operation, exit from sleep mode.

If, while in sleep mode, battery capacity should become completely discharged, replace the batteries with fully charged ones and turn on the power. The GB-1000 returns to sleep mode.

Menu Operation

GB-1000 menus enable the various measurements and settings required for observations and general operation. Use the up/down cursor keys to navigate between the five menu screens.

- The current screen number displays next to the status icons.
- Each screen has up to three menus available.

Table 3-1 displays the menu screens and their available menus.

Table 3-1. GB-1000 Menus

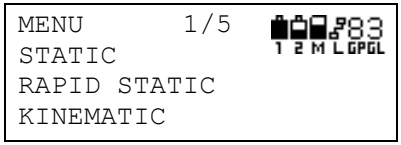
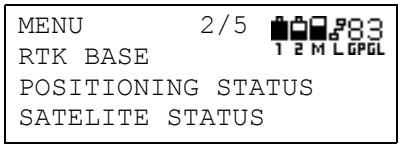
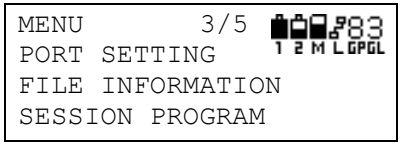
Menu Screen	Menu Options
	STATIC – see "Static Observation Parameters" on page 3-12. RAPID STATIC – see "Rapid Static Observation Parameters" on page 3-16. KINEMATIC – see "Kinematic Observation Parameters" on page 3-21.
	RTK BASE – see "RTK Base Setting" on page 3-26. POSITIONING STATUS – see "Displaying Positioning Information" on page 3-29. SATELITE STATUS – see "Displaying Satellite Reception Status" on page 3-31.
	PORT SETTING – see "Setting the Ports" on page 3-37. FILE INFORMATION – see "Displaying and Managing File Information" on page 3-45. SESSION PROGRAM – see "Programming a Session" on page 3-53.

Table 3-1. GB-1000 Menus (Continued)

Menu Screen	Menu Options
MENU 4/5 NMEA OUTPUT HARDWARE INFORMATION SETTINGS	NMEA OUTPUT – Refer to "NMEA Output" on page 3-58. HARDWARE INFORMATION – see "Displaying Hardware Information" on page 3-59. SETTINGS – see "Settings" on page 3-62.
MENU 5/5 SLEEP MODE TERMINAL MODE NVRAM RESET	SLEEP MODE – see "Turning Power On/Off and Sleep Mode" on page 3-2. TERMINAL MODE – see "Terminal Mode" on page 3-66. NVRAM RESET – see "Resetting the NVRAM" on page 3-68.

Entering Numbers, Letters, and Symbols

For user-entered information, such as the names of points used in static observation, use the GB-1000 display to enter numbers, upper case letters, and/or symbols (., -, +, #).

1. On an input screen, press **F1** (EDIT) to initiate the input mode (Figure 3-9). Letter groups corresponding to the function keys display at the bottom of the screen.

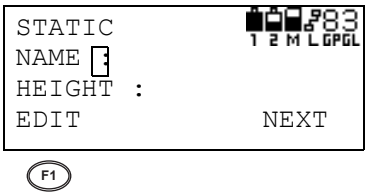


Figure 3-9. Press F1 to Input Information

2. Press the **up/down cursor key** to scroll through the letter groups (Figure 3-10).

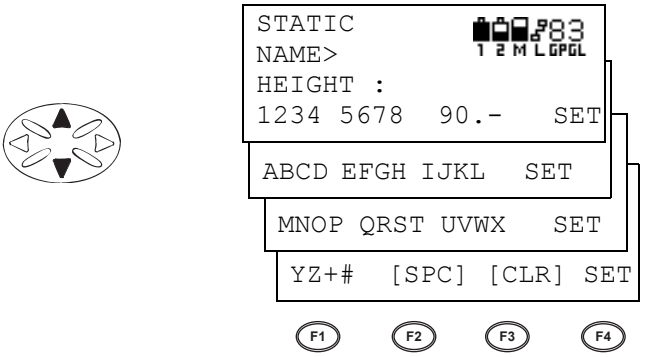


Figure 3-10. Use the Cursor to Scroll through Letter Groups

3. Press the **function key** for the letter group containing the letter, number, or symbol (Figure 3-11). For example, press **F2** for QRST.

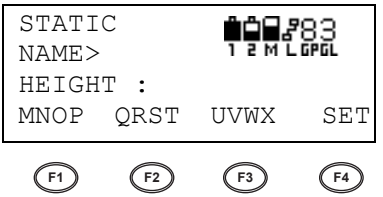


Figure 3-11. Press Function Key for Desired Letter Group

4. Press the **function** key for the desired letter (Figure 3-12). For example, press **F4** for T.

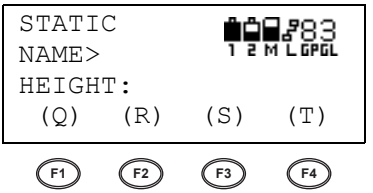


Figure 3-12. Press Function Key for Desired Letter

5. Repeat steps 2 through 4 on page 3-8 to input succeeding letters, numbers, and symbols (Figure 3-13).

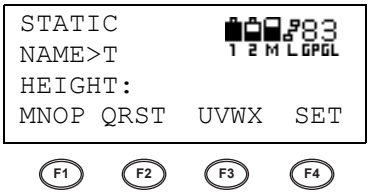


Figure 3-13. Use Cursor and Function Keys to Input

6. To edit information while in the EDIT mode, press the **left/ right cursor key**, moving the cursor to the character to be changed. Then use the same steps to change the desired letter, number, or symbol.

   Up to 10 letters can be input for a point name.

7. When finished, press **F4** (SET) or the **Enter** key to set and save the information. The screen returns to the beginning screen for the menu selection (Figure 3-14).

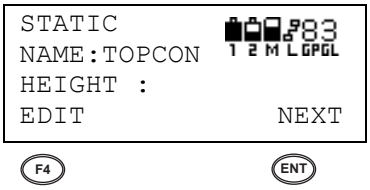


Figure 3-14. Press F4 or Enter to Save

Selecting Parameters

To select parameters in the different menus selections (static observation, kinematic observation, sleep mode, etc.), use the cursor key or the corresponding function key to select the antenna type, measuring method, or other parameters.

The following steps are an example for selecting the interval to be used for static observation.

1. From the main menu, navigate to STATIC and press ENT to activate the Static observation screen. Press the **up/down cursor key** (Figure 3-15), moving the cursor to INTVL.

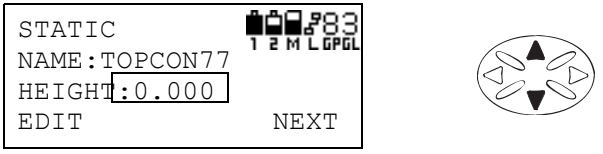


Figure 3-15. Static Observation Screen – Navigate to Interval Selection

2. With the interval parameter highlighted, press the **F1** (CHG) key to edit the parameter (Figure 3-16).

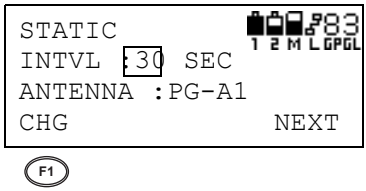


Figure 3-16. Press F1 to Edit the Observation Interval

3. Press the **left/right cursor keys** or **F2/F3** to scroll through the available options, then select the desired interval (Figure 3-17); available intervals are: 1, 5, 10, 15, 30, 60.

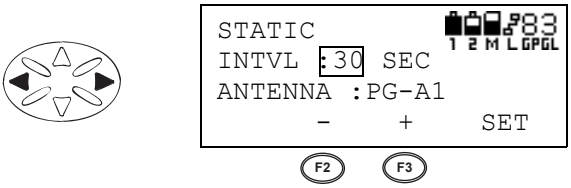


Figure 3-17. Select Desired Interval

4. Confirm that the selected interval is correct, then press **F4** (SET) or **ENT** to set the interval (Figure 3-18).

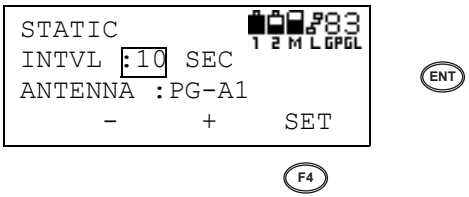


Figure 3-18. Confirm Selection and Press Enter or F4

5. Use the cursor key to navigate to the next parameter. In this example, the antenna parameter (Figure 3-19). Change the selected parameter as described in above steps.

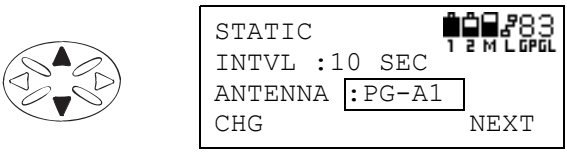


Figure 3-19. Change Other Parameters As Needed

Static Observation Parameters

Table 3-2 lists the parameters available for static observation, their range, and the default for each one.

Table 3-2. Static Observation Parameters

Parameter	Range	Default
Point name	Up to 10 letters	-
Antenna height	0.000m to 99.999m	0.000m
Interval time	1, 5, 10, 15, 30, 60 seconds	30 sec.
Type of antenna	PG-A1, Legant, Legant-G, PG-A5, PG-A1 w/GP, unknown	PG-A1
Measuring method	ARP, slant	ARP
Elevation mask angle	0 to 90°; set in increments of 1°	15°

1. Press the menu key, initiating the menu mode (Figure 3-20).

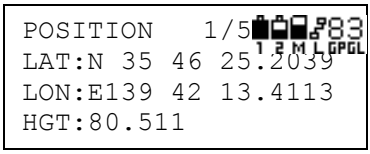


Figure 3-20. Current Display and Menu Key

2. Confirm that STATIC observation is selected, then press the **ENT** key (Figure 3-21). If observation is currently under way, a confirmation message will appear, then press **F2** (YES).

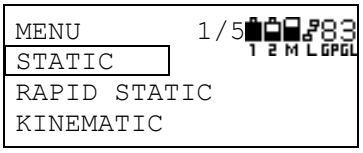


Figure 3-21. Static Observation Menu Selection

3. Press **F1** (EDIT) and enter the point name (Figure 3-22). See "Entering Numbers, Letters, and Symbols" on page 3-7 for details on this procedure.

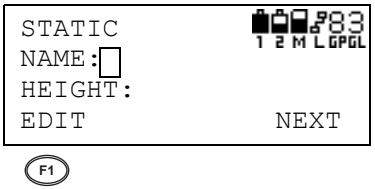


Figure 3-22. Enter Point Name

4. Press the **up/down cursor key** to select the HEIGHT parameter (Figure 3-23). Enter the antenna height as described in "Selecting Parameters" on page 3-10.

Figure 3-23. Enter Height Information

5. Press the **down cursor key** to move to the INTVL parameter. Press **F1** (CHG) and change the interval (Figure 3-24). For the interval, select either 1, 5, 10, 15, 30 or 60 seconds.

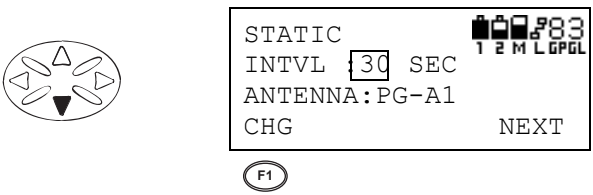


Figure 3-24. Select Interval

6. Use the **up/down cursor key** to scroll down to the antenna height measuring method. Press **F1** (CHG) and select either antenna reference point (ARP) or slant using the left/right cursor keys (Figure 3-25).

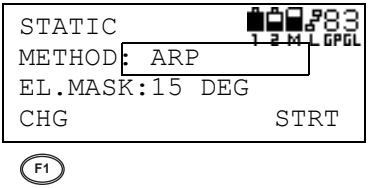


Figure 3-25. Enter Measuring Method

7. Scroll down to the elevation-mask angle and set the mask in increments of 1 degree (Figure 3-26).

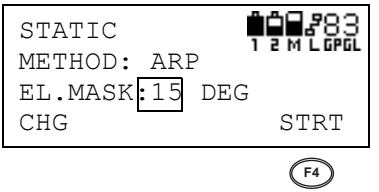


Figure 3-26. Select Elevation-mask Angle

8. Press **F4** (START) (Figure 3-26).

   The confirmation screen for starting observation displays (Figure 3-27). At this point, check the various parameters as needed.

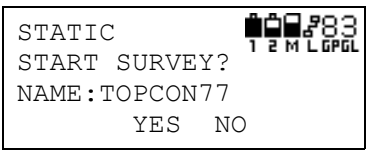


Figure 3-27. Start Survey?

9. To check parameters, use the **up/down cursor** to scroll through the available parameters (Figure 3-28).

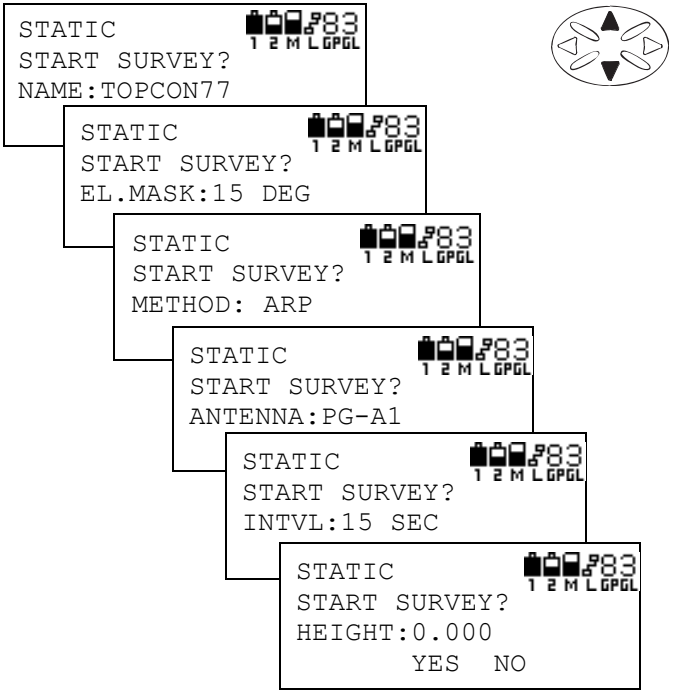


Figure 3-28. Check Parameters

10. Press **F2** (YES). Observation will begin (Figure 3-29).

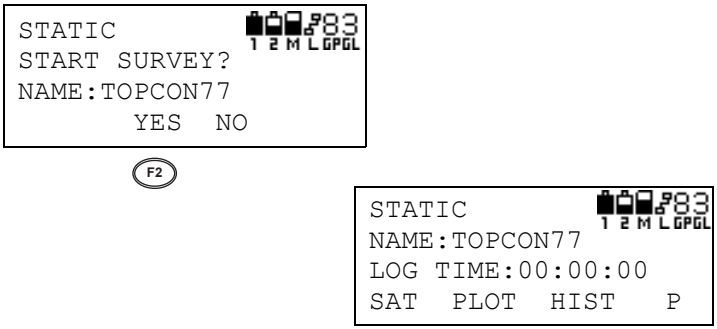


Figure 3-29. Press F2 to Begin Observation

11. When the observation completes, press **F4** (P), changing to page 2 of the function key operations.

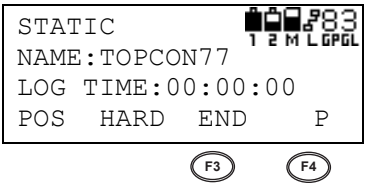


Figure 3-30. Static Observation Menu Selection

12. Press **F3** (END) to end the survey (Figure 3-30).
13. Press **F2** (YES) to confirm (Figure 3-31).

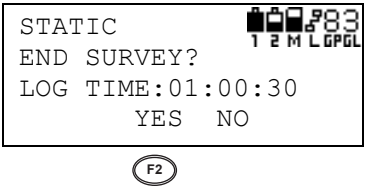


Figure 3-31. Confirm Observation Complete

Rapid Static Observation Parameters

Table 3-3 lists the parameters available for rapid static observation, their range, and the default for each one.

Table 3-3. Rapid Static Observation Parameters

Parameter	Range	Default
Point name	Up to 10 letters	-
Antenna height	0.000m to 99.999m	0.000m
Interval time	1, 5, 10, 15, 30, 60 seconds	15 sec.
Type of antenna	PG-A1, Legant, Legant-G, PG-A5, PG-A1 w/GP, unknown	PG-A1
Measuring method	ARP, slant	ARP

Table 3-3. Rapid Static Observation Parameters (Continued)

Parameter	Range	Default
Elevation mask angle	0 to 90°; set in increments of 1°	15°

1. Press the **menu** key, initiating the menu mode (Figure 3-32).

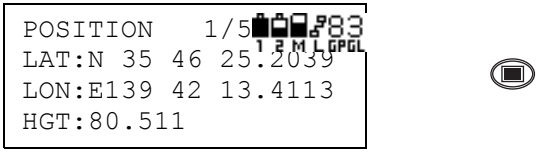


Figure 3-32. Current Display and Menu Key

2. Press the **up/down cursor key** to select Rapid Static, then press the **ENT** key (Figure 3-21). If observation is currently under way, a confirmation message will appear, then press **F2** (YES).

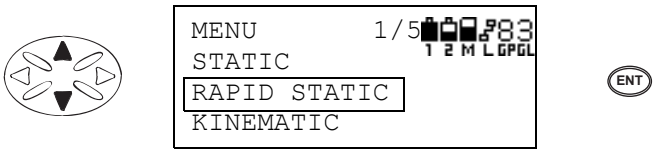


Figure 3-33. Static Observation Menu Selection

3. Press **F1** (EDIT) and enter the point name (Figure 3-34). See "Entering Numbers, Letters, and Symbols" on page 3-7 for details on this procedure.

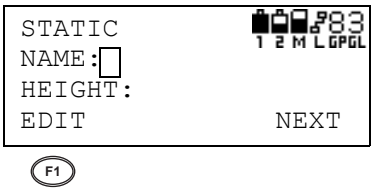


Figure 3-34. Enter Point Name

4. Press the **up/down cursor key** to select the HEIGHT parameter (Figure 3-35). Enter the antenna height as described in "Selecting Parameters" on page 3-10.

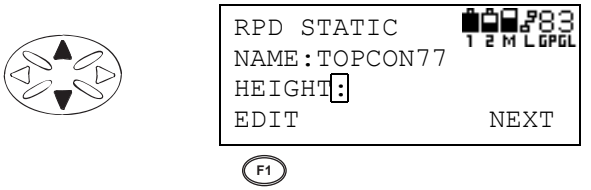


Figure 3-35. Enter Height Information

5. Press the **down cursor key** to move to the INTVL parameter. Press **F1** (CHG) and change the interval (Figure 3-36). For the interval, select either 1, 5, 10, 15, 30 or 60 seconds.

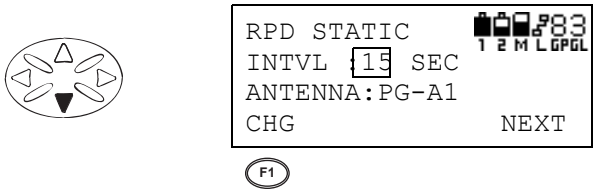


Figure 3-36. Select Interval

6. Use the **up/down cursor key** to scroll down to the antenna height measuring method. Press **F1** (CHG) and select either antenna reference point (ARP) or slant using the left/right cursor keys (Figure 3-37).

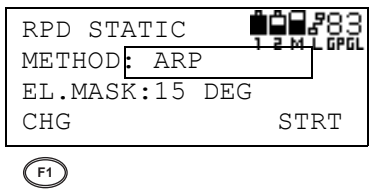


Figure 3-37. Enter Measuring Method

7. Scroll down to the elevation-mask angle and set the mask in increments of 1 degree (Figure 3-38).

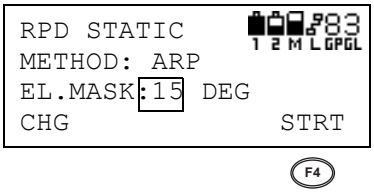


Figure 3-38. Select Elevation-mask Angle

8. Press **F4** (START) (Figure 3-26).

   The confirmation screen for starting observation displays (Figure 3-39). At this point, check the various parameters as needed.

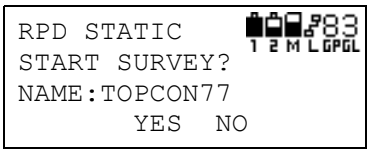


Figure 3-39. Start Survey?

9. To check parameters, use the **up/down cursor** to scroll through the available parameters (Figure 3-40).

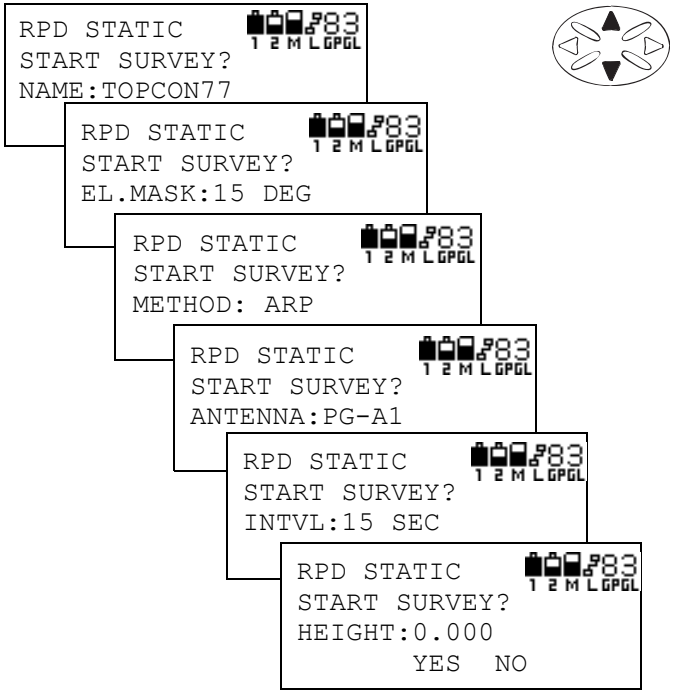


Figure 3-40. Check Parameters

10. Press **F2** (YES). Observation will begin (Figure 3-41).

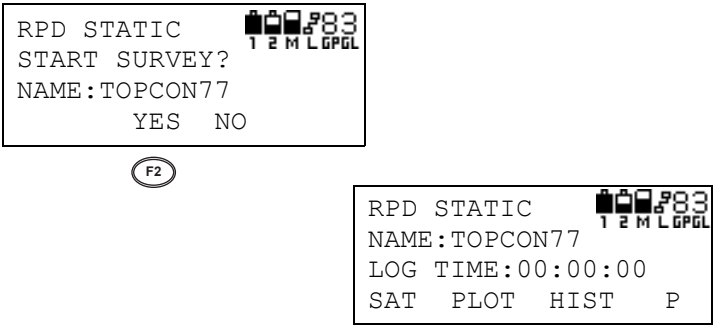


Figure 3-41. Press F2 to Begin Observation

11. When the observation completes, press **F4** (P), changing to page 2 of the function key operations.

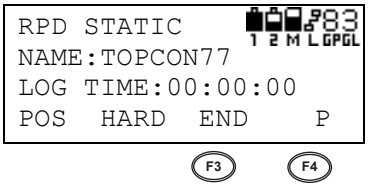


Figure 3-42. Rapid Static Observation Menu Selection

12. Press **F3** (END) to end the survey (Figure 3-42).
13. Press **F2** (YES) to confirm (Figure 3-43).

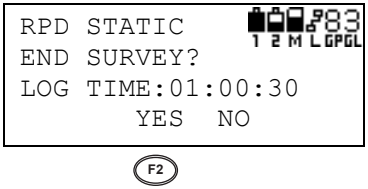


Figure 3-43. Confirm Observation Complete

Kinematic Observation Parameters

Table 3-4 lists the parameters available for kinematic observation, their range, and the default for each one.

Table 3-4. Rapid Static Observation Parameters

Parameter	Range	Default
Point name	Up to 10 letters	-
Antenna height	0.000m to 99.999m	0.000m
Interval time	1, 5, 10, 15, 30, 60 seconds	5 sec.
Type of antenna	PG-A1, Legant, Legant-G, PG-A5, PG-A1 w/GP, unknown	PG-A1
Measuring method	ARP, slant	ARP

Table 3-4. Rapid Static Observation Parameters (Continued)

Parameter	Range	Default
Elevation mask angle	0 to 90°; set in increments of 1°	15°
Initialize time (I.TIME)	0 to 999 sec.	300 sec.
Observation time	0 to 999 sec.	60 sec.

1. Press the **menu key**, initiating the menu mode (Figure 3-44).

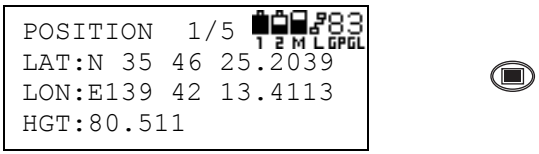


Figure 3-44. Current Display and Menu Key

2. Press the **up/down cursor key** to select Kinematic, then press the **ENT** key (Figure 3-45). If observation is currently under way, a confirmation message will appear, then press **F2** (YES).

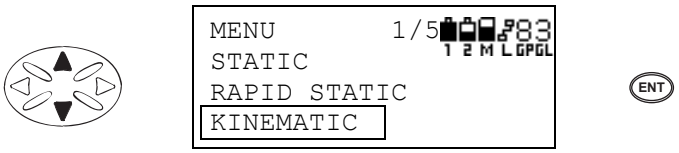


Figure 3-45. Kinematic Observation Menu Selection

3. Press **F1** (EDIT) and enter the point name (Figure 3-46). See "Entering Numbers, Letters, and Symbols" on page 3-7 for details on this procedure.

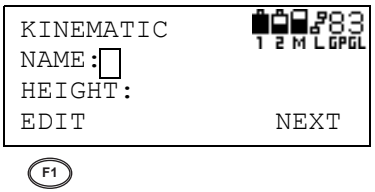


Figure 3-46. Enter Point Name

4. Press the **up/down cursor key** to select the HEIGHT parameter (Figure 3-47). Enter the antenna height as described in "Selecting Parameters" on page 3-10.

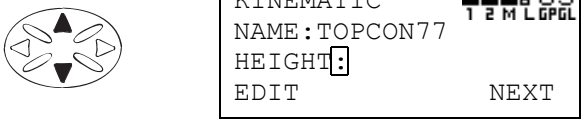


Figure 3-47. Enter Height Information

5. Press the **down cursor key** to move to the INTVL parameter. Press **F1** (CHG) and change the interval (Figure 3-48). For the interval, select either 1, 5, 10, 15, 30 or 60 seconds.

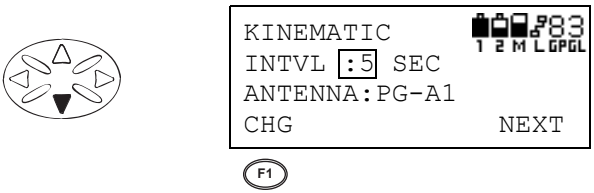


Figure 3-48. Select Interval

6. Use the **up/down cursor key** to scroll down to the antenna height measuring method. Press **F1** (CHG) and select either antenna reference point (ARP), or slant using the left/right cursor keys (Figure 3-49).

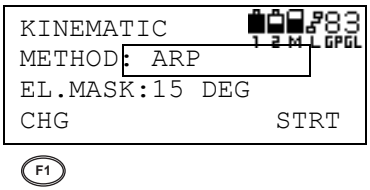


Figure 3-49. Enter Measuring Method

7. Scroll down to the elevation-mask angle and set the mask in increments of 1 degree (Figure 3-50).

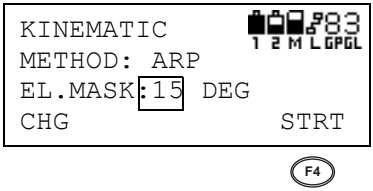


Figure 3-50. Select Elevation-mask Angle

8. Scroll down to the initialize time parameter and set the I.TIME in increments of 1 second (Figure 3-51).

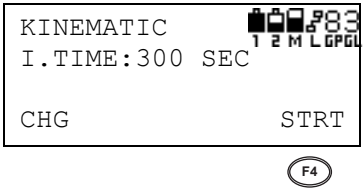


Figure 3-51. Set I.TIME

9. Press **F4** (START) (Figure 3-51).

   The confirmation screen for starting observation displays (Figure 3-52). At this point, check the various parameters as needed.

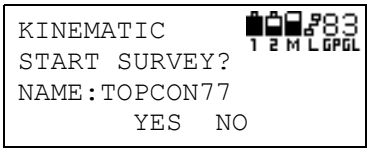


Figure 3-52. Start Survey?

10. Press **F2** (YES). Observation will begin (Figure 3-53).

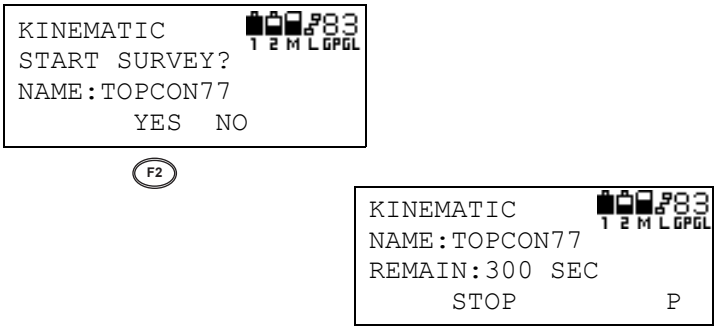


Figure 3-53. Press F2 to Begin Observation

When initial observation completes, the point name will be changed (incremented) and the remaining time will change to 60 seconds (Figure 3-54).

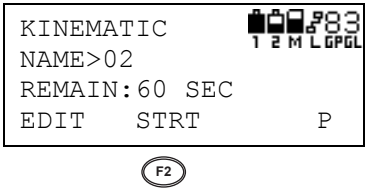


Figure 3-54. Next Point and Remaining Observation Time

11. Move to the next measuring point and press **F2** (START) the GB-1000 receiver measures the next point.

    To confirm the settings at any time, press the up/down cursor key, moving through the parameters. Press **F1** (EDIT) to display or change any settings.

12. When the observation completes, press **F4** (P) twice, changing to page 3 of the function key operations.

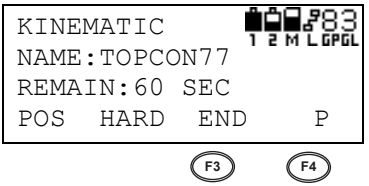


Figure 3-55. Static Observation Menu Selection

13. Press **F3** (END) to end the survey (Figure 3-55).
14. Press **F2** (YES) to confirm (Figure 3-56).

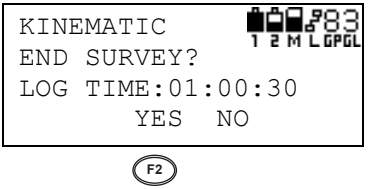


Figure 3-56. Confirm Observation Complete

RTK Base Setting

Real-time kinematic (RTK) is a differential GPS process where information, such as differential corrections, is transmitted in real-time from a Base station to one or more Rover stations.

Setting the Reference Coordinates

1. In the menu mode, press the **cursor key** to navigate to RTK BASE and press **ENT** (Figure 3-57).

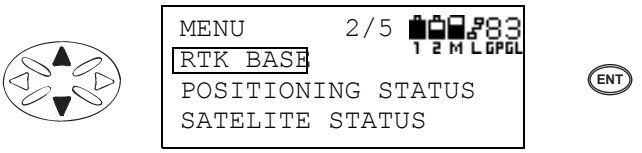


Figure 3-57. Select RTK Base

2. From the RTK BASE menu, select REF. COORDINATE and press **ENT** (Figure 3-58).

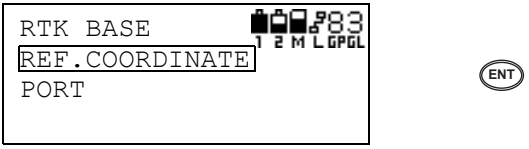


Figure 3-58. Select Reference Coordinate and Press Enter

3. Check the coordinates (Figure 3-59).
   - To use the current position, press **F2** (HERE), then **F4** to set.
   - To edit the position, press **F1** (EDIT), then edit the position. See "Entering Numbers, Letters, and Symbols" on page 3-7 for details on this procedure.

Figure 3-59. Enter or Edit Position Coordinates

Selecting Port and Format

1. From the RTK BASE menu, use the **up/down cursor key** to select PORT, then press **ENT** (Figure 3-60).

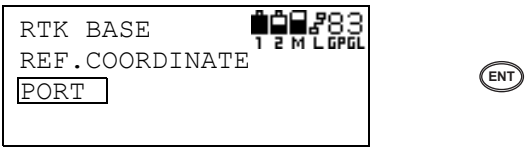


Figure 3-60. Select Format and Press Enter

2. Press **F1** (CHG) to change the port setting, either OFF, A, B, or C (Figure 3-61). See “Selecting Parameters” on page 3-10 for details on this procedure.

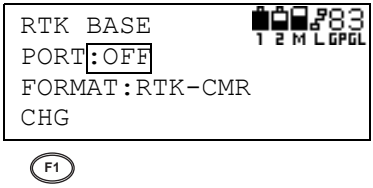


Figure 3-61. Select Port Setting

3. Press the **up/down cursor key** to select FORMAT. Press **F1** (CHG) to change the format setting, either RTK-CMR, RTK-CMR+, or RTK-RTCM (Figure 3-62). See “Selecting Parameters” on page 3-10 for details on this procedure.

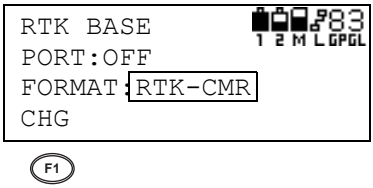


Figure 3-62. Select Format Type

NOTICE *NOTICE*

If Port is “Off” the Format setting cannot be changed.

Displaying Positioning Information

To display positioning information, select POSITIONING STATUS on menu page 2/5 and press **ENT**. During observation, press F1 (POS) on page 2 of the function key operations (Figure 3-63).

- Press the **ESC** key to return to the Menu or Observation screen.
- Press the **up/down cursor** to scroll through the positioning information screens.

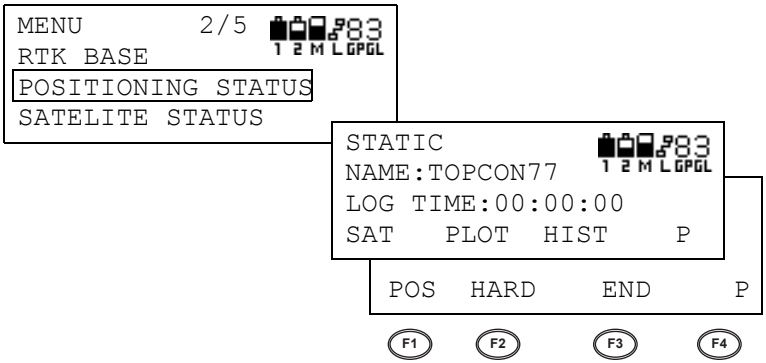


Figure 3-63. Select Positioning Status Menu

The positioning information screens include the following:

- the position's coordinates (WGS84) (Figure 3-64).

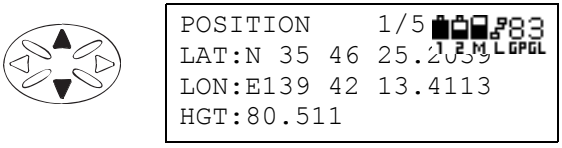


Figure 3-64. Position's Coordinates

- the current date and time (Figure 3-65).

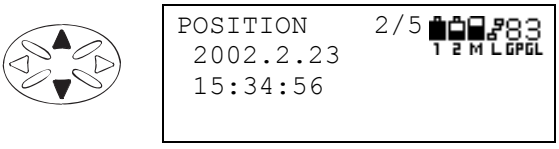


Figure 3-65. Current Date and Time

- the position's DOP (dilution of precision) (Figure 3-66):
  - –PDOP: the precision of the 3D position.
  - –HDOP: the precision of the horizontal component.
  - –VDOP: the precision of the vertical component.

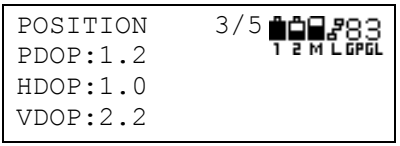


Figure 3-66. DOP

- the RTK status (Figure 3-67).

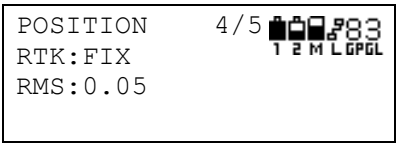


Figure 3-67. Position Status

- the radio modem's link status (Figure 3-68). LINK indicates the quality of the data link. If the link has no errors, 100% displays.

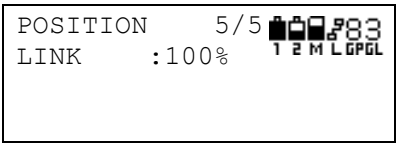


Figure 3-68. Link Status

Displaying Satellite Reception Status

The GB-1000 receiver displays satellite information and sky plot information for tracked satellites.

Satellite Information

To display satellite information, select SATELLITE STATUS on menu page 2/5 and press **ENT**. During observation, press **F1** (SAT) on page 2 of the function key operations (Figure 3-69).

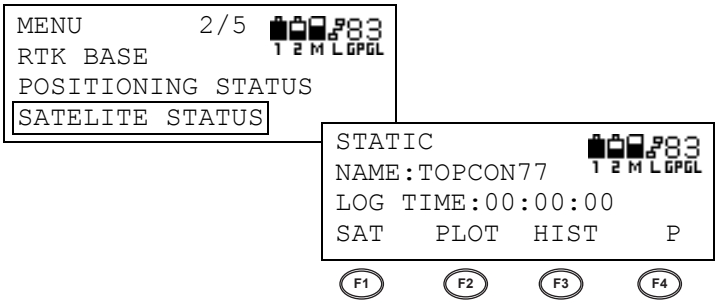


Figure 3-69. Open Satellite Information Screen

If selecting Satellite Status from the Menu screen, press the **up/down cursor key** to select List on the Satellite screen and press **ENT** (Figure 3-70).

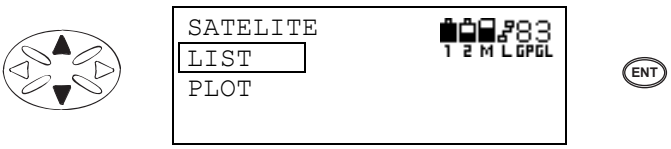


Figure 3-70. Select List and Press Enter

The Satellite Information screen scrolls horizontally and vertically (Figure 3-71 on page 3-32).

- SV – satellite number; for GLONASS satellites, an asterisk (*) follows the satellite number (for example, “12*”).
- CA, P1, and P2 – signal strength; CA is the C/A code on the L1 frequency, P1 is the P code on the L1 frequency, and P2 is the P code on the L2 frequency.

- EL – angle of elevation
- AZ – azimuth
- SS – satellite status

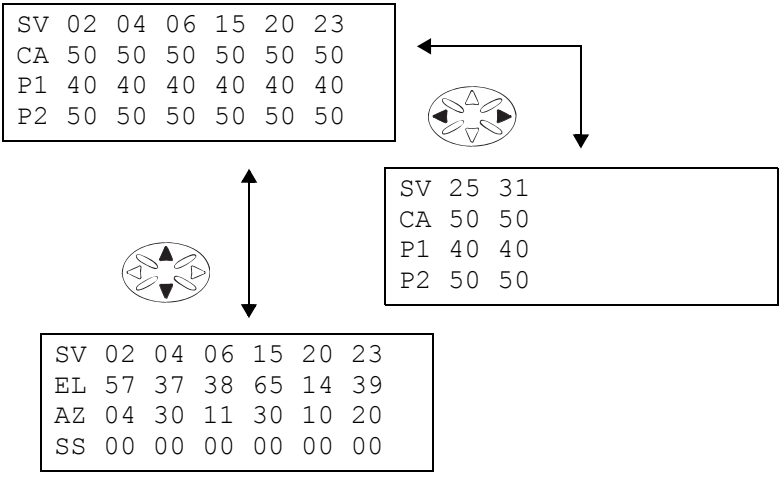


Figure 3-71. Satellite Status Information Screen

Table 3-5 describes the satellite status numbers (SV is Satellite Vehicle).

Table 3-5. Satellite Status Information

Status Number	Description
00	C/A data used for position computation.
01	P1 data used for position computation.
02	P2 data used for position computation.
03	Ionosphere-free combination used for position computation.
04	Measurements are not available.
05	Ephemeris is not available.
06	Unhealthy SV (as follows from operational (=ephemeris) SV health).
07	Time-frequency parameters from the ephemeris data set may be wrong (GLONASS only).

Table 3-5. Satellite Status Information (Continued)

Status Number	Description
08	Initial conditions (position and velocity vectors) from the ephemeris data set may be wrong (GLONASS only).
09	Almanac SV health indicator is not available for this satellite (GLONASS only).
10	Unhealthy SV (as follows from the almanac SV health indicator) (GLONASS only).
11	“Alert” flag (from the word “HOW”) is set (GPS only).
12	URA indicates the absence of accuracy prediction for this SV (GPS only).
13	The user has excluded this SV is excluded from position computation.
14	The user has excluded this SV with this frequency channel number from position computation (GLONASS only).
15	This SV is excluded from the solution since its system number is unknown (GLONASS only).
16	This SV has an elevation lower than the specified mask angle.
17	Reserved.
18	Ephemeris data is too old.
19	This SV does not belong to the constellation the user has selected.
20	Differential data from Base Station are not available for given satellite (this field is applicable only when receiver runs in DGPS).
21	Reserved.
22	RAIM has detected incorrect measurements.
23	SNR below specified minimum level.
24	Reserved.
25	Reserved.
26	DLL is not settled.
27	Ionospheric corrections are not received from the Base Station.
28	Coarse code outlier has been detected.
29	Reserved.

Table 3-5. Satellite Status Information (Continued)

Status Number	Description
30	This SV is not used in RTK processing. This status is similar to status number 20 but is used specifically for RTK.
31	This SV is not used in RTK processing. This status is similar to status number 20 but is used specifically for RTK.
32-50	Reserved.
51	C/A slot is used in RTK processing.
52	P L1 slot is used in RTK processing.
53	P L2 slot is used in RTK processing.
54	P L1 & P L2 measurements are used in RTK processing.
55	C/A & P L2 measurements are used in RTK processing.
56-62	Reserved.
63	Satellite navigation status is undefined.

Press the **ESC** key to return to the Observation screen or main Menu.

Sky Plot

To display a sky plot, select SATELLITE STATUS on menu page 2/5 and press **ENT**. During observation, press **F2** (PLOT) on page 2 of the function key operations (Figure 3-72).

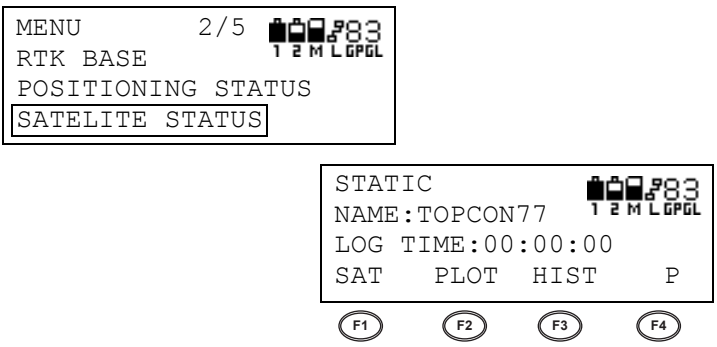


Figure 3-72. Open Satellite Plot Screen

If selecting Satellite Status from the Menu screen, use the **up/down cursor key** to select Plot on the Satellite screen and press **ENT** (Figure 3-73).

Figure 3-73. Select Plot and Press Enter

The Satellite/Sky Plot screen scrolls vertically (**up/down cursor key**) to display satellite information (Figure 3-74).

- GPS – the number of GPS satellites (H)
- GLO – the number of GLONASS satellites (I)
- PRN – Satellite number
- EL – angle of elevation
- AZ – azimuth

To view information on other satellites within the plot, press the left/right cursor key (Figure 3-74).

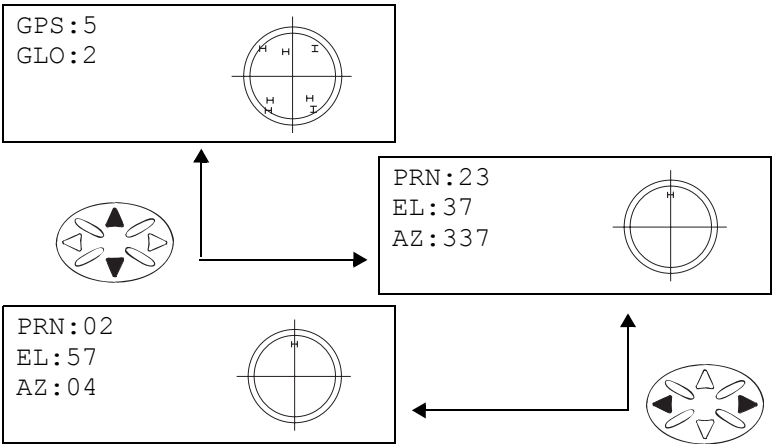


Figure 3-74. Satellite Plot, All and Individual, Screens

Press the **ESC** key to return to the Observation screen or main Menu.

Logging History for Received Signals

To display a logging history, press **F3** (HIST) on page 1 of the function key operations (Figure 3-75).

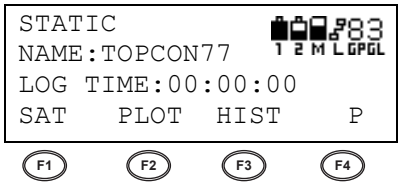


Figure 3-75. Open Logging History Screen

Each satellite's data acquisition log displays on the logging history screen (Figure 3-76),with a maximum of 3 hours (180 minutes). When 3 hours of logging has been exceeded, the latest 3 hours of log will display.

The Logging History screen scrolls horizontally and vertically.

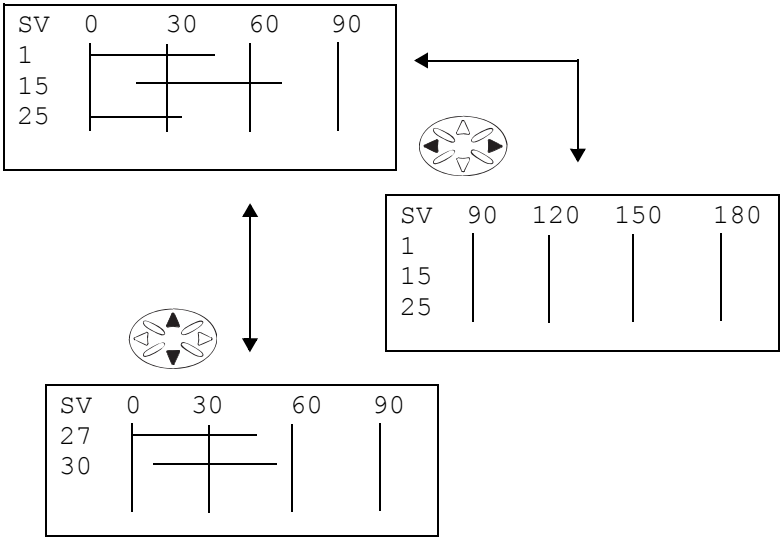


Figure 3-76. Satellite Logging History Screen

Setting the Ports

The GB-1000 has three serial ports, a USB port, and an ethernet/ LAN port. Each port can have different settings based on the requirements of the connected external device.

Serial Port Settings

Serial ports have the following settings (Table 3-6):

Table 3-6. Serial Port Settings

Parameter	Range	Default
Baud rate	460,800 / 230,400 / 153,600 / 115,200 / 57,600 / 38,400 / 19,200 / 9,600 / 4,800 / 2,400 / 1,200 / 600 / 300	115,200
Format	7-N-1, 5-ODD-1, 5-EVEN-1----------8-EVEN-2	8-N-1
Flow control	ON, OFF	OFF

1. Press the **menu** key to enter the menu mode. Press the **up/ down cursor key** to select PORT SETTING and press **ENT** (Figure 3-77).

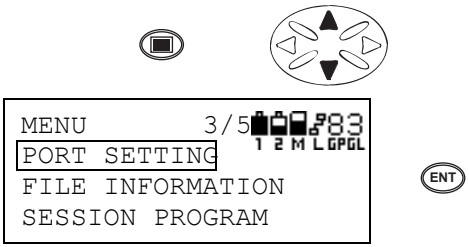


Figure 3-77. Initiate Menu Mode, Scroll to Port Setting, and Press Enter

2. On the Port Setting screen, select SERIAL PORT and press **ENT** (Figure 3-78).

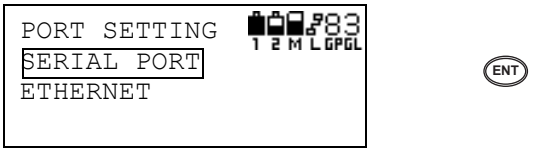


Figure 3-78. Select Serial Port and Press Enter

3. On the Serial Port screen, select the port to be set and press **ENT** (Figure 3-79).

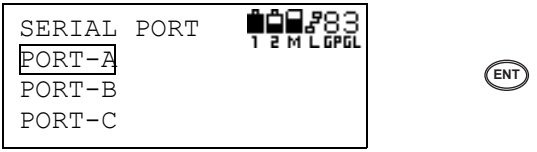


Figure 3-79. Select Port and Press Enter

4. Press **F1** (CHG) to change the port's parameters (Figure 3-80). See "Selecting Parameters" on page 3-10 for details on this procedure.

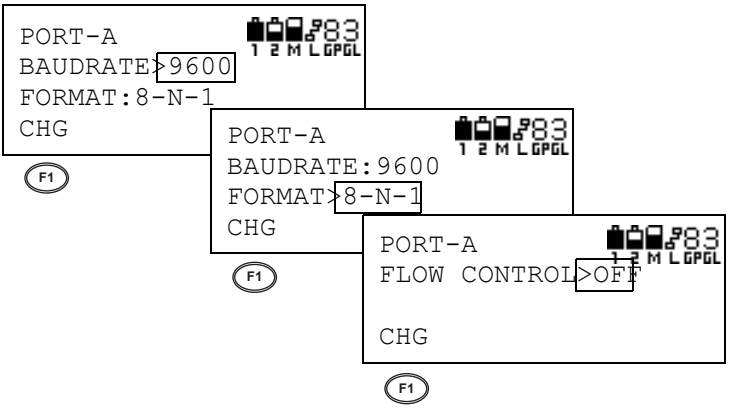


Figure 3-80. Press F1 when Changing Each Parameter

5. After completing the settings, press the **ESC** button.

Ethernet Port Settings

After setting up the ethernet port parameters, the GB-1000 receiver can connect to and operate from the network via Telnet, as well as download files through the FTP server.

Telnet allows a maximum of five users to simultaneously access the network. The FTP server is accessible to one user at a time. Users have login IDs (‘a’, ‘b’, ‘c’, ‘d’, and ‘e’) and password specified in the corresponding settings for Telnet.

IP Settings

The IP parameter has the following settings (Table 3-7):

Table 3-7. IP Settings

Parameter	Range
ADD (IP address)	0.0.0.0 to 255.255.255.255
MASK (Network mask)	0.0.0.0 to 255.255.255.255
GW (Gate way)	0.0.0.0 to 255.255.255.255

TIP

Settings become operative after restarting the receiver.

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select PORT SETTING and press **ENT** (Figure 3-81 on page 3-40).

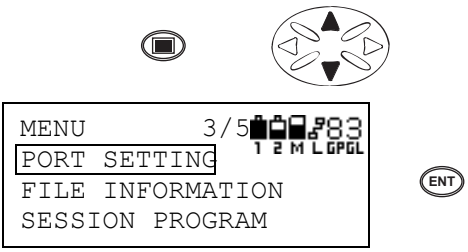


Figure 3-81. Initiate Menu Mode, Scroll to Port Setting, and Press Enter

2. On the Port Setting screen, select ETHERNET and press **ENT** (Figure 3-82).

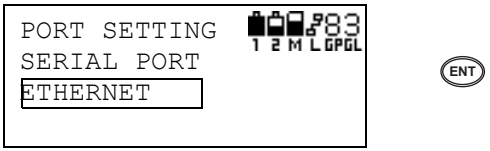


Figure 3-82. Select Ethernet and Press Enter

3. On the ETHER screen, select IP SETTING and press **ENT** (Figure 3-83).

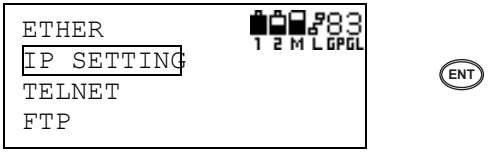


Figure 3-83. Select IP Setting and Press Enter

4. Press **F1** (CHG) to change IP parameters (Figure 3-84). See "Selecting Parameters" on page 3-10 for details on this procedure.

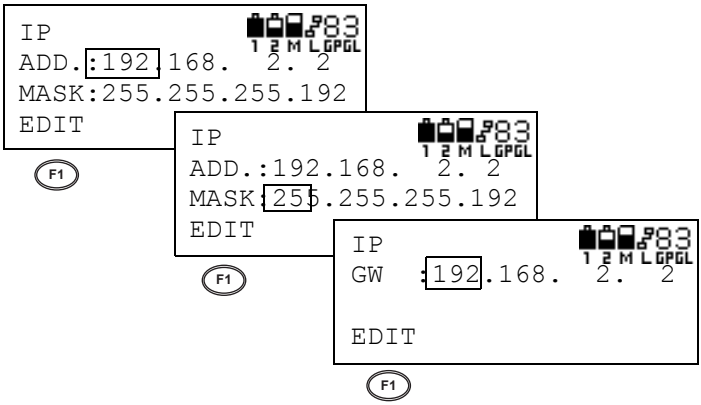


Figure 3-84. Press F1 when Changing Each Parameter

5. After completing the settings, press the **ESC** button.

Telnet Settings

The Telnet parameter has the following settings (Table 3-8):

Table 3-8. Telnet Settings

Parameter	Range	Default
Port number	1 to 65535	8002
Time out	1 to 2147483647 seconds	600 sec.
Password	Up to 15 letters	User specified

TIP

Settings become operative after restarting the receiver.

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select PORT SETTING and press **ENT** (Figure 3-85).

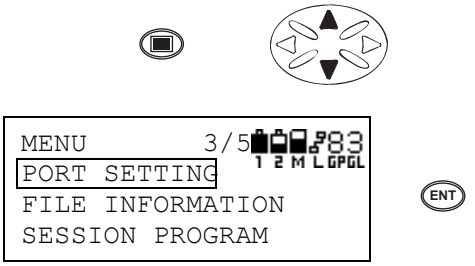


Figure 3-85. Initiate Menu Mode, Scroll to Port Setting, and Press Enter

2. On the Port Setting screen, select ETHERNET and press **ENT** (Figure 3-86).

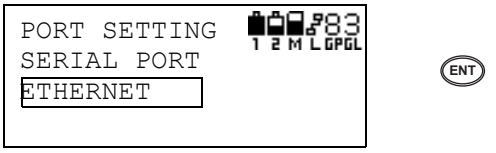


Figure 3-86. Select Ethernet and Press Enter

3. On the ETHER screen, select TELNET and press **ENT** (Figure 3-87).

Figure 3-87. Select Telenet Setting and Press Enter

4. Press **F1** (CHG) to change Telnet parameters (Figure 3-88). See “Selecting Parameters” on page 3-10 for details on this procedure.

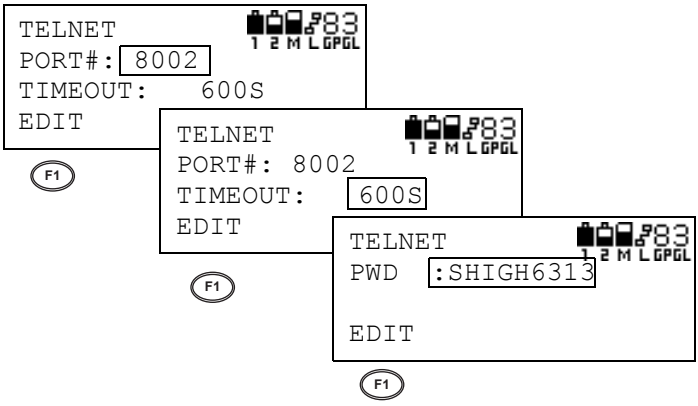


Figure 3-88. Press F1 when Changing Each Parameter

5. After completing the settings, press the **ESC** button.

FTP Settings

The FTP parameter has the following settings (Table 3-9):

Table 3-9. FTP Settings

Parameter	Range	Default
Port number	1 to 65535	21
Time out	1 to 2147483647 seconds	600 sec.

TIP

Settings become operative after restarting the receiver.

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select PORT SETTING and press **ENT** (Figure 3-89).

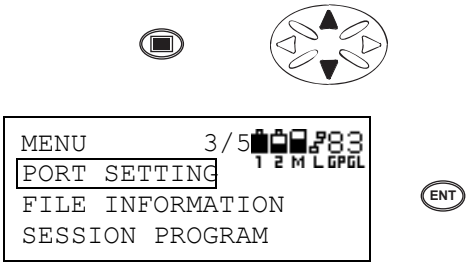


Figure 3-89. Initiate Menu Mode, Scroll to Port Setting, and Press Enter

2. On the Port Setting screen, select ETHERNET and press **ENT** (Figure 3-90).

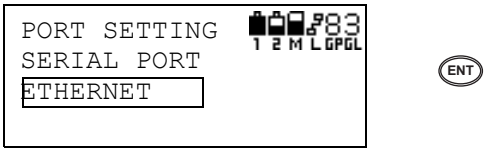


Figure 3-90. Select Ethernet and Press Enter

3. On the ETHER screen, select FTP and press **ENT** (Figure 3-91).

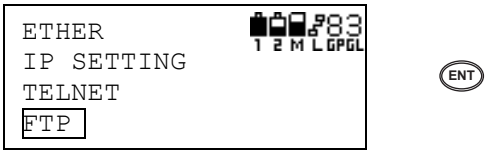


Figure 3-91. Select FTP Setting and Press Enter

4. Press **F1** (CHG) to change FTP parameters (Figure 3-92). See “Selecting Parameters” on page 3-10 for details on this procedure.

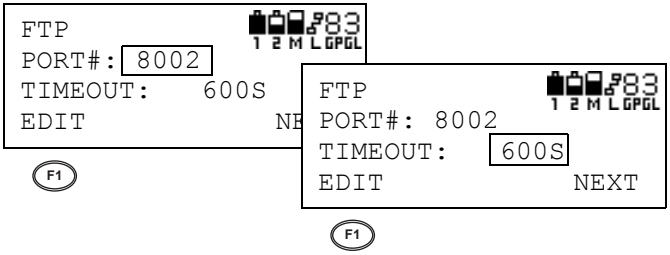


Figure 3-92. Press F1 when Changing Each Parameter

5. After completing the settings, press the **ESC** button.

Displaying and Managing File Information

From the File Information menu selection, you can view file details in internal/external memory, copy data files between the internal memory and a compact flash (CF) card, delete a file from internal memory, or format a CF card.

Displaying File Details

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select FILE INFORMATION and press **ENT** (Figure 3-93).

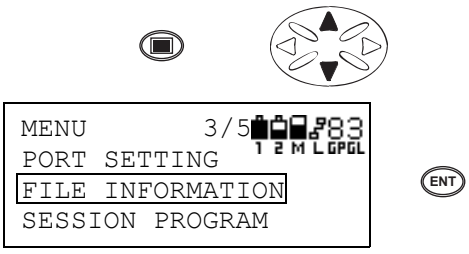


Figure 3-93. Initiate Menu Mode, Scroll to File Information, and Press Enter

2. On the File Info screen, select either INTERNAL MEMORY or EXTERNAL MEMORY and press **ENT** (Figure 3-94).

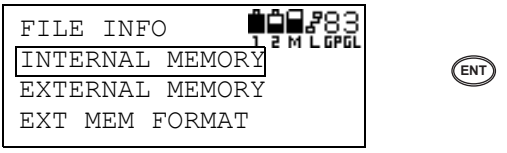


Figure 3-94. Select Internal Memory and Press Enter

3. Press the **up/down cursor key** to scroll through the files (Figure 3-95).

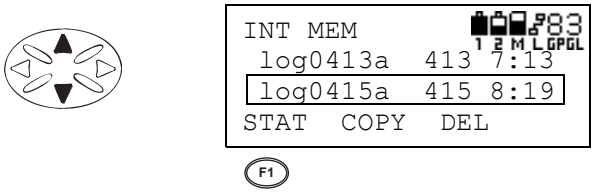


Figure 3-95. Scroll through Files and Press F1 to Select

4. Once the desired file is selected, press F1 (STATUS) (Figure 3-95) to display the file's details: file name, date, and file size (Figure 3-96).

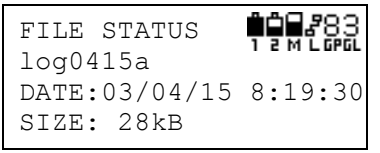


Figure 3-96. File Information

5. Press the **ESC** button to return to the previous screen.

Copying a File to External Memory

When copying a file to external memory, the GB-1000 first checks the CF card for any files of the same name. If the external memory has an file of the same name, “CP” will be added to the start of the file name before being copied. The file in the external memory will not be overwritten.

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select FILE INFORMATION and press **ENT** (Figure 3-97).

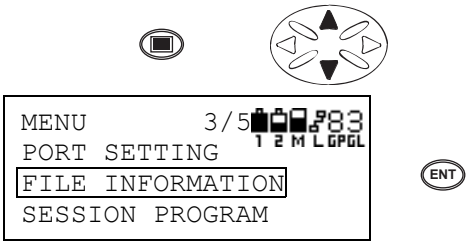


Figure 3-97. Initiate Menu Mode, Scroll to File Information, and Press Enter

2. On the File Info screen, select INTERNAL MEMORY and press **ENT** (Figure 3-98).

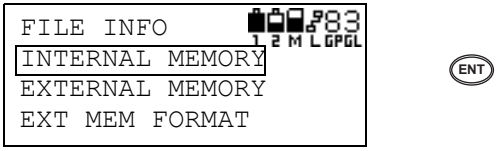


Figure 3-98. Select Internal Memory and Press Enter

3. Press the **up/down cursor key** to scroll through the files to select the desired file, then press **F2** (COPY) to copy (Figure 3-99).

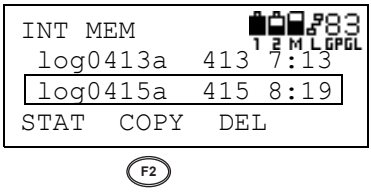


Figure 3-99. Scroll through Files to Select

4. Press **F3** (YES) to begin the copying process (Figure 3-100).

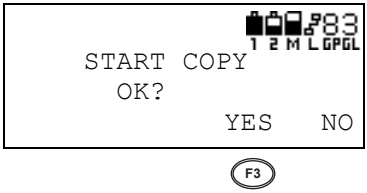


Figure 3-100. Press F3 to Copy

The copy status displays on the screen (Figure 3-101).

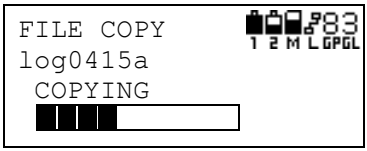


Figure 3-101. Copy Status

5. When copying completes, press any key to return to the internal memory screen (Figure 3-102).

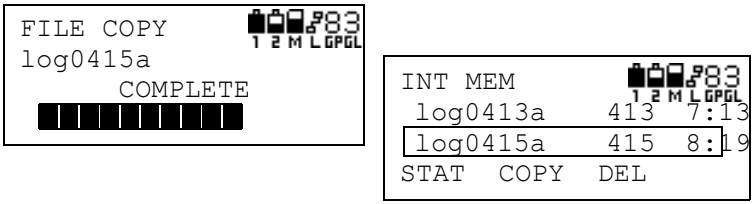


Figure 3-102. Copy Complete, Press Key to Display Internal Memory Screen

6. Press the **ESC** button to return to the previous screen.

Deleting a File from Memory

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select FILE INFORMATION and press **ENT** (Figure 3-103).

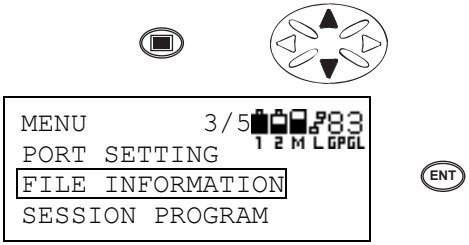


Figure 3-103. Initiate Menu Mode, Scroll to File Information, and Press Enter

2. On the File Info screen, select either INTERNAL MEMORY or EXTERNAL MEMORY and press **ENT** (Figure 3-104).

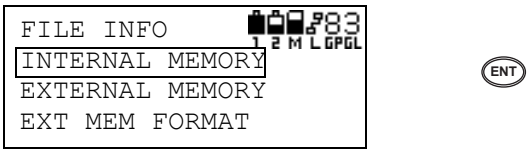


Figure 3-104. Select Internal Memory and Press Enter

3. Press the **up/down cursor key** to scroll through the files then press **F3** (DEL) to delete (Figure 3-105).

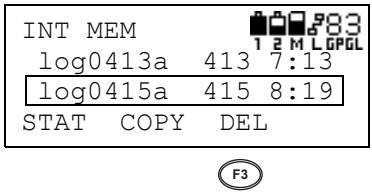


Figure 3-105. Scroll through Files to Select and Press F3 to Delete

4. Check that the correct file is selected, then press **F1** (YES) to delete the file (Figure 3-106).

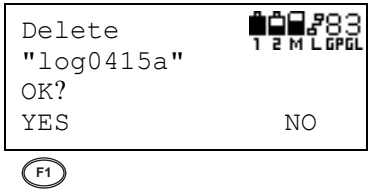


Figure 3-106. Confirm File and Press F1 to Delete

5. Once deleted, press any key to return to the memory screen (Figure 3-107).

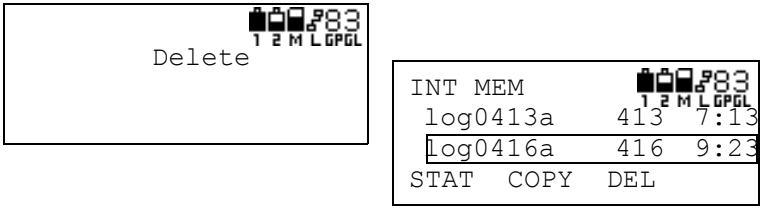


Figure 3-107. File Deleted, Press Key to Display Memory Screen

6. Press the **ESC** button to return to the previous screen.

Formatting External Memory (CF Card)

Format a compact flash (CF) card only under the following circumstances:

- data cannot be read from or written to the card (for example, a new CF card).
- to erase all of the files on the card.

WARNING

Formatting a CF card completely erases all files on the card. No files will be recoverable.

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select FILE INFORMATION and press **ENT** (Figure 3-108).

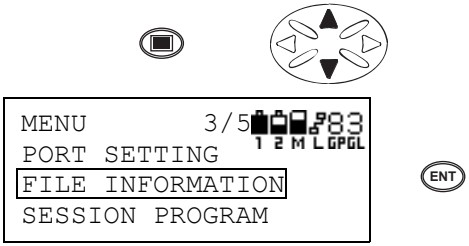


Figure 3-108. Initiate Menu Mode, Scroll to File Information, and Press Enter

2. On the File Info screen, select EXTERNAL MEMORY FORMAT and press **ENT** (Figure 3-109).

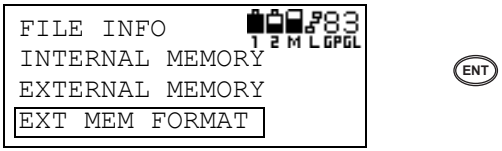


Figure 3-109. Select External Memory Format and Press Enter

3. On the EXTERNAL FORMAT screen, press **F1** (YES) to format the compact flash card (Figure 3-110).

   Press **F4** (No) or **ESC** to return to the previous screen.

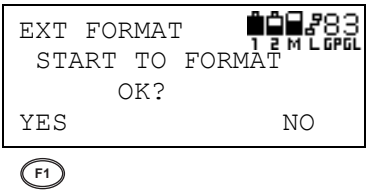


Figure 3-110. Start Format Process

4. At the confirmation screen, press **F2** (YES) to begin the format (Figure 3-111).

   Press **F4** (NO) or **ESC** to return to the previous screen.

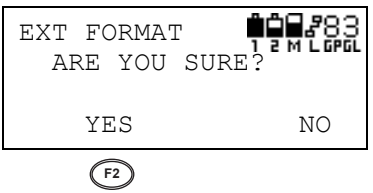


Figure 3-111. Confirm External Memory Format

The Formatting process begins and the format status displays on the screen (Figure 3-112).

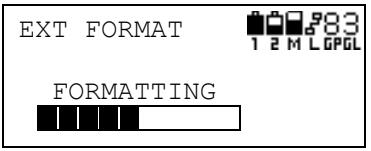


Figure 3-112. Format Status

5. Once the format completes, press any key to return to the memory screen (Figure 3-113).

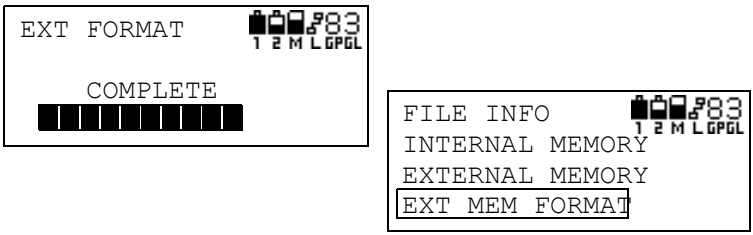


Figure 3-113. Format Complete, Press Key to Display Memory Screen

6. Press the **ESC** button to return to the previous screen.

Programming a Session

Using the session program function, you can pre-program up to three observation sessions for a specific day of the week, up to one week from the time of entry. The various parameters for the session are set in advance, the session will automatically begin and end at the specified start and end times.

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select SESSION PROGRAM and press **ENT** (Figure 3-114).

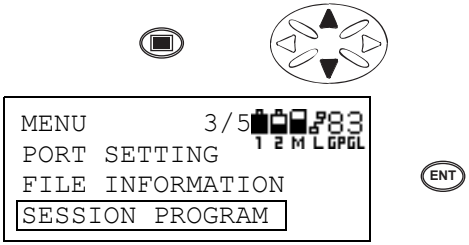


Figure 3-114. Initiate Menu Mode, Scroll to Session Program, and Press Enter

If the GB-1000 has no current time information (such as, after clearing the NVRAM), the screen shows a “NO GPS TIME” message. The Session Programs function requires complete time information; collect satellite data to continue.

2. Select the desired session, A, B or C, and press **ENT** (Figure 3-115). Press **F4** (NEXT) to see other sessions.

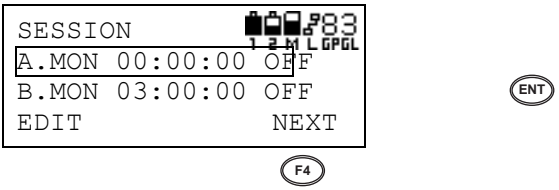


Figure 3-115. Select Session and Press Enter

3. Change the settings for the start and end times, the measuring interval, and the angle of elevation. Press **F4** (NEXT) to display each screen (Figure 3-116).

   See "Entering Numbers, Letters, and Symbols" on page 3-7 and "Selecting Parameters" on page 3-10 for details on this procedure.

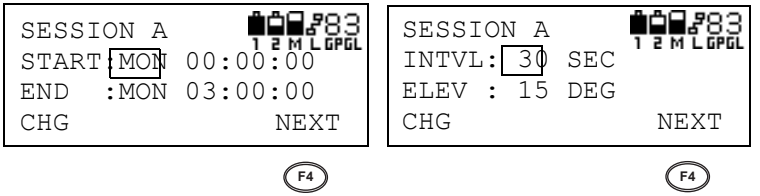


Figure 3-116. Change Parameters

4. Turn this session on or off and press **F4** (SET) to apply the settings (Figure 3-117). A session that is off will not run.

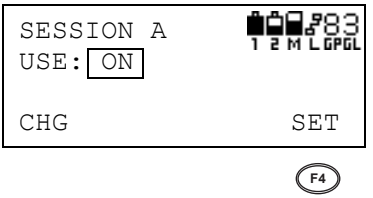


Figure 3-117. Use (Turn On) Session

All parameters entered for the session will be set. Press **ESC** to return parameters to the previous settings.

5. Confirm that the selected session is correct, then press **F4** (SET) (Figure 3-118).

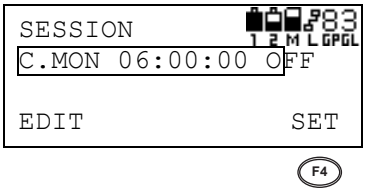


Figure 3-118. Confirm Session and Press F4

Any session set to ON will now become operative. However, if you press ESC, all of the parameters will return to their previous settings.

6. A message asking whether to switch to the sleep mode display. Press **F2** (YES) to enter sleep mode (Figure 3-119).

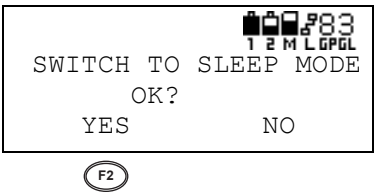


Figure 3-119. Confirm Switch to Sleep Mode

The GB-1000 will enter sleep mode and then automatically begin and end the operative session at the specified start and end times (Figure 3-120).

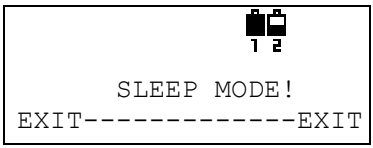


Figure 3-120. GB-1000 in Sleep Mode for Session

- In sleep mode, no key operation except simultaneously pressing of **F1** (EXIT) and **F4** (EXIT) has any effect.

- When exiting from sleep mode before or after a session, all programmed sessions (A, B, C) will be cleared.
- If while in sleep mode the batteries become completely depleted and the power is off, then you replace the batteries and turn the receiver on, the GB-1000 will enter sleep mode and the session program will continue.

When a session has been set, the GB-1000 enters sleep mode, and waits for the session's start time to arrive.

- When the specified start time arrives, the session automatically starts and ends at the specified times (Figure 3-121).

Figure 3-121. Session in Progress

- When the session ends, the GB-1000 again enters the sleep mode (Figure 3-122).

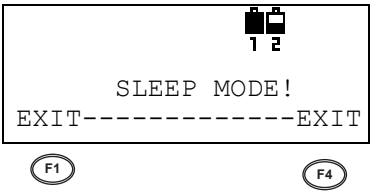


Figure 3-122. GB-1000 in Sleep Mode

To exit from the session program during any of the above stages, press **F1** (EXIT) and **F4** (EXIT) simultaneously. Then press F2 (YES) (Figure 3-123).

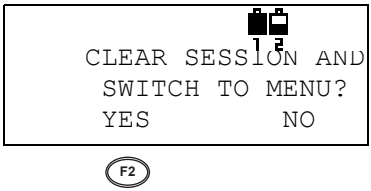


Figure 3-123. Press F2 to Exit Session

The GB-1000 will exit from the session programs menu and return to the main menu (Figure 3-124).

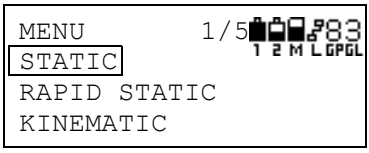


Figure 3-124. GB-1000 in Sleep Mode for Session

- During a session, or in sleep mode before or after a session, no key operation other than the simultaneous pressing of **F1** (EXIT) and **F4** (EXIT) has any effect.
- When you exit from sleep mode before, during, or after a session, all programmed sessions (A, B, C) will be cleared.
- If the batteries become completely depleted during a session and observation is interrupted, and you replace the batteries with fully charged ones and turn the power on, the GB-1000 receiver will enter sleep mode and the session will continue.
- During a session, the status icon for the internal memory's remaining capacity does not display.

NMEA Output

For details on NMEA, see “NMEA Standards” on page D-1.

Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select NMEA OUTPUT and press **ENT** (Figure 3-125).

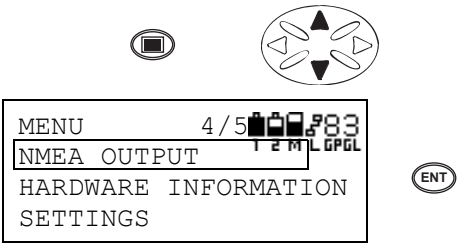


Figure 3-125. Initiate Menu Mode, Scroll to NMEA Output, and Press Enter

The NMEA screen displays (Figure 3-126).

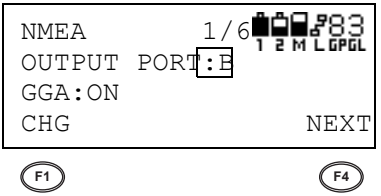


Figure 3-126. NMEA Output Screen

To change NMEA settings, press **F1** (CHG), then change the settings. See “Selecting Parameters” on page 3-10 for details on this procedure.

- For output, select OFF, A, B, or C.
- NMEA menu items are GGA, GLL, GNS, GSA, GST, GSV, HDT, GRS, RMC, VTG, and ZDA.

NMEA messages set to ON will output at intervals of 1 second from the specified port.

Displaying Hardware Information

The hardware menu selection displays information on the batteries information, remaining memory space, the serial number, version level, and other information about the hardware, as will information about optional software that has been installed.

Hardware Information

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select HARDWARE INFORMATION and press **ENT** (Figure 3-127).

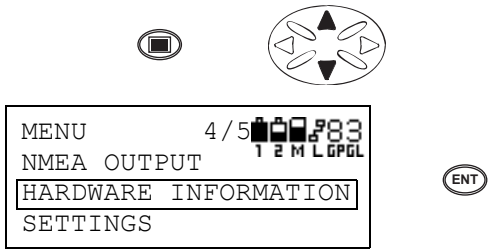


Figure 3-127. Initiate Menu Mode, Scroll to Hardware Information, Press Enter

2. On the Hardware Information screen, select HARDWARE and press **ENT** (Figure 3-128).

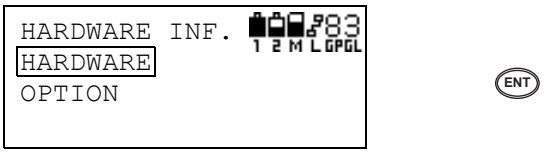


Figure 3-128. Select Hardware and Press Enter

The Hardware screens display (Figure 3-129):

- Remaining battery capacity and other hardware information. (During charge, battery capacity is blank.)
- Internal memory size and remaining internal memory capacity information.

- External memory size and remaining external memory capacity (CF card) information.
- The serial number and firmware version information.

Press the **F4** (NEXT) key or the **up/down cursor key** to move to the next screen.

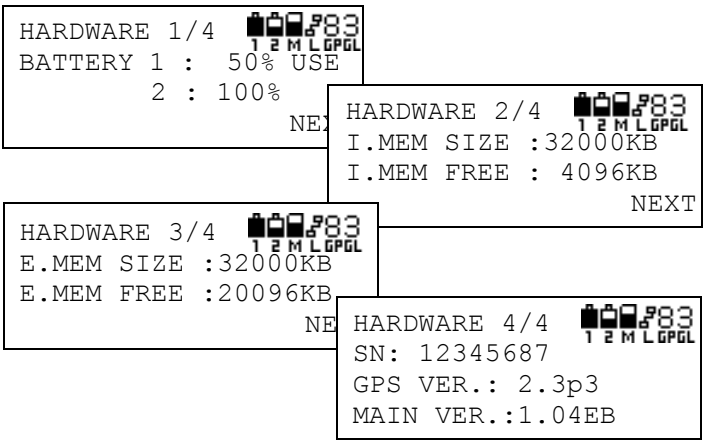


Figure 3-129. Hardware Information Screens

3. Press the **ESC** button to return to the previous screen.

Firmware Option Information

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select HARDWARE INFORMATION and press **ENT** (Figure 3-130).

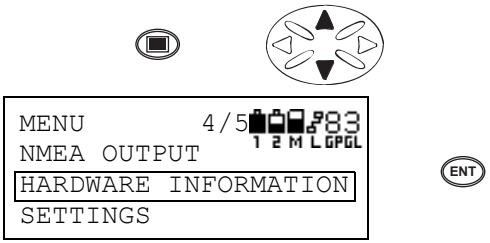


Figure 3-130. Initiate Menu Mode, Scroll to Hardware Information, Press Enter

2. On the Hardware Information screen, select OPTION and press **ENT** (Figure 3-131).

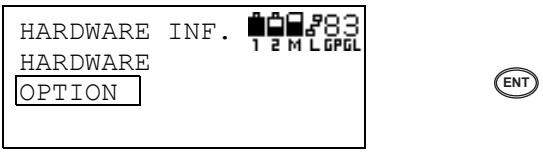


Figure 3-131. Select Option and Press Enter

The installed firmware options screens display. Use the **cursor key** to scroll through the screens (Figure 3-132).

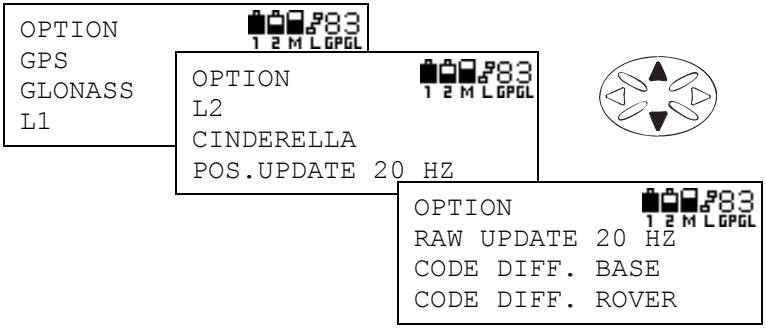


Figure 3-132. Firmware Options

3. Press the **ESC** button to return to the previous screen.

Settings

The GB-1000 screen has a backlight, as well as a heater for when the ambient temperature falls to 0°C. The settings menu selection sets the parameters for the backlight and the heater.

Adjusting Display Contrast

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select SETTINGS and press **ENT** (Figure 3-133).

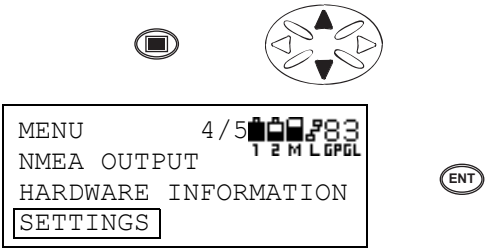


Figure 3-133. Initiate Menu Mode, Scroll to Settings, Press Enter

2. On the Settings screen, press **Enter** to select DISPLAY (Figure 3-134).

Figure 3-134. Press Enter to Select Display

3. On the Display screen, press **ENT** to select CONTRAST ADJ (Figure 3-135).

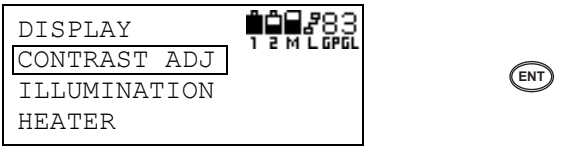


Figure 3-135. Select Contrast Setting

4. On the Contrast Adjustment screen, use the **F2/F3** (-/+) buttons to set the contrast level (Figure 3-136). The contrast can be set at 9 levels. See "Selecting Parameters" on page 3-10 for details on changing parameters.

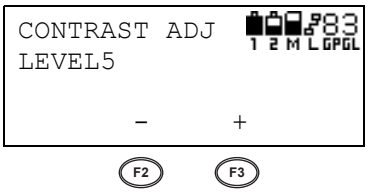


Figure 3-136. Set Contrast Level

5. Press the **ESC** button to return to the previous screen.

Adjusting Display Lighting

When the display lighting is set to ON, a backlight illuminates the screen.

- If none of the keys are operated for roughly 3 minutes, the backlight automatically turns off.
- If any of the keys is then operated, the backlight automatically turns on.

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select SETTINGS and press **ENT** (Figure 3-137).

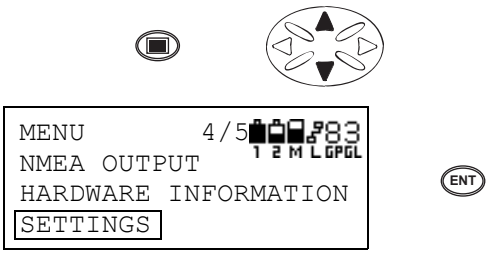


Figure 3-137. Initiate Menu Mode, Scroll to Settings, Press Enter

2. On the Settings screen, press **Enter** to select DISPLAY (Figure 3-138).

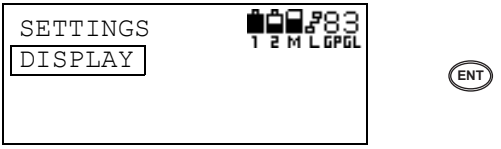


Figure 3-138. Press Enter to Select Display

3. On the Display screen, use the **up/down cursor key** to select ILLUMINATION and press **ENT** (Figure 3-139).

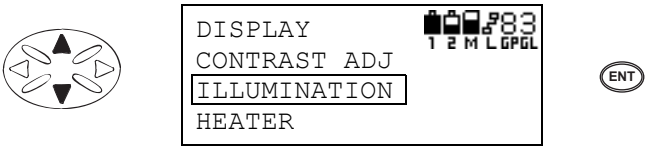


Figure 3-139. Select Illumination Setting

4. On the Illumination screen, set the screen's illumination (backlight) at either ON or OFF (Figure 3-140). See "Selecting Parameters" on page 3-10 for details on changing parameters.

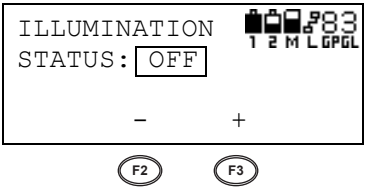


Figure 3-140. Set Illumination

5. Press the **ESC** button to return to the previous screen.

Adjusting the Display's Heater

The display has a built-in automatic heater. When the ambient temperature falls to 0°C, the heater automatically operates, maintaining the LCD's display speed.

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select SETTINGS and press **ENT** (Figure 3-141).

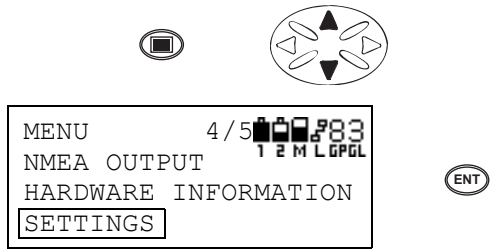


Figure 3-141. Initiate Menu Mode, Scroll to Settings, Press Enter

2. On the Settings screen, press **Enter** to select DISPLAY (Figure 3-142).

Figure 3-142. Press Enter to Select Display

3. On the Display screen, use the **up/down cursor key** to select HEATER and press **ENT** (Figure 3-143).

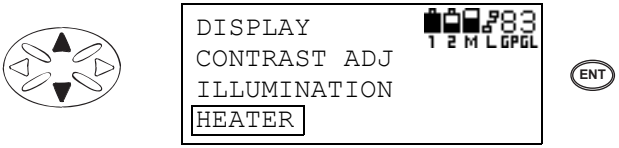


Figure 3-143. Select Heater Setting

4. On the Heater screen, use the **F2/F3** (-/+) buttons to set the heater at either ON or OFF (Figure 3-144). See "Selecting Parameters" on page 3-10 for details on changing parameters.

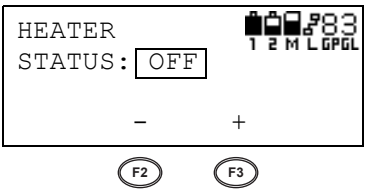


Figure 3-144. Set Heater

5. Press the **ESC** button to return to the previous screen.

Terminal Mode

Before operating the GB-1000 from an external controller (personal computer, FC-1000, etc.), switch the GB-1000 to terminal mode.

CAUTION

If operating the GB-1000 from an external controller, problems could occur with some GB-1000 functions if not in terminal mode.

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select TERMINAL MODE and press **ENT** (Figure 3-145).

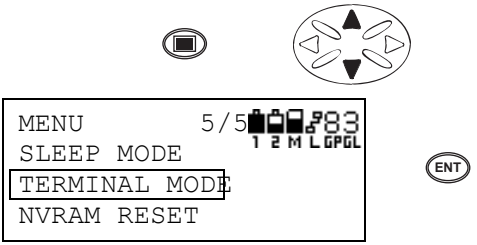


Figure 3-145. Initiate Menu Mode, Scroll to Terminal Mode, Press Enter

2. On the Terminal Mode screen, press **F1** (CHG) to change the setting (Figure 3-146).

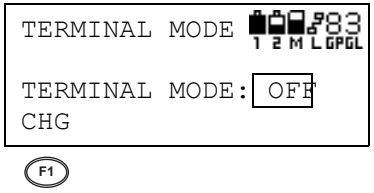


Figure 3-146. Press F1 to Change Setting

3. Press the **left/right cursor key** or **F2/F3** (-/+) to select ON (Figure 3-147). Press **F4** set the GB-1000 in terminal mode.

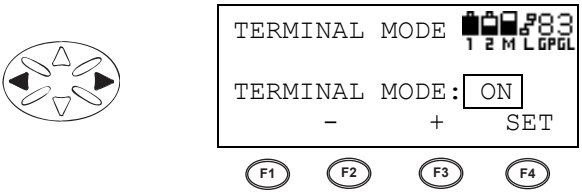


Figure 3-147. Change Setting

Terminal mode commences (Figure 3-148).

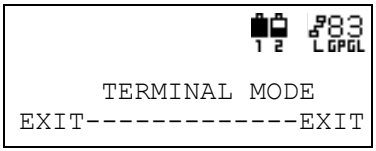


Figure 3-148. GB-1000 in Terminal Mode

In terminal mode, the status icon for the internal memory's remaining capacity does not display.

When, in terminal mode, the GB-1000 is set in sleep mode (or so that it will enter sleep mode following a session program) from an external controller, only the status icons for remaining battery capacity display.

If, the batteries become completely discharged while in terminal mode, and you replace them with fully charged batteries an turn on the power, the GB-1000 receiver will re-

enter terminal mode. If the GB-1000 was also in sleep mode (or it will enter sleep mode following a session program), the receiver will enter sleep mode following battery replacement.

4. To exit Terminal Mode, press **F1** (EXIT) and **F4** (EXIT) simultaneously until the screen changes (Figure 3-149).

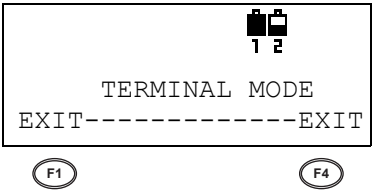


Figure 3-149. Exit Terminal Mode

In terminal mode, no key operation other than the simultaneous pressing of F1 (EXIT) and F4 (EXIT) has any effect. Before conducting some other operation, exit from terminal mode.

Resetting the NVRAM

With the GB-1000, the NVRAM of the receiver can be reset using the corresponding menu selection or the appropriate key combination.

NOTICE *NOTICE*

Resetting the NVRAM erases the receiver's settings and almanac. Observation data in internal memory remains.

After resetting the NVRAM, conduct satellite reception for about 25 minutes in order to acquire almanac data, etc.

Method 1: Use the Menu to Reset the NVRAM

Use this method when the receiver is already on and the menu screen displays.

1. Press the **menu** key to enter the menu mode. Press the **up/down cursor key** to select NVRAM RESET and press **ENT** (Figure 3-150).

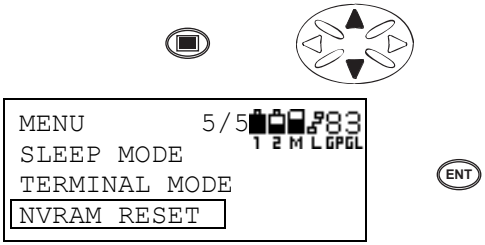


Figure 3-150. Initiate Menu Mode, Scroll to NVRAM Reset, Press Enter

2. On the NVRAM Reset screen, press **F2** to start begin resetting the NVRAM (Figure 3-151).

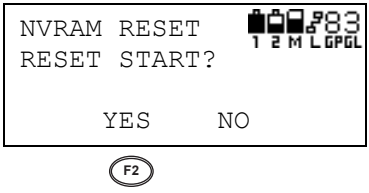


Figure 3-151. Select Yes and Press F2

The NVRAM resets (Figure 3-152).

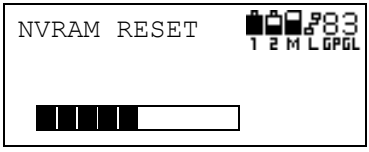


Figure 3-152. NVRAM Reset Status

Once the NVRAM reset completes, the main menu displays (Figure 3-153).

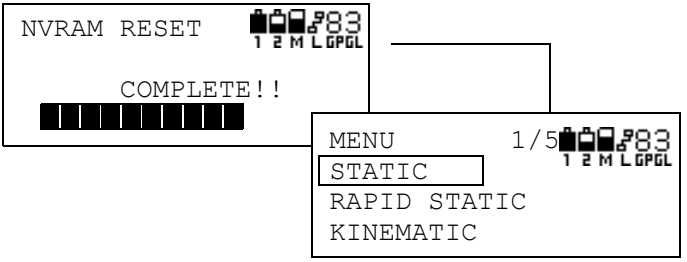


Figure 3-153. NVRAM Reset Complete and Main Menu

Method 2: Use the Keys to Reset the NVRAM

Use this method when the receiver power is off.

1. With the receiver's power off, press and hold the **F1** and **F4** keys (Figure 3-154).

Figure 3-154. Hold F1/F4 Keys to Initiate NVRAM Reset

2. Turn on the receiver's power.
3. Wait until the NVRAM RESET menu displays, then release the F1 and F4 keys (Figure 3-155).

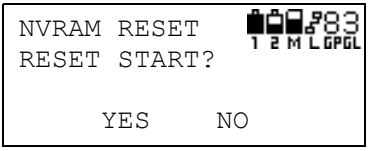


Figure 3-155. Start NVRAM Reset?

4. Press **F2** to start the NVRAM reset (Figure 3-155).

   The NVRAM resets (Figure 3-152 on page 3-69).

Once the NVRAM reset completes, the main menu displays.

Data Management

The GB-1000 stores observation data in its internal memory. This chapter discusses accessing these files.

Automatic Observation Data File

After the GB-1000 has started recording observation data, it automatically determines a file name, unless otherwise specified by the controller or computer, and create a session file. File names are based on the observation date using the following format:

XXXXMMDDS

- XXXX – A specified character string (20 characters max.); the default is log.
- MM – the month of the observation (January = 01, December = 12).
- DD – the day of the observation (1st day = 01, 31st day = 31).
- S – the session number (a to z).

NOTICE *NOTICE*

This file name is managed in the GB-1000. A different file name may be displayed depending on the controller, downloading software, etc.

Downloading Observation Data Files

The GB-1000 records observation data as a file in the internal memory. To post-process the file, download it to a computer.

To download, use either a serial port or the USB port and a computer with downloading software installed (such as PC-CDU or Topcon Link). If using the USB port, a dedicated USB driver is required. If needed, download the required USB driver from the TPS website (www.topcongps.com). For further details on downloading and installing the USB driver, refer to the user's manual for the software

Connect the receiver and computer (Figure 4-1):

- USB cable connected to the USB port on the receiver then to the USB port on the computer.
- Ethernet cable connected to the ethernet port on the receiver then to the ethernet port on the computer.
- RS232C cable connected to port B on the receiver then to the applicable serial port on the computer.

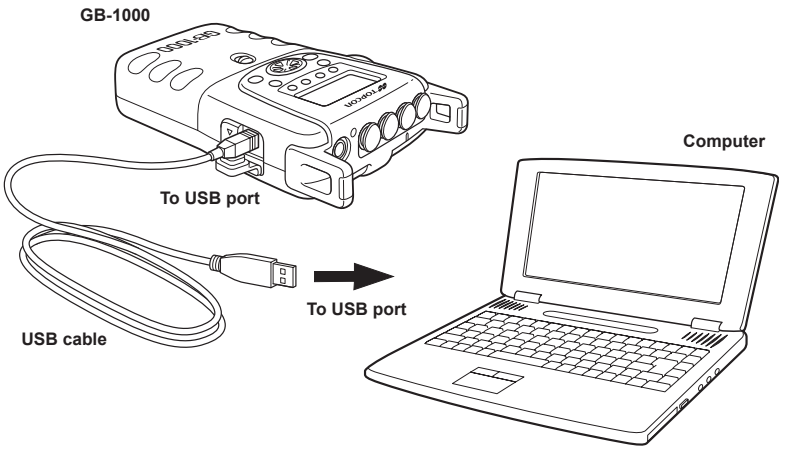


Figure 4-1. Example GB-1000 and Computer Connection via USB

While downloading observation data, internal communications stop and a “Communication Data waiting” message displays. When finished downloading, press any key to return the display to normal.

Note on COCOM Restriction

The GB-1000 will stop the calculation of any position and speed, as well as the output and recording of any observation data, if it exceeds the range specified by COCOM (if the moving velocity of the GB-1000 exceeds 1,000 knots or its altitude exceeds 18,000 meters).

Notes:

Troubleshooting

In general, as long as you follow the maintenance and safety instructions provided in this manual, you should have few problems with your receiver. This chapter describes possible error message that may display, as well as how to obtain technical support.

Before contacting TPS customer support, try clearing the NVRAM See “Resetting the NVRAM” on page 3-68 for details.

WARNING

Do not attempt to repair equipment yourself. Doing so will void your warranty and may damage the hardware.

Check This First

Before contacting TPS Customer support about any problems with the receiver, try the following:

- First, check all external receiver connections carefully to ensure correct and secure connections.
- Second, double check for worn or defective cables.
- Next, see the sections below for more specific solutions.

If the problem persists, try clearing the NVRAM and resetting the receiver (see “Resetting the NVRAM” on page 3-68).

Error Messages

Table 5-1 lists error messages that may display. If the suggested solution does not fix the problem, try clearing the NVRAM.

Table 5-1. Error Messages with Solutions

Message	Description	Solution
INT COM ERROR	An abnormality has occurred in the internal communications.	If the error occurs after power is turned off and on, reset the NVRAM.
INT MEMORY ERROR	An abnormality has occurred in internal memory.	Repair is necessary. Contact TPS.
MEMORY FULL CAN NOT SURVEY	There is little available capacity in internal memory and surveying cannot be carried out.	Delete some of the files from internal memory to increase the available capacity.
MEMORY FULL SURVEY WAS ENDED	The internal memory became full during surveying and surveying was forced to end.	Delete some of the files from internal memory to increase the available capacity.
SET UP IMPOSSIBLE	The entered parameter values, etc., exceed the acceptable ranges.	Check the ranges and re-enter the values.
CF CARD ERROR	An abnormality has occurred on the CF card.	Replace the CF card.
CF R/W ERROR	An error has occurred in reading and writing the CF card.	Copy the needed files to the PC, then format the CF card.
CF CARD ERROR	A CF card is not inserted.	Insert a CF card.

Table 5-1. Error Messages with Solutions (Continued)

Message	Description	Solution
CF CARD FULL	The CF card's capacity has been filled up.	Copy the needed files to a PC, then delete the files on the CF card to obtain available capacity.
FORMAT IS REQUIRED	The CF card has not been formatted.	Format the CF card.
NO OPTION	The appropriate firmware option has not been installed.	Install the appropriate firmware option.
COMMUNICATION DATA WAITING	An abnormality has occurred in the internal communications.	Press any key. If the message persists, reset the NVRAM.

Obtaining Technical Support

If the above solution fail to remedy the problem, contact TPS Customer Support.

Before contacting TPS customer support, try clearing the NVRAM See “Resetting the NVRAM” on page 3-68 for details.

Phone

To get in contact with TPS Customer Support by phone, call 1-866-4TOPCON (1-866-486-7266).

E-mail

To get in contact with TPS Customer Support by e-mail, use the electronic mail addresses shown in Table 5-2.

Table 5-2. Technical Support E-mail

For Questions Related To...	Use...
Hardware (receivers, antennas, firmware)	hardware@topcon.com
GPS+ and 3DMC	psg@topcon.com
OAF (Option Authorization File)	options@topcon.com
RTK	rtk@topcon.com

If in doubt about which e-mail address to use for your particular question, e-mail the support group (support@topcon.com).

Website

The Topcon Positioning Systems website provides current information about Topcon's line of products. The support area of the website provides access to frequently asked questions, configuration procedures, manuals, e-mail support, etc.

To access the TPS website home page, use: www.topconpositioning.com

To visit the support area, use: www.topcongps.com/support/

Base Checks & Adjustments

NOTICE *NOTICE*

Your kit may not include one or more of the devices mentioned in this chapter. Contact your Topcon dealer for more information on purchasing any of these devices.

Pointers on adjustment:

1. Adjust the eyepiece of the telescope prior to any checking operation that involves sighting through the telescope.

   Remember to focus properly, with parallax completely eliminated.
2. Carry out the adjustments in the order of indicated, as the adjustments are dependent one upon each other. Adjustments carried out in the wrong sequence may nullify previous adjustment.
3. Always conclude adjustments by tightening the adjustment screws securely; but do not tighten them more than necessary, to prevent striping the threads, twisting off the screw, or placing undue stress on the parts.

   Furthermore, always tighten by revolving in the direction of tightening tension.
4. Tighten the attachment screws sufficiently, upon completion of adjustments.
5. Always repeat checking operations after making adjustments, in order to confirm results.

Notes on the tribrach:

An insecure or loose installation of the tribrach may directly affect measure precisions.

Adjusting the Base

To eliminate slack between the leveling screws and the base (Figure A-1),

1. Loosen the set screw of the holding ring.
2. Tighten the holding ring with the adjusting pin until it is properly adjusted.
3. Re-tighten the set screw upon completing the adjustment.

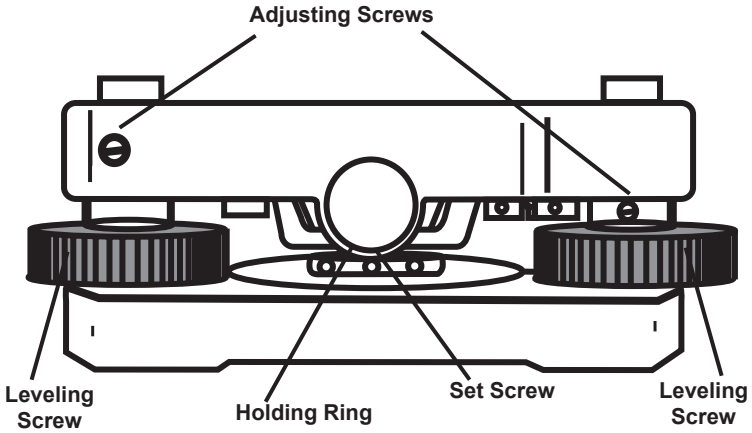


Figure A-1. Base Components

Checking & Adjusting the Plate Level

The plate level will need to be adjusted if the axis of the plate level is not perpendicular to the vertical axis.

Checking the Plate Level

1. Place the plate level parallel to a line running through the center of two leveling screws; for example, leveling screws A and B (Figure A-2).
2. Use only these two leveling screws to place the bubble in the center of the plate level.
3. Rotate the instrument 180° or 200g around the vertical axis and check bubble movement of the plate level (Figure A-2). If the bubble has been displaced, then adjust the plate level as seen in “Adjusting the Plate Level” on page A-4.

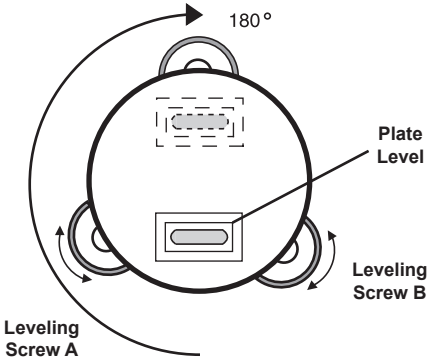


Figure A-2. Checking the Plate Level

Adjusting the Plate Level

1. Adjust the level adjustment capstan screw, with the accessory adjusting pin and return the bubble to the center of the plate level. This corrects only half of the displacement (Figure A-3).
2. Correct the remaining half of the bubble displacement with the leveling screws as described above.
3. Rotate the instrument 180° or 200g around the vertical axis once more and check bubble movement (Figure A-2 on page A-3). If the bubble is still displaced, then repeat the adjustment.

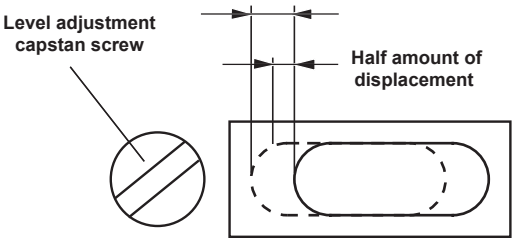


Figure A-3. Adjusting the Plate Level

Checking & Adjusting the Circular Level

Adjustment is required if the axis of the circular level is not perpendicular to the vertical axis.

Checking the Circular Level

Carefully level the instrument with the plate level. If the bubble of the circular level is centered properly, adjustment is not required (Figure A-4). Otherwise, proceed with the following adjustment.

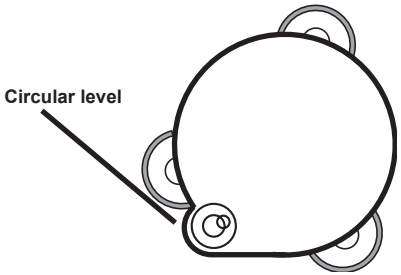


Figure A-4. Checking the Circular Level

Adjusting the Circular Level

Using the accessory pin to adjust the three capstan adjustment screws located on the bottom surface of the circular level, shift the bubble to the center of the circular level (Figure A-5).

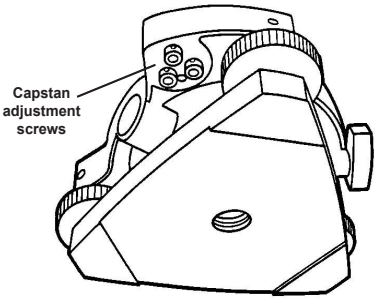


Figure A-5. Adjusting the Circular Level

Checking & Adjusting the Optical Plummet Telescope

Adjustment is required to make the line of sight of the optical plummet telescope coincide with the vertical axis; otherwise, the vertical axis will not be in the true vertical above the reference point when the instrument is optically plumbed.

Checking the Optical Plummet Telescope

1. Align the center mark and the point.
2. Rotate the instrument 180° or 200g around the vertical axis and check the center mark.

   If the point is properly centered in the center mark, adjustment is not required. Otherwise, adjust in the following manner.

Adjusting the Optical Plummet Telescope

1. Take off the adjustment section cover of the optical plummet telescope eyepiece. This will expose four capstan adjustment screws which should be adjusted with the accessory adjusting pin to shift the center mark to the point. However, only half of the displacement is corrected (Figure A-6).

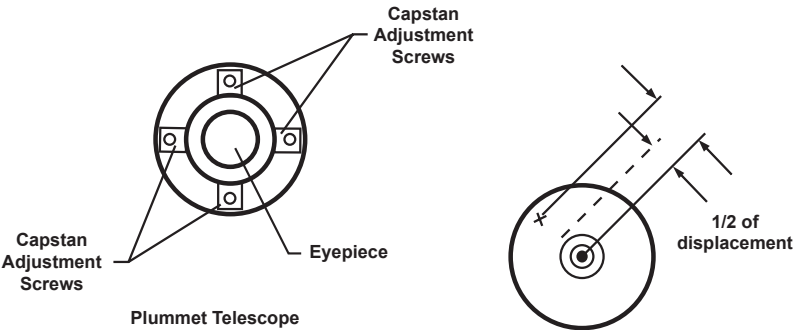


Figure A-6. Adjusting the Optical Plummet Telescope

2. Use the leveling screws to align the point and center mark, correcting the other half of the displacement.
3. Rotate the instrument 180° or 200g around the vertical axis once more and check the center mark (Figure A-2 on page A-3). If it aligns to the point, further adjustment is not required. Otherwise, repeat the adjustment.

TIP

First, loosen the capstan adjustment screw on the side to which the center mark must be moved. Then tighten the adjustment screw on the opposite side by an equal amount, leaving the tension of the adjustment screws unchanged.
Revolve counter clockwise to loosen and clockwise to tighten, but revolve as little as possible.

Notes:

Handling and Safety Precautions

Before starting work or operation, be sure to check that the instrument is functioning correctly with normal performance.

General Handling Precautions

- **Water Resistance and Dust Resistance:**

  Do not submerge the GB-1000 in water.

  The GB-1000 conforms with Protection Class IP66.

  The GB-1000 can withstand ordinary rain, etc. However, its water resistance cannot be guaranteed in if submerged.

- **Mounting the instrument on a Tripod:**

  When mounting the GB-1000 on a tripod, use a wooden tripod whenever possible.

  A metal tripod can produce vibrations that affect the precision of measurement.

  Also, be sure to firmly tighten all tripod screws.

- **Installing the tribrach:**

  Any looseness in the tribrach might affect the precision of measurement. Therefore, inspect the various base adjustment screws occasionally and make sure that they are tight.

- **Guarding the instrument against shocks:**

  When transporting or carrying the GB-1000 receiver, use cushions to protect it from impacts to the extent possible.

- **Checking the batteries:**

  Before using the instrument, be sure to check the remaining capacity in the batteries.

- **Checking the internal memory:**

  Before using the instrument, be sure to check the remaining capacity of the internal memory.

- **Backup battery:**

  So that the GB-1000 can retain its settings, almanac information, etc., it is equipped with a built-in backup battery. This battery always emits a slight current. Depending on the conditions of use, the backup battery will normally last for about 10 years from the time of manufacture. If battery capacity should be depleted, the GB-1000 will be unable to retain its settings, almanac information, etc.

  If settings return to the default settings when power is turned on, or if, at the start of satellite reception, satellite tracking and positioning are always slow (cold start), the problem could be that the capacity in the backup battery has run out.

  For replacing the backup battery, please contact TPS or your local distributor.

- **About the almanac:**

  Before using the GB-1000 for the first time, before using it after a long period of non-use, or after resetting the NVRAM, track satellites for about 25 minutes in order to obtain new almanac information.

- **An external controller access the GB-1000:**

  When accessing the GB-1000 from a personal computer or some other external controllers, a D port will exist among the serial ports. The D port is for internal control only. Therefore, do not change the communication speed or other parameters of port D from the external controller/computer.

Safety Cautions

WARNING

A risk of fire, electric shock or physical harm exists if you attempt to disassemble or repair the instrument yourself. This is only to be carried out by TOPCON or an authorized dealer.

WARNING

High temperature may cause fire. Do not cover the charger while it is charging.

WARNING

Risk of fire or electric shock.

–Do not use damaged power cable, plug and socket.

–Do not use a wet battery or charger.

–Do not use any power voltage except the one given in the manufacturer's instructions.

WARNING

Battery can ignite explosively. Never use an instrument near flammable gas or liquid matter, and do not use in a coal mine.

WARNING

Battery can cause explosion or injury. Do not dispose in fire or heat.

WARNING

Battery can cause outbreak of fire. Do not use any charger other than the one specified.

WARNING

Risk of fire. Do not use any power cable other than the one specified.

WARNING

A short circuiting battery can cause a fire. Do not short circuit the battery when storing it.

CAUTION

Do not connect or disconnect equipment with wet hands, you are at risk of electric shock if you do!

CAUTION

Risk of injury by overturning the carrying case. Do not stand or sit on the carrying cases.

CAUTION

Please note that the tips of tripod can be hazardous, be aware of this when setting up or carrying the tripod.

CAUTION

Risk of injury or damage from falling instrument or case. Do not use a carrying case with damaged belts, grips or latches.

CAUTION

Do not allow skin or clothing to come into contact with acid from the batteries. If this does occur, wash off with copious amounts of water and seek medical advice.

CAUTION

A plumb bob can cause injury to a person if used incorrectly.

CAUTION

Ensure that you mount the Tribrach correctly, failing to do so may result in injury if the tribrach were to fall over.

CAUTION

A falling instrument can be dangerous, check that you fix the instrument to the tripod correctly.

CAUTION

A falling tripod and instrument can cause injury. Always check that the screws of tripod are securely tightened.

Specifications

This TPS product is a 40-channel GPS+ receiver in a rugged housing complete with display, user-keys, and cable connectors.

Receiver Specifications

Table C-1 lists receiver component details.

Table C-1. Receiver Specifications

Component	Details
Channel	
Number of channels	40 L1 20 L1/L2
Receiving frequency	Normal model GPS L1 (L1 C/A code) Dual Frequency option model GPS L1/L2 (L1/L2 C/A,P code) Dual Frequency+ GLONASS model GPS/GLONASS L1/L2

Table C-1. Receiver Specifications (Continued)

Component	Details
Survey Accuracy (1 sigma D: measuring distance in mm) Precisions vary depending on number of satellites, satellite geometry, multi-path, ionosphere, and atmospheric conditions.	
Static, Fast Static	H: 3mm + 0.5ppm (x baseline length); V: 5mm + 0.5ppm (x baseline length)
Kinematic, RTK	H: 10mm + 1.0ppm (x baseline length); V: 15mm + 1.0ppm (x baseline length)
Physical	
Dimensions	W:150 x H:257 x D:63mm
Weight	1.0Kg (without batteries) 1.2Kg (with batteries)
Protection against water and dust	IP66 (based on IEC60529)
Battery	Two internal
Memory card slot	Compact Flash™ Type I (3.3V) x 1 slot
Display	Monochrome graphic liquid crystal 160x64dot (with backlight and heater) 20 characters x 4 lines
Internal memory	Optionally upgradable to 128 MB maximum
Data recording time	74 hours subject to 8M bytes, 15-second interval, L1/L2, and 5 satellites
Ports	
Antenna	Lemo coaxial cable 50W x 1port
External power	ODU 5pin x 1port
Serial	ODU 7pin x 3ports
USB	Type B connector (USB1.1) x 1port

Table C-1. Receiver Specifications (Continued)

Component	Details
Ethernet	RJ45 (10Base-T) x 1port
Environment	
Operating temperature	-20°C to +55°C
Storage temperature	-30°C to +60°C
Power	
Consumption	3.9W (with PG-A1 antenna and batteries)
Maximum operating time	Approximately 7.5 hours (at +20°C and using two BT-60Q batteries)
Input voltage	DC12 to 28V
Formats	
DGPS recording format	RTCM 2.3(1,2,3,9,16,31,32,34,36)
RTK data format	RTCM 2.3 (3,16,18,19,20,21,22,36), CMR2/CMR+
NMEA output format	NMEA 2.3 (GGA, GLL, GNS, GBS, GSA, GST, GSV, HDT, RMC, VTG, ZDA
Communication	
Baud rate	460,800 / 230,400 / 153,600 / 115,200 / 57,600 / 38,400 / 19,200 / 9,600 / 4,800 / 2,400 / 1,200 / 600 / 300 (Default: 115,200)
Data bit	7, 8 (Default: 8) Parity – none, odd, even (Default: none) Stop bit – 1, 2 (Default: 1)

Port Configurations

The GB-1000 is equipped with a serial port (RS-232C), external power port, GPS antenna port, USB port and Ethernet port. The pin assignment on each port is shown below.

Serial Port (RS-232)

For ports A, B, and C. The RS-232 connectors (Figure C-1) are sealed receptacle, 7 pin, ODU ports.

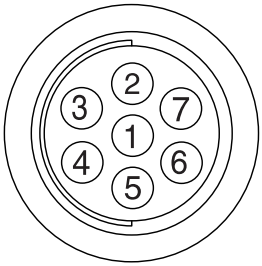


Figure C-1. RS-232 Serial Port – Ports A, B, and C

Table C-2 gives the RS232 cable connector specifications for Port A.

Table C-2. RS232 Connector Specifications for Port A

Number	Signal Name	Dir	Details
1	Power_OUT	P	Power Output Using internal battery: supplied voltage Using extermal power: 7.5V
2	GND	I/O	Signal ground
3	CTS	I	Clear to send
4	RTS	O	Request to send
5	RXD	I	Receive data
6	TXD	O	Transmit data
7	-	-	Not used

Table C-3 gives RS232 cable connector specifications for Port B. To use port B, install the appropriate firmware option.

Table C-3. RS232 Connector Specifications for Port B

Number	Signal Name	Dir	Details
1	Power_OUT	P	Power Output Using internal battery: supplied voltage Using extermal power: 7.5V
2	GND	I/O	Signal ground
3	CTS	I	Clear to send
4	RTS	O	Request to send
5	RXD	I	Receive data
6	TXD	O	Transmit data
7	EVENT	I	Event marker input

Table C-4 gives RS232 cable connector specifications for Port C.

Table C-4. RS232 Connector Specifications for Port C

Number	Signal Name	Dir	Details
1	Power_OUT	P	Power Output Using internal battery: supplied voltage Using extermal power: 7.5V
2	GND	I/O	Signal ground
3	CTS	I	Clear to send
4	RTS	O	Request to send
5	RXD	I	Receive data
6	TXD	O	Transmit data
7	PPS	O	PPS signal output

External Power Port

Pins 1 and 2 and pins 3 and 4 on the external power port are internally short-circuited. To connect any external unit, check the pin assignment on that unit.

The power connector (Figure C-2) is a sealed receptacle, 5 pin, ODU port.

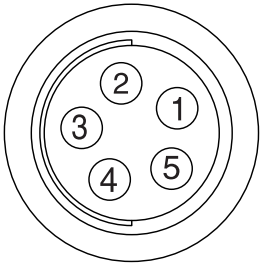


Figure C-2. External Power Port

Table C-5 gives the external power connector specifications.

Table C-5. External Power Connector Specifications

Number	Signal Name	Dir	Details
1	Power_INP	P	Power input
2	Power_INP	P	Power input
3	Power_GND	P	Power ground
4	Power_GND	P	Power ground
5	-	-	Not used

USB Port

The USB port (Figure C-3) provides connection through a USB cable to a computer.

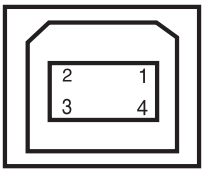


Figure C-3. USB Port

Table C-6 gives the USB port specifications.

Table C-6. USB Port Specifications

Number	Signal Name	Dir	Details
1	USB_PWR	P	Bus power input
2	USB D-	I/O	Data minus
3	USB D+	I/O	Data plus
4	GND	GND	Ground

Ethernet Port

The Ethernet port (Figure C-4) provides connection through a LAN cable to a computer.

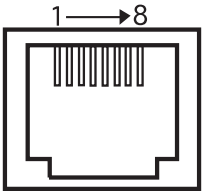


Figure C-4. Ethernet Port

Table C-7 gives the ethernet port specifications.

Table C-7. Ethernet Port Specifications

Number	Signal Name	Dir	Details
1	TX+	O	Transmitting data output
2	TX-	O	Transmitting data output
3	RX+	I	Receiving data input
4	-	-	Not used
5	-	-	Not used
6	RX-	I	Receiving data input
7	-	-	Not used
8	-	-	Not used

Antenna

The PG-A1 antenna is for precise geodetic use. Table C-8 lists antenna component details.

Table C-8. Antenna Specifications

Component	Details
Type	Micro strip GPS/GLONASS Micro-Center antenna
Connector	50 : TNC
Ground plane	Built-in Flat type
Dimension	W:141.6 x H:141.6 x D:53.7mm
Weight	492g
Protection against water and dust	IP66 (Based on IEC60529)

Table C-8. Antenna Specifications (Continued)

Component	Details
Operating temperature	-40°C to +55°C
Input voltage	DC 2.7 to 12V

BT-60Q Battery

The battery life varies depending upon the ambient temperature and the usage conditions of the GB-1000. Table C-9 lists battery component details.

Table C-9. Battery Specifications

Component	Details
Type	Lithium ion
Rated voltage	DC7.4V
Capacity	2000mAh
Charging time	Approx. 3 hours
Dimensions	W:38 x D:20 x H:72(H)mm
Weight	100g

The life of the rechargeable lithium ion battery may be shortened depending upon the method of use. The following sections describe electric discharge, storage, and recharging cycle, which are related to the battery life.

Discharge Characteristics

The discharge characteristics of the battery at high temperature is the same as that at room temperature. However, when discharge occurs at low temperature, the capacity of the battery tends to decrease.

The capacity of the battery at a temperature of minus 20 degrees Celsius will decrease to 80% of the capacity at room temperature (20 degrees Celsius).

Excessive discharge will shorten the battery life.

Storage Characteristics

The deterioration characteristics of the battery accelerate as the storage temperature increases. The battery should be stored below room temperature.

The battery will deteriorate faster when stored in a fully recharged state. For long-term storage, lower the remaining capacity (charge) of the battery.

Recharge/Discharge Cycle Characteristics

Repeated recharging/discharging cycles will cause the battery to deteriorate. After about 500 recharge/discharge cycles, the remaining capacity of the battery will decrease to below 60%.

BC-29 Charger

Table C-10 lists charger component details.

Table C-10. Charger Specifications

Component	Details
Input voltage range	AC100 to 240V
Charging output voltage	8.4V ±0.1V (Current for charging is 0A)
Frequency	50/60Hz
Charging temperature	+10°C to +40°C
Dimensions	W:70 x D:120 x H:40 mm
Weight	140g

AC Adapter

Table C-11 lists adapter component details.

Table C-11. Adapter Specifications

Component	Details
Size	W:60 x L:112 x H:36 mm
Weight	235 g
Operating Temperature	0°C to +40°C
Storage Temperature	-40°C to +85°C
Input	AC 100 to 240 V 1A (110 V AC) 50 to 60 Hz
Output	DC 12 V 2.5 A (30 W)
Connectors	Input (AC): Standard 3-pins AC receptacle Output (DC): SAE
Battery charge time	7 hours for Full Charge 6 hours for 90% Charge

Notes:

NMEA Standards

NMEA-0183 is a standard intended to facilitate the connectivity and compatibility between equipment manufactured by different manufacturers. This standard defines the data exchange protocol, message type, and data transmission specification between the transmitting and receiving terminals, and is widely used in many applications.

General NMEA Format

Each NMEA message has the following format:

$AACCC,c-c*hh<CR><LF>

$:	Start of the message
AACCC:	Address field
	The first 2 characters are the identifier of transmitting terminal.
	The last 3 characters are the identifier of the message type.
c-c:	Data block
*:	Checksum separator
hh:	Checksum
<CR><LF>:	End of message (carriage return, line feed)

For each NMEA message, a NULL field will be used when one or more parameters are not reliable or not available. This field is described with 2 commas (,,) or a comma and an asterisk (,*) depending on the message position.

TOPCON receivers support the following transmission identifiers:

- GP – Global Positioning System (GPS)
- GL – GLONASS
- GN – Global Navigation Satellite System (GNSS)

In general, the transmission identifier notifies the receiving terminal whether the position information included in the message is generated by GPS alone, GLONASS alone, or the combination of GPS with GLONASS. Among actual NMEA messages, however, there are some messages that do not show the satellite used for positioning. (For further details, see "Supported Messages" on page D-3.)

Fields

Latitude and Longitude

The latitude is shown as DDMM.MMMM and the longitude as DDDMM.MMMM.

DD and DDD represent a degree and MM.MMMM is an arcminute with a decimal point.

Direction

The characters representing the north latitude, south latitude, east longitude, and west longitude are N, S, E, and W, respectively

Time

Time is expressed as UTC in the format of HHMMSS.

HH denotes hours between 00 and 23, MM denotes minutes between 00 and 59, and SS denotes seconds between 00 and 59.

Supported Messages

Table D-1 lists NMEA messages the GB-1000 receiver supports.

Table D-1. Supported NMEA Messages

Message	Description
GGA	Data on time, position, and positioning
GLL	Position and positioning mode
GNS	Data on time, position and positioning of GPS+GLONASS (GNSS)
GRS	Residual error of distance for each satellite
GSA	Operation mode, satellite used, and DOP of GNSS receiver
GST	Statistics of position errors
GSV	Number of satellites, satellite number, elevation angle, azimuthal angle, and SNR
HDT	Heading
RMC	Positioning time, date, position, course, and speed
VTG	Course and speed
ZDA	UTC, day, month, year, and local time zone

GGA Message

This message outputs data on time, position and positioning, and is described in Table D-2.

Table D-2. GGA Message Ouputs

Field	Description
1	UTC time of position fix (first two digits designate hours, the next two designate minutes, and the remaining digits designate seconds)
2	Latitude in selected datum (first two digits designate degrees and the remaining digits designate minutes of arc)
3	Latitude hemisphere: N - northern, S - southern
4	Longitude in selected datum (first three digits designate degrees and the remaining digits designate minutes of arc)
5	Longitude hemisphere: E - eastern, W - western

Table D-2. GGA Message Ouputs (Continued)

Field	Description
6	GPS quality indicator 0: Fix not available or invalid. 1: GPS SPS Mode (single point mode), fix valid 2: Differential GPS SPS Mode, fix valid 3: GPS PPS Mode (single point mode), fix valid 4: RTK Fix solution 5: RTK Float solution 6: Estimated (dead reckoning) mode 7: Manual input mode 8: Simulator mode
7	Number of satellites used for position computation
8	Horizontal dilution of precision (HDOP) [-]
9	Altitude above geoid in selected datum [meters]
10	Symbol “M” (denotes that altitude is in meters)
11	Geoidal separation: the difference between the earth ellipsoid and geoid defined by the reference datum [meters]
12	Symbol “M” (denotes that geoidal separation is in meters)
13	Age of differential GPS data [seconds]
14	Differential reference station ID (an integer between 0000 and 1023)
15	Checksum

- The transmission identifier of the GGA message is always set to GP, regardless of whether positioning is calculated with GPS only, GLONASS only, or a combination of GPS and GLONASS.
- When the GB-1000 uses GPS+GLONASS data for RTK and DGPS positioning, the age of differential GPS data and the differential reference station ID will be shown regarding the GPS data.

  In contrast, when the GB-1000 uses GLONASS data only, the age of differential GPS data and the differential reference station ID will be shown regarding the GLONASS data.

- In general, when operating a GPS/GLONASS receiver, use the GNS message rather than the GGA message. The GGA message is used mainly for GPS only receivers.

GLL Message

This message outputs data on the current latitude/longitude and positioning state, and is described in Table D-3.

Table D-3. GLL Message Ouputs

Field	Description
1	Latitude in selected datum (first two digits designate degrees and the remaining digits designate minutes of arc)
2	Latitude hemisphere: N - northern, S- southern
3	Longitude in selected datum (first three digits designate degrees and the remaining digits designate minutes of arc)
4	Longitude hemisphere: E - eastern, W - western
5	UTC time of position (first two digits designate hours, the next two digits designate minutes, and the remaining digits designate seconds)
6	Status field V: Invalid for all values of positioning system mode indicator A: Autonomous D: Differential P: Precise R: RTK with fixed integers F: RTK with floating integers
7	Positioning system mode indicator A: Autonomous. Satellite system used in non-differential mode in position fix D: Differential. Satellite system used in differential mode in position fix E: Estimated (dead reckoning) mode M: Manual input mode S: Simulator mode N: Data not valid
8	Checksum

GNS Message

This message outputs data on time, position, and positioning of GPS+GLONASS (GNSS), and is described in Table D-4.

Table D-4. GNS Message Ouputs

Field	Description
1	UTC time of position fix (first two digits designate hours, the next two digits designate minutes, and the remaining digits designate seconds)
2	Latitude in selected datum (first two digits designate degrees and the remaining digits designate minutes of arc)
3	Latitude hemisphere: N - northern, S - southern
4	Longitude in selected datum (first three digits designate degrees and the remaining digits designate minutes of arc)
5	Longitude hemisphere: E - eastern, W - western
6	Mode indicator: variable length valid character field type with the first two characters currently defined. The first character indicates the use of GPS satellites, the second character indicates the use of GLONASS satellites. The indicators are: N: No fix. Satellite system not used in position fix, or fix not valid A: Autonomous. Satellite system used in non-differential mode in position fix D: Differential. Satellite system used in differential mode in position fix P: PPS independent positioning R: RTK Fix solution F: RTK Float solution E: Estimated position mode M: Manual input mode S: Simulator mode
7	Total number of satellites used for position computation
8	Horizontal dilution of precision (HDOP) [-]
9	Altitude above geoid in selected datum [meters]
10	Geoidal separation: the difference between the earth ellipsoid and geoid defined by the reference datum [meters]
11	Age of differential data [seconds] (see the note below)
12	Checksum

When the GB-1000 performs RTK or DGPS positioning using GPS alone or GLONASS alone, one GNS message will be output for the positioning result. When the GB-1000 performs RTK or DGPS using GPS+GLONASS, three serial GNS messages will be output for each positioning result.

The first one of three serial GNS messages outputs the majority of information and plays the most important role. The other two messages output the respective information on GPS and GLONASS (in particular, the number of satellites, the age of differential data, and reference station ID).

Below is an example of three serial GNS messages:

$GNGNS,122310.20,3722.425671,N,12258.856215,W,DD ,14,0.9,1005.543,6.5,,*74<CR><LF>

$GPGNS,122310.20,,,,,,7,,,,5.2,23*4D<CR><LF>

$GLGNS,122310.20,,,,,,7,,,,3.0,23*55<CR><LF>

GRS Message

This message outputs the residual error of distance, is used to support RAIM, and is described in Table D-5.

Table D-5. GRS Message Ouputs

Field	Description
1	UTC time (the first two digits designate hours, the next two digits designate minutes, and the remaining digits designate seconds)
2	Mode 0: residuals were used to calculate the position given in the matching GGA or GNS sentence 1: residuals were recomputed after the GGA or GNS position was computed Currently, the receiver uses only the first mode (Mode = 0)
3	A sequence of range residuals (in meters). Sequence length depends on the number of satellites used in the position solution. Order must match order of satellite ID numbers in GSA. When GRS is used, GSA and GSV are generally required. If the range residual exceeds 99.9 meters, then the decimal part is discarded, resulting in an integer (-103.7 becomes -103). The maximum value for this field is 999.

Table D-5. GRS Message Ouputs (Continued)

Field	Description
4	Checksum

The NMEA standard is as follows:

- When either GPS or GLONASS is used, the transmission identifier will be set to GP or GL, respectively.
- If GPS and GLONASS are used together, the GB-1000 will create 2 GRS messages. The first message indicates the residual error of distance for GPS and the next message indicates the residual error of distance for GLONASS. The transmission identifier of each message uses GN, which represents the residual error of distance for GNSS.

GSA Message

This message outputs the operation mode of the GNSS receiver, the satellite used for positioning, and DOP, and is described in Table D-6.

Table D-6. GSA Message Ouputs

Field	Description
1	Switching mode M: Manual; forced switching of 2D/3D mode A: Auto; automatic switching of 2D/3D mode
2	Positioning mode 1: Positioning is invalid 2: 2D 3: 3D
3	A sequence of satellite ID numbers. Sequence length is variable (depending on the amount of satellites used in the solution) 1 to 32: GPS PRN numbers 1 to 24: GLONASS slot numbers 1 to 32: NMEA satellite ID numbers 65 to 68: NMEA satellite ID numbers
4	Position dilution of precision (PDOP)
5	Horizontal dilution of precision (HDOP)

Table D-6. GSA Message Ouputs (Continued)

Field	Description
6	Vertical dilution of precision (VDOP)
7	Checksum

The NMEA standard is as follows:

- When either GPS or GLONASS is used, the transmission identifier will be set to GP or GL, respectively.
- If GPS and GLONASS are used together, the GB-1000 will create two GSA messages once. The first message is for GPS and the next message for GLONASS. Each message uses the same transmission identifier, GN, and has the same DOP value (DOP is a value calculated using a series of linked satellites).

GST Message

This message outputs the statistics of position errors, and is described in Table D-7.

Table D-7. GST Message Ouputs

Field	Description
1	UTC time of position (the first two digits designate hours, the next two digits designate minutes, and the remaining digits designate seconds)
2	Estimated standard deviation of the range input's error. “SV Range input”, which is used in the navigation process, includes this satellite‘s pseudo-range and the corresponding DGNSS correction [meters].
3	Semi-major axis of error ellipse [meters]
4	Semi-minor axis of error ellipse [meters]
5	Orientation of semi-major axis of error ellipse [degrees from true north]
6	RMS latitude error [meters]
7	RMS longitude error [meters]
8	RMS altitude error [meters]
9	Checksum

GSV Message

This message outputs the number of satellites, satellite number, elevation angle, azimuthal angle, and SNR, and is described in Table D-8.

Table D-8. GSV Message Ouputs

Field	Description
1	Total number of messages, 1 to 3
2	Message number, 1 to 3
3	Total number of satellites in view
4	Satellite ID number (see GSA for ID numbers), elevation in degrees, azimuth in degrees and C/A signal-to-noise ratio (SNR) in dB*Hz
5	Checksum

The number of sets consisting of satellite number, elevation angle, azimuthal angle, and SNR is variable (up to four sets for each message).

If the number of satellites exceeds four, multiple messages will be output. The first field indicates the total number of messages and the second field indicates the order of this message. GPS and GLONASS messages are separately output. The identifier of the GPS message is GP, and of the GLONASS is GL.

The number of satellites may exceed 12; however, the NMEA standard specifies that only three messages are permitted for one epoch and that data on maximum 12 satellites can be output. If the number of satellites exceeds 12, some satellites may not be included in the epochs for which the GSV message has been given.

Examples of 1 epoch with the GSV message are shown below:

$GPGSV,3,1,10.....<CR><LF>

$GPGSV,3,2,10.....<CR><LF>

$GPGSV,3,3,10.....<CR><LF>

$GLGSV,2,1,7.....<CR><LF>

$GLGSV,2,2,7.....<CR><LF>

HDT Message

This message outputs the direction and is described in Table D-9.

Table D-9. HDT Message Ouputs

Field	Description
1	True Heading in degrees
2	Symbol “T” indicates true heading
3	Checksum

RMC Message

This message outputs time, date, position, course and speed data provided by a GNSS navigation receiver, and is described in Table D-10.

Table D-10. RMC Message Ouputs

Field	Description
1	UTC time of position fix (first two digits designate hours, the next two designate minutes and the remaining digits designate seconds)
2	Positioning state A: Data valid V: Navigation receiver warning
3	Latitude in selected datum (first two digits designate degrees and the remaining digits designates minutes of arc)
4	Latitude hemisphere: N - northern, S - southern
5	Longitude in selected datum (first three digits designate degrees and the remaining digits designate minutes of arc)
6	Longitude hemisphere: E - eastern, W - western
7	Speed over ground (horizontal speed) [knots]
8	Course over ground (true course) [degrees]
9	Date (day/month/year)
10	Magnetic variation [degrees]
11	Magnetic variation direction: E - eastern, W - western

Table D-10. RMC Message Ouputs (Continued)

Field	Description
12	Positioning mode A: Autonomous. Satellite system used in non-differential mode in position fix D: Differential. Satellite system used in differential mode in position fix E: Estimated (dead reckoning) mode M: Manual input mode S: Simulator mode N: Data not valid
13	Checksum

VTG Message

This message outputs the traveling direction and velocity, and is described in Table D-11.

Table D-11. VTG Message Ouputs

Field	Description
1	True course [degrees]
2	Symbol “T” indicates True course
3	Magnetic course [degrees]
4	Symbol “M” indicates Magnetic course
5	Horizontal speed [knots]
6	Symbol “N” indicates that horizontal speed is given in knots
7	Horizontal speed [km/h]
8	Symbol “K” indicates that horizontal speed is given in km/h
9	Positioning system mode indicator A: Autonomous. Satellite system used in non-differential mode in position fix D: Differential. Satellite system used in differential mode in position fix E: Estimated (dead reckoning) mode M: Manual input mode S: Simulator mode N: Data not valid

Table D-11. VTG Message Ouputs (Continued)

Field	Description
10	Checksum

ZDA Message

This message outputs UTC, day, month, year, and local time zone and is described in Table D-12.

Table D-12. ZDA Message Ouputs

Field	Description
1	UTC time (first two digits designate hours, next two digits designate minutes and the remaining digits designate seconds)
2	Day (varies between 01 to 31)
3	Month (varies between 01 to 12)
4	Year
5	Local zone hours (varies from -13 to +13)
6	Local zone minutes (varies from 00 to 59)
7	Checksum

The local time zone hour and minute refers to the difference from UTC.

Notes:

Warranty Terms

TPS laser and electronic positioning equipment are guaranteed against defective material and workmanship under normal use and application consistent with this Manual. The equipment is guaranteed for the period indicated, on the warranty card accompanying the product, starting from the date that the product is sold to the original purchaser by TPS' Authorized Dealers.[1]

During the warranty period, TPS will, at its option, repair or replace this product at no additional charge. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. This limited warranty does not include service to repair damage to the product resulting from an accident, disaster, misuses, abuse or modification of the product.

Warranty service may be obtained from an authorized TPS warranty service dealer. If this product is delivered by mail, purchaser agrees to insure the product or assume the risk of loss or damage in transit, to prepay shipping charges to the warranty service location and to use the original shipping container or equivalent. A letter should accompany the package furnishing a description of the problem and/or defect.

The purchaser's sole remedy shall be replacement as provided above. In no event shall TPS be liable for any damages or other claim including any claim for lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, the product.

1. The warranty against defects in Topcon battery, charger, or cable is 90 days.

Notes:

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