

# BR-1



## Operator's Manual





# **BR-1**

## **Operator's Manual**

Part Number 7010-0796

Rev A

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# Preface

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## Manual Conventions

This manual uses the following conventions:

Example	Description
<b>File ▶ Exit</b>	Click the <b>File</b> menu and click <b>Exit</b> .
<i>Connection</i>	Indicates the name of a dialog box or screen.
<i>Frequency</i>	Indicates a field on a dialog box or screen, or a tab within a dialog box or screen.
<b>Enter</b>	Press or click the button or key labeled <b>Enter</b> .



Further information to note about the configuration, maintenance, or setup of a system.

---



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

---



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

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

---



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

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Under no circumstances should this action be performed.

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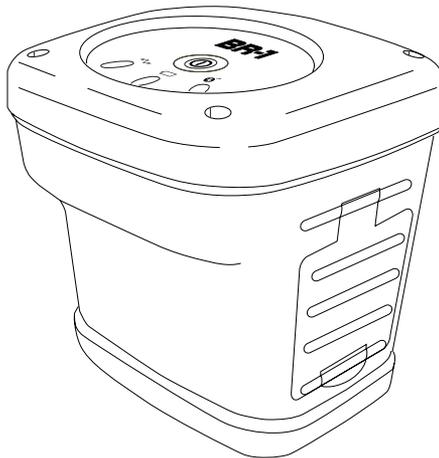


# Introduction

The BR-1 is a receiver that detects radio beacon signals, and is built to be the most advanced, compact, and portable receiver for the GIS surveying market.

The BR-1 receiver is a single-function, single-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.

When combined with the GMS-2, the BR-1 provides the functionality, accuracy, availability, and integrity needed for fast and easy data collection.



**Figure 1-1. BR-1**

# Principles of Operation

Surveying with the right GPS receiver can provide users accurate and precise positioning, a requirement for any surveying project.

This section gives an overview of existing and proposed Global Navigation Satellite Systems (GNSS) and receiver functions to help you understand and apply basic operating principles, allowing you to get the most out of your receiver. Also discussed are the principles behind surveying with Differential GPS, and using radio beacon signals as the source of corrections to locate unknown points.

## GNSS Overview

Currently, the following three global navigation satellite systems (GNSS) offer line-of-site radio navigation and positioning, velocity, and time services on a global, all-weather, 24-hour scale to any user equipped with a GNSS tracking receiver on or near the Earth's surface:

- GPS – the Global Positioning System maintained and operated by the United States Department of Defense. For information on the status of this system, visit the US Naval Observatory website (<http://tycho.usno.navy.mil/>) or the US Coast Guard website (<http://www.navcen.uscg.gov/>).
- GLONASS – the Global Navigation Satellite System maintained and operated by the Russian Federation Ministry of Defense. For information on the status of this system, visit the Ministry of Defense website ([http://www.glonass-center.ru/frame\\_e.html](http://www.glonass-center.ru/frame_e.html)).
- GALILEO – an upcoming global positioning system maintained and operated by Galileo Industries, a joint venture of several European space agencies working closely with the European Space Agency. Unlike GPS and GLONASS, this is a civil endeavor and is currently in the development and validation stage. For information on the status of this system, visit the Galileo Industries website (<http://www.galileo-industries.net>).

Despite numerous technical differences in the implementation of these systems, satellite positioning systems have three essential components:

- Space – GPS, GLONASS, and GALILEO satellites orbit approximately 12,000 nautical miles above Earth and are equipped with a clock and radio. These satellites broadcast digital information (ephemerides, almanacs, time&frequency corrections, etc.).
- Control – Ground stations located around the Earth that monitor the satellites and upload data, including clock corrections and new ephemerides (satellite positions as a function of time), to ensure the satellites transmit data properly.
- User – The community and military that use GNSS receivers and the corresponding satellites to calculate positions.

## **Calculating Absolute Positions**

When calculating an absolute position, a stationary or moving receiver determines its three-dimensional position with respect to the origin of an Earth-Center Earth-Fixed coordinate system. To calculate this position, the receiver measures the distance (called pseudo-ranges) between it and at least four satellites. The measured pseudo-ranges are corrected for clock differences (receiver and satellites) and signal propagation delays due to atmospheric effects. The positions of the satellites are computed from the ephemeris data transmitted to the receiver in navigation messages. When using a single satellite system, the minimum number of satellites needed to compute a position is four. In a mixed satellite scenario (GPS, GLONASS, GALILEO), the receiver must lock onto at least five satellites to obtain an absolute position.

To provide fault tolerance using only GPS or only GLONASS, the receiver must lock onto a fifth satellite. Six satellites will provide fault tolerance in mixed scenarios.

## Calculating Differential Positions

DGPS, or Differential GPS, typically uses the measurements from two or more remote receivers to calculate the difference (corrections) between measurements, thus providing more accurate position solutions.

With DGPS, one receiver is placed at a known, surveyed location and is referred to as the reference receiver or base station. Another receiver is placed at an unknown, location and is referred to as the remote receiver or rover. The reference station collects the range measurements from each GPS satellite in view and forms the differences (corrections) between the calculated distance to the satellites and the measured pseudo-ranges to the satellites.

These corrections are then built up to the industry standard (RTCM or various proprietary standards) established for transmitting differential corrections and broadcast to the remote receiver(s) using a data communication link. The remote receiver applies the transmitted DGPS corrections to its range measurements of the same satellites.

Using this technique, the spatially correlated errors—such as satellite orbital errors, ionospheric errors, and tropospheric errors—can be significantly reduced, thus improving the position solution accuracy of the GPS.

A number of differential positioning implementations exist, including post-processing surveying, real-time kinematic surveying, maritime radio beacons, geostationary satellites (as with the OmniSTAR service), and the wide area augmentation system (WAAS) service.

The real-time kinematic (RTK) method is the most precise method of real-time surveying. RTK requires at least two receivers collecting navigation data and communication data link between the receivers. One of the receivers is usually at a known location (Base) and the other is at an unknown location (Rover). The Base receiver collects carrier phase measurements, generates RTK corrections, and sends this data to the Rover receiver. The Rover processes this transmitted data with its own carrier phase observations to compute its relative position with high accuracy, achieving an RTK accuracy of up to 1 cm horizontal and 1.5 cm vertical.

## Essential Components for Quality Surveying

Achieving quality position results requires the following elements:

- Accuracy – The accuracy of a position primarily depends upon the satellite geometry (Geometric Dilution of Precision, or GDOP) and the measurement (ranging) errors.
  - Differential positioning (DGPS and RTK) strongly mitigates atmospheric and orbital errors, and counteracts Selective Availability (SA) signals the US Department of Defense transmits with GPS signals.
  - The more satellites in view, the stronger the signal, the lower the DOP number, the higher positioning accuracy.
- Availability – The availability of satellites affects the calculation of valid positions. The more visible satellites available, the more valid and accurate the position. Natural and man-made objects can block, interrupt, and distort signals, lowering the number of available satellites and adversely affecting signal reception.
- Integrity – Fault tolerance allows a position to have greater integrity, increasing accuracy. Several factors combine to provide fault tolerance, including:
  - Receiver Autonomous Integrity Monitoring (RAIM) detects faulty GPS and GLONASS satellites and removes them from the position calculation.
  - Five or more visible satellites for only GPS or only GLONASS; six or more satellites for mixed scenarios.
  - Wide Area Augmentation Systems (WAAS, EGNOS, etc.) creates and transmit, along with DGPS corrections, data integrity information (for example, satellite health warnings).
  - Current ephemerides and almanacs.

## Conclusion

This overview simply outlines the basics of satellite positioning. For more detailed information, visit the TPS website.

# Coastal Navigation Beacons DGPS Service

Throughout the world, a number of coastal radio beacon networks have been established to improve the accuracy of maritime navigation around harbors and critical waterways. These beacon networks provide correction information to GIS users with the proper equipment. Since beacon stations act as the known reference point, the repetitive set up, survey, and configuration of a base station has been eliminated. A beacon system provides  $\pm 3$  meter accuracy

In the United States, the coastal navigation beacons are managed by the United States Coast Guard and provide differential correction service in coastal areas and much of the interior of the United States.

In other parts of the world, coastal navigation beacons modeled after the US Coast Guard system are available. Check with your local maritime authority to learn more about services available in your area. The Beacon system is provided free of charge in the United States.

- For detailed information on the coastal navigation beacon system in the United States, visit the US Coast Guard's Navigation Center website ([www.navcen.uscg.gov](http://www.navcen.uscg.gov)).
- For detailed information on the coastal navigation beacon system in other parts of the world, visit the International Association of Marine Aids to Navigation and Lighthouse Authorities website (<http://www.iala-aism.org/web/index.html>).

## BR-1 Overview

The BR-1 is a 4-channel radio beacon receiver. Included in the system is beacon and Bluetooth. Bluetooth provides a connection with an external device such as GMS-2. This cable free connection allows for smart field work.

**The Beacon receiver component of the BR-1** can receive the DGPS correction data from the Beacon reference station. The BR-1 searches and receives the beacon signal and automatically exports the correction data after the unit is powered on. Because the BR-1 has a 4-channel beacon receiver, it simultaneously receives up to 4 beacon

signals. The BR-1 then chooses the optimal beacon station, then exports the correction data from the station.

## Getting Acquainted with the BR-1

The BR-1 is a beacon receiver. A serial port with Bluetooth® wireless technology provides communication paths with other devices.

The standard BR-1 package contains the following items:

- BR-1 beacon receiver with rechargeable battery
- Soft carry case and belt
- Unit-to-PC serial cable and power converter/adaptor cable
- Configuration software and assorted documentation

For more details on accessories and options available for the BR-1, contact your local Topcon dealer.

## Rechargeable Battery

The BR-1 comes equipped with a rechargeable battery (Figure 1-2) for powering the unit. The battery can be charged in the unit or in an optional battery charger.



The BR-1 cannot receive a Beacon signal while charging.



You may hear a high pitch sound while charging the battery. The sound does not cause a problem. Continue charging the battery.

---

The battery provides fifteen hours of operation, depending on the mode of the receiver.

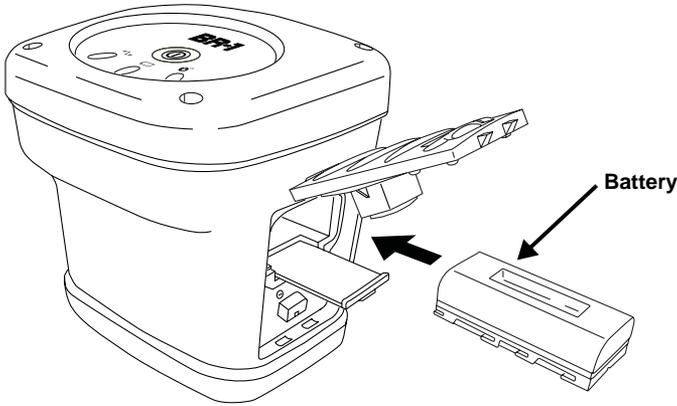


Figure 1-2. GMS-2 Battery

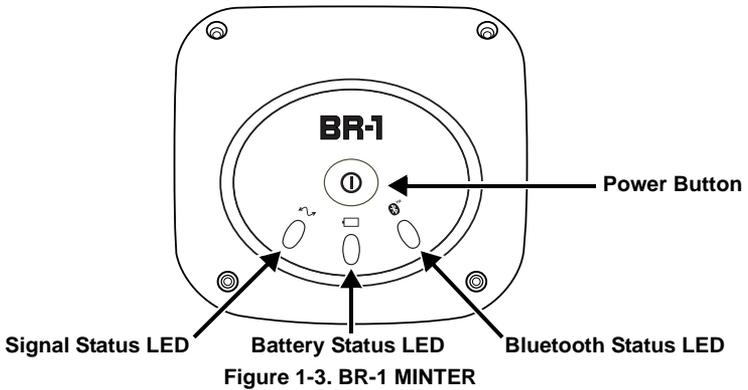
## BR-1 MINTER

The Minimum INTERface for the BR-1 turns on the receiver and has LEDs to monitor battery status and communication status.

- The **power button** turns the receiver on and off.
- The **status LED** indicates the status of the beacon signal:
  - Green blink: receiving a beacon signal, where each blink indicates a detected beacon station.
  - Red blink: searching for a beacon signal or no beacon signal detected.
- The **power LED** indicates the level of charge in the battery:

During Use	During Charge
<ul style="list-style-type: none"> <li>– Green blink: battery has a full charge (more than 80%).</li> <li>– Yellow blink: intermediate charge.</li> <li>– Red blink: battery requires charging (less than 20%).</li> </ul>	<ul style="list-style-type: none"> <li>– Fast blink: battery is charging.</li> <li>– Solid Green: battery is fully charged.</li> </ul>

- The **Bluetooth LED** indicates the level of activity at the Bluetooth wireless technology module:
  - Blue blink: the module is on and a connection has been established.
  - Slow Blue blink: waiting for a connection.



## BR-1 Ports

The BR-1 has the following two ports:

- Serial – used for communication between the internal beacon module (port A of the module) and an external device.
- Power – used to connect the BR-1 to an external power source. This port is used to charge the battery.

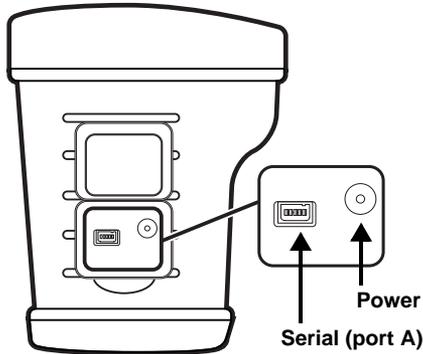


Figure 1-4. BR-1 Ports

## Carry Case and Belt

The carry case for the BR-1 has soft sides for comfort and is attached to an adjustable comfort-belt. The top of the case is clear for easy access to the MINTER. The case is waterproof.

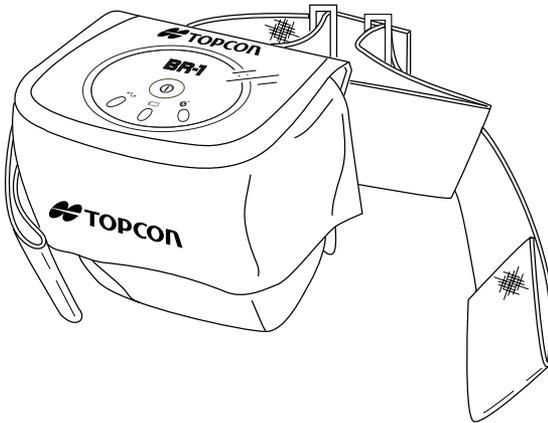
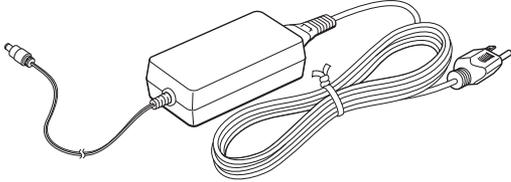
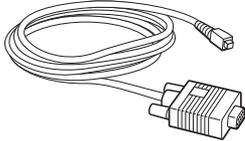


Figure 1-5. BR-1 Carry Case and Belt

# System Cables

The standard BR-1 package includes communication and power cables (Table 1-1).

Table 1-1. BR-1 Package Cables

Cable Description	Cable Illustration
<p><b>AC Power cable and adapter</b></p> <p>Connects the BR-1 to a grounded outlet.</p>	
<p><b>Serial cable</b></p> <p>Connects the BR-1 to a computer for high-speed data transfer and receiver configuration.</p>	

## BR-1 Configuration Software

The BR-1 comes with BR-1 Control Center software for configuring the ports, satellite almanac, radio channels, power usage, and other functions. The software is installed on a computer and will be used for configuring the BR-1 prior to performing fieldwork.

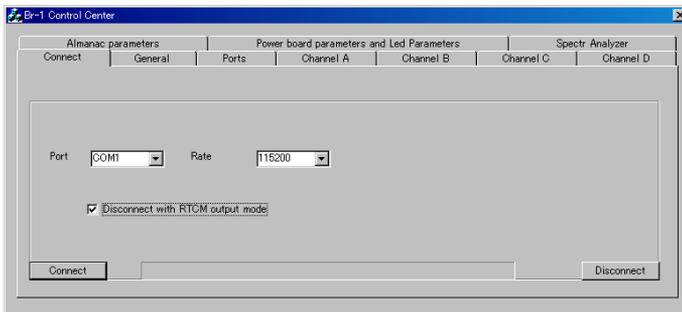
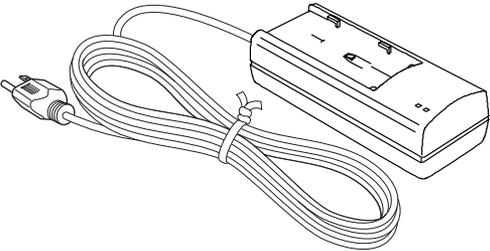
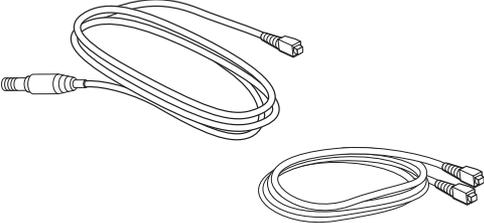


Figure 1-6. BR-1 Control Center

# Optional Accessories

Table 1-2 gives a brief list of optional accessories that can be used with the GMS-2. For more details on accessories and package options available for the BR-1, contact your local Topcon dealer.

**Table 1-2. GMS-2 Optional Accessories**

Accessory	Illustration
<p><b>External Battery Charger</b> Connects to an outlet to charge the battery outside the unit.</p>	
<p><b>Extra Battery</b> Provides a backup source of power. Be sure to turn off the unit before switching batteries.</p>	
<p><b>Serial cables</b></p> <ul style="list-style-type: none"> <li>• Connects the BR-1 to a HiPer or GB series GPS receiver</li> <li>• Connects the BR-1 to a GMS-2 controller/receiver</li> </ul>	

# Preparing the BR-1 for Use

Before using the BR-1, check that its battery is fully charged. While the BR-1 is ready to use without needing to be configured, perform any configurations in the office and prior to performing fieldwork.

## Powering the BR-1

The BR-1 uses a BT-62Q battery for its primary power source. The battery will last up to fifteen hours during continuous use.

## Charging the Battery

The AC/DC converter provides power to the BR-1 and charges the battery. The BR-1 cannot receive a beacon signal while the battery is charging.



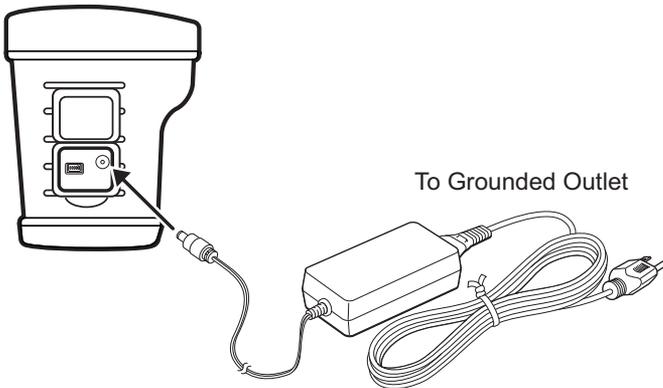
You may hear a high pitch sound while charging the battery. The sound does not cause any problem, so it is okay to continue charging the battery.

---

**To charge the battery using the adapter**, (Figure 2-1 on page 2-2) plug the connector into the power port of the BR-1. Then plug the converter into a grounded outlet. The battery will be fully charged in about three hours.

The power LED indicates the level of charge in the battery:

During Use	During Charge
<ul style="list-style-type: none"> <li>• Green blink: battery has a full charge (more than 80%).</li> <li>• Yellow blink: intermediate charge.</li> <li>• Red blink: battery requires charging (less than 20%).</li> </ul>	<ul style="list-style-type: none"> <li>• Fast blink: battery is charging.</li> <li>• Solid Green: battery is fully charged.</li> </ul>



**Figure 2-1. Charging the Battery in the BR-1**

**To charge the battery using the optional charger,** (Figure 2-2) remove the battery from the BR-1 (see “Installing the Battery” on page 2-3 for details) and slide it onto the charger. Plug the charger in to a grounded outlet.

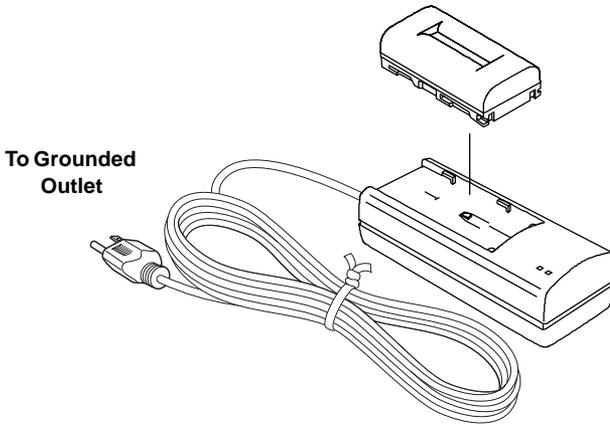


Figure 2-2. Charging the Battery in the Charger

## Charging and Battery Storage Notes

Keep the following in mind for proper charging, maintenance, and storage of the battery.

- Only recharge the battery at room temperature, approximately 50°F to 104°F (10°C to 40°C). Charging at a high temperature will increase the time it takes to charge the battery.
- The battery will discharge during storage. Always check the battery charge before using the BR-1.
- Charge a stored battery every 7 days. Allowing a battery to become discharged can reduce the overall performance of the battery and charge efficiency.
- The charger may become somewhat heated while charging the BR-1.

## Installing the Battery

The rechargeable battery can be charged using either the power port (see “Charging the Battery” on page 2-1) or the optional charger.

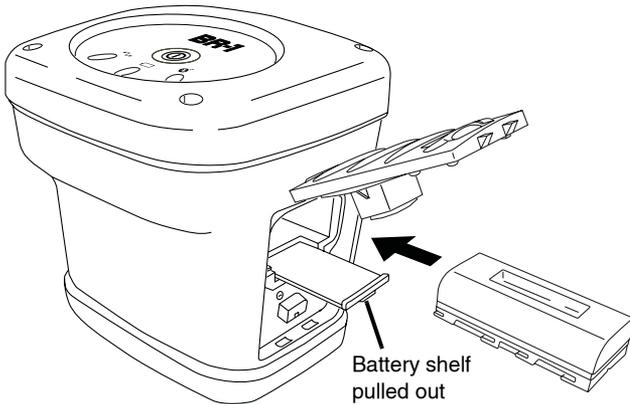
Follow these steps to remove/replace the battery (Figure 2-3 on page 2-4).

1. Open the battery cover. If needed, pull out the shelf to remove the (discharged) battery.
2. Insert a fully charged battery, sliding it into place. Then close the battery cover.



If the battery cover does not close, rotate the battery 180° to snap it into place.

---



**Figure 2-3. Installing the Battery**

## Starting the BR-1

To start the BR-1, briefly press the power button. The LEDs light up.

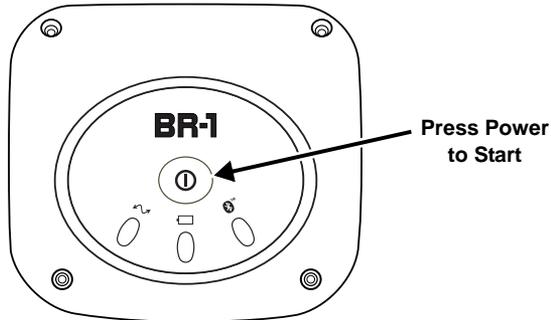


Figure 2-4. Press Power to Start the BR-1

Once the unit is turned on it begins to search for beacon signals and outputs correction information via the serial or Bluetooth port.

## Installing BR-1 Control Center onto a Computer

The BR-1 Control Center is a utility software used to configure the BR-1. This software installs onto a desktop computer or notebook computer. Computer requirements for the BR-1 Control Center are: Windows® 98 or newer and an RS-232C (serial).

1. Create a BR-1 Control Center folder on your hard drive and place the compressed BR-1 Control Center software file (retrieved from either the website or the CD) in this folder.
2. Create a shortcut on the computer's desktop for quick access to BR-1 Control Center. Extract Program and Create Shortcut

To uninstall BR-1 Control Center, navigate to the location of the \*.exe file. Select the file and press **Delete**.

# Configuring the BR-1

The BR-1 default settings are the automatic mode settings. The BR-1 searches for a signal, then automatically produces the RTCM correction from that signal, without special settings. The BR-1 can use its default settings, without changing parameters, for the majority of its use.

The following steps describe how to change the parameters to receive specific frequencies. For details on the BR-1 Control Center, see Appendix A.

1. Turn on the BR-1.
2. Connect the BR-1 and a computer using the serial cable.

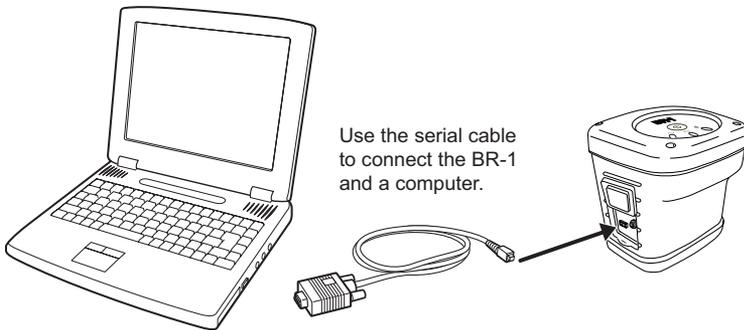


Figure 2-5. Connect BR-1 and Computer

3. Start BR-1 Control Center. Select the COM port and click Connect.

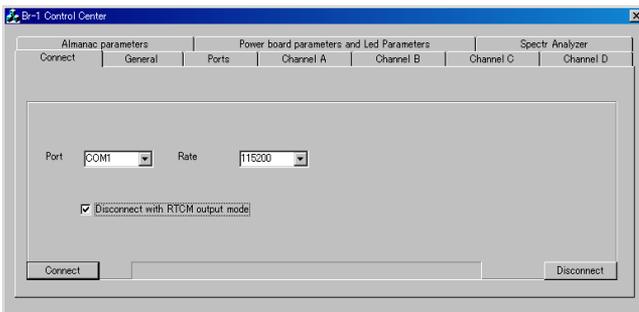
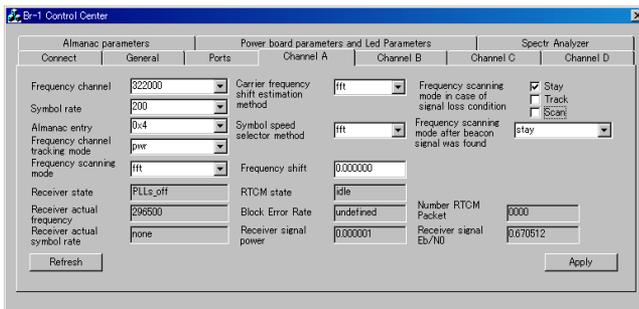


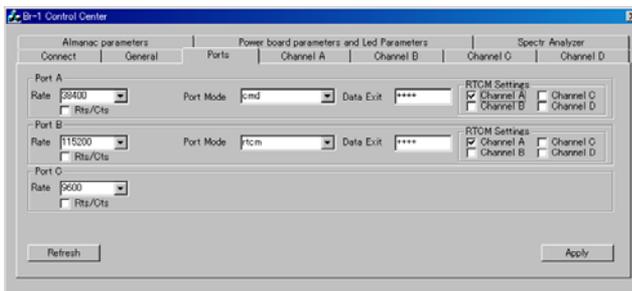
Figure 2-6. Connect BOB-CDU and the BR-1

4. Configure Channel A for specific frequency setup.
  - Frequency channel: Select desired frequency
  - Frequency scanning mode in case of signal loss condition: Check “Stay”
  - Frequency scanning mode after beacon signal was found: Select “Stay”
5. Click Apply to save the settings.



**Figure 2-7. Select Channel Information**

6. Configure the Ports for RTCM output settings.
  - RTCM Settings: Enable Channel A.



**Figure 2-8. Configure RTCM Settings**

7. Click Apply to save your settings (Figure 2-8).
8. On the Connect tab, check “Disconnect with RTCM output mode”. Then click Disconnect.



You must click Disconnect to prevent port communication problems with the computer.

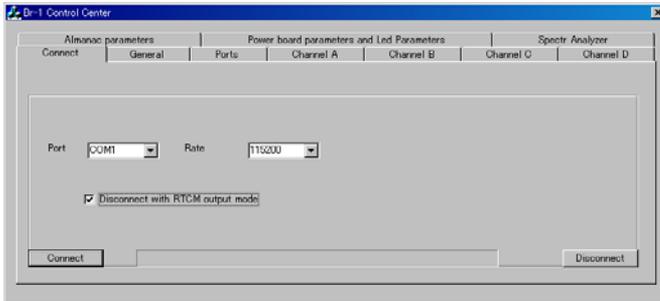


Figure 2-9. Disconnect with RTCM Output

## Bluetooth Module Configuration

Use BTCONF, Topcon's Bluetooth module's configuration program, and your computer to:

- access the Bluetooth wireless technology module
- configure the Bluetooth module
- check or change the module's configuration

To access the Bluetooth wireless technology module, first download and install BTCONF, then connect your computer and the receiver and run the configuration program.

1. Create or locate the following folder:

C:\Program Files\TPS\BTCONF

2. Download btconf.zip from the TPS website and unzip it into the BTCONF folder. This file contains Btconf.exe, the executable file for the Bluetooth module configuration program.

Each time you run BTCONF and configure the Bluetooth module, BTCONF saves your settings in a file (btconf.ini). BTCONF automatically updates the file each time you make changes to the Bluetooth module's settings.



To maintain unique Bluetooth module settings for different purposes, keep copies of BTCONF in separate folders.

To uninstall BTCONF, delete any applicable BTCONF directories or folders, and any BTCONF shortcuts.

Once you have BTCONF available, follow these steps to configure the Bluetooth module.

1. Using the RS232 cable, connect the serial port of your computer (usually COM1) to the receiver's serial port A. If needed, turn on the receiver and computer.
2. Run the Bluetooth module configuration program (Btconf.exe) (Figure 2-10).

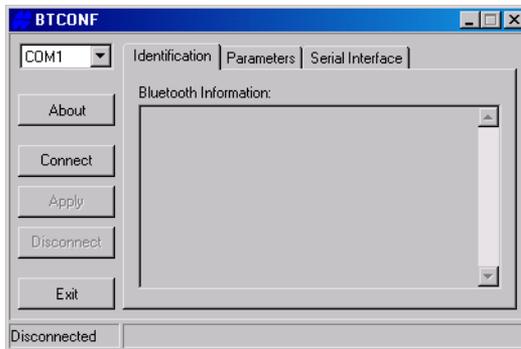
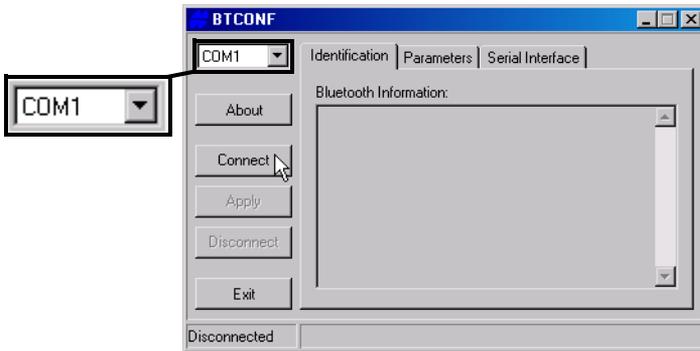


Figure 2-10. Bluetooth Module Configuration Main Screen

Notice that the lower left corner shows a “Disconnected” status for the computer and Bluetooth module.

For BTCONF version and copyright information, click the **About** button.

3. From the drop-down list in the upper left corner, select the computer serial port (usually COM1) used for communication (Figure 2-11).
4. Click **Connect** to connect the computer and Bluetooth module (Figure 2-11).



**Figure 2-11. Select Communication Port and Click Connect**

Once the receiver and computer connect through BTCONF, the Identification tab (Figure 2-12) displays the following information:

- Bluetooth name – the name of the Bluetooth module.
- Bluetooth address – the unique electronic address for the module.
- Firmware version – the current firmware version of the Bluetooth module.
- The COM port and baud rate display in the lower left corner.

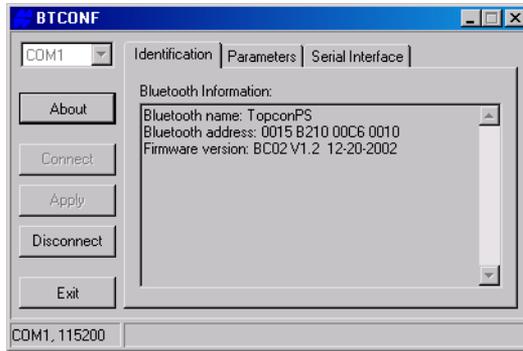


Figure 2-12. BTCONF Identification Tab

5. Click the **Parameters** tab (Figure 2-13 on page 2-11). The Parameters tab sets identifying and security information for your Bluetooth module. The security section allows you to set data security and unauthorized access parameters for the Bluetooth module.
6. Enter up to 14 characters to set a unique name for the Bluetooth module (Figure 2-13), and click **Apply**.

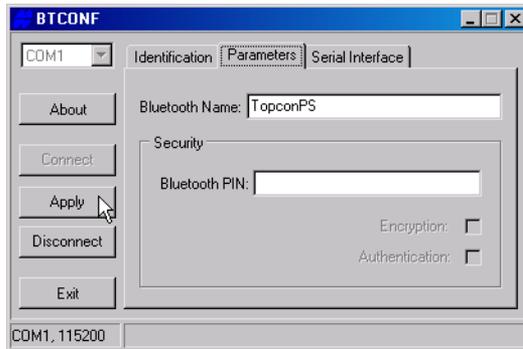


Figure 2-13. BTCONF Parameters Tab

7. To set security parameters (Figure 2-14 on page 2-12), enter and enable the following, then click **Apply**:
  - Bluetooth PIN – enter up to 16 characters to specify a personal identification number for the Bluetooth module.

- Encryption – enable to have the Bluetooth module encrypt wirelessly sent data. To read encrypted data, the user must have the same PIN used in the device that sent the data.
- Authentication – enable to require a PIN before two Bluetooth enabled devices (such as, the receiver and a computer) can establish a communication link. The two devices must use the same PIN.



If you do not need security settings, leave these parameters disabled.

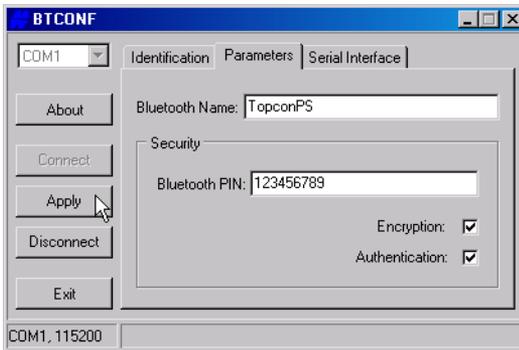


Figure 2-14. BTCONF Security Parameters

8. Click the **Serial Interface** tab (Figure 2-15 on page 2-13). Enable Echo to display Bluetooth module replies and corresponding commands on the computer terminal. If needed, click **Apply**.

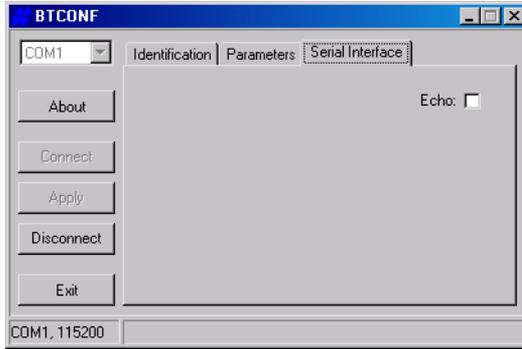


Figure 2-15. BTCONF Serial Interface Tab

9. Click **Disconnect** then **Exit** (Figure 2-16) to quit BTCONF.

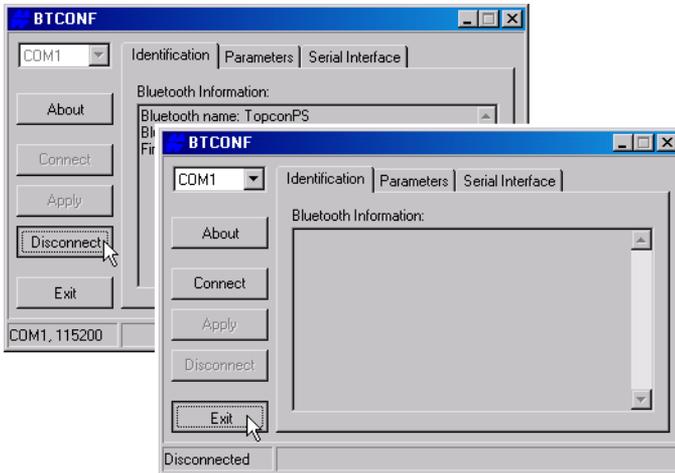
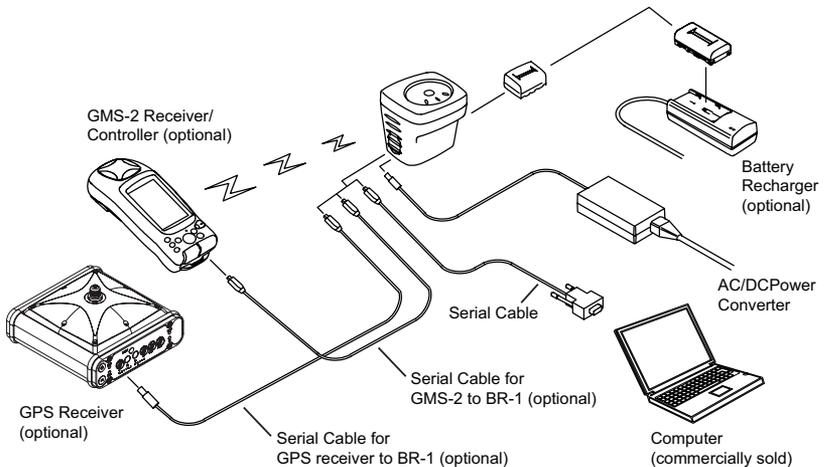


Figure 2-16. Click Disconnect then Exit



# Surveying with the BR-1

The BR-1 can be used as a stand-alone Beacon receiver, with Topcon's GMS-2, or with an external GPS receiver to provide correction data. The BR-1 provides direct connection to devices via a serial port or Bluetooth wireless technology.



**Figure 3-1. GMS-2 System Connections**



Refer to the *GMS-2 Operator's Manual* for GMS-2 setup and configurations.

When connected to the GMS-2 or other GPS receiver, the BR-1 Beacon receiver provides correction data for better position accuracy.

# BR-1 Surveying with the GMS-2

When surveying with the BR-1 in a GMS-2 configuration, the Beacon receiver provides DGPS correction data from the Beacon station.

1. Complete any required set up steps for the BR-1 as described in Chapter 2.
2. In the field, turn on the BR-1.
  - If using a serial connection, make sure to connect the optional GMS-2-to-BR-1 serial cable to both devices.
  - If using a Bluetooth wireless technology connection, make sure BTManager on the GMS-2 is open and detects the BR-1. In BTManager, the BR-1 is considered an “uncategorized” device. Refer to the *GMS-2 Operator’s Manual* for details on BTManager.
3. Using BTManager on the GMS-2, connect to the BR-1.

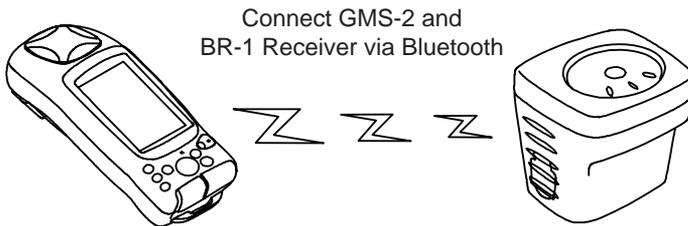


Figure 3-2. BR-1 and GMS-2 Setup

4. Configure the controller (GMS-2) for data collection as described in the corresponding software manual.



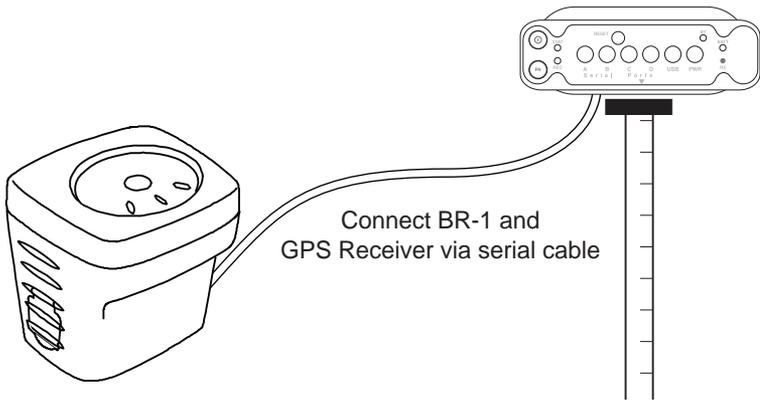
Ensure the survey configuration is for an external receiver.

5. Via the data collection software, begin logging data.
6. When you reach a location to record a point, pause and press the **Enter** button on the controller. Wait until the point is recorded before moving to the next location.

# BR-1 Surveying with an External GPS Receiver

When surveying with the BR-1 in an external GPS receiver configuration, the Beacon receiver provides DGPS data correction to the GPS receiver. When using this system configuration with a data controller, make sure to connect the BR-1 and GPS receiver using a port other than the one used for the controller.

1. Complete any required set up steps for the BR-1 as described in Chapter 2.
2. In the field connect the BR-1 and GPS receiver with a serial cable, turn on the external GPS receiver and the BR-1.
3. If using a serial connection, make sure to connect the optional GPS receiver-to-BR-1 serial cable to both devices.



**Figure 3-3. BR-1 and External GPS Receiver Setup**

4. Begin surveying according to the external GPS receiver's manual. The surveying may be conducted using just the GPS receiver, or a controller (such as the FC-200 or GMS-2) also connected to the the GPS receiver.



# Troubleshooting

This chapter will help you diagnose and solve some common problems you may encounter with the BR-1.



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

## Check This First!

Before contacting Topcon support, check the following:

- Check all external connections (cable and wireless).
- Check all power sources for drained batteries or incorrectly connected batteries/cables.
- Check that the most current firmware is downloaded onto the receiver. Check the TPS website for the latest updates.

Then, try the resetting the hardware. See “Resetting the Beacon Receiver” on page 4-2.

If the problem persists, see the following sections for other solutions.

## **Troubleshooting Quick List**

To reset the hardware, see “Resetting the Beacon Receiver” on page 4-2.

For power problems:

If “The BR-1 does not power up.” see page 4-3.

For general BR-1 problems:

If “The BR-1 is not receiving data (corrections) from a Beacon station.” see page 4-3.

If “The BR-1 is not transmitting data (corrections).” see page 4-4.

For Bluetooth problems:

If “Cannot connect to BR-1 via Bluetooth.” see page 4-4.

If “The BR-1 is no longer connected via Bluetooth.” see page 4-4.

## **Resetting the Beacon Receiver**

Only perform a hardware reset when the BR-1 has become completely unresponsive. A hardware reset will revert all settings to defaults.

1. Power off the BR-1.
2. Press and hold the power button.
3. The Status LED lights and Bluetooth LED lights will become solid after ten seconds.
4. Release the power button.
5. Press the power button to turn off the unit.

# Charging/Powering Problems

## The BR-1 does not power up.

- ⇒ The batteries may be discharged.
  - Connect the BR-1 to a grounded outlet to charge the battery. See “Charging the Battery” on page 2-1.
  - Insert a fully charged battery. See “Installing the Battery” on page 2-3.
- ⇒ The charging cable may be disconnected or damaged.

Check that the cable is securely connected and undamaged.
- ⇒ The BR-1 may have a defective charger or defective internal battery.

If, after changing the battery or connecting an external power source, the BR-1 still does not power up, contact TPS Customer Support for advice.

## BR-1 Problems

The following are some of the most commonly encountered problems with the BR-1.

### The BR-1 is not receiving data (corrections) from a Beacon station.

- ⇒ Check that the correct frequency has been selected. See “Configuring the BR-1” on page 2-6 for selecting Beacon frequencies.

**The BR-1 is not transmitting data (corrections).**

- ⇒ Check the Bluetooth LED. The LED will be blue when a connection has been established.
- ⇒ Check the serial cable connections. The connectors should be securely plugged in.
- ⇒ Check that the port settings (Port A and Port B) are setup as RTCM output mode.

## **Bluetooth Problems**

The following are some of the most commonly encountered problems with the BR-1.

**Cannot connect to BR-1 via Bluetooth.**

- ⇒ Check the Bluetooth setting. If there is a PIN setting, use the BR-1 Bluetooth PIN for the device PIN.

**The BR-1 is no longer connected via Bluetooth.**

- ⇒ Check the Bluetooth LED. The LED will be blue when a connection has been established.
- ⇒ Check the connection at the other device.

## **Obtaining Technical Support**

If the troubleshooting hints and tips in this Operator's Manual fail to remedy the problem, contact TPS Customer Support.

Before contacting TPS Customer support about any problems with the unit, see "Check This First!" on page 4-1 for some solutions that may fix the issue.

## Phone

To contact TPS Customer Support by phone, call:

1-866-4TOPCON (1-866-486-7266)

Monday through Friday

5:00am to 5:00pm, Pacific time

## E-mail

To contact TPS Customer Support via e-mail, use one of the following electronic mail addresses (Table 4-1).

**Table 4-1. Technical Support E-mail**

For Questions Related To...	Use...
Hardware (receivers, antennas, firmware)	hardware@topcon.com
GPS+ and 3DMC	psg@topcon.com
OAF	options@topcon.com
RTK	rtk@topcon.com
PC-CDU	pccdu@topcon.com
If in doubt...	support@topcon.com



For quick and effective support, provide a detailed description of the problem as described below.

When e-mailing TPS customer support, provide the following information for better, faster service:

1. The device's model and configuration settings.
2. The serial number of the device (located on the bottom of the unit).
3. The symptoms and/or error codes/messages that precede and follow the problem.
4. The activities being tried when the problem occurs. If possible, include the exact steps being taken up to when the error message or other problem occurs.
5. How regularly the problem occurs.

Generally, a customer support representative will reply within 24 hours, depending on the severity of the problem.

## **Website**

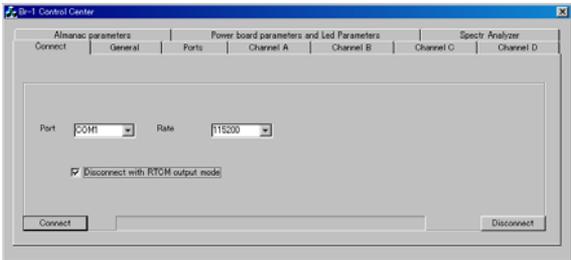
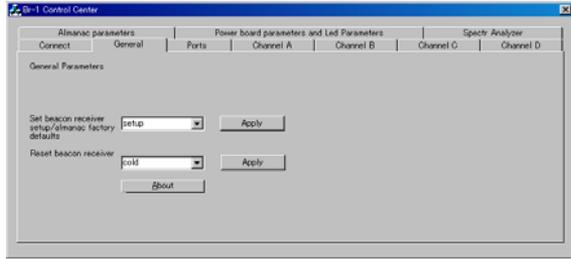
The Topcon Positioning Systems website provides current information about Topcon's line of products. The support area of the website provides access to frequently asked questions, configuration procedures, manuals, e-mail support, etc.

To access the TPS website, use: [www.topconpositioning.com](http://www.topconpositioning.com)

# BR-1 Control Center Software Reference

BR-1 Control Center is a simple utility that connects to the internal modules of the BR-1 for unit configuration and unit details. Table A-1 summarizes the screens and settings in BR-1 Control Center.

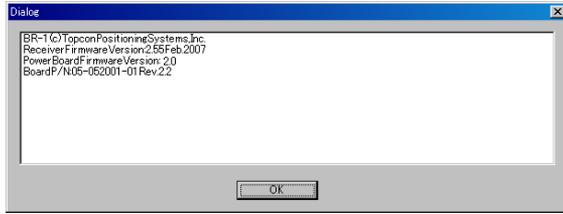
**Table A-1. BR-1 Control Center Quick Reference**

<p><b>Connect</b></p> <p>Connect to the BR-1 by pressing the Connect button. Select your connected port number. The software automatically searches for the proper baud rate and connects to the desired rate.</p> <p>Port: select your connected port on your computer.</p>	
<p><b>General</b></p> <p>This tab applies factory defaults, resets the receiver, displays firmware information (see the “About” row on page A-2).</p>	

**Table A-1. BR-1 Control Center Quick Reference (Continued)**

**About**

This screen displays current firmware versions for the receiver and power boards.

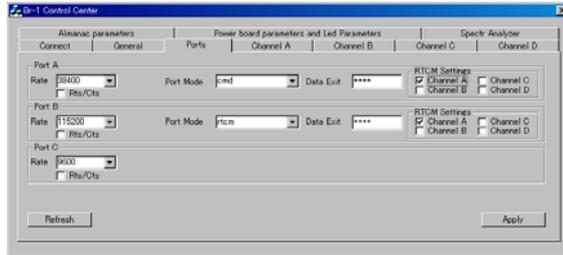


**Ports**

This tab applies settings to the BR-1 ports. The ports have the following default settings:

- Port A – serial
- Port B – Bluetooth
- Port C – power

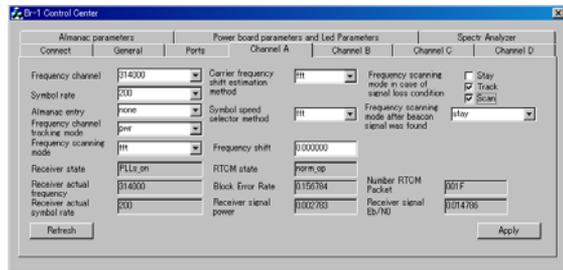
See “Setting up the Ports” on page A-6 for details.



**Channel A, B, C, D**

These tabs apply settings to the various channels used to track Beacon transmissions.

See “Setting up Channels” on page A-7 for details on changing these settings.

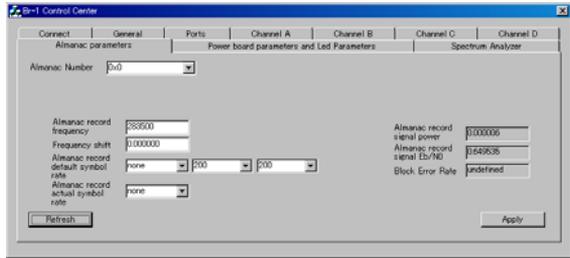


**Table A-1. BR-1 Control Center Quick Reference (Continued)**

**Almanac Parameters**

This tab provides settings for selecting the almanac number and its parameters.

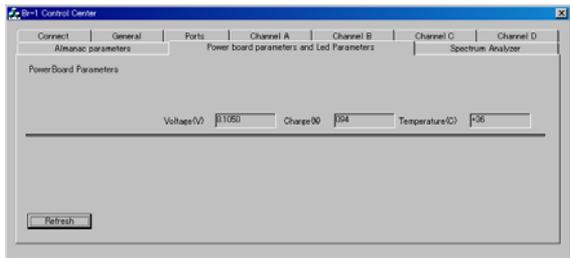
See “Setting up the Almanac” on page A-9 for details.



**Power Board and LED Parameters**

This tab displays information on the current power status.

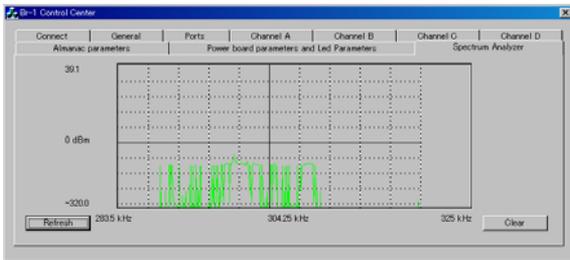
See “Power Board Parameters and Led Parameters” on page A-10 for details.



**Spectrum Analyzer**

This tab displays the spectrum input for the Beacon receiver.

See “Spectrum Analyzer” on page A-11 for details.



# General Settings

The General Settings screen can restore the parameters to their factory default settings, as well as reset the device. In order to restore or reset, select the desired parameter and click Apply.

- Set beacon receiver setup/almanac factory defaults
  - setup: restores parameter defaults
  - Almanac: clears almanac information
- Reset beacon receiver
  - Cold: rests receiver firmware, and restores parameters to the factory default.
  - Receiver: receiver firmware is reset.
  - Flash\_prog: resets flash memory, parameters are restored to the factory default.
  - Bluetooth\_prog: resets Bluetooth
  - Pwrbrd\_prog: resets the power board.

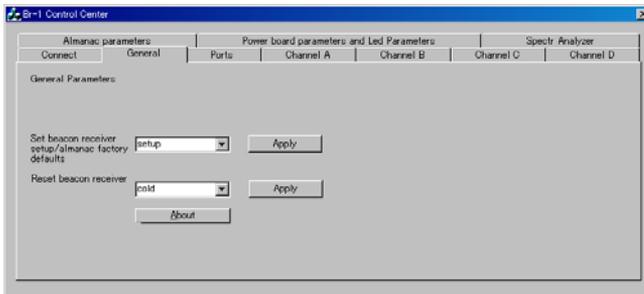
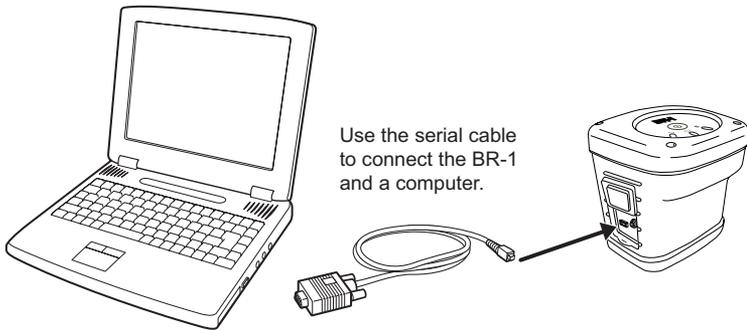


Figure A-1. General Settings Screen

# Connecting to BR-1 Control Center

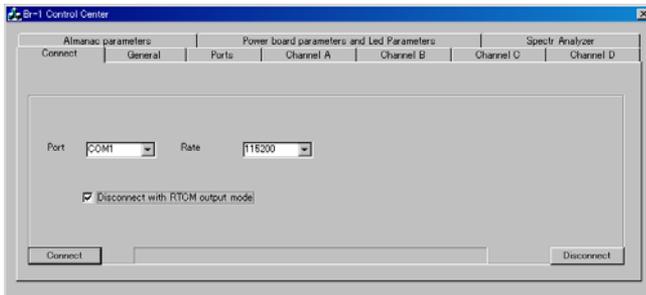
The BR-1 uses either a serial port or Bluetooth wireless technology to connect to a computer, and thus to BR-1 Control Center.

1. Connect the BR-1 and a computer using the serial cable.



**Figure A-2. Connect BR-1 and Computer**

2. Start BR-1 Control Center. Select the COM port and rate to connect to the BR-1 and click Connect.
3. Click Disconnect to exit the connection. To exit with RTCM output mode, turn on “Exit with RTCM output mode” then click Disconnect.



**Figure A-3. Connect BR-1 Control Center and the BR-1**

# Setting up the Ports

The BR-1 has three ports, two physical ports and one Bluetooth port. By default, the serial port is considered port A, the Bluetooth wireless technology port is port B, and the power port is port C. The Port's TabSheet displays the port's current state and mode.

1. After connecting BR-1 Control Center to the BR-1, click the Ports tab.
2. Click Refresh to view the current settings.
3. Select the following settings for the desired port:
  - Mode:
    - RtcM: RTCM output mode
    - Cmd: Command mode
    - None
  - Data Exit: Edit the character set to interrupt the RTCM output mode.
  - RTCM setting: Allows you to edit/enable the channel for RTCM output. The BR-1 has 4 channels (A,B,C,D), which allow the BR-1 to receive up to 4 beacon station signals. The BR-1 selects the best RTCM data from the enabled channel, for output.
4. Click Apply. Continue with other set up activities, or click Disconnect on the Connect tab and the close button to quit BR-1 Control Center.

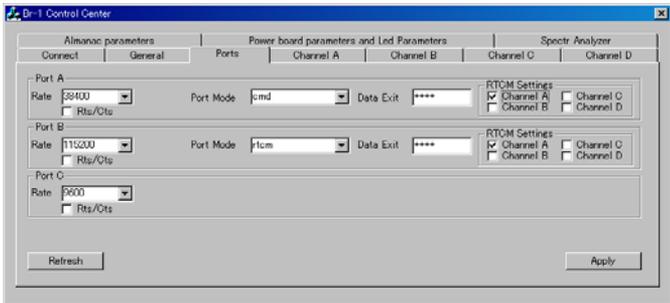


Figure A-4. BR-1 Ports Settings

## Setting up Channels

The BR-1 supports up to four separate channels for tracking a Beacon signal. Each channel has a unique frequency and set up parameters. The channel tabs also show the current status of the parameters. These parameters can be edited.

1. After connecting BR-1 Control Center to the BR-1, click the desired channel tab.
2. Click Refresh to view the current settings.
3. Select the following settings for the channel (Figure A-5 on page A-9).
  - Frequency channel – 283.5Khz-325Khz. Select the desired frequency.
  - Symbol rate – 50,100 or 200. Select the desired rate.
  - Almanac entry – Enter the almanac frequency.
  - Frequency channel tracking mode:
    - None
    - Power: Tracks the most powerful signal available.
    - Ber: Tracks the signal with a minimum Ber (Block error rate).

- Frequency channel mode – Select “prog” or “fft.” fft is faster than prog, but prog is more reliable.
  - Prog: searches the signal carefully with full diapason.
  - Fft: searches the signal with the Fast Fourier transform method.
- Carrier frequency shift estimation method – Select “prog” or “fft.” fft is faster than prog, but prog is more reliable.
  - Prog: searches the signal carefully with full diapason.
  - Fft: searches the signal with the Fast Fourier transform method.
- Symbol speed selector method – Select “prog” or “fft.” fft is faster than prog, but prog is more reliable.
  - Prog: searches the signal carefully with full diapason.
  - Fft: searches the signal with the Fast Fourier transform method.
- Frequency shift – input the frequency shift value within 0.01Hz precision if you can.
- Frequency scanning mode in case of signal loss condition.
  - Stay: keeps the current frequency.
  - Track: enters the current frequency to the Almanac and waits until the other channel finds the new frequency. This new frequency is set to this channel.
  - Scan: starts to find the new signal.
- Frequency scanning mode after beacon signal was found.
  - Stay: keeps the current frequency.
  - Track: keeps the current frequency until another channel finds a better frequency. This new frequency is set to this channel.
  - Scan: finds the new signal.

- RTCM state– displays the status of the following:
    - Norm\_op: Operating normally. The receiver receives and sends out RTCM data.
    - Sync\_srch: Receiver is searching for a signal.
    - Sync\_check: Receiver is verifying RTCM messages.
    - Idle: no signal input or output.
4. Click Apply (Figure A-5 on page A-9). Continue with other set up activities, or click Disconnect on the Connect tab and the close button to quit BR-1 Control Center.

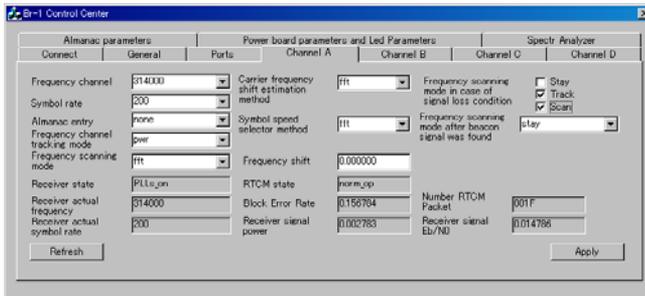


Figure A-5. BR-1 Channel (A) Settings

## Setting up the Almanac

The almanac number directly relates to all data collected by the receiver. The almanac information listed below allows the receiver to find the beacon signal quickly. Once the BR-1 has acquired the new beacon signal frequency, the information is stored in the almanac. Therefore the information can be used in future signal searches.

1. After connecting BR-1 Control Center to the BR-1, click the Almanac parameters tab.

The following can be edited:

- Almanac record frequency
  - Frequency shift
  - Almanac record default symbol rate (select the possible symbol rate)
  - Almanac record actual symbol rate
2. Click Apply (Figure A-6 on page A-10). Continue with other set up activities, or click Disconnect on the Connect tab and the close button to quit BR-1 Control Center.

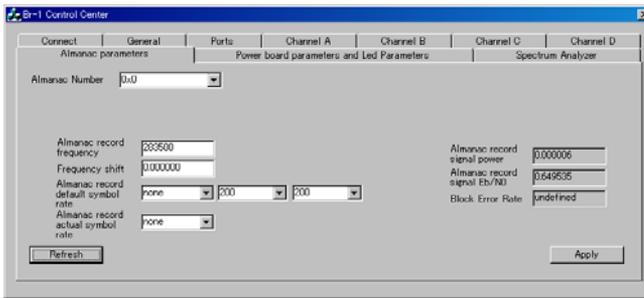


Figure A-6. BR-1 Almanac Settings

## Power Board Parameters and Led Parameters

The Power Board Parameters tab displays: the current voltage, charge degree, and current temperature.

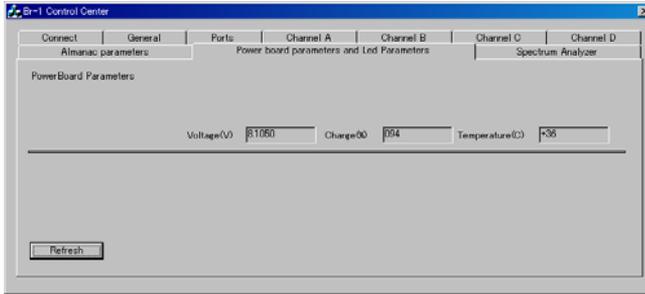


Figure A-7. Power Board Parameters

## Spectrum Analyzer

This tab displays the spectrum of the input signal. You can view the correlation peak of the received signal. Define the approximate locking frequency and signal power.

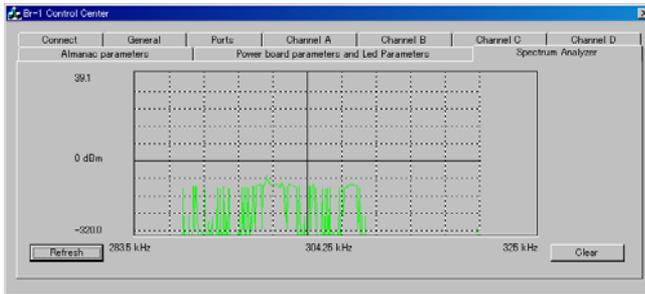


Figure A-8. Spectrum Analyzer



# Specifications

This TPS product is a 4-channel Beacon receiver with a Bluetooth® wireless technology module. The portable design allows this device to be a fully-functional, productive tool at any job.

## BR-1 Specifications

The following sections provide specifications for the BR-1 and its internal components.

### General Details

Table B-1 table lists the receiver's general specifications.

**Table B-1. BR-1 General Specifications**

<b>Physical</b>	
Enclosure	Molded ABS
Color	Topcon Yellow and Topcon Grey
Dimensions	W:112 x D:101 x H:122 mm
Weight	0.79 kg (including battery)
Battery	Internal, rechargeable/replaceable
Keys (buttons)	One key: Power – On/Off
LEDs	Three LEDs: Bluetooth – indicates Bluetooth wireless technology connection status Power – indicates charge level Signal status – indicates Beacon signal reception status

**Table B-1. BR-1 General Specifications (Continued)**

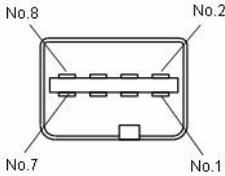
<b>Environment</b>	
Operating temperature	-20 C° to +50 C°
Storage temperature	-30 C° to +60 C°
Waterproof	IP66
Shockproof	1m drop
<b>Power</b>	
Internal battery	Li-ion, 2200 mAh, 7.4 V; repeatable
Operating time	No less than 15 hours with fully charged battery
External power	1 port
Input voltage	8 to 15 V DC (for work) 12 to 15 V DC (for charge battery)
Consumption	1.2 W at 12 V DC
Battery charger	Connect the AC adaptor to charge via the power port.
Charging time	~3 hours for full charge
<b>Connectors</b>	
Serial port	1 port for communication with the receiver board (port A); small connector
External power port	1 port; DC Jack type A; for connecting the AC adaptor or external battery
<b>Communication</b>	
Serial port	Port A of receiver board Baud rate = 115200, 57600, 38400, 19200, 9600, 4800, 2400, 1200, 600, 300 Flow control = RTC/CTS
Bluetooth	Version: Bluetooth standard 1.2; Class 2; Profile: SPP

# Connector Specifications

The BR-1 has two port connectors for power and data input/output.

## Serial Connector

The serial connector (Figure B-1) is a sealed receptacle, 5 pin, port. This connector is configured as port A of the internal Beacon receiver.



No.1	NC
No.2	RXD
No.3	CTS
No.4	TXD
No.5	NC
No.6	NC
No.7	NC
No.8	RTS
Cover Shield	GND

**Figure B-1. Serial RS232 Connector**



# Safety Warnings

## General Warnings



TPS receivers are designed for survey and survey related uses (that is, surveying coordinates, distances, angles and depths, and recording such measurements). This product should never be used:

- Without the user thoroughly understanding this manual.
- After disabling safety systems or altering the product.
- With unauthorized accessories.
- Without proper safeguards at the survey site.
- Contrary to applicable laws, rules, and regulations.



TPS receivers should never be used in dangerous environments. Use in rain or snow for a limited period is permitted.

---

## Battery Pack Warnings



Never attempt to open the casing of the removable battery! Lithium-Ion batteries can be dangerous if mishandled!

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Do not incinerate or the heat battery above 212° fahrenheit (100° celsius). Excessive heat can cause serious damage and possible explosion.

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Tampering with the batteries by end users or non-factory authorized technicians will void the battery's warranty.

- Do not attempt to open the battery pack or replace it.
  - Do not disassemble the battery pack.
  - Do not charge in conditions different than specified.
  - Do not use other than the specified battery charger.
  - Do not short circuit.
  - Do not crush or modify.
- 

## Usage Warnings

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If this product has been dropped, altered, transported or shipped without proper packaging, or otherwise treated without care, erroneous measurements may occur.

The owner should periodically test this product to ensure it provides accurate measurements.

Inform TPS immediately if this product does not function properly.

---



Only allow authorized TPS warranty service centers to service or repair this product.

---

# Regulatory Information

The following sections provide information on this product's compliance with government regulations for use.

## FCC Compliance

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause interference to radio or television equipment reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Move the equipment away from the receiver.
- Plug the equipment into an outlet on a circuit different from that to which the receiver is powered.
- Consult the dealer or an experienced radio/television technician for additional suggestions.



Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void your authority to operate such equipment.

---

## **Canadian Emission Labeling Requirements**

1. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
2. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.
3. This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte conform a la norme NMB-003 du Canada.

## **Community of Europe Compliance**

The product described in this manual is in compliance with the R&TTE and EMC directives from the European Community.

# WEEE Directive

Following information is for EU-member states only:

The use of the symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about the take-back and recycling of this product, please contact your supplier where you purchased the product or consult.





# 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.<sup>1</sup>

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.

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



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