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BRx7



USER MANUAL

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BREAK NEW GROUND

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Chapter 1: Introduction

Overview

Introduction This User Guide provides information to help you quickly set up your BRx7 GNSS Smart Antenna. You can download this manual from the Carlson website at www.carlsonsw.com.

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Product Overview

Product

The BRx7 is an all-new multi-frequency, multi-GNSS smart antenna. The

Overview

BRx7 provides robust performance and high precision in a compact and rugged package. With multiple wireless communications ports and an open GNSS interface, the BRx7 can be used in a variety of operating modes.

Use the BRx7 as a precise base station for sending RTK to your existing rover network. Turn BRx7 into a lightweight and easy-to-use rover by connecting it to your base via UHF radio or cellular network. Use the built-in web user interface (WebUI) to control, manage, and upgrade the BRx7 with new firmware and activations. BRx7 is Athena®-enabled and Atlas®-capable.

Powered by the Phantom™ 40 OEM board, the BRx7 supports 800+ channels and can simultaneously track all satellite signals including GPS, GLONASS, BeiDou, Galileo, QZSS and NavIC (IRNSS), making them robust and reliable.

BRx7 comes standard with two long-life lithium batteries providing up to 12 hours of operation. The batteries are hot-swappable, and may be changed while working, maximizing your efficiency and Return on Investment (ROI).

The BRx7 combines Athena GNSS engine and Atlas L-band correction technologies with a sophisticated WebUI, offering an unparalleled level of customer-friendly performance.

The ruggedized antenna is designed for very challenging environments and meets IP67-standard requirements.

The BRx7 is the ideal positioning system to use in land or marine survey, GIS, mapping, and construction. Together with SureFix™ advanced processor, the BRx7 delivers high-fidelity RTK quality information that results in guaranteed precision with virtually 100% reliability.

Product Overview

Product Overview



The BRx7 receiver is powered by the Athena RTK technology. The BRx7 provides state-of-the-art RTK performance when receiving corrections from a static base station or network RTK correction system. With multiple connectivity options, the BRx7 allows for RTK corrections to be received over radio, cell modem, Wi-Fi, Bluetooth, or serial connection. BRx7 delivers centimeter-level accuracy with virtually instantaneously initialization times and cutting-edge robustness in challenging environments.

Athena RTK is next-generation RTK engine designed to support all available constellations and takes advantage of available new signals. Athena was designed to seamlessly integrate into existing product portfolios and supports all major industry correction formats and standards.

Athena RTK can be added to the BRx7 as an activation.

Athena RTK has the following benefits:

- Improved Initialization time - Performing initializations in less than 15 seconds at better than 99.9% of the time.
- Robustness in difficult operating environments - Extremely high productivity under the most aggressive of geographic and landscape-oriented environments.
- Performance on long baselines - Industry-leading position stability for long baseline applications.

Product Overview

Atlas L-band

The Atlas system delivers world-wide centimeter-level correction data over L-band communication satellites. BRx7 users can experience sub-decimeter positioning performance anywhere on earth, without the need to be near a GNSS or communication infrastructure.

With Atlas, the positioning accuracy does not degrade as a function of distance to a base station, as the data content is not composed of a single base station's information, but an entire network's information.

Atlas L-band is Hemisphere's industry leading correction service, which can be added to the BRx7 as a subscription. Atlas L-band has the following benefits:

- Positioning accuracy - Competitive positioning accuracies down to 4cm RMS in certain applications.
- Positioning sustainability - Cutting edge position quality maintenance in the absence of correction signals, using Hemisphere's patented technology.
- Scalable service levels - Capable of providing virtually any accuracy, precision, and repeatability level in the 4cm to 50cm range.
- Convergence time - Industry-leading convergence times of 10-40 minutes.
- Global Ionospheric Model - Real-time ionospheric activity and data is sent to the receiver and allows Atlas-capable devices to adjust accordingly, providing excellent convergence performance.

WARNING

Your BRx7 is equipped with a UHF radio. If you choose to use the radio, you may need to obtain a license.

Product Overview

aRTK Position Aiding

aRTK is an innovative feature available in Carlson’s BRx7 Smart Antenna that greatly mitigates the impact of land-based communication instability.

Powered by Hemisphere’s Atlas L-band system service, aRTK provides an additional layer of communication redundancy to RTK users, assuring that productivity is not impacted by intermittent data connectivity.

BRx7 receives the aRTK augmentation correction data over satellite, while also receiving the land-based RTK correction data. With this, the receiver internally operates with two sources of RTK correction, creating one additional layer of correction redundancy as compared to typical RTK systems.

Once this process is established (a few seconds), the receiver can operate in the absence of either correction source. The receiver can continue generating RTK positions if the land-based RTK correction source becomes unavailable for a period of time.

SureFix™ RTK Position

SureFix is an additional processor that runs in combination with the RTK engine and provides high fidelity quality indicators to users.

The SureFix processor takes several inputs, such as GNSS data, data preprocessing results, and generated RTK solutions. Using all the available information and functional and stochastic analysis methods, SureFix determines the quality of the current RTK engine solution.

Shown as SureFix quality indicators, these indicators are combined with the RTK solution before being provided to the user. At the end of the process, the user has access to high fidelity information about the quality of the RTK solution.

Key Features

Key features

The key features of the BRx7 Smart Antenna include:

- Multi-frequency GPS, GLONASS, BeiDou, Galileo, QZSS, IRNSS, and Atlas Lband
 - Long-range RTK baselines up to 50 km with fast acquisition times
 - UHF (400 MHz & 900 MHz), cellular, Bluetooth, and Wi-Fi wireless communication
 - Athena GNSS engine providing best-in-class RTK performance
 - Internal sensor corrects collected point coordinates to within 2 cm
-

What's Included in Your Kit

What's included in your kit As shown in Table 1-1 below, the BRx7 is available in a variety of kits, with supplementary products sold as “controller/option kits”, “accessory kits” or simply as separate accessories. Contents can change without prior notice. Check the official price list to confirm contents.

Important: Charge your Li-Ion battery upon receipt of shipment. According to the 2017 IATA Dangerous Goods Regulations and supplemental IATA Lithium Battery Guidance, batteries must be charged to less than 30% to meet international air freight requirements.

Table 1-1: BRx7 parts list

Main Kits	Part Number	Quantity
BRx7 Power Cable to Rcvr & DB-9 Serial	8030.064.027	1
BRx7 Serial Cable (5-pin)	8030.064.028	1
BRx7 GPRS Antenna (SMA)	8030.043.006	1
BRx7 UHF Antenna	8030.042.007	1
s Series BP-5S Battery	8030.060.005	2
Battery Charger Adapter	8030.060.004	1
Battery Charger	8030.060.007	1
Car Charger Adapter	8030.064.027	1
Quick Release	8030.085.002	1
Carry Case with Measuring Tape	8030.080.067	1
External UHF Antenna Bracket Kit	-	1
BRx7 Power Cable (Alligator Clips)	8030.064.036	1

Chapter 2: Installation

Overview

Introduction Chapter 2 provides instruction on how to install your BRx7 Smart Antenna.

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Ports and Connections

Ports and Connections

All ports and connections are located on the bottom of the unit, as shown in Figure 2-1. Table 2-1 provides additional information about each port/connection.

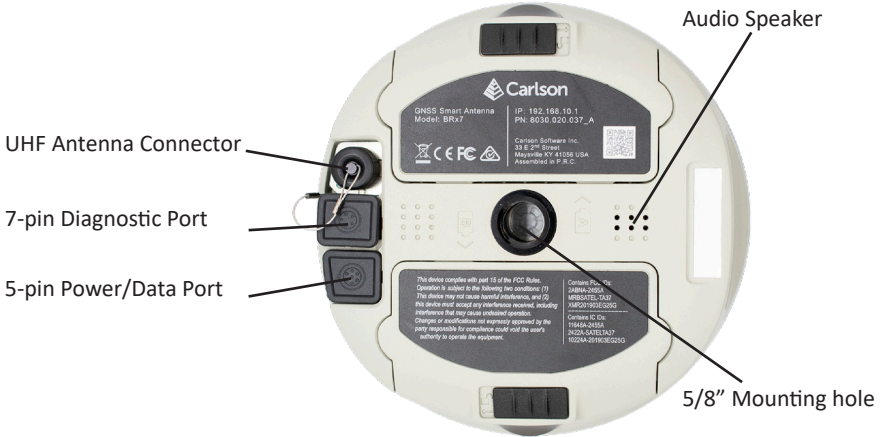


Figure 2-1: BRx7 ports and connectors

Table 2-1: BRx7 ports and connections

Main Kits	What to connect
7-pin Diagnostic Port (LEMO)	Diagnostic cable for serial or USB
5-pin Power/Data Port (LEMO)	External Power, data, and radio devices
UHF Antenna Connector	External UHF antenna
Mounting hole	Pole or tripod mount

Installing/Connecting the BRx7

Installing batteries

The BRx7 comes standard with two long-life lithium batteries (see What's Included in Your Kit) providing up to 12 hours of operation. The batteries are hot-swappable and may be changed while your work.

To install the battery, slide each latch so that the lock is showing.

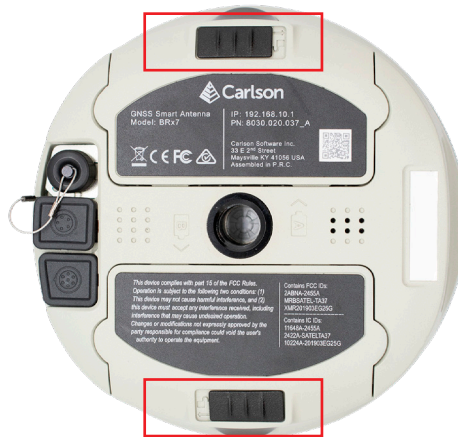


Figure 2-2: Battery latches

Installing/Connecting the BRx7

Installing batteries

Press the button on the side to open the battery compartment and remove the door as shown in Figure 2-3.



Figure 2-3: Battery compartment door removed

Installing batteries

Place the battery into the compartment. Take care to ensure the contacts on the battery are on the same side as the contacts on the receiver. The battery will fit down onto the notch. Slide the battery forward until it clicks and locks into place (Figure 2-4).



Figure 2-4: Installed battery

Installing/Connecting the BRx7

Installing batteries

To close the door cover, ensure the tab is unlocked. Slide the latch to cover the lock and lock the door (Figure 2-5).



Figure 2-5: Closed and locked battery compartment door

Installing UHF Antennas

Installing UHF Antennas

To install the external UHF antenna of the BRx7, locate the UHF antenna (8030.042.007) from the kit list under What’s Included in Your Kit.

Insert the connector end of the UHF antenna and rotate clockwise to secure the antenna to the BRx7.

Installing the BRx7 on a Tribrach

Installing the BRx7 on a tribrach

The BRx7 mounts flush to the tribrach by securing the 5/8-11” female metal mounting portion of the BRx7 to the standard 5/8-11” male portion of the tribrach. Hand-tighten (35-40 in-lbs. of torque) to secure the BRx7 onto the mount in a clockwise rotation.



Figure 2-6: Installing BRx7 on a tribrach

Installing the BRx7 on a Range Pole

Installing the BRx7 on a range pole

Use the standard 5/8-11" mount on the bottom of the BRx7 to secure the unit to a field standard 5/8-11" range pole.

The BRx7 should be placed carefully on the range pole to ensure cross-threading does not occur while rotating the unit in a clockwise direction. Hand-tighten (35-40 in-lbs. of torque) to secure the unit.



Figure 2-7: Range pole installation

Connecting to a Power Source

Connecting to a power source

The BRx7 has two main power sources. The first power source is the internal removable battery described in the earlier portion of this chapter. The second power source is the external power cable (Part Number 8030.064.027).

The 5-pin (LEMO) connector allows 9 to 24V of power into the BRx7.



Figure 2-8: External power connector

Connecting to an External Device

Connecting to an External Device

The 7-pin connector is available for diagnostics. You can also use this pin connector to download your data files.



Figure 2-9: 7-pin diagnostic connector

To download your data files, connect the 7-pin Lemo connector end of the cable to the BRx7. Plug the USB end into a computer. You can access the internal memory of the receiver via the filesystem.

The data files are kept in the “record” folder. Text files with a .script file extension that contain commands (see BRx7 Series Command Interface Integrator Guide) are placed into the “update” folder and sent upon startup of the receiver.

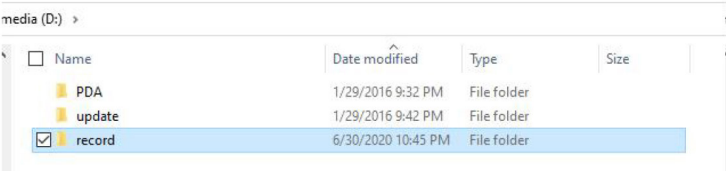


Figure 2-10: Record folder

Powering the BRx7 On/Off

Powering the BRx7 On/Off

To power on the BRx7 receiver, press the I key for one second, and wait for the device to beep three times and power on.

To power off the BRx7 receiver, press the I key until the receiver beeps and the LED lights blink. Then press the power key again to power off.

Inserting and Removing the MicroSD Card/SIM Card

Inserting and Removing the MicroSD Card/SIM Card

To remove the MicroSD card or SIM card:

- Open the battery compartment A.
- Remove the battery.
- Remove the cover for the SD or SIM card.
- Gently slide the tray backward until it clicks out of place.
- Gently lift the tray up and remove the card.

Note: When you insert either card make sure the contacts on the card are facing downward (toward the top of the unit).

Caution: Use electrostatic discharge (ESD) protection, such as wearing an ESD strap that is attached to an earth ground before inserting or removing the SIM card on the BRx7. If an ESD strap is not available, then touch a metal object prior to accessing the SIM card holder.

The MicroSD card and the SIM card are only accessible by first opening battery compartment A, where:

- The “SIM” card slot is positioned on the left side of the battery opening.
- The “TF” card slot is positioned on the right side of the battery opening.

Warning! Ensure the unit is powered off when inserting or removing the SIM card.



Figure 2-11: MicroSD/SIM card slot

Chapter 3: Setup and Configuration

Overview

Introduction Chapter 3 contains the information you need to set up and configure your BRx7 Smart Antenna.






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Control Panel Overview

Control Panel overview

Refer to the table below for information on the control panel LED indicators.

Table 3-1: LED Indicators

Icon	Colors	Description	
	Red Green	Off	Not receiving satellites
		Flashing Red	Receiving satellites but no solution
		Flashing Green	Has a solution but is not fixed
		Green	Fixed
		Alternate Red and Green	GNSS receiver board abnormal
	Green Blue	Green	Datalink setup complete
		Flashing Green	Data transmitting normally
		Flashing Blue	In static mode, flashes according to the sampling intervals
	Blue	Off	No Bluetooth connection is established
		Blue	Bluetooth connection established
	Red Green	Green	Power is between 30% and 100%
		Flashing Green	Power is between 10% and 30%
		Flashing Red	Power is below 10%
	-	-	Used to turn on and off the receiver
		-	Short press to broadcast the current working mode and status

Setting up the BRx7

Setting up the BRx7

Figure 3-1 shows a typical setup for a base station (tripod is not included).

The antenna is connected to the bottom of the unit; you have the option of attaching the antenna to the antenna bracket to face the antenna upward.



Figure 3-1: Base setup

Installing the base

To install the base, complete the following steps:

- Put a tripod on a location with known or unknown coordinates, attach the receiver to the tribrach.
 - Attach the UHF radio antenna (not shown) to the TNC connector (if using the internal UHF radio). We recommend using the 40 cm pole extension to increase the height of the antenna.
 - Switch on the receiver and select the base working mode.
-

Installing the ROVER

To install the rover, complete the following steps:

- Attach the hand-held bracket on the pole, fix the hand-held to the bracket, put the rover on the pole and attach the UHF antenna to the TNC connector (if using the internal UHF radio).
 - Power on the receiver and select the rover working mode.
 - Open the hand-held and start the software, then you can configure the instruments.
-

Bluetooth Communication

Bluetooth Communication If you have a Bluetooth-enabled device, such as a data collector, you can wirelessly communicate with the BRx7.

When you attempt to connect the BRx7 to a Bluetooth-enabled device, such as a hand-held data collector, the following BRx7 Bluetooth information appears on the device:

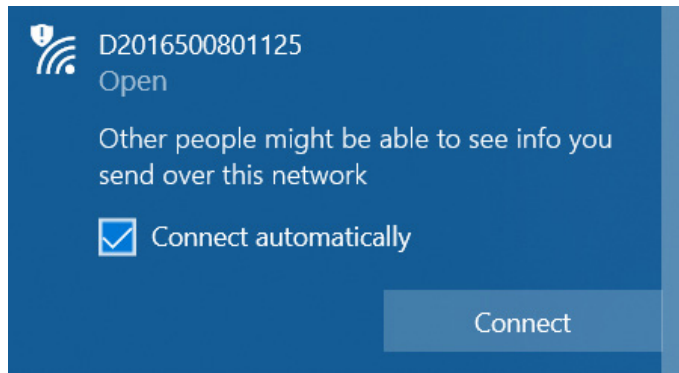
xxxxxxxxxxxxx, e.g. Dxxxxxxxxxxxxx”

where “xxxxxxxxxxxxx” is the serial number

WebUI

Carlson WebUI The WebUI can work on any PC, tablet, or phone that has Wi-Fi network capabilities.

Initial setup Using the Windows Wi-Fi network, locate the Wireless Network Connection labeled the same as the serial number of the device.



If you want this network to automatically connect, select the Connect automatically check box before pushing the Connect button. If not, click the Connect button. We suggest setting this to a private connection.

Once connected to your device, type or copy the following IP address into your URL bar:

`http://192.168.10.1/`

The WebUI will prompt you for a username and password. The default username and password are:

- Username: admin
 - Password: brx7
-

WebUI (continued)

Status tab

The **Status tab** provides general GNSS information including **System Mode**, **Latitude**, **Longitude**, and **Height**.

BRx7 D2016500801125 SN: D2016500801125
FW: 0.40.200720
IP: 192.168.10.1
2020-08-05 08:35:13

Status Information Download Management Settings

- System Mode: Rover
- Longitude: 21.044459024 °
- Height: 131.267 m
- Satellites: 16 (GPS: 4, BeiDou: 6, Glonass: 4, Galileo: 2)
- HDOP: 1.365
- HRMS: 2.730 m
- GNSS Time: 2020-08-05 08:35:13
- Current Datalink: Network [Error: SIM card not detected] Connect
- Latitude: 52.299370309 °
- Status: Single
- PDOP: 1.893
- TDOP: 1.284
- VRMS: 2.623 m

Information tab

The **Information tab** contains device and module information and current software and firmware versions.

BRx7 D2016500801125 SN: D2016500801125
FW: 0.40.200720
IP: 192.168.10.1
2020-08-05 08:36:10

Status Information Download Management Settings

- Device Model: BRx7
- Hardware Version: S631-V2.02
- Firmware Version: 0.40.200720
- MCU Version: 1.37
- Sensor Hardware Version: 2.2
- Power Source: battery
- Data Memory: Total 6.74 GB; Free 6.74 GB
- GNSS Model: F40
- GNSS Hardware Version: 1
- 3G/GPRS Model: EQ25-G
- Firmware Version: EQ25GGBR07A07M2G
- Signal Level: 0%
- IP Address: system.aageupos.pt2101
- Device Serial: D2016500801125
- BOOT Version: 1.09
- OS Version: 1.14
- Sensor Firmware Version: 1.3.3
- Battery Power: 75%
- Used Memory: Internal Storage
- Manufacture Date: 2020-04-23
- GNSS Serial: 21006079
- GNSS Firmware Version: 6.0Aa02a
- IMEI: 867698041479646
- 3G/GPRS Hardware Version:
- Protocol: NTRIP
- Mountpoint: RTN4G_VRS_RTCM32

Download tab

The **Download tab** allows you to log and review multiple data files from the on-board memory of the device.

BRx7 D2016500801125 SN: D2016500801125
FW: 0.40.200720
IP: 192.168.10.1
2020-08-05 08:36:52

Status Information Download Management Settings

Select	Name	Size	Modification Time(UTC)	Operation
<input type="checkbox"/>				

Select All

WebUI (continued)

Management tab The **Management** tab provides access to the firmware update tools, a terminal to register authorization codes, and password customization to properly secure your device.

The screenshot displays the Management tab of the BRx7 WebUI. At the top, the device ID is BRx7 D2016500801125. The Management tab is highlighted in red. The interface includes several sections: 'Install New Firmware' with a 'Choose File' button and an '@Upload File' button; 'GNSS Registration' with a GNSs Functionality field, an Auth Code field, and a Submit button; 'Security' with a checked 'Enable Login Authentication' option, Old Password, New Password, and Confirm Password fields, and a Change button; 'WiFi Access Point' with an SSID field, an unchecked 'Enable WiFi Connect Authentication' option, and a Change button; 'View Logs' with a list of logs (APP Log, OS Log) and Download/View buttons; and a bottom section with buttons for 'Format Internal Disk', 'Self Test', 'Restore Factory Settings', and 'Reset', each with an OK button.

Install New Firmware

This feature allows you to update the menu application software. Once the correct software is selected under the **Choose File** browser, the **Upload File** button initiates the update procedure and re-starts the BRx7 device.

GNSS Registration

GNSS Registration displays the expiration date of various subscription features on the BRx7.

The Atlas expiration date will be displayed under this field. In addition, the ability to update the BRx7 with new subscriptions is available under the AuthCode field. Type the new Atlas code and the device will automatically update.

WebUI (continued)

Management tab Security

(continued)

The Security field allows the user to enable or disable login requirements. The user can reset or customize a new password for their device. By filling in the required fields you can change, create and/or confirm your password.

View Logs

The View Logs field allows you to track any activity at the application and Operating System (OS) level. (This is important when troubleshooting any issues.)

Formatting / Self-Test / Reset:

The **Format Internal Disk** button allows you to reformat the internal hard drive in the BRx7.

Self-Test provides an application review to ensure the device functioning properly.

Restore Factory Settings returns the BRx7 to all default settings and performs a full power cycle.

Reset initiates a complete device shut down, creating a hard reset to the device and stopping any application activity.

WebUI (continued)

Working Mode UHF

When using a UHF datalink, channel tables must be configured by a certified Carlson dealer, or by uploading a channel table file provided by a dealer.

Important: The Advanced UHF Settings can only be accessed by Carlson or certified Carlson dealers.

Settings Working Mode Device Configuration NMEA & Athena Log Satellites ×

System Mode Static Rover Base

Current Datalink UHF Network External Bluetooth

Cutoff Angle °

GPS Enable Disable

GLONASS Enable Disable

Beidou Enable Disable

Galileo Enable Disable

SBAS Enable Disable

L-Band Enable Disable

aRTK Enable Disable

WebUI (continued)**Working Mode**
(continued)

Reference the following table for **Working Mode** fields and descriptions:

Field	Description
Cutoff Angle	Satellites at a lower angle to the horizon than "5" are not used in the GNSS solution.
GLONASS	Enable or disable the use of GLONASS satellites.
BeiDou	Enable or disable the use of BeiDou satellites.
Galileo	Enable or disable the use of Galileo satellites.
SBAS	Enable or disable the use of SBAS for DGNSS corrections.
L-band	Enable to use Atlas corrections or aRTK.
Atlas Frequency	If using Atlas, set to Auto to automatically tune to the correct frequency, or manually tune to the correct frequency.
Atlas Datum	If receiving Atlas corrections, you can use the ITRF08 datum, the GDA94 datum, or input custom X, Y, Z offsets. Note: This only affects Atlas positions.
RTK Timeout	This field indicates the amount of time an RTK correction will continue to be used after RTK corrections are lost. Note: If using aRTK, set the L-band to Enable and RTK Timeout should be set to 2700.

WebUI (continued)

Working Mode

(continued)

System Mode

The BRX7 can be configured as a survey rover, base station, or run a static observation.

To set the base location select one of the following positions:

- **Single Position:** Upon startup, the BRx7 will average its position and use that position for the base position.
- **Repeat Position:** Used to input a permanent base station position into the BRx7. You may type in a latitude, longitude, and altitude, or click **Current Position** to automatically populate the field with the current GNSS position.
- **Baselink Position:** (Requires an Atlas H1O (10-centimeter) subscription.) Used to input a Target Accuracy. Once the accuracy of the GNSS position of the receiver has reached the Target Accuracy, the receiver will begin to output RTK based on its calculated position. The accuracy of the GNSS position may continue to improve. If it does improve, a new target accuracy may be entered, and the base position will shift to reflect the new accuracy.

The screenshot shows the WebUI for a BRx7 receiver. At the top right, it displays the device ID: SN: D2016500801125, FW: 0.40.200720, IP: 192.168.10.1, and a timestamp: 2020/08/05 08:35:13. Below this is a navigation bar with tabs for Status, Information, Download, and Management, and a Settings icon. The 'Information' tab is active, showing system details. A red box highlights the 'System Mode: Rover' field. Other fields include Longitude (21.044459024 °), Height (131.267 m), Satellites (16), HDOP (1.365), HRMS (2.730 m), GNSS Time (2020-08-05 08:35:13), Current Datalink (Network [Error: SIM card not detected]), Latitude (52.299370309 °), Status (Single), PDOP (1.693), TDOP (1.284), and VRMS (2.623 m).

Field	Value
System Mode	Rover
Longitude	21.044459024 °
Height	131.267 m
Satellites	16 [GPS: 4, BeiDou: 6, Glonass: 4, Galileo: 2]
HDOP	1.365
HRMS	2.730 m
GNSS Time	2020-08-05 08:35:13
Current Datalink	Network [Error: SIM card not detected]
Latitude	52.299370309 °
Status	Single
PDOP	1.693
TDOP	1.284
VRMS	2.623 m

WebUI (continued)

Working Mode

(continued)

Data Link

The BRx7 supports the sending and receiving of RTK via the internal UHF radio, external devices (such as an external radio) via serial, TCP/IP, NTRIP, and Bluetooth (rover only).

Internal UHF

Your BRx7 comes without a channel table loaded. Only Carlson or a Carlson certified dealer can create the file to upload a channel table.

Next to **Current Datalink** select **UHF**.

The screenshot shows the 'Settings' page with tabs for 'Working Mode', 'Device Configuration', 'NMEA & Athena Log', and 'Satellites'. Under 'System Mode', 'Static', 'Rover', and 'Base' are listed with radio buttons, where 'Rover' is selected. Below this, the 'Current Datalink' dropdown menu is highlighted with a red box, showing options: 'UHF' (selected), 'Network', 'External', and 'Bluetooth'.

Note: The radio frequency should match the transmitting base.

The following dialogue window appears:

Radio Configuration File

You can also upload a file by clicking **Import** next to **Radio Configuration File** and uploading a channel table file (file extension .ud) provided by your dealer.

Import radio configuration file

No file chosen

WebUI (continued)

Working Mode The following dialogue window appears at the bottom of the page.
(continued)

Radio Channel MHz, kHz Spacing, mW TX

Radio Mode

FEC

Radio Configuration File

Radio Channel: Select a channel from the channel table provided by your dealer. The frequency, bandwidth, and transmit power (base only) is shown next to the channel.

Radio Mode: The BRx7 supports PacCrest protocols (GMSK and 4FSK modulation), Satel protocols, and Trimtalk protocols. For a full list of protocols, with descriptions (FEC, Scrambling, over the air link rate, and modulation), please refer to Appendix C.

FEC: Forward Error Corrections

Radio Power: Transmit RTK corrections at 100mW, 200mW, 500mW, or 1W (dependent upon the radio settings and restrictions provided by your dealer). This feature is only displayed when running as a base.

WebUI (continued)

Working Mode External

(continued)

If you wish to send RTK corrections out of the serial port (i.e., an external UHF radio) instead of to the Internal UHF radio (as explained above) select **External** next to **Current Datalink**.

Use the drop-down arrow to select the **baud rate** of the external device and plug that device into the 5-pin serial port. (Baud rates range from 9600 bps - 115200 bps.)

External Serial Port Baud Rate

The part numbers for the 5-pin cable are as follows:

Table 3-2: BRx7 5-pin cables

5-pin Cable	Part Number	Description
BRx7 Power Cable (Alligator Clips)	8030.064.036	Alligator clip adapter for the 054- 0180 serial cable and the 054- 0178-0 power cable.
BRx7 Serial Cable	8030.064.028	Serial cable only Serial comes out to a DB9. To connect to an external UHF radio, you may need a null modem adapter.
BRx7 Power + Serial	8030.064.027	Power and serial cable
BRx7 Power Cable	- n/a -	Power cable only

Network

The BRx7 supports TCP/IP connections for a direct connection between base and rovers via cellular as well as NTRIP.

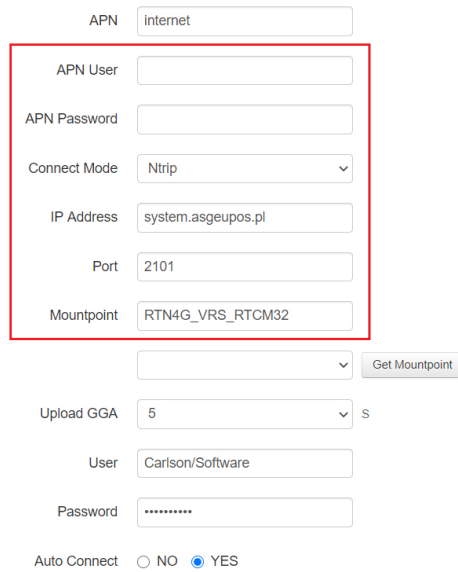
NTRIP

NTRIP requires a specific IP address, username, and password. When used as a base, the BRx7 is an NTRIP server.

WebUI (continued)

Working Mode (continued)

Type your **APN Username**, **APN Password**, **IP address**, **Port**, and **Mountpoint**. If a username and password is not required for your APN, you can leave those fields blank. The configuration of NTRIP for a base is shown below.



APN

APN User

APN Password

Connect Mode

IP Address

Port

Mountpoint

Upload GGA s

User

Password

Auto Connect NO YES

If configuring NTRIP for a Rover, click Get Mountpoint to generate a list of available mountpoints.

WARNING: If the BRx7 has not yet established an internet connection via the Internal GSM modem, the Get Mountpoint button will not operate. You can configure the APN settings while using TCP/IP so that an internet connection is established.

WebUI (continued)

Working Mode (continued) Some networks require a GNSS position prior to sending RTK. To send GNSS positions to the network, click on the dropdown menu next to **Upload GGA** and select a rate.

After establishing an internet connection, change **Connect Mode** back to **NTRIP** and proceed with the configuration.

APN	<input type="text" value="internet"/>
APN User	<input type="text"/>
APN Password	<input type="text"/>
Connect Mode	<input type="text" value="Ntrip"/> ▼
IP Address	<input type="text" value="system.asgeupos.pl"/>
Port	<input type="text" value="2101"/>
Mountpoint	<input type="text" value="RTN4G_VRS_RTCM32"/>
	<input type="text"/> ▼ <input type="button" value="Get Mountpoint"/>
Upload GGA	<input type="text" value="5"/> ▼ S
User	<input type="text" value="Carlson/Software"/>
Password	<input type="password" value="....."/>
Auto Connect	<input type="radio"/> NO <input checked="" type="radio"/> YES

WebUI (continued)

Working Mode TCP/IP

(continued)

If running as a base station, select **TCP Server** and type in a **Port** name. The TCP Server requires that the SIM card provide a public IP address. The public IP address can be found in the **Information** tab on the BRx7 WebUI.

Note: The **Auto Connect** identifies that the receiver connects to the network when powered up.

Settings Working Mode Device Configuration NMEA & Athena Log Satellites x

Target Accuracy 10 cm v

APN internet

APN User

APN Password

Connect Mode TCP Server v

Port 2101

Auto Connect NO YES

External Serial Port Baud Rate 38400 v

Save Cancel

WebUI (continued)

Working Mode (continued) If the BRx7 is running as a rover, select **TCP Client** and type in the **IP address** and **Port** of the base.

Note: The **IP address** and **Port** of the base is under the **Information** tab of the base station.

Settings **Working Mode** Device Configuration NMEA & Athena Log Satellites ×

APN

APN User

APN Password

Connect Mode

IP Address

Port

Auto Connect NO YES

External Serial Port Baud Rate

WebUI (continued)

Working Mode Rover/Bluetooth

(continued)

The Rover/Bluetooth is typically used with third-party software when streaming network corrections to the data collector internet and then sending them to the BRx7 via the Bluetooth communication port.

Settings **Working Mode** Device Configuration NMEA & Athena Log Satellites ×

System Mode Static Rover Base

Current Datalink UHF Network External Bluetooth

Cutoff Angle °

GPS Enable Disable

GLONASS Enable Disable

Beidou Enable Disable

Galileo Enable Disable

SBAS Enable Disable

L-Band Enable Disable

aRTK Enable Disable

WebUI (continued)

Working Mode **Static**

(continued)

Use **Static** mode to take a static observation of a point and stop logging (for both base and rover) if the position moves.

Select **Static** next to **System Mode** and configure the log file. To configure a file, refer to Working Mode for instructions.

Settings Working Mode Device Configuration NMEA & Athena Log Satellites ×

System Mode Static Rover Base

Cutoff Angle °

GPS Enable Disable

GLONASS Enable Disable

Beidou Enable Disable

Galileo Enable Disable

SBAS Enable Disable

L-Band Enable Disable

aRTK Enable Disable

Atlas Frequency ▾

Save Cancel

WebUI (continued)

Device Configuration

The **Device Configuration** tab allows for custom settings for language, time zones, storage, and several other options.

When enabling the speaker, the BRx7 relays the status of the positioning via voice updates. The BRx7 will audibly indicate when the receiver is in **Base** or **Rover** mode. Voice indication covers logging data and declaring when the BRx7 has achieved RTK float and RTK fix. This is important when working in a low visibility environment.

Direct link mode enables certain troubleshooting features for Carlson and certified Carlson dealers. In addition, the easy-to-use radio buttons allow you to use tracker and disable or enable Bluetooth.

Note: Restore Factory Defaults re-enables Bluetooth.

Settings Working Mode **Device Configuration** NMEA & Athena Log Satellites x

Language

Time Zone

Direct Link Mode

Sensor Frequency

Speaker Enable Disable

Bluetooth Enable Disable

Tracker Enable Disable

WebUI (continued)

Device

Configuration

(continued)

Sensor

Turn on the Sensor, using the drop-down arrow to select the desired rate.

Settings

Working Mode

Device Configuration

NMEA & Athena Log

Satellites



Language English

Time Zone GMT

Direct Link Mode Disable

Sensor Frequency Disable

Speaker Enable Disable

Bluetooth Enable Disable

Tracker Enable Disable

Save

Cancel

WebUI (continued)

NMEA Message To enable NMEA messages, click the **NMEA & Athena Log** tab. Adjust the NMEA messages that are output over the 5-pin serial port and over Bluetooth.

Settings Working Mode Device Configuration **NMEA & Athena Log** Satellites ×

NMEA by Bluetooth:

GGA:	Off	ZDA:	Off	GEDOP:	Off
GSA:	Off	GSV:	Off	GEREF:	Off
GST:	Off	VTG:	Off	GESNR:	Off
RMC:	Off	GLL:	Off	GEVCV:	Off
BIN3:	Off	BIN5:	Off	GELBD:	Off
BIN209:	Off	RTKSTAT:	Off		

NMEA by Serial Port:

GGA:	1Hz	ZDA:	Off	GSA:	Off
GSV:	Off	GST:	Off	VTG:	Off
RMC:	Off	GLL:	Off	BIN3:	Off
BIN5:	Off	BIN209:	Off	RTKSTAT:	Off

WebUI (continued)

NMEA Message Refer to Table 3-3 for NMEA Message fields and descriptions:
(continued)

Table 3-3: NMEA Message Fields and Descriptions

Field	Description
NMEA Log	Store the NMEA or binary messages that are turned on to the internal memory of the receiver or to an SD Card.
First Storage	Select if NMEA, binary, or Athena logs should be stored to the internal memory of the receiver or to an SD card.
Athena Log	Record raw data for converting to Rinex and post-processing. If “Yes” is selected, the following dialogue will display: Access the Rinex converter using the following hyperlink: https://www.hemispheregnss.com/firmware-software/
Point Name	Choose a name for the point that is occupied.
Antenna Height	Type the height of the antenna in meters. Note: Older versions of firmware required millimeters (mm) as seen in the image. Please refer to the unit listed to the right side of the field.
Pdop Threshold	Data will not be logged if the Pdop of the receiver exceeds the user defined value (3.5 is the default value and can be changed).
Interval	Log data at intervals of 30s, 15s, 5s, 1Hz, 2Hz, 5Hz, or 10Hz.

WebUI (continued)

NMEA Message While the receiver is logging data, the WebUI will display [Recording] next to **System Mode** under the **Status** tab. To stop recording, click **Stop Record**.
(continued)

The screenshot shows the 'Status' tab of the BRx7 WebUI. The device ID is BRx7 D2016500801125. The 'System Mode' is 'Static (Recording)', with a 'Stop Record' button next to it. Other details include: Longitude: 21.044333378, Height: 135.274 m, Satellites: 17 (GPS: 4, BeiDou: 5, Glonass: 5, Galileo: 3), HDOP: 1.601, HRMS: 3.203 m, GNSS Time: 2020-08-05 09:00:09. On the right, 'Current Datalink' details are shown: Latitude: 52.299354366, Status: Single, PDOP: 2.104, TDOP: 1.540, VRMS: 2.729 m. A 'Settings' button is visible in the top right.

To download the log, click the **Download** tab.

The screenshot shows the 'Download' tab of the BRx7 WebUI. The device ID is BRx7 D2016500801125. A table displays log files stored on the internal hard drive:

Select	Name	Size	Modification Time(UTC)	Operation
<input type="checkbox"/>	1125.bin	201.637K	2020-08-05 09:00:47	Download Delete
<input type="checkbox"/>	20200805080916.nmea	8.132K	2020-08-05 09:00:50	Download Delete

Below the table are buttons for 'Select All', 'Package', and 'Delete Selected'. A 'Settings' button is also present in the top right.

All logs stored on the BRx7 internal hard drive will display.

WebUI (continued)

NMEA Message Click **Delete** to delete the log.
(continued)

BRx7 D2016500801125 SN: D2016500801125
FW: 0.40.203720
IP: 192.168.10.1
2020-08-05 09:00:50

Status Information Download Management Settings

Select	Name	Size	Modification Time(UTC)	Operation
<input type="checkbox"/>	1125.bin	201.637K	2020-08-05 09:00:47	<input type="button" value="Download"/> <input type="button" value="Delete"/>
<input type="checkbox"/>	20200805085916.nmea	8.132K	2020-08-05 09:00:50	<input type="button" value="Download"/> <input type="button" value="Delete"/>

Multiple logs can be downloaded or deleted at one time by selecting the box next to each of the logs and clicking **Package** or **Delete Selected**.

Satellites

If you wish to exclude a specific satellite, select the **Don't track** checkbox next to that satellite in the list.

Settings Working Mode Device Configuration NMEA & Athena Log Satellites

GPS	Don't track	Glonass	Don't track	BeiDou	Don't track	Galileo	Don't track
G1	<input type="checkbox"/>	R1	<input type="checkbox"/>	C1	<input type="checkbox"/>	E1	<input type="checkbox"/>
G2	<input type="checkbox"/>	R2	<input type="checkbox"/>	C2	<input type="checkbox"/>	E2	<input type="checkbox"/>
G3	<input type="checkbox"/>	R3	<input type="checkbox"/>	C3	<input type="checkbox"/>	E3	<input type="checkbox"/>
G4	<input type="checkbox"/>	R4	<input type="checkbox"/>	C4	<input type="checkbox"/>	E4	<input type="checkbox"/>
G5	<input type="checkbox"/>	R5	<input type="checkbox"/>	C5	<input type="checkbox"/>	E5	<input type="checkbox"/>
G6	<input type="checkbox"/>	R6	<input type="checkbox"/>	C6	<input type="checkbox"/>	E6	<input type="checkbox"/>
G7	<input type="checkbox"/>	R7	<input type="checkbox"/>	C7	<input type="checkbox"/>	E7	<input type="checkbox"/>
G8	<input type="checkbox"/>	R8	<input type="checkbox"/>	C8	<input type="checkbox"/>	E8	<input type="checkbox"/>
G9	<input type="checkbox"/>	R9	<input type="checkbox"/>	C9	<input type="checkbox"/>	E9	<input type="checkbox"/>
G10	<input type="checkbox"/>	R10	<input type="checkbox"/>	C10	<input type="checkbox"/>	E10	<input type="checkbox"/>
G11	<input type="checkbox"/>	R11	<input type="checkbox"/>	C11	<input type="checkbox"/>	E11	<input type="checkbox"/>
G12	<input type="checkbox"/>	R12	<input type="checkbox"/>	C12	<input type="checkbox"/>	E12	<input type="checkbox"/>
G13	<input type="checkbox"/>	R13	<input type="checkbox"/>	C13	<input type="checkbox"/>	E13	<input type="checkbox"/>

Firmware Update

Updating Firmware via WebUI

Updating Firmware via WebUI



Using the **Management** tab under the WebUI, select the Choose File button to find the appropriate firmware of application software for the BRx7 device.

After selecting the correct firmware/software file, click the green **Upload File** button.



When the file is uploaded, be sure to compare the current firmware version with the new firmware version. When you have verified the correct files are in place, click the **OK** button.

NOTE: For additional information regarding periodic BRx7 firmware updates, please contact your authorized Carlson dealer or Carlson Technical Support or refer to Carlson Knowledgebase article #1197).

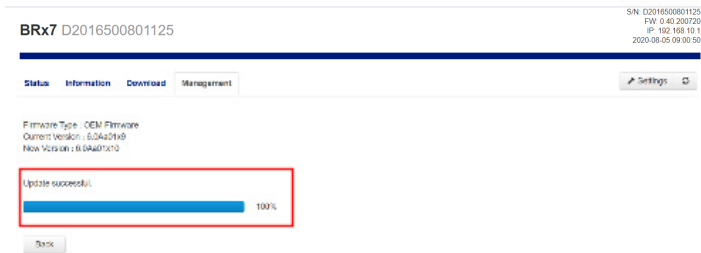
Firmware Update (continued)

Updating Firmware via WebUI (continued)

A status bar indicates the level of progress for the updating firmware / software.



When the status bar reaches 100%, the upgrade is complete. The WebUI will indicate **Update successful**.



Firmware Update (continued)

Updating
Firmware via
WebUI
(continued)

Updating Firmware via MicroSD Card

Using the WebUI, select Settings and **Device Configuration**. Under **Device Configuration**, locate the **First Storage** option, and select the **SD Card** radio button.

Click the **Save** button at the bottom right of the screen.

Place the upgrade files under “update” folder of the MicroSD card. Version info must be place after the file name and separated by “_”.

The name must follow the naming convention listed below.

Receiver firmware: BRx7_update_YYMMDD.bin YY: Year
MM: Month OD: Day

e.g. BRx7_update_160202.bin

Radio firmware: SATEL_update_XXXXX.bin XXXXX: version

e.g. SATEL_update_V07.27.2.0.8.6.bin

3G module firmware: PHS_update_XXXXX.bin XXXXX: version

e.g. PHS_update_03.001.bin

How to Download Static Data

How to download static data

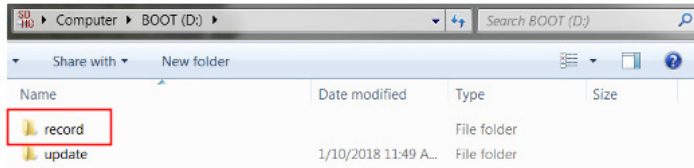
Static data can be logged to the BRx7 internal memory or to a MicroSD card.

If **First Storage** is set to **Internal Storage** (see Device Configuration), the log files save to the internal memory of the BRx7.

To download the logs, log into the **WebUI** and click **Download**.



If **First Storage** is set to **SD Card**, the files save to the MicroSD card in the BRx7. If the MicroSD card is full, or the BRx7 does not have a MicroSD card placed inside, the files will save to the BRx7 in the **record** folder.



Appendix A: Troubleshooting

Overview

Introduction Appendix A provides troubleshooting and solutions for common questions.

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Troubleshooting

Troubleshooting Table A-1 provides troubleshooting tips for the BRx7.

Issue	Possible Resolution
Receiver fails to power	<ul style="list-style-type: none"> • External power is low. • Check charge on external battery and the fuse on the power cable, if applicable. • Internal power: Check charge on internal battery. • Check all power cables and pins. • Try other batteries or cables. • Make sure to hold the power button down for a minimum of one full second to turn on. • Ensure the battery is installed with contacts pointed in the correct direction.
Random data from WebUI or BRx7 Direct Link mode	<ul style="list-style-type: none"> • Verify the messages selected in the output messages in the WebUI match what you desire. • Verify the baud rate settings match. <p>Potentially the volume of data requested to be output could be higher than the current baud rate supports. Try using a higher baud rate for communications.</p>

Table A-1: Troubleshooting

Troubleshooting (continued)

Troubleshooting	Issue	Possible Resolution
	BRx7 will not go RTK Fixed	<ul style="list-style-type: none"> • If the BRx7 is “RTK Float” then it is receiving RTK or Atlas corrections. • If the RTK latency is between 10-15 seconds, these are most likely Atlas corrections. • If the RTK latency is less than 10-15 seconds, the BRx7 is receiving RTK, but probably will not Fix because of the environment. • If the BRx7 will not go RTK Float or RTK Fixed, check to ensure the base station is operating. • Verify the settings of the UHF radio at the base and at the rover are the same. • If using a network, check the Cellular Signal Quality (CSQ) under the Information tab for cellular reception. • If using the internal UHF radio, ensure a valid 400 MHz or 900 MHz UHF antenna is plugged into the TNC connector. <p>If using Bluetooth, ensure RTK is reaching the data collector (check the data collector internet or data collector radio).</p>

Appendix B: Technical Specifications

Overview

Introduction The BRx7 GNSS Smart Antenna technical specifications are contained in Appendix B.

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Technical Specifications

BRx7 Technical specifications

Table B-1: GNSS Receiver

Item	Specification
Receiver Type:	Multi-Frequency GPS, GLONASS, BeiDou, Galileo, QZSS, IRNSS, and Atlas L-band
Signals Received:	GPS L1CA/L1P/L1C/L2P/L2C/L5 GLONASS G1/G2/G3, P1/P2 BeiDou B1i/B2i/B3i/B10C/B2A/B2B/ACEBOC GALILEO E1BC/E5a/E5b/E6BC/ALTBOC QZSS L1CA/L2C/L5/L1C/LEX IRNSS L5 Atlas
Channels:	800+
RTK Formats:	RTCM2.1, RTCM2.3, RTCM3.0, RTCM3.1, RTCM3.2 including MSM, CMR, CMR+
Recording Intervals:	Selectable from 1, 2, 4, 5, 10 Hz (20 Hz or 50 Hz optional)

Table B-2: Accuracy

Positioning	RMS (67%)	2DRMS (95%)
Autonomous, no SA: ¹	1.2m	2.4m
SBAS: ¹	0.3m	0.6m
Atlas H10: ^{1,3}	0.04m	0.08m
RTK ^{1,2}	8 mm + 1 ppm	15 mm + 2 ppm
Static Performance ¹	2.5 mm + 1 ppm	5 mm + 1 ppm
Tilt Compensation	(within 30°): 2 cm (with 1.8 m pole) (within 60°): 5 cm (with 1.8 m pole) ⁴	
Initialization Time	<10 s	

Technical Specifications (continued)

BRx7 Technical specifications

Table B-3: L-band Receiver

Item	Specification
Receiver Type	Single Channel
Frequency Range	1525 to 1560 MHz
Sensitivity	-130 dBm
Channel Spacing	5.0 kHz
Satellite Selection	Manual and Automatic
Reacquisition Time	15 seconds (typical)

Table B-4: Communications

Item	Specification
Bluetooth	Bluetooth 2.1+EDR / 4.0 LE
Wi-Fi	802.11 b/g
Network	LTE FDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/ B18/B19/B20/B25/B26/B28 LTE TDD: B38/B39/B40/B41 UMTS: B1/B2/B4/B5/B6/B8/B19 GSM: B2/B3/B5/B8
Radio	Frequency range: 410MHz ~ 470MHz and 902.4MHz ~ 928MHz Channel Spacing: 12.5 KHz / 25 KHz Protocol: TrimTalk 450S, PCC EOT, TrimMark III(19200)
WebUI	To upgrade software, manage status and settings, data download, via smartphone, tablet or other electronic device, configure advanced radio settings.

Technical Specifications

BRx7 Technical specifications

Table B-5: Connector Ports

Item	Description
TNC	For connecting to UHF radio antenna
LEMO	5-pin For connecting to external power supply, external radio
LEMO 7-pin	For serial port, USB
Card Slots	For Micro SIM card and Micro SD card

Table B-6: Data Storage

Item	Description
Storage Type	8 GB internal, SD card up to 32 GB

Table B-7: Physical

Item	Specification
Weight	1.12 kg (1 battery), 1.25 kg (2 batteries)
Dimensions Diameter:	152mm
Height:	76mm

Technical Specifications (continued)

BRx7 Technical specifications

Table B-8: Environmental

Item	Specification
Operating Temperature	-30°C to 65°C
Storage Temperature	-40°C to 80°C
Temperature Protection	IP67, Protect from temporary immersion to a depth of 1 meter
Shock Resistance	MIL-STD-810G, method 516.6 Designed to survive a 2m pole drop on concrete floor with no damage; designed to survive a 1m free drop on hardwood floor with no damage
Vibration	MIL-STD-810G, method 514.6E-I
Humidity	Up to 100%
Flammability	UL recognized, 94HB Flame Class Rating (3). 1.49mm
Chemical Resistance	Cleaning agents, soapy water, industrial alcohol, water vapor, solar radiation (UV)

Table B-9: Electrical

Item	Specification
Input Voltage	9 to 28 VDC
Battery	With removable dual battery, for single battery parameter: 7.2 V, 3400 mAh, 24.48 Wh
Working Time	Up to 12 hours (2 batteries hot swap)

Technical Specifications

BRx7 Technical specifications

Table B-10: User Interface

Item	Specification
Button	Switch receiver on/off, broadcast current operation mode and status.
LEDs	Power, Satellite, Data Link, Bluetooth
WebUI	Supports software updates, receiver status and settings, and data downloads via smartphones, tablets, or other Wi-Fi capable devices.

Appendix C: Radio Mode/QR Code

Overview

Introduction The BRx7 Radio Mode information and the QR code is provided in Appendix C.

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Radio Mode

Radio Mode

The following tables show the available BRx7 radio modes. Table C-1 displays the information for the BRx7 model part number 752-0042-10, and Table C-2 displays the information for the BRx7 model part number 752-0043-10.

Table C-1: Radio Mode G.E. Protocols

BRx7 part number 752-0042-10

Radio Mode	Link Rate	Spacing	Modulation	Scrambling	FEC
Trimtalk 1	4800 bps	12.5 kHz	GMSK	OFF	OFF
Trimtalk 2	9600 bps	25.0 kHz			OFF
Trimmark III	19200 bps	25.0 kHz	GMSK	OFF	OFF
PC5	4800 bps	12.5 kHz	GMSK	ON	ON
PC1	9600 bps	25.0 kHz	GMSK	ON	ON
Satel	9600 bps	12.5 kHz	4FSK	ON	OFF
					ON
	19200 bps	25.0 kHz			OFF
PacCrest			4-FSK	ON	ON
	9600 bps	12.5 kHz			OFF
	19200 bps	25.0 kHz			ON
900MHz	--	--	--	--	--

Radio Mode, continued

Radio Mode
continued

Table C-2: Radio Mode Satel Protocols
S631 part number 752-0043-10

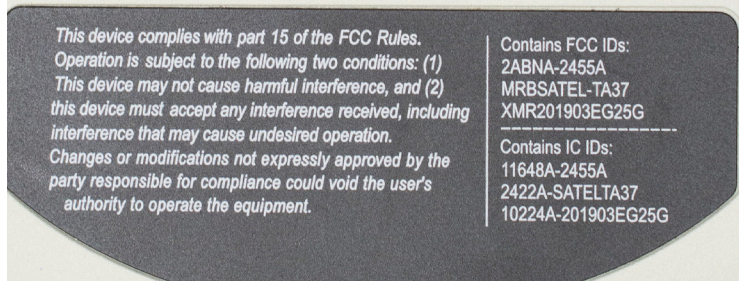
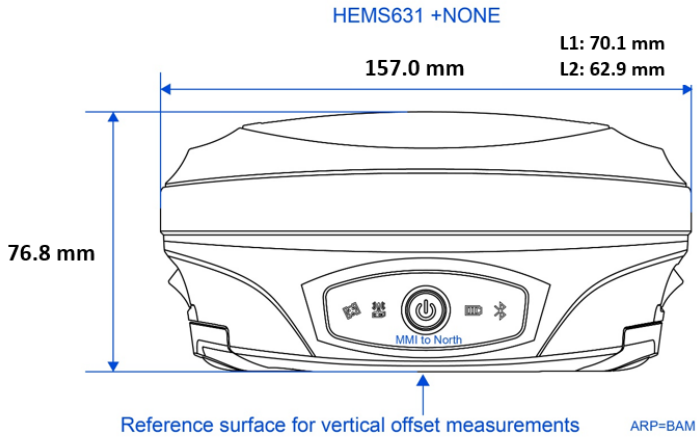
Radio Mode	Link Rate	Spacing	Modulation	Scrambling	FEC
Trimtalk 1	4800 bps	12.5 kHz	GMSK	OFF	OFF
Trimtalk 2	9600 bps	25.0 kHz			ON
PacCrest GMSK	4800 bps	12.5 kHz	GMSK	OFF	OFF
				ON	ON
	9600 bps	25.0 kHz		OFF	OFF
				ON	ON
PacCrest 4FSK	9600 bps	12.5 kHz	4FSK	OFF	OFF
				ON	ON
	19200 bps	25.0 kHz		OFF	OFF
				ON	ON
Satel	9600 bps	12.5 kHz	4FSK	ON	OFF
	19200 bps	25.0 kHz			ON
900MHz	--	--	--	--	--

QR Code and L1/L2 Offsets

QR Code and L1/ The below image shows the S631 QR code.

L2 Offsets Use a QR Code app or visit the URL below for additional information regarding the BRx7 and its L1/L2 offsets:

https://www.atlasgnss.com/images/BRx7/phase_center.png



Warranty Notice

Warranty Notice

COVERED PRODUCTS: This warranty covers all products manufactured by Hemisphere GNSS and purchased by the end purchaser (the "Products"), unless otherwise specifically and expressly agreed in writing by Hemisphere GNSS.

LIMITED WARRANTY: Hemisphere GNSS warrants solely to the end purchaser of the Products, subject to the exclusions and procedures set forth below, that the Products sold to such end purchaser and its internal components shall be free, under normal use and maintenance, from defects in materials, and workmanship and will substantially conform to Hemisphere GNSS's applicable specifications for the Product, for a period of 24 months from delivery of such Product to such end purchaser (the "Warranty Period"). Repairs and replacement components for the Products are warranted, subject to the exclusions and procedures set forth below, to be free, under normal use and maintenance, from defects in material and workmanship, and will substantially conform to Hemisphere GNSS's applicable specifications for the Product, for 90 days from performance or delivery, or for the balance of the original Warranty Period, whichever is greater.

EXCLUSION OF ALL OTHER WARRANTIES. The LIMITED WARRANTY shall apply only if the Product is properly and correctly installed, configured, interfaced, maintained, stored, and operated in accordance with Hemisphere GNSS relevant User's Manual and Specifications, AND the Product is not modified or misused. The Product is provided "AS IS" and the implied warranties of MERCHANTABILITY and FITNESS FOR A PARTICULAR PURPOSE and ALL OTHER WARRANTIES, express, implied or arising by statute, by course of dealing or by trade usage, in connection with the design, sale, installation, service or use of any products or any component thereof, are EXCLUDED from this transaction and shall not apply to the Product. The LIMITED WARRANTY is IN LIEU OF any other warranty, express or implied, including but not limited to, any warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE, title, and non-infringement.

LIMITATION OF REMEDIES. The purchaser's EXCLUSIVE REMEDY against Hemisphere GNSS shall be, at Hemisphere GNSS's option, the repair or replacement of any defective Product or components thereof. The purchaser shall notify Hemisphere GNSS or a Hemisphere GNSS's approved service center immediately of any defect. Repairs shall be made through a Hemisphere GNSS approved service center only. Repair, modification or service of Hemisphere GNSS products by any party other than a Hemisphere GNSS approved service center shall render this warranty null and void. The remedy in this paragraph shall only be applied in the event that the Product is properly and correctly installed, configured, interfaced, maintained, stored, and operated in accordance with Hemisphere GNSS's relevant User's Manual and Specifications, AND the Product is not modified or misused. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO PURCHASER, even if Hemisphere GNSS has been advised of the possibility of such damages. Without limiting the foregoing, Hemisphere GNSS shall not be liable for any damages of any kind resulting from installation, use, quality, performance or accuracy of any Product.

HEMISPHERE IS NOT RESPONSIBLE FOR PURCHASER'S NEGLIGENCE OR UNAUTHORIZED USES OF THE PRODUCT. IN NO EVENT SHALL Hemisphere GNSS BE IN ANY WAY RESPONSIBLE FOR ANY DAMAGES RESULTING FROM PURCHASER'S OWN NEGLIGENCE, OR FROM OPERATION OF THE PRODUCT IN ANY WAY OTHER THAN AS SPECIFIED IN Hemisphere GNSS's RELEVANT USER'S MANUAL AND SPECIFICATIONS. Hemisphere GNSS is NOT RESPONSIBLE for defects or performance problems resulting from (1) misuse, abuse, improper installation, neglect of Product; (2) the utilization of the Product with hardware or software products, information, data, systems, interfaces or devices not made, supplied or specified by Hemisphere GNSS; (3) the operation of the Product under any specification other than, or in addition to, the specifications set forth in Hemisphere GNSS's relevant User's Manual and Specifications; (4) damage caused by accident or natural events, such as lightning (or other electrical discharge) or fresh/ salt water immersion of Product; (5) damage occurring in transit; (6) normal wear and tear; or (7) the operation or failure of operation of any satellite-based positioning system or differential correction service; or the availability or performance of any satellite-based positioning signal or differential correction signal.

THE PURCHASER IS RESPONSIBLE FOR OPERATING THE VEHICLE SAFELY. The purchaser is solely responsible for the safe operation of the vehicle used in connection with the Product, and for maintaining proper system control settings. UNSAFE DRIVING OR SYSTEM CONTROL SETTINGS CAN RESULT IN PROPERTY DAMAGE, INJURY, OR Warranty Notice DEATH.

Warranty Notice, Continued

Warranty Notice, Continued

The purchaser is solely responsible for his/her safety and for the safety of others. The purchaser is solely responsible for maintaining control of the automated steering system at all times. THE PURCHASER IS SOLELY RESPONSIBLE FOR ENSURING THE PRODUCT IS PROPERLY AND CORRECTLY INSTALLED, CONFIGURED, INTERFACED, MAINTAINED, STORED, AND OPERATED IN ACCORDANCE WITH Hemisphere GNSS's RELEVANT USER'S MANUAL AND SPECIFICATIONS. Hemisphere GNSS does not warrant or guarantee the positioning and navigation precision or accuracy obtained when using Products. Products are not intended for primary navigation or for use in safety of life applications. The potential accuracy of Products as stated in Hemisphere GNSS literature and/or Product specifications serves to provide only an estimate of achievable accuracy based on performance specifications provided by the satellite service operator (i.e. US Department of Defense in the case of GPS and differential correction service provider. Hemisphere GNSS reserves the right to modify Products without any obligation to notify, supply or install any improvements or alterations to existing Products.

GOVERNING LAW. This agreement and any disputes relating to, concerning or based upon the Product shall be governed by and interpreted in accordance with the laws of the State of Arizona.

OBTAINING WARRANTY SERVICE. In order to obtain warranty service, the end purchaser must bring the Product to a Hemisphere GNSS approved service center along with the end purchaser's proof of purchase. Hemisphere GNSS does not warrant claims asserted after the end of the warranty period. For any questions regarding warranty service or to obtain information regarding the location of any of Hemisphere GNSS approved service center, contact Hemisphere GNSS at the following address:

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