Bad Elf
Flex™
BE-GPS-5500

User Manual
V2.1
December 1, 2021

Bluetooth®

Table of Contents

Introduction

Thank you for purchasing a Bad Elf Flex® GNSS receiver. This manual describes the basic operation of your Bad Elf Flex as well as specifications and warranty information. For the most recent information, visit bad-elf.com/flex.

What's in the Box?

The following items are included in the standard Bad Elf Flex configuration:

- Bad Elf Flex
- Rugged carrying case
- Accessory case
- AC wall charger
- Vehicle charger
- 1m USB charging cable
- USB OTG adapter cable
- 5/8" x 11 to 1/4" x 20 pole mount adapter
- Quick start guide

Product Overview - Front

Antenna cap

Helical GNSS antenna & SMA connector (inside cap)

LCD screen

Status LED's

Directional keys

Enter key

Power key

Back/Cancel key

5/8 x 11 UNC female pole mount

Product Overview - Rear

Top lanyard mount

1/4" x 20 accessory

Bad Elf Flex™
BE-GPS-5500
Designed & Assembled in USA. Made in China.
SN : 123456

USB charging and data

Bottom lanyard mount
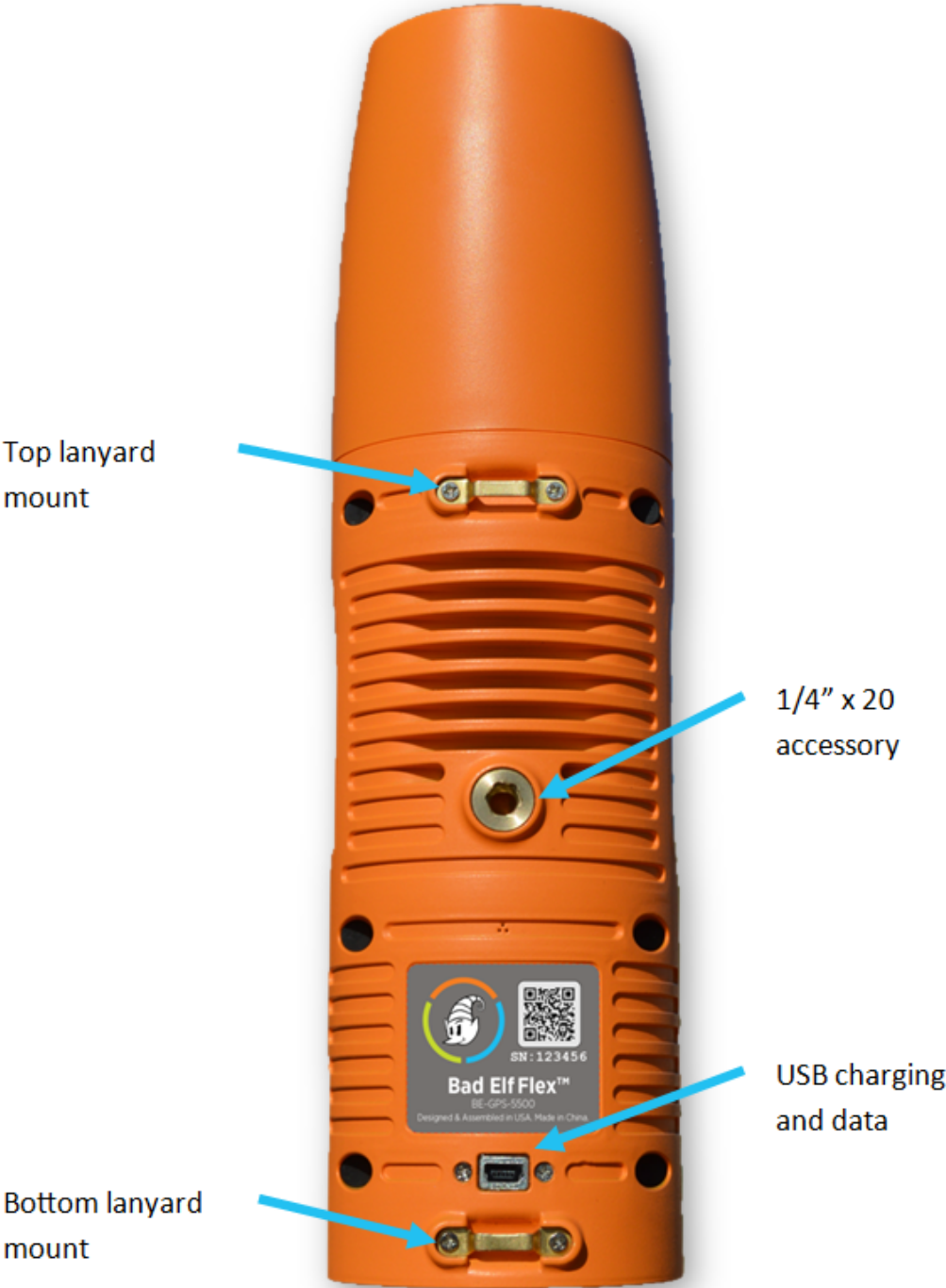
Supported Platforms

You can connect a Bad Elf Flex to a phone, tablet, or PC powered by the following operating systems:

- iOS version 11 or newer
- Android version 4.1x or newer
- Windows version 10.x or newer
- Mac OS X version 10.4 or newer

Charging and Charge Management

Charging your Bad Elf Flex

Charge your Bad Elf Flex fully before first use. Here's how to properly charge your Bad Elf Flex:

- Using the supplied USB charging cable, insert the mini-USB connector into your Bad Elf Flex.
- Insert the other end of the charging cable into the supplied AC wall charger or the supplied vehicle charger.
- Charge your Bad Elf Flex until the LED on the left turns green.

Operation while charging

You can operate your Bad Elf Flex while it is charging. A charge current of 1500 maH or greater can sustain unlimited operation regardless of the charge state.

Compatible chargers

The standard configuration for the Bad Elf Flex includes an AC charger and a vehicle charger. Any standard USB compatible charger may be used as an alternative. The Bad Elf Flex can support quick-charger adapters as well as standard USB charging from a PC or laptop. The charge rate depends on the USB charger current.

Temperature limitations

Charging only occurs within the valid temperature range defined in the specifications of this manual. Battery temperatures outside the listed charge temperature range prevent the Bad Elf Flex from charging to protect the battery.

Note: The battery temperature may differ from the ambient air temperature as internal temperatures vary during usage.

Low battery

The Bad Elf Flex actively monitors the charge level of the battery. As the battery's charge approaches a low point, an icon appears on the screen. Using the Bad Elf Flex beyond this point can cause it to automatically shut down to avoid over-discharge of the battery. If this happens, you must charge the battery sufficiently to restore operation. Normal operation can begin once the Bad Elf Flex detects either sufficient USB charging or a battery charge level above low threshold.

Battery Safety

Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage. To prevent injury or damage:

- Do not charge or use the product if it appears to be damaged or leaking.
- Charge the product only with an approved USB power source that can provide at least 1500 maH of charging current at 5VDC.
- Discontinue charging a battery that gives off extreme heat or a burning odor.
- Use the product only for its intended use and according to the instructions found in this document.

Basics of Operation

Powering On and Off

To turn the Bad Elf Flex on, press and hold the power button for 3 seconds. It will take approximately 20 seconds to start up and to begin searching for satellites.
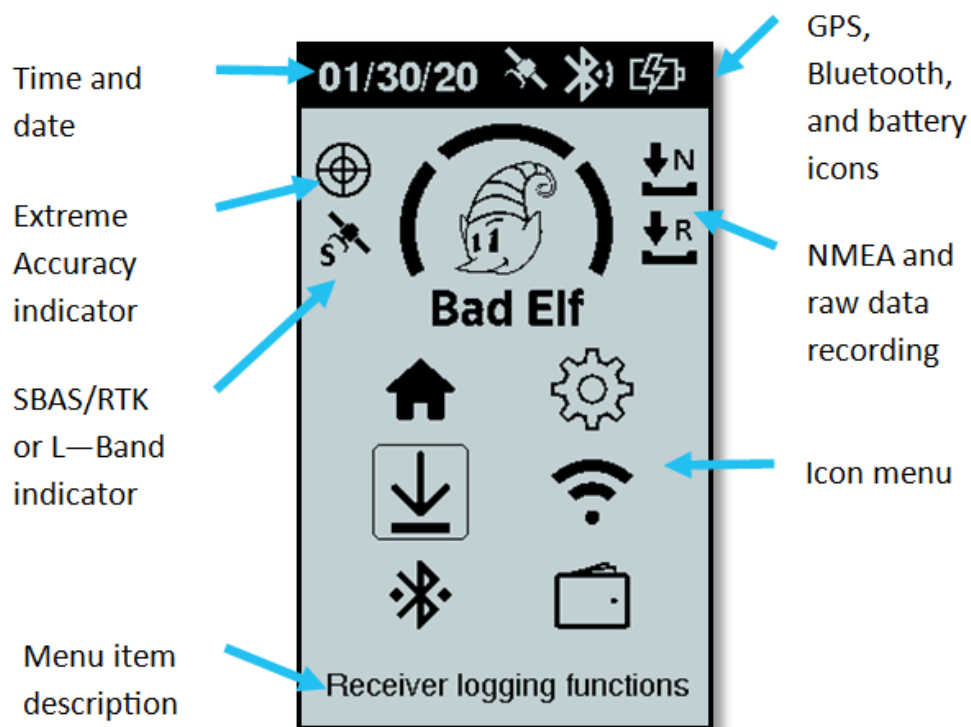
To turn the Bad Elf Flex off, press and hold the power button until the display turns off.

Using Your Bad Elf Flex

We've designed the Flex to be as simple and intuitive as possible. See the pictures and illustrations below for a description of the primary components of the user interface.

Status information - LCD & LEDs

The LCD display is the primary user interface of the Bad Elf Flex.

Time and date

GPS, Bluetooth, and battery icons

Extreme Accuracy indicator

NMEA and raw data recording

SBAS/RTK or L—Band indicator

Icon menu

Menu item description

Receiver logging functions

Status Icons

The status bar at the top of the screen provides status of the GNSS engine, Bluetooth, and battery. Each of the icons represents the current state of a particular function of the Bad Elf Flex. The table below contains descriptions of each icon.

GNSS Icons

GNSS lock   **GNSS not locked**

Bluetooth Icons

On   **Disabled**   **Connected**

Battery Icons

Battery below 10%	Battery 10%-25%	Battery 25%-50%	Battery 50% -75%	Battery above 75%

Battery charged	Battery charging	Battery temperature	USB on the go

Icon Menu Status Icons

Extreme mode enabled

GNSS is using SBAS or RTK

GNSS is using L-Band satellite corrections

Recording NMEA

Recording raw data

LEDs

The LEDs located directly below the display show the following status information:

Power LED (left)

The power status LED indicates the battery condition, charging source type, and operating status.

Color	Meaning
Solid Green	Fully charged
Pulsing Green	Charging, battery > 75% ~2.5 sec interval => high current charging source ~5 sec interval => low current charging source
Pulsing Red	Charging, battery < 75% ~2.5 sec interval => high current charging source ~5 sec interval => low current charging source
Fast Red	During normal operation without USB power and battery low USB charging source not usable—invalid or low current charger
Fast Yellow	Battery temperature out of range for charging
Purple	On-the-go (OTG) port in use
None	Not charging

GNSS LED (center)

Color	Meaning
Solid Green	GNSS has a satellite lock
Solid Red	GNSS does not have a satellite lock

Bluetooth LED (right)

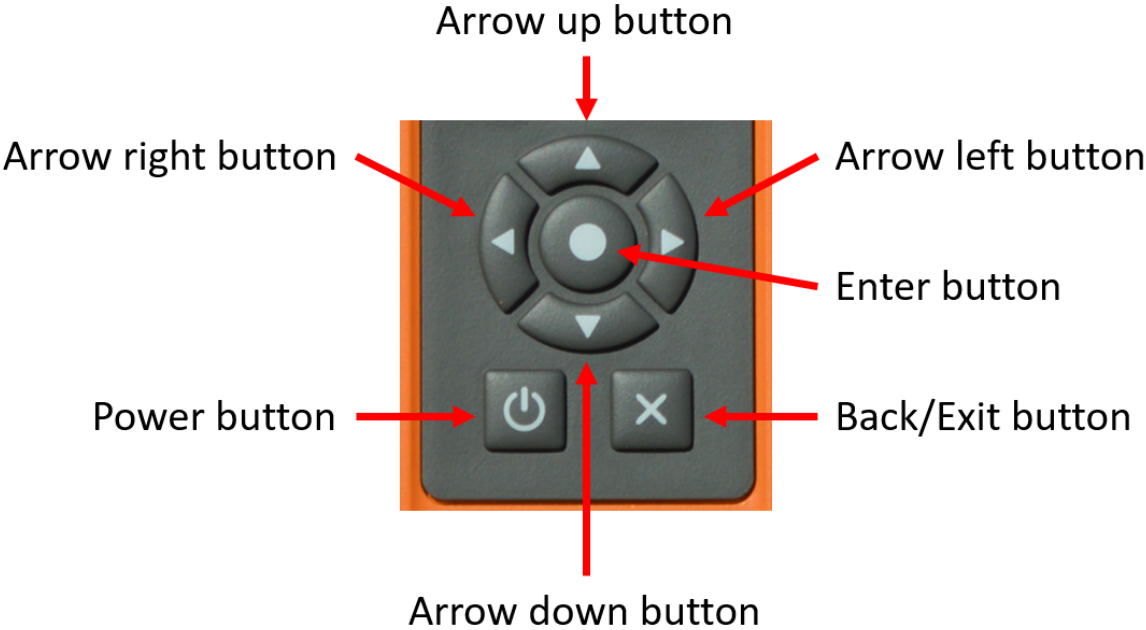| Color	Meaning
Solid Blue	Bluetooth connection established
None	No Bluetooth connection found

Keypad

The keypad on the front of the Bad Elf Flex provides buttons for interacting with the screens and menus. Descriptions for each button are provided in the table below.
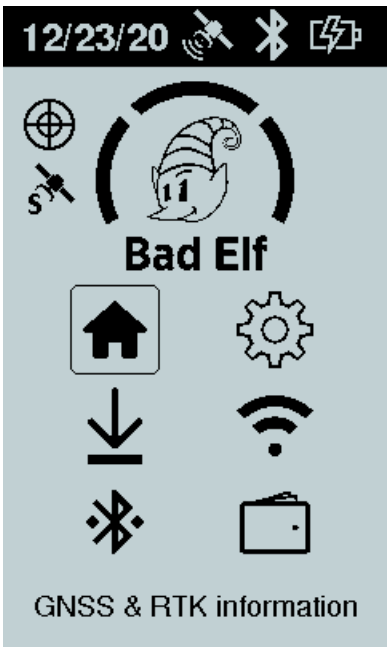
Button	Function

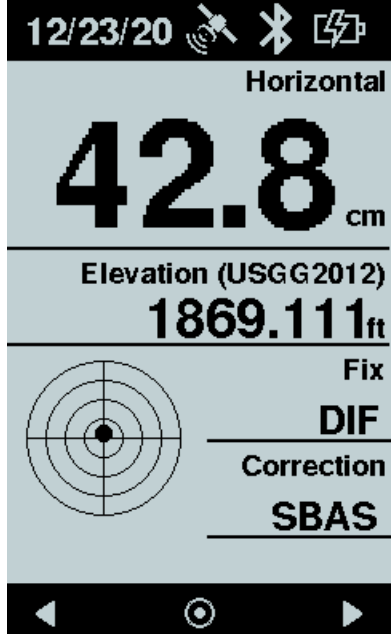| Arrow buttons	Used to navigate the menus, submenus, and selections found in the one of the Bad Elf Flex features
Enter button	Used to accept an action or open a submenu within a feature
Back button	Used to exit a submenu or feature
Power button	Holding for 3 seconds to power on or power off the Bad Elf Flex. Note: holding for 15 seconds achieves a system shutdown

Arrow up button

Arrow right button

Arrow left button

Enter button

Power button

Back/Exit button

Arrow down button
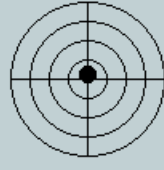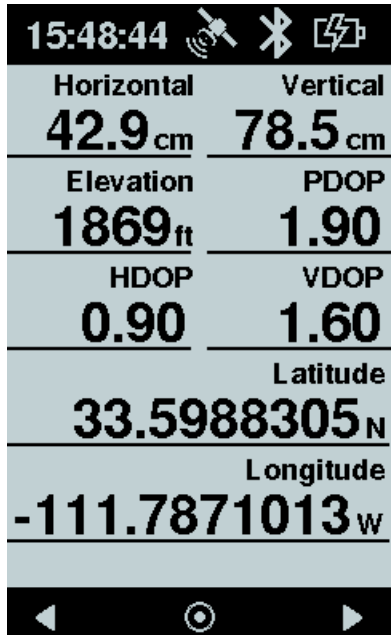
Bad Elf Flex Primary User Interface

Main Menu

	This feature provides detailed information specific to the performance of the GNSS engine including: ● GNSS accuracy measures ● GNSS positional measurements ● Operating configuration ● Sky plots ● RTK statistics ● L-Band Statistics ● Orthometric heights All logging recording features are available while using this feature. Navigating the GNSS & RTK feature ● Left ◀ and right ▶ arrow buttons select the previous or next display screen ● Enter button ● selects the logging functions ● Back button ☒ returns to the main menu While in the logging submenu ● Up ▲, down ▼, left ◀, or right ▶ buttons scroll throw the logging selections ● Enter button ● selects a logging operation ● Back button ☒ dismisses the logging submenu
12/23/20 **Bad Elf** 🏠 ⚙ ↓ 📶 * 📁 GNSS & RTK information	

GNSS & RTK Feature

12/23/20 📡 ☀ 🔋
 	
Horizontal
 	
42.8 cm
 	
Elevation (USGG 2012)
1869.111 ft
 	
Fix
DIF
 	
Correction
SBAS
 	
◀ ◎ ▶
	Primary GNSS Status Page
	
	Field descriptions
	● Horizontal - the reported statistical accuracy reported by the GNSS
	● Elevation - the reported GNSS elevation as configured by the Bad Elf Flex app. This includes the specific geoid model currently in use.
	● Fix - the type of GNSS fix:
	  ○ FIX - RTK or L-Band Fixed solution
	  ○ FLT - RTK or L-Band Float solution
	  ○ DIF - Differential corrected solution
	  ○ AUT - Autonomous solution
	  ○ NO - No solution
	● Correction - the source of corrections:
	  ○ SBAS
	  ○ RTCM3
	  ○ L-Band
	● Bubble level - the orientation of the Flex with respect to vertical
	
	Note: You can configure the units used for each of these fields by using either the Flex UI or the Bad Elf Flex app.

15:48:44 📡 ☀ 🔋 **Horizontal** **Vertical** **42.9** cm **78.5** cm **Elevation** **PDOP** **1869** ft **1.90** **HDOP** **VDOP** **0.90** **1.60** **Latitude** **33.5988305** N **Longitude** **-111.7871013** W ◀ ◎ ▶	Detailed GNSS Status Page ● Horizontal - the statistical horizontal accuracy reported by the GNSS ● Vertical - the statistical vertical accuracy reported by the GNSS ● Elevation - the reported GNSS elevation as configured by the Bad Elf Flex app ● PDOP - positional dilution of precision ● HDOP - horizontal dilution of precision ● VDOP - vertical dilution of precision ● Latitude - the current latitude north or south ● Longitude - the current longitude east or west Note: You can configure latitude and longitude to appear in decimal degrees, degrees with decimal minutes, or degrees and minutes with seconds

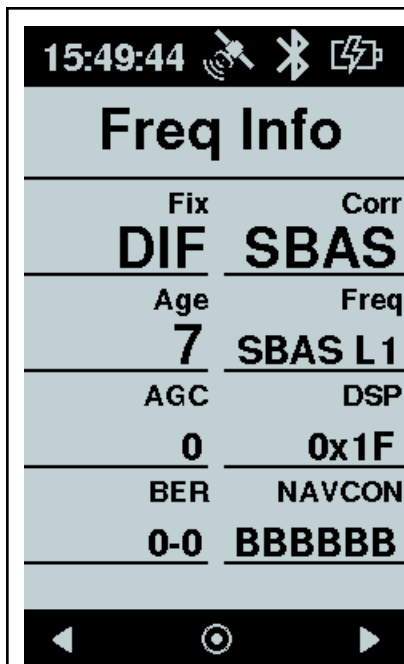|	

15:48:52 🛰 ✳ 🔋
 	
 Fix ACC
 DIF **000**
 	
 Correction in use
 SBAS
 	
 Age Distance
 7 s **0.0 cm**
 	
 Horizontal Estimate
 25.5 cm
 	
 Inbound Corrections
 No source
 	
 ◀ ◎ ▶
	GNSS Corrections Page
	
	 ● Fix - the type of GNSS fix:
	     ○ FIX - RTK or L-Band Fixed solution
	     ○ FLT - RTK or L-Band Float solution
	     ○ DIF - Differential corrected solution
	     ○ AUT - Autonomous solution
	     ○ NO - No solution
	 ● ACC - the RTK accuracy status (This is a hex encoded field used for diagnostics.)
	 ● Corrections in use - the source of corrections:
	     ○ SBAS
	     ○ RTCM3
	     ○ L-Band
	 ● Age - the age in seconds of the corrections source
	 ● Distance - the distance between the Flex and the corrections source
	 ● Horizontal Estimate - an estimate of the horizontal accuracy based on the corrections source
	 ● Inbound Corrections - information about the source producing corrections for the GNSS or No Source

12/23/20 🛰 ✳ 🔋 **RTK Info** ◀ ◎ ▶	RTK Status Page This page displays text information pertaining to the quality of an RTK fix. Any issues limiting the quality of the fix appear here.

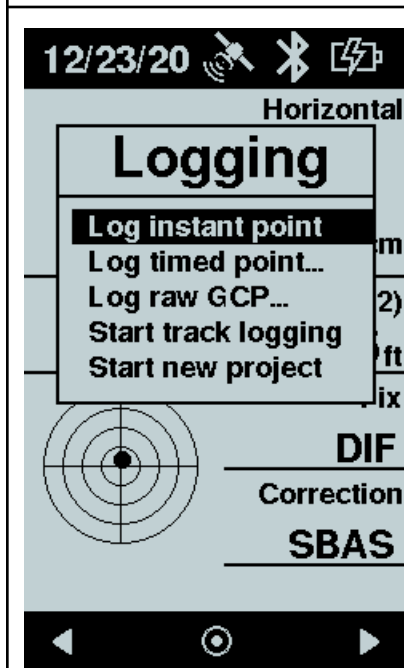|	

15:49:44
 Freq Info
 	
 Fix   Corr
 DIF SBAS
 Age   Freq
 7 SBAS L1
 AGC   DSP
 0 0x1F
 BER   NAVCON
 0-0 BBBBBB
 	
 ◀   ◉   ▶
	L-Band Status Page
	
	 ● Fix - the type of GNSS fix:
	     ○ FIX - RTK or L-Band Fixed solution
	     ○ FLT - RTK or L-Band Float solution
	     ○ DIF - Differential corrected solution
	     ○ AUT - Autonomous solution
	     ○ NO - No solution
	 ● Corrections in use - the source of corrections:
	     ○ SBAS
	     ○ RTCM3
	     ○ L-Band
	 ● Age - the age in seconds of the corrections source
	 ● Freq - the frequency used for corrections. In SBAS mode this reports SBAS L1. In L-Band mode this reports the satellite frequency received.
	 ● AGC, DSP, BER, NAVCON - diagnostic fields for use by Bad Elf primarily related to L-Band reception

15:49:51 **Ortho Height** Model In Use (Sats) **USGG2012** Ellipsoidal Height **1771.604**ft Antenna Geoid **0.75**ft **-97.53**ft Final Orthometric Height **1868.383**ft ◀ ◉ ▶	Orthometric Height Page This page displays a complete picture of how orthometric height is calculated. You can configure geoids, antenna offsets, and final heights by using the Bad Elf Flex app. ● Model in use - the geoid model used to calculate orthometric height, (Sats) indicates that the solution is autonomous, (RTK) indicates that the solution is using a geoid model based on the corrections source ● Ellipsoidal height - the GNSS ellipsoidal height as reported by the Flex with no offset ● Antenna - the antenna height offset including any pole height adjustments as defined in the Bad Elf Flex app ● Geoid - the geoidial offset calculated using the current GNSS position and geoid model ● Final Orthometric Height - the orthometric height (H) calculated using the geoid model (N), ellipsoidal height (h), and antenna offset (A) using the formula: $H = h - A - N$
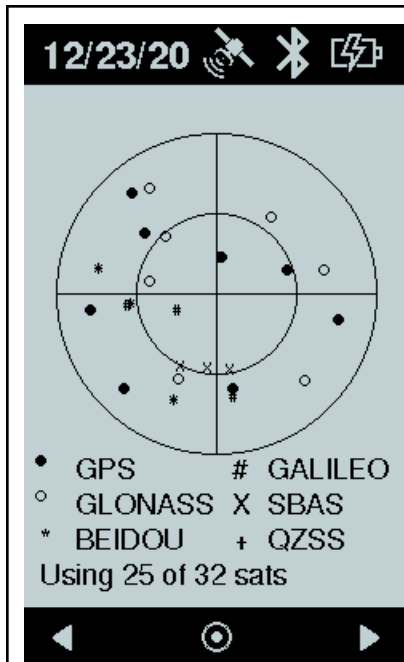
12/23/20 🛰 ✳ 🔋 (satellite sky plot) • GPS # GALILEO ○ GLONASS X SBAS * BEIDOU + QZSS Using 25 of 32 sats ◀ ◉ ▶	**Satellite Page** This page displays a sky portrait of the approximate location and orientation of visible satellites used in the solution. Orientation is north-up. The outer ring represents the horizon, and the inner ring represents 45 degrees off the horizon. The line at the bottom shows how many satellites are part of the solution and how many are visible.

12/23/20 🛰 ✳ 🔋
Horizontal
 	
Logging
Log instant point m
Log timed point… 2)
Log raw GCP…
Start track logging ft
Start new project
                ix
 	
(target circle)   **DIF**
              Correction
              SBAS
 	
◀   ◉   ▶
	Logging Popup
	
	Actions
	
	• Press the enter button ◉ on any of the pages to bring up a popup containing logging options.
	• You can scroll through the list of logging options using the up and down arrow buttons ▲ ▼
	    ○ Press the enter button ◉ on an option to activate that logging feature
	    ○ Press the back button ✕ to dismiss the logging popup

	No Fix Indication
12/23/20 🛰️ ∗ 🔋 **No GPS Fix** ◀ ◉ ▶	When the Bad Elf Flex cannot compute a GNSS solution, relevant display pages will revert to the message: No GNSS Fix Primary reasons for this message include: ● The Flex has recently powered up and has not yet acquired a position. ● The Flex has changed location significantly, or has been off for some time, and needs to receive information from the satellites to derive its new location. ● The Flex has poor orientation or has a limited view of the sky.
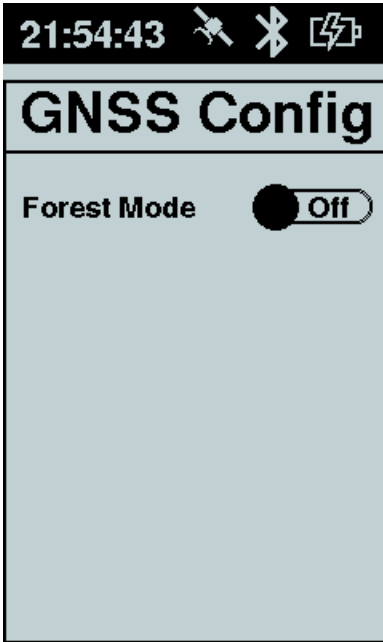
Flex Settings Feature

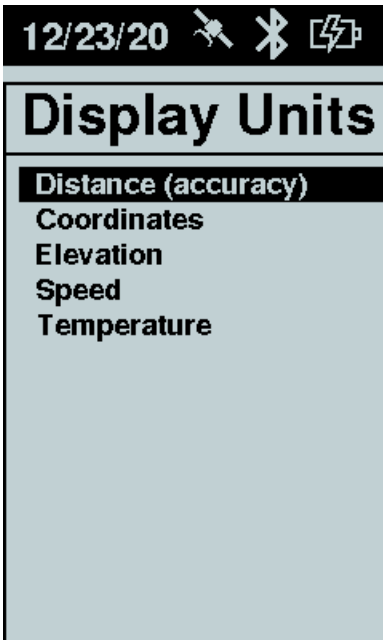|	
21:19:42 🛰️ ∗ 🔋 🛰️ **Bad Elf** 🏠 ⚙️ ↓ 📶 ∗ 📷 Global device settings	The settings feature of the Bad Elf Flex provides the ability to modify some of the settings directly on the Bad Elf Flex. ● Correction source selection ● GNSS configuration ● Display settings ● Charging system status ● Flex information ● Digital bubble level calibration ● Temperature monitoring ● License information

Correction source

	This feature provides you the ability to explicitly select a corrections source. The "X" indicates the current primary corrections source. *Note: If an option has an asterisk next to the text, this means that the option requires a Bad Elf Flex token for selection.* By default, **SBAS** is the primary corrections source. However, if the Bad Elf Flex is using a token or is in Extreme mode, corrections from **RTK via NTRIP** will override the default setting of **SBAS**. To use **Atlas L-Band** corrections, you must have L-Band enabled via Bad Elf Flex token or subscription, and you must explicitly select the L-Band option. *Note: using of L-Band will reduce the battery life. See specifications for more details.* Actions: ● Use the up and down arrow buttons ▲ ▼ to select one of the corrections sources. ● Press the enter button ◉ on a selection to make it active ● Press the back button ⊠ to return to the settings feature
21:54:31 🛰 ✱ 🔋 **Corrections** **[X] SBAS** **[ ] RTK via NTRIP** **[ ] Atlas via L-BAND** **** requires token**	
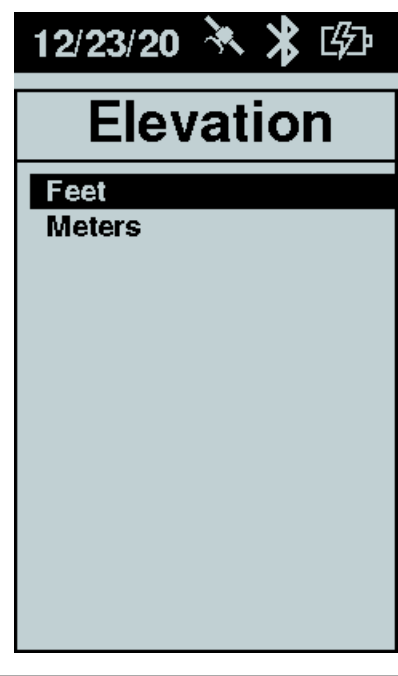
GNSS Configuration

GNSS Configuration

- To enable **Forest Mode**, use the down button ▼ to select **Forest Mode**
- Press the enter button ⊙ to toggle Forest Mode on or off
- Press the back button ✕ to return to the settings feature

Note: Forest mode allows the Flex to accept weaker signals from satellites. This may improve the reception of additional or weak satellites. Using this feature may degrade your positional accuracy slightly.

Display Settings

The display units feature allows you to change some of the information displayed directly on the Bad Elf Flex. You can also modify the display units and settings using the Bad Elf Flex app.

Actions

- Use the up and down arrow buttons ▲ ▼ to select an item you want to configure
- Press the enter button ⊙ on a selected configuration item to display a list of available options
- Press the back button ✕ to return to the settings menu

21:55:44 🛰️ ✳️ 🔋 **Distance** **Imperial** **Metric**	This setting allows you to configure imperial or metric units for all horizontal distance measurements shown on the Bad Elf Flex. The highlighted line represents the currently selected option. Actions ● Use the up and down arrow buttons ▲ ▼ to select imperial or metric ● Press the enter button ⊙ on a selected item to make it active ● Press the back button ⊠ to return to the settings menu
03/01/21 🛰️ ✳️ 🔋 **Coordinates** **HDD - HDD.ddddd** **DDM - HDD MM.mmm** **DMS - HDD MM SS.ss**	This setting allows you to configure the coordinate display for latitude and longitude shown on the Bad Elf Flex. The highlighted line represents the currently selected option. Actions ● Use the up and down arrow buttons ▲ ▼ to select a coordinate display configuration ● Press the enter button ⊙ on a selected item to make it active ● Press the back button ⊠ to return to the settings menu Examples ● HDD ⇒ -111.23456 ● DDM ⇒ 33 34.567 ● DMS ⇒ 33 34 55.66

12/23/20 📡 ※ 🔋 **Elevation** **Feet** **Meters**	This setting allows you to configure feet or meters for all vertical distance measurements shown on the Bad Elf Flex. The highlighted line represents the currently selected option. Actions ● Use the up and down arrow buttons ▲ ▼ to select feet or meters ● Press the enter button ⬤ on a selected item to make it active ● Press the back button ☒ to return to the settings menu
21:55:32 📡 ※ 🔋 **Speed** **kilometers/hr** **miles/hr** **knots** **m/s**	This setting allows you to configure the speed units for measurements shown on the Bad Elf Flex. The highlighted line represents the currently selected option. Actions ● Use the up and down arrow buttons <icon> to select your preferred speed units ● Press the enter button ⬤ on a selected item to make it active ● Press the back button ☒ to return to the settings menu

12/23/20 🛰 ✳ 🔋 **Temperature** **C** **F**	This setting allows you to configure the temperature in Celsius or Fahrenheit as shown on the Bad Elf Flex. The highlighted line represents the currently selected option. Actions ● Use the up and down arrow buttons ▲▼ to select C for Celsius or F for Fahrenheit ● Press the enter button ⬤ on a selected item to make it active ● Press the back button ✕ to return to the settings menu

Charging System Information

03/01/21 🛰 ✳ 🔋 **Charge %** **87%** **Time to Empty** **77h** **Charging Status** **Fast Charge** **Charging Input** **USB SDP** ◉	This setting displays the current charging information for the Bad Elf Flex. Field descriptions: ● Charge % - the charge level of the internal battery ● Time to Empty - the estimated hours remaining based on the current charging configuration. *Note: when connection and disconnecting a charge source please allow one minute for this value to stabilize.* ● Charging Status - the type of charging taking place based on the type of charge adapter being used. ● Charge Input - the type of charger detected by the Bad Elf Flex. Battery Icon | Four bars	>75% charge
Three bars	>50% charge
Two bars	>25% charge
One bar	>10% charge
Exclamation Point	<10% charge	

Charging Input

Text Shown	Meaning
No Input	No charging input provided
USB SDP	USB standard downstream port (500ma)
USB CDP	USB charging downstream port (1500ma)
USB DCP	USB dedicated charging port (1500ma)
DCP Max	Dedicated charging port (12v/3000ma)
Unk (500mA)	Unknown adapter (500ma max)
Non-std	Non standard adapter - not recommended
OTG	On the Go cable attached

Actions

- Press the enter button ⬤ to show the charging system details.
- Press the back button ⊠ to return to the settings menu.
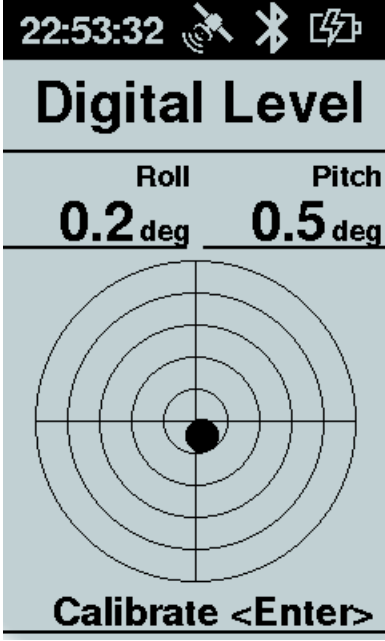
	Charging System Details
21:51:34	This screen shows detailed information for the internal systems of the Bad Elf Flex. The information used on this screen is helpful for charging system diagnosis.
Capacity **12**Ah Charge % **87**%	
Fuel Gauge **4069**mV **-104**mA	**Actions**
Battery Power Draw **-435**mW	● Press the back button ⊠ to return to the charging information screen..
Charging Status **Fast Charge**	
Charging Input **USB SDP**	
USB Voltage **4.60**v Faults **00**	
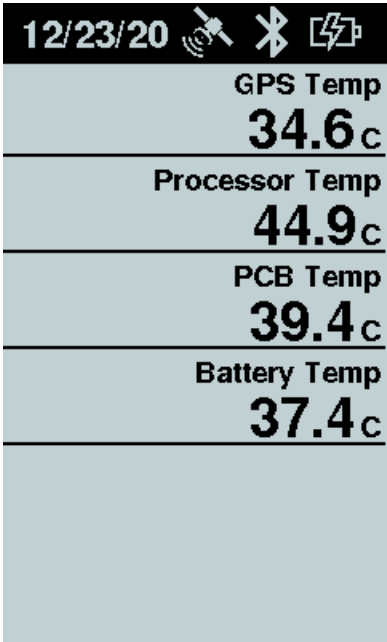
Flex Information

	The Flex Information feature shows information specific to the Bad Elf Flex.
12/23/20	Field descriptions:
Nickname **Bad Elf Flex**	● Nickname - a friendly name for this receiver, modifiable in the Flex app
Serial Number **998877**	● Serial Number - the numeric serial number uniquely identifying this receiver. This number is also on the sticker on the back of the Bad Elf Flex.
Firmware Version **1.0.19 (1092)**	● Firmware version - numeric information of the firmware version **X.X.X** and build number **(YYYY)**
Eclipse GNSS ID **99001224**	● Eclipse GNSS ID - this is the unique serial number of the GNSS module inside the Bad Elf Flex
Configuration **Extreme Unlocked**	● Configuration - a single line of text that indicates how the receiver is configured. A Bad Elf Flex uses the text **Standard (GPS,L1)**. A Bad Elf Flex Extreme uses the text **Extreme Unlocked.**
L-Band **Available via token**	● L-Band - availability of L-Band services. **Available by token** means that the receiver can use L-Band by consuming a token. **Token in use** means that L-Band is currently available. **L-Band Expires MMDDYY** means there is an L-Band subscription that will expire on the given date.
	Actions

	● Press the back button ☒ to return to the settings menu

Digital Level Calibration

22:53:32 📡 ✳ 🔋 **Digital Level** Roll Pitch **0.2**deg **0.5**deg (bubble level target image) **Calibrate <Enter>**	The digital level provides a visual reference to ensure proper vertical orientation of the Bad Elf Flex. The bubble level is shown on the Primary GNSS Status Page. Calibrate the receiver using this utility while positioning the receiver on a level surface. ● Set the Flex on a level surface. Press the enter button ◉ to save the calibration. The bubble should be approximately centered in the image upon calibration, though some fluctuation may occur. ● Press the back button ☒ to return to the settings menu *Note, this calibration is permanently stored with the Bad Elf Flex and does not need to be repeated after powering off.*
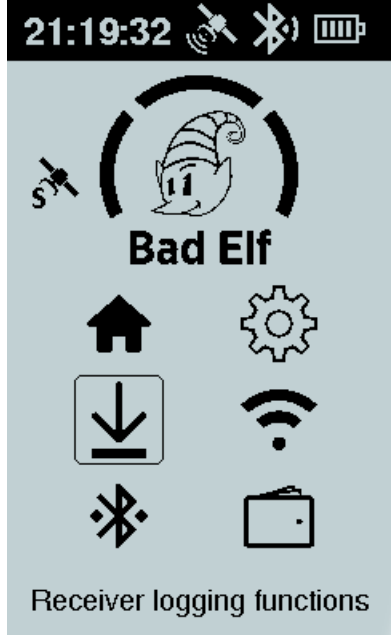
Internal Temperature Display

12/23/20 🛰 ✳ 🔋 **GPS Temp** **34.6**c **Processor Temp** **44.9**c **PCB Temp** **39.4**c **Battery Temp** **37.4**c	The Bad Elf Flex contains four sensors to monitor temperature inside the enclosure: ● GPS Temp - the temperature reported by the GNSS module ● Processor Temp - the temperature reported by the internal processor module ● PCB Temp - the temperature of the primary power circuitry printed circuit board ● Battery Temp - the temperature of the internal battery Note: temperature display follows the Bad Elf Flex configuration for fahrenheit or celsius. Actions ● Press the back button ⊠ to return to the settings menu

License Information

12/23/20 🛰 ✳ 🔋 **License** Software copyright (C) 2019-20 Bad Elf, LLC. All rights reserved. For detailed license info visit our web site bad-elf.com/flex/license	The license screen shows specific information about the Bad Elf Flex. For more information see the Bad Elf Flex License page.

Logging Features

The Bad Elf Flex produces location data valuable for storage and analysis after field data collection. The logging feature, accessed from the main menu, allows you to store different types of GNSS data. You can also transfer data stored on the Bad Elf Flex and manage the logging projects.

The Bad Elf Flex records all data in the context of a project, a logical container of different types of GNSS data. You may use the default project (created when the Flex starts up) or create a new project at any time during operation. Each project may contain one or more of the following types of data.

- Points - instant or timed in .CSV format
- Track logs - points recorded continuously at the recording rate configured for this Bad Elf Flex in .CSV format
- Raw data recordings - both the binary data from the Bad Elf Flex and a RINEX file. The typical use for either file type is GNSS data post-correction.
- NMEA logs - a standard ASCII format produced by the GNSS engine. For more information see the NMEA 0183 standard.
- Project metadata - a JSON file containing information describing the project contents, information identifying the Bad Elf Flex that made the recordings, and date/time information for the project data.

For details on the project container and data files contained therein, refer to the **Data Storage Specifications** section of this document.

Log Instant Point
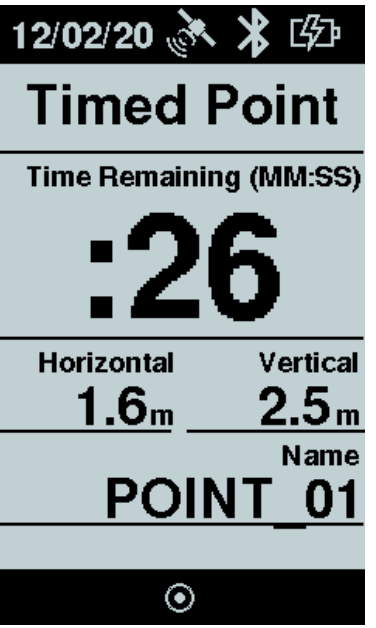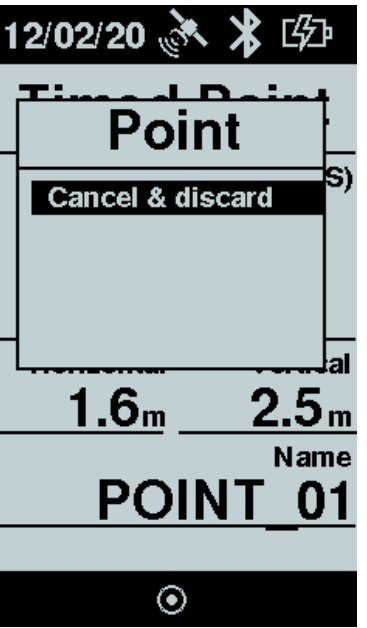
| | An instant point records a location sample using the current GPS fix. If the Bad Elf Flex does not have a fix, then it does not record anything. When the Bad Elf Flex finishes recording the point, you'll hear an audible tone. The Bad Elf Flex stores the resulting logged point in a .CSV file along with other logged points.

If you have not already created a project to contain the logged point, the Bad Elf Flex creates a project for you. You can create a new project using the Start New Project option as described below or by using the Bad Elf Flex app. |

23:13:21

Logging

Log instant point
Log timed point...
Log raw GCP...
Start track logging
Start new project
Manage logs...

Log Timed Point

The Bad Elf Flex can record a timed point by averaging the GPS fix over a specified time interval. The default time interval is 30 seconds, but you can adjust it as needed. The Bad Elf Flex stores the resulting timed point along with any other logged points in a .CSV file within the current project.

Actions:
- Press enter button ⬤ to start recording a timed point. You'll see the time count down as recording proceeds. You'll hear an audible tone once it completes.
- If you press enter button ⬤ while the timer is still counting down, the Bad Elf Flex cancels the recording and discards any data recorded so far.

22:43:01 🛰 ✳ 🔋	**12/02/20** 🛰 ✳ 🔋	**12/02/20** 🛰 ✳ 🔋
Logging	**Timed Point**	**Point**
Log instant point **Log timed point…** Log raw GCP… Start track logging Start new project Manage logs…	Time Remaining (MM:SS) **:26** Horizontal Vertical **1.6**m **2.5**m Name **POINT_01** ◉	**Cancel & discard** 1.6m 2.5m Name **POINT_01** ◉
Timed point menu item	Timed point recording status screen	Timed point options screen

Log Raw GCP (Ground Control Point)

The Bad Elf Flex can record a ground control point as raw observation data in binary format to be converted to RINEX (Receiver Independent Exchange) format. By default, it converts the raw data to RINEX 3.x. You can use the Bad Elf Flex app to change the target RINEX version to 2.x.

You can also use the Bad Elf Flex app to configure the recording duration and auto-stop duration. By default, the Bad Elf Flex will automatically stop recording after 15 minutes. You'll hear an audible tone when recording stops. If auto-stop is disabled, recording continues until you manually stop it.

Actions:
- Press enter button ◉ to start recording a raw GCP. The raw GCP recording status screen then appears.
- Press options button ◉ to cancel and discard the current recording or to finish and save the current recording. Select an option and press enter button ◉ or press back button ⊠ to continue the recording.

22:43:04 📡 ✳ ⚡
 	
## Logging 	
 	
Log instant point
Log timed point...
Log raw GCP...
Start track logging
Start new project
Manage logs...
	12/02/20 📡 ✳ ⚡
	
	## Raw Point
	Time Remaining (MM:SS)
	
	# 15:28
	
	Horizontal Vertical
	2.0m **3.2**m
	          Name
	MARKER_01
	
	⊙
		22:43:30 📡 ✳ ⚡
		
		## Raw Point
		Save point now
		Cancel & discard
		
		2.0m **3.3**m
		          Name
		MARKER_01
		
		⊙

Raw GCP menu item	Raw GCP recording status screen	Raw GCP options screen

Start/Stop Track Logging

A track log records a series of points at one-second intervals. The Bad Elf Flex stores each track log in its own separate .CSV file within the current project using the same format as point data.

Actions:
- Press enter button ⊙ to start recording a tracklog. Once recording starts, you'll hear an audible tone. Notice that the menu item changes to "Stop track logging."
- Press enter button ⊙ again to stop recording. You'll hear an audible tone, and the menu item reverts to "Start track logging."

22:43:10 📡 ✱ 🔋	**22:43:44** 📡 ✱ 🔋
Logging	**Logging**
Log instant point	Log instant point
Log timed point...	Log timed point...
Log raw GCP...	Log raw GCP...
Start track logging	**Stop track logging**
Start new project	Start new project
Manage logs...	Manage logs...
Start tracking menu item	Stop Tracking menu item
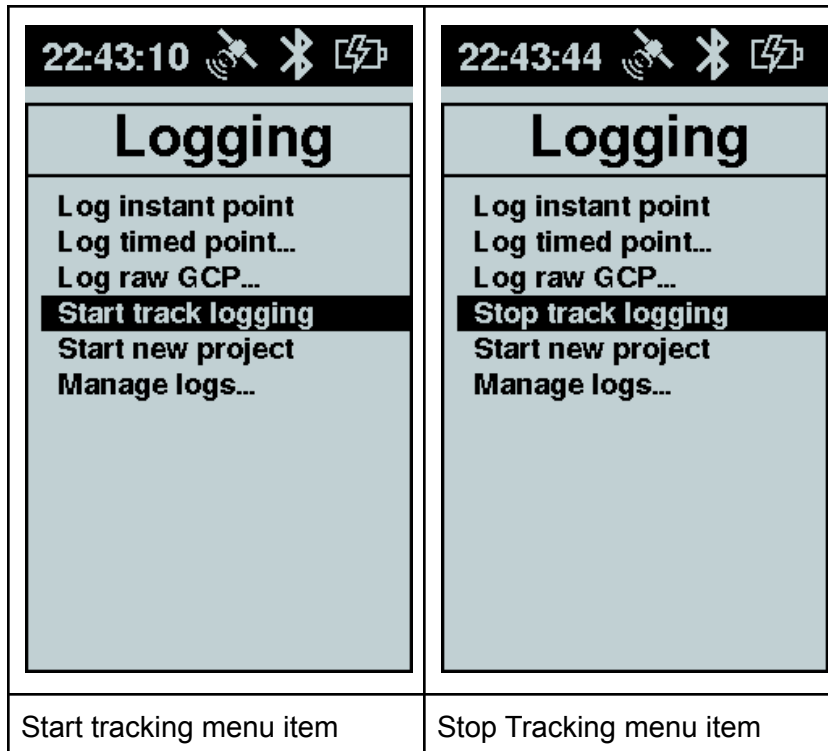
Start New Project

The Bad Elf Flex stores all point and log files in the context of a project. The Start new project option creates a new project with a name based on the current date and time. (You don't need to explicitly start a new project before logging points and tracks, since the Bad Elf Flex will start one for you when you begin logging of any kind.)

If there is already an open project when you choose the Start new project option, the Bad Elf Flex stops any logging in progress and closes the current project. It then processes any raw logs in the project into RINEX.

Actions:
- Press the enter button ⬤ on the Start new project menu item to confirm the creation of a new project. You'll hear an audible tone.

```
 22:43:13  📡  ✳  🔋

      Logging

Log instant point
Log timed point…
Log raw GCP…
Start track logging
Start new project
Manage logs…
```

Start new project menu item
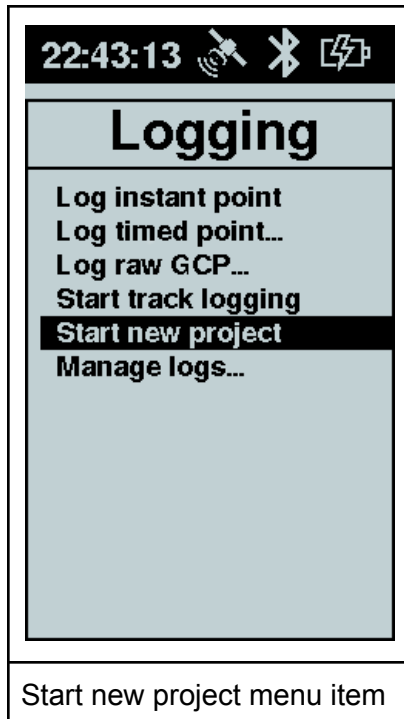
Manage Logs

The manage logs function allows you to view, delete, and export logs from the Bad Elf Flex. Selecting the all XX logs function shows the number of completed logs and an indication of any active logging session.
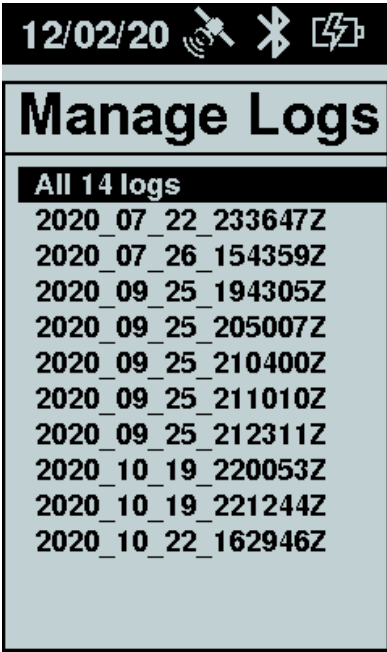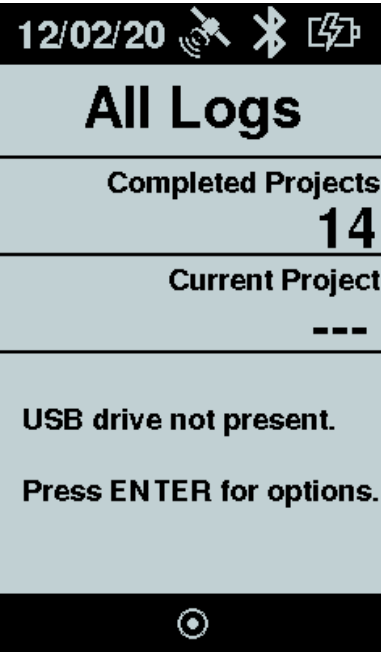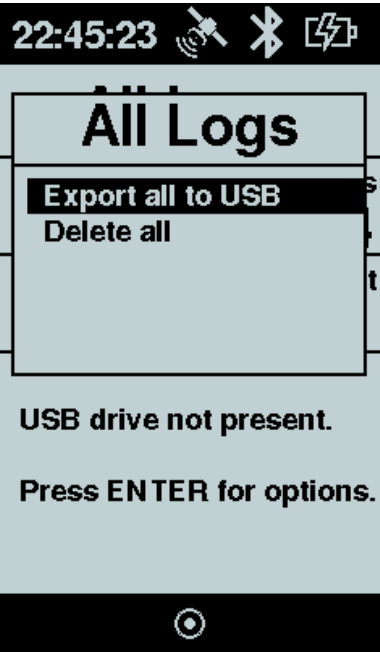
Actions (All Logs):

- Press the options ⦿ on the line listing All XX logs to view the all logs detail screen.
- Press the enter button ⦿ from the all logs details screen using the export all to USB option screen copy all of the logs to an external USB drive, if connected. Storing logs on an external USB drive does not remove the logs from the Bad Elf Flex.
- Press the enter button ⦿ from the all logs options screen using the delete all logs function to delete all logs stored on the Bad Elf Flex.
- Press the back button ⊠ to exit the all log options screen or the all log actions menu.

Actions (Individual Log):

- Press the options ⦿ on a specific log to view the log detail screen.
- Press the enter button ⦿ from the log project screen to show the log project action menu.
- Press the enter button ⦿ on the action export to USB to copy this specific project to an external USB drive. Storing a log on an external USB drive does not remove the log from the Bad Elf Flex.

- Press the enter button ⊙ on the action delete to delete this specific log from the Bad Elf Flex.
- Press the enter button ⊙ on the action **Regenerate RINEX** to rebuild all RINEX from raw data stored in this specific project.
- Press the back button ⊠ to exit the log project details screen or the log projects actions menu.

12/02/20 📡 ✶ 🔋 **Manage Logs** **All 14 logs** 2020_07_22_233647Z 2020_07_26_154359Z 2020_09_25_194305Z 2020_09_25_205007Z 2020_09_25_210400Z 2020_09_25_211010Z 2020_09_25_212311Z 2020_10_19_220053Z 2020_10_19_221244Z 2020_10_22_162946Z	**12/02/20** 📡 ✶ 🔋 **All Logs** **Completed Projects** **14** **Current Project** **---** USB drive not present. Press ENTER for options. ⊙	**22:45:23** 📡 ✶ 🔋 **All Logs** **Export all to USB** **Delete all** USB drive not present. Press ENTER for options. ⊙
Manage logs - log listing	Manage logs - all logs detail screen	Manage logs - all logs actions menu
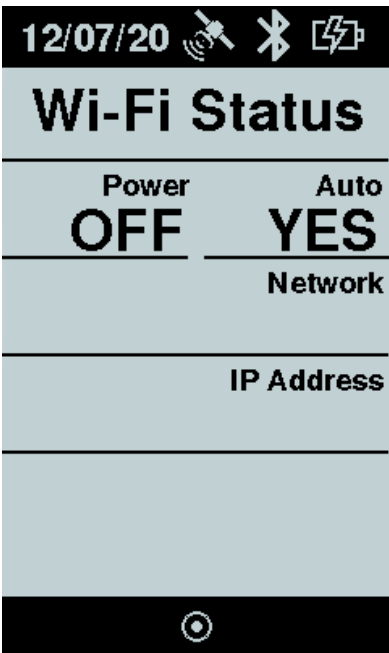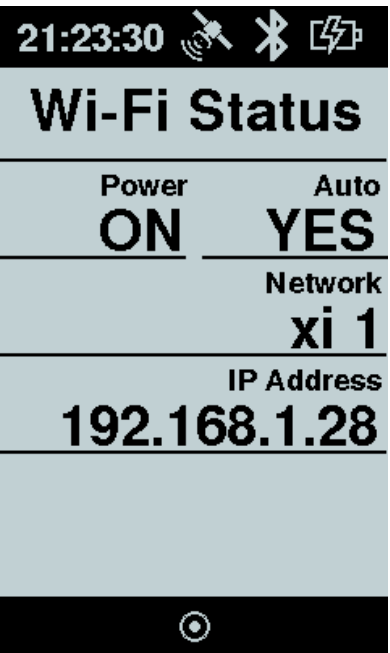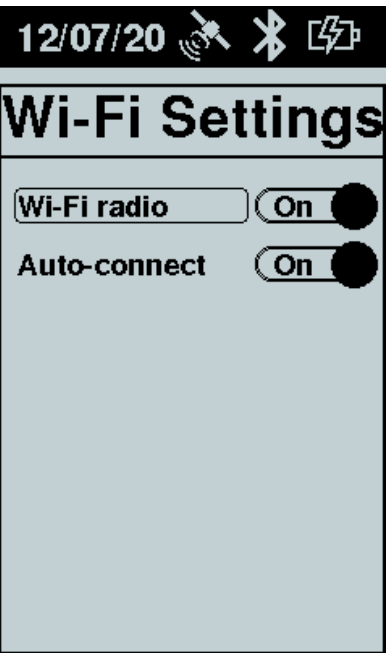
Manage logs - log details	Manage logs - log project action menu	

WiFi Function
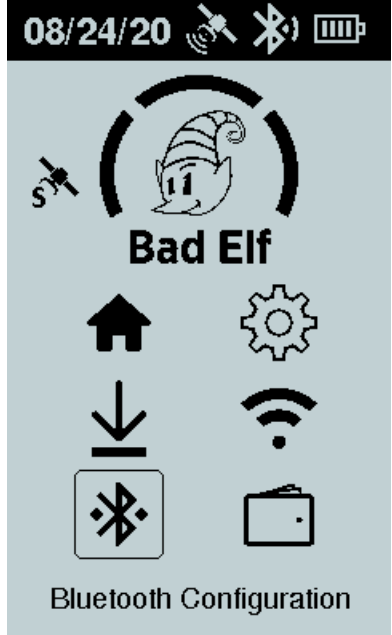
	- Use this feature to enable or disable the internal Wi-Fi capability - Note: this feature is unused but may be enabled in future firmware releases. - Note: turning on Wi-Fi can limit bluetooth range - Note: currently, there is no way to configure Wi-Fi networks

- The main menu of the Wi-Fi Function displays status and configuration
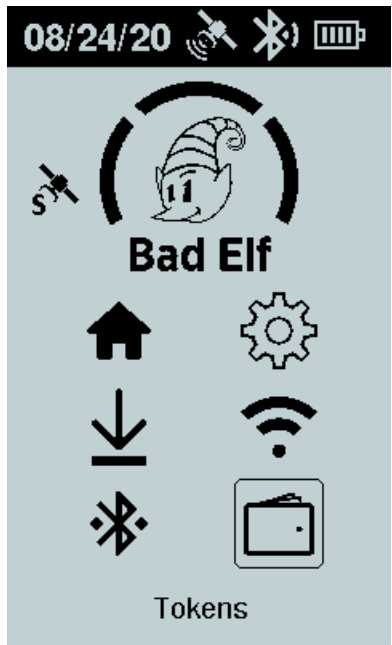
- The information displayed includes Wi-Fi module power, auto-connect enabled, IP address, and network name
- Press the enter button ⦿ to enable or disable various settings
- Press the back button ⊠ to return to the main menu
- From the settings page
    - Press the up and down arrow buttons <> select a setting
    - Press the enter button ⦿ on a setting to toggle the setting on/off
    - Press the back button ⊠ to return to the Wi-Fi status screen
    - Turning the Wi-Fi on/off powers on/off the wifi module
    - Turning on auto-connect enables automatic connection to a stored Wi-Fi profile (SSID & password)

Wi-Fi status - powered off	WiFi status - powered on and connected	Wi-Fi settings - radio power and auto-connect

Bluetooth Function

08/24/20
 	
 Bad Elf
 	
 Bluetooth Configuration
	Basic Bluetooth options are available from this function
	
	 Actions
	 ● Press the enter button ⬤ on **Bluetooth Status** to display the number of active Bluetooth connections
	      ○ Press the back button ⊠ to return to the Bluetooth options menu
	 ● Press the enter button ⬤ on **Clear all pairings** to delete all Bluetooth records for any device that has connected to this Flex
	      ○ You'll hear a beep when this action completes

Tokens Function

08/24/20
 	
 Bad Elf
 	
 Tokens
	● This function provides the following capabilities
	      ○ Visibility of loaded tokens
	      ○ Consumption and use of tokens
	      ○ Operating mode(s) available
	
	 For more information regarding the purpose, usage, and loading of Bad Elf Flex Tokens, see the Bad Elf Flex Tokens section under Installing the Bad Elf Flex app.

22:39:03 🛰 Ⓑⁱ 🔋
 	
Flex Tokens
 	
Unused Tokens
0
 	
Extreme Mode
No tokens loaded
 	
Constellations
All, L1/L2/L5
 	
RTK   **L-Band**
YES   **NO**
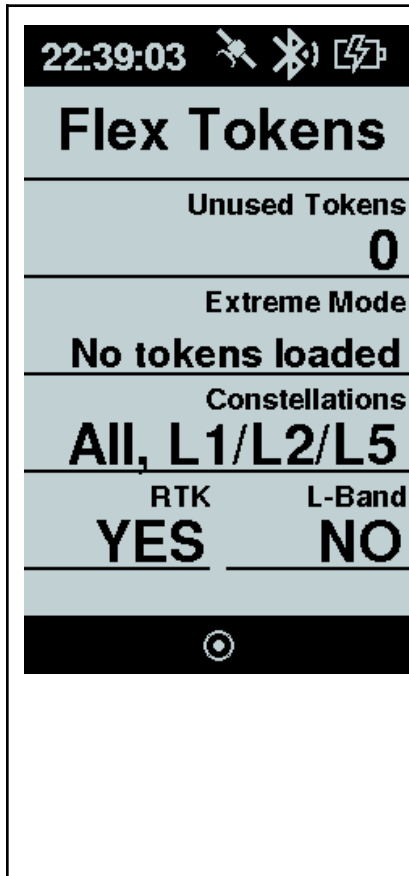 	
◎
	The Flex Tokens screen show the following information:
	● **Unused tokens** shows the number of tokens stored on the Bad Elf Flex that are not currently being used
	● **Extreme mode** shows the GNSS engine operating mode or the expiration time for an in-use token
	   ○ **No tokens loaded** means that RTK and/or L-Band services are not available without a token
	   ○ **Ready** means that a token can be used to unlock RTK and/or L-Band
	   ○ **HH:MM** counts down the time remaining for the currently active token
	● **Constellations** shows what frequencies and GNSS constellations are available
	   ○ **GPS, L1** means single constellation support, single frequency
	   ○ **Multi-GNSS, L1** means multi-constellation support, single frequency
	   ○ **All, L1/L2/L5** means multi-constellation support and all GNSS frequencies are supported
	● **RTK** shows the availability for the GNSS engine to use **RTK** corrections services, options (**YES, NO**)
	● **L-Band** shows the availability for the GNSS engine to use **L-Band** corrections services, options (**YES, NO**)

Actions Available
- Press the enter button ◎ to see available actions for using tokens.
  - **No tokens loaded!** means there are no tokens currently stored on this Flex
  - **Enable Extreme Accuracy** means enable multi-constellation, multi-frequency, RTK mode. L-Band services are also available.
  - **Use token for L-Band** means that this unit is already in Extreme mode and using a token enables the use of L-Band services
  - **Cancel token usage** means disable the features associated with the token usage and return the token to the unused count of tokens stored on the Bad Elf Flex. *Note: the grace period for canceling a token is XX minutes.*
- Press the back button ⊠ from the token options page to to the tokens function page.
- Press the back button ⊠ from the tokens function page to return to the main menu

---

Connecting Phones or Tablets via Bluetooth

Follow these steps to connect your mobile phone or tablet to the Bad Elf Flex via Bluetooth.

Start by making sure your Bad Elf Flex is turned on and within range of your phone or tablet. Follow the instructions below for your phone or tablet's operating system.

For iPhones and iPads running iOS

1. Open the Settings app and navigate to the Bluetooth screen.
2. Make sure Bluetooth is turned on.
3. If you have not previously paired with this Bad Elf Flex, it will appear in the "Other Devices" section. Tap Bad Elf Flex in the list to start the pairing process. If requested, confirm the pairing on your phone or tablet and on the Bad Elf Flex.
4. Once you are paired, the Bad Elf Flex will appear in the My Devices section. If the status shows as Disconnected, you can tap the Flex name to connect.
5. Once the pairing succeeds, you should see it listed as Connected in the list of devices..

For Android phones and tablets

1. Go to Settings > Wireless & Networks.
2. Make sure Bluetooth is turned on.
3. Go to Settings > Wireless & Networks > Bluetooth Settings and tap Scan for devices.
4. After a few seconds, the Bad Elf Flex should appear in the list of available Bluetooth devices.
5. Tap the name in the list to start the pairing process. If requested, confirm the pairing on your phone or tablet and on the Bad Elf Flex.
6. Once paired, you will see the Bad Elf Flex appear in the list as Connected for a few seconds then return to Disconnected. This is normal. The Bluetooth connection will be established whenever an app requests it.

For Windows

1. Select Bluetooth Devices from the icon list in the lower right portion of your desktop.
2. The Bluetooth option may not be displayed. If not click the up arrow.
3. If your Bad Elf accessory is turned on, you should see it appear in the list as something like BE5500-XXXXXX (with its serial number).
4. Select your Bad Elf Flex from the list, and tap the Pair button.

5. Within 5-10 seconds, you should see a prompt from windows showing pairing is complete. Once this action is completed, the message "Ready to pair" will change to "Paired".

At this point you have successfully paired your Bad Elf Flex with your Windows computer. Next, you will need to determine the COM port assigned by the operating system.

1. Click on the icon to the left of BE5500-XXXXXX
2. Click on "More Bluetooth Options"
3. A Bluetooth settings dialog will open
4. Click on the "COM Ports" tab
5. The COM port with your device serial number labeled as "Outgoing" is the COM port you should use for your application.

Installing the Bad Elf Flex app

From your phone or tablet, visit http://bad-elf.com/flex/app to download the correct Bad Elf Flex companion app for your operating system. This app is used to check the health of your hardware, perform firmware upgrades, change settings, and stream correction data to your Bad Elf Flex.

Bad Elf Flex Tokens

Each Bad Elf Flex Token is good for 24 hours. With one Bad Elf Flex Token you can do any of the following:

- Unlock multi-constellation and multi-frequency for higher accuracy SBAS (30-60cm accuracy).*
- Use RTK with your local CORS or VRS network for survey-grade accuracy (1cm).*
- Use L-Band satellite corrections for places without SBAS or Internet connectivity (5-10cm worldwide).

If your Bad Elf Flex is permanently unlocked these features do not require a Bad Elf Flex Token.

Use the Bad Elf Flex app to load tokens

- Scan the QR code on the back of the Bad Elf Flex Token card.
- Or, type in the code on the back of the Bad Elf Flex Token card.
- Transfer some or all of your tokens to your Bad Elf Flex.
- When you require higher accuracy, use a token to activate Extreme mode using the app or the Bad Elf Flex user interface.

Using a Bad Elf Flex Token does not require wireless data connectivity. Bad Elf Flex Tokens don't expire, and you can load more tokens onto your Bad Elf Flex using the Bad Elf Flex app.

Using tokens directly on the Bad Elf Flex

- Select the Tokens menu option from the Bad Elf Flex main menu
- If there are any tokens available, press the enter key to enable Extreme Accuracy
- From the Tokens screen, press enter to enable Extreme Accuracy

Using 3rd party apps

Any location-based app on iOS or Android can be used with the Bad Elf Flex. You can visit http://bad-elf.com/apps for a list of compatible apps that we've either tested or have been recommended by other customers.

Using an External Antenna

To connect an external antenna, remove the top cover by leaning it towards the back of the unit. With the top cap removed, unscrew the helical antenna by rotating it counterclockwise as seen from the top of the Bad Elf Flex.

The top connector utilizes a standard SMA connector. Attach your antenna using a 50 ohm cable.

- Remove top cap
- Remove antenna by rotating counter-clockwise.
- Attach external antenna to SMA connector

Ensure the antenna being connected does not exceed the voltage and current limits defined in the Bad Elf Flex product specifications.

Height Reference

For measurements along the Z-axis, height reference, use the diagram below to assist in determining your height offset.
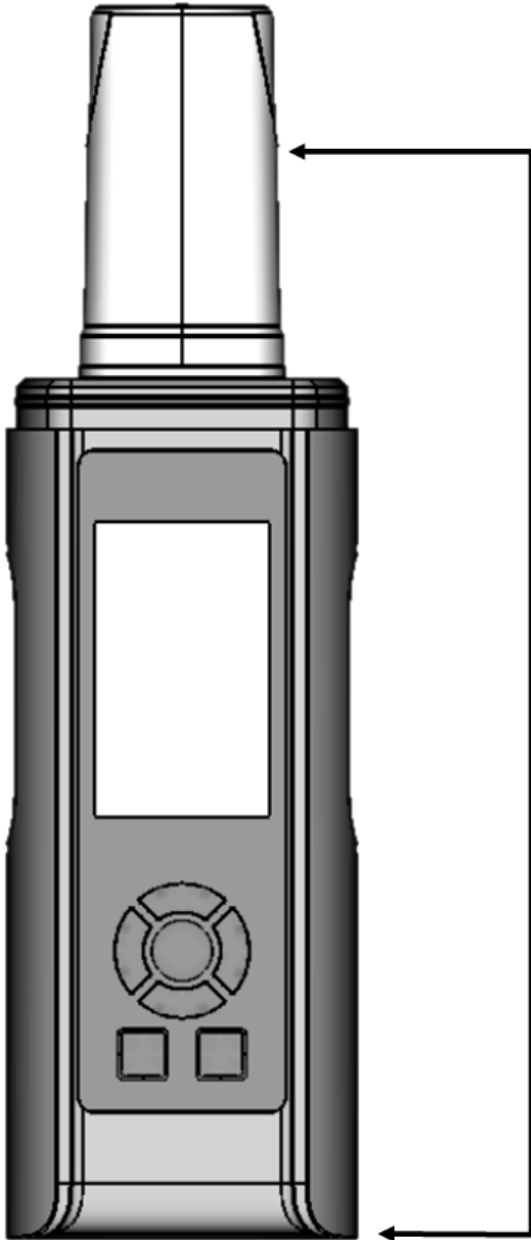
GNSS height offset is measured from the base of the Bad Elf Flex to 58mm above the top of the case.

Vertical reference offset is 230mm.

Specifications

Communications

USB	USB 2.0 device via Mini-USB receptacle USB 2.0 host OTG via supplied adapter
Bluetooth	Bluetooth V4.0 (HS) with integrated Class 1.5 PA, Supports 3 simultaneous connections
Wi-Fi	Client and access point (AP) modes 802.11b/g/n

Positioning Engine

GPS	L1CA/L1P/L1C/L2P/L2C/L5
GLONASS	G1/G2/G3, P code (P1/P2)
BeiDou	B1i/B2i/B3i/B10C/B2A/B2B/ACEBOC
Galileo	E1BC/E5a/E5b/E6BC/ALTBOC
QZSS	L1CA/L2C/L5/L1C/LEX
IRNSS	L5

Note: constellations and frequencies are dependent on Flex configuration and subscriptions.

Positioning Performance

Horizontal accuracy		RMS (67%)	2DMRS (95%)
	RTK	8 mm + 1 ppm	15 mm + 2 ppm
	SBAS (WAAS)	0.3 m	0.6 m
	Autonomous	1.2 m	2.4 m
	L-Band Atlas	4 cm	8 cm
Timing (1PPS) accuracy	20 ns		
Cold start time	< 60 s typical (no almanac or RTC)		
Warm start time	< 30 s typical (almanac and RTC)		
Hot start time	< 10 s (almanac, RTC, and position)		
Maximum speed	1,850 kph (999 kts)		

Maximum altitude	18,288 m (60,000 ft)
Differential options	SBAS, Autonomous, External RTCM v2.3, RTK v3, L-band (Atlas), and DGPS
Correction I/O protocol	Hemisphere GNSS' ROX, RTCM v2.3 (DGPS), RTCMv3 (RTK), CMR, CMR+, Atlas

Antenna

Antenna input impedance	50Ω
Antenna gain input range	10 to 40 dB
Antenna Voltage	5VDC
Antenna Current	Up to 500mA, with short circuit protection

Battery and Power

Internal Battery	Non-replaceable 3.7VDC, 12000mAh, Lithium ion
Battery Life	11 hours in RTK, SBAS, or autonomous modes 7hrs with L-Band corrections enabled
External Power	Mini-USB power input from 10W or greater USB power source

Mechanical

User interface	Transflective LCD Membrane Keypad 3 multicolor LEDs Audible tones
Dimensions	10.0" x 2.75" / 254mm x 70mm
Weight	29oz / 854g
Helical Antenna Phase Center	177 mm above base of Flex unit without adapter installed Add 1.5cm with adapter installed

Environmental

Temperature	Operating: –20°C to +55°C (–4°F to +131°F)
	Storage: –40°C to +75°C (–40°F to +167°F)
Humidity	100% condensing
Waterproof	IP65

Bluetooth RF Characteristics

Frequency band	2402MHz ~ 2480MHz
Number of channels	79 channels
Modulation	FHSS, GFSK, DPSK, DQPSK
Output Power (Class 1.5)	9 dBm (typical)
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-86 dBm (typical)
Sensitivity @ BER=0.01% for Ω/4-DQPSK (2Mbps)	-86 dBm (typical)
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-80 dBm (typical)
Maximum Input Level	GFSK (1Mbps):-20dBm Ω/4-DQPSK (2Mbps) :-20dBm 8DPSK (3Mbps) :-20dBm
Antenna	Internal whip antenna (shared with Wi-Fi)

WI-FI RF Characteristics

WLAN Standard	IEEE 802.11b/g/n, Wi-Fi compliant
Frequency range	2.400 GHz ~ 2.497 GHz (2.4 GHz ISM Band)
Number of channels	2.4GHz:Ch1 ~ Ch14
Modulation	802.11b : DQPSK, DBPSK, CCK 802.11 g/n : OFDM /64-QAM,16-QAM, QPSK, BPSK
Output power	802.11b /11Mbps : 16 dBm ± 1.5 dB @ EVM -9dB 802.11g /54Mbps : 15 dBm ± 1.5 dB @ EVM -25dB 802.11n /65Mbps : 14 dBm ± 1.5 dB @ EVM -28dB

Receive Sensitivity (11n) @10% PER	MCS=0 PER @ -85 dBm, typical MCS=1 PER @ -84 dBm, typical MCS=2 PER @ -82 dBm, typical MCS=3 PER @ -80 dBm, typical MCS=4 PER @ -77 dBm, typical MCS=5 PER @ -73 dBm, typical MCS=6 PER @ -71 dBm, typical MCS=7 PER @ -68 dBm, typical
Receive Sensitivity (11g) @10% PER	6Mbps PER @ -86 dBm, typical 9Mbps PER @ -85 dBm, typical 12Mbps PER @ -85 dBm, typical 18Mbps PER @ -83 dBm, typical 24Mbps PER @ -81 dBm, typical 36Mbps PER @ -78 dBm, typical 48Mbps PER @ -73 dBm, typical 54Mbps PER @ -71 dBm, typical
Receive Sensitivity (11b) @8% PER	1Mbps PER @ -90 dBm, typical 2Mbps PER @ -88 dBm, typical 5.5Mbps PER @ -87 dBm, typical 11Mbps PER @ -84 dBm, typical
Data rate	802.11b : 1, 2, 5.5, 11Mbps 802.11g : 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n (20MHz, long GI, 800ns): 6.5, 13, 19.5, 26, 39, 52, 58.5, 65Mbps 802.11n (20MHz, short GI, 400ns) : 7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65,72.2Mbps
Maximum input level	802.11b : -10 dBm 802.11g/n : -20 dBm
Antenna	Internal whip antenna (shared with Bluetooth)

Data Storage Specifications

Project Container

The image below shows an example of a Bad Elf Flex project ZIP file with the name 2020_09_02_145525Z.zip. The convention used for naming uses GMT time format. Therefore, this project was started on September 2, 2020 at 14:55:25 GMT time. Unless you are using the Bad Elf Flex app, all data recorded using the logging function of the Bad Elf Flex use this naming convention.

A description of the contents of this project file is found below.

Filename	Description
2020_09_02_145525Z.points.csv	Instant point log file
2020_09_02_145602Z.20o	Converted raw GCP file in RINEX 2 format
2020_09_02_145602Z.bin	Raw GCP binary file
2020_09_02_145602Z.env	RINEX header metadata
2020_09_02_145602Z.gnav	RINEX GLONASS Nav file
2020_09_02_145602Z.nav	RINEX GPS Nav file
2020_09_02_145602Z.summary	RINEX Processing summary
2020_09_02_150321Z_TRACK_01.track.csv	Track log file (_01) indicates first track log
flex-log-processor-v1.0.16-build-1075.txt	Text file indicating log processor build information
metadata.json	Metadata json file describing the contents of the project ZIP file

Point/Track recordings

The list below contains the field names and definitions for a Bad Elf Flex generated point or track log CSV file.

Note: Any additional fields added in the future are appending to the rightmost column.

Field Name	Description
LINE	Auto-incrementing line number starting with 1
DATE_TIME_UTC	Date and time in GMT
LATITUDE	Latitude in decimal degrees
LONGITUDE	Longitude in decimal degrees
ELEVATION_MSL	Elevation value reported by GPS in meters
ELLIPSOID_ELEVATION_M	Ellipsoidal value reported by GPS in meters (does not include pole height or antenna offset)
RECEIVER_GEOID_M	Geoid separation reported by GPS in meters, EGM96
SPEED_KPH	Speed in KPH
COURSE_ANGLE	Heading in decimal degrees
HDOP	Horizontal dilution of precision
VDOP	Vertical dilution of precision
PDOP	Positional dilution of precision
TYPE	Type of GPS fix, 1=none, 2=2d, 3=3d
QUALITY	Quality of GPS fix 0 = invalid 1 = GPS fix (SPS) 2 = DGPS fix 3 = PPS fix 4 = Real-Time Kinematic (RTK) 5 = Float RTK 6 = estimated (dead reckoning)
NST	Number of satellites being tracked
NSV	Number of satellites visible
HRMS	Horizontal RMS accuracy in meters (reported)
VRMS	Vertical RMS accuracy in meters (reported)
3DRMS	3D RMS accuracy in meters (reported)
CORR_TYPE	Correction type, ex. SBAS, RTCM3, L-BAND
CORR_FIX	Correction fix type, ex. FIX, FLOAT

CORR_AGE_SEC	Correction age in seconds
CORR_DISTANCE_KM	Distance to corrections source in KM
DATUM	DATUM in use, RTK_DATUM when in RTK mode
NTRIP_MOUNT	NTRIP mount point in use
ORTHO_MODEL	Orthometric model used for this recording
ORTHO_GEOID_M	Geoid separation in meters
ANTENNA_HEIGHT_M	Antenna height in meters including Bad Elf Flex antenna offset
ORTHO_HEIGHT_M	Calculated orthometric height
POINT_NAME	Point name, auto generated or defined through the Bad Elf Flex app, empty for track logs

Raw data recordings

The binary data file stored with a raw GCP session contains mixed NMEA and select Hemisphere binary messages. Bad Elf Flex processes this file locally and upon project completion, converts this data to a RINEX output based on settings for the project. Hemisphere binary and NMEA messages included in a recording may include any of the following based upon mode of operation and satellite visibility.

Message	Type
16	binary
25	binary
34	binary
35	binary
36	binary
44	binary
45	binary
65	binary
66	binary

76	binary
80	binary
93	binary
94	binary
95	binary
209	binary
GPGGA	NMEA

Metadata

The included metadata file provides a common format for external tools to reference and parse the contents of a Bad Elf Flex project file. The project section of the metadata file contains information relevant to recordings contained within the project. The source section of the metadata documents the current configuration of the Bad Elf Flex.

Sample data from a Bad Elf Flex project ZIP file (metadata.json)

```json
{
    "project": {
        "end": "2020_09_02_151837Z",
        "firstGpsTimestamp": "2020_09_02_145525Z",
        "name": "2020_09_02_145525Z",
        "pointCount": 2,
        "rawLogCount": 1,
        "start": "2020_09_02_145543Z",
        "trackLogCount": 1
    },
    "source": {
        "firmwareVersion": "1.0.16.1075",
        "hardwareVersion": "11.0.0",
        "model": "BE-GPS-5500",
        "modelName": "Bad Elf Flex",
        "nickname": "",
        "serialNumber": "145692"
    },
    "version": 1
}
```

RF Disclosures

Class B Statement – Notice to Users:

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.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules and Part 90. These limits are designed to provide reasonable protection against harmful interference in a residential installation. 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 communication. However, there is no guarantee that interference will not occur in a particular use. If this equipment does cause harmful interference to radio or television 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.
- Increase the separation between the equipment and the Bad Elf Flex.
- Consult Bad Elf for help.

Changes and modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under Federal Communications Commission rules.

Human exposure to radio frequency energy

Like any other mobile device, the Bad Elf Flex emits radio frequency energy (RF) during use. According to the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the critical effect of RF exposure relevant to human health and safety is heating of exposed tissue.

According to the Federal Communications Commission (FCC), "Some health and safety interest groups have interpreted certain reports to suggest that wireless device use may be linked to cancer and other illnesses, posing potentially greater risks for children than adults. While these assertions have gained increased public attention, currently no scientific evidence establishes a causal link between wireless device use and cancer or other illnesses."

However, above a certain level (referred to as the threshold) depending on the duration of exposure, RF exposure and the accompanying temperature rise can provoke serious health effects, such as heat stroke and tissue damage (burns). To avoid hazards to health deriving from high RF exposure, limits are set in relation to the threshold known to show adverse effects, with an additional reduction factor to take care of scientific uncertainties. These limits are

generally expressed in terms of the specific absorption rate (SAR). SAR is a measure of the rate of absorption of RF energy in the body. Tests for SAR are conducted with the device transmitting at its highest power level in all tested frequency bands. SAR-limits were first established in 1996 by the FCC in the USA and they were then adopted elsewhere.

You can find additional information about SAR at the following pages:

http://fcc.gov

http://icnirp.org

http://ec.europa.eu

Bad Elf Flex has been tested and certified to not exceed SAR limits in the U.S., Canada, European Union, or Australia.

Limited Warranty Terms and Conditions

Warranty

Bad Elf products will substantially conform to publicly available specifications for the product and that the hardware and any storage media components of the product will be substantially free from defects in materials or workmanship for one year from the date of purchase. Within this period, Bad Elf will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor.

This warranty does not apply to: (i) cosmetic damage, such as scratches, nicks and dents; (ii) consumable parts, such as batteries, unless product damage has occurred due to a defect in materials or workmanship; (iii) damage caused by accident, abuse, misuse, water, flood, fire, or other acts of nature or external causes; (iv) damage caused by service performed by anyone who is not an authorized service provider of Bad Elf; or (v) damage to a product that has been modified or altered without the written permission of Bad Elf. In addition, Bad Elf reserves the right to refuse warranty claims against products or services that are obtained and/or used in contravention of the laws of any country.

Bad Elf makes no warranty as to the accuracy or completeness of third-party applications that use Bad Elf position data.

Repairs have a 90 day warranty. If the unit sent in is still under its original warranty, then the new warranty is 90 days or to the end of the original one year warranty, depending upon which is longer.

Limitations and Remedies

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

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

Bad Elf retains the exclusive right to repair or replace (with a new or newly-overhauled replacement product) the device or software or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

How to Obtain Warranty Service

To obtain warranty service, contact Bad Elf Product Support for shipping instructions and an RMA tracking number. Securely pack the device and a copy of the original sales receipt, which is required as the proof of purchase for warranty repairs. Write the tracking number clearly on the outside of the package. Send the device to the Bad Elf warranty service station.

Online Auction Purchases: Products purchased through online auctions (that means purchases not made through bad-elf.com, on eBay from bad-elf-llc, on Amazon from Bad Elf, LLC, or an approved reseller) are not eligible for warranty coverage. Online auction confirmations are not accepted for warranty verification. To obtain warranty service, an original or copy of the sales receipt from the original retailer is required. Bad Elf will not replace missing components from any package purchased through any online auction.

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References

- RINEX 2 specification
- RINEX 3 Specification