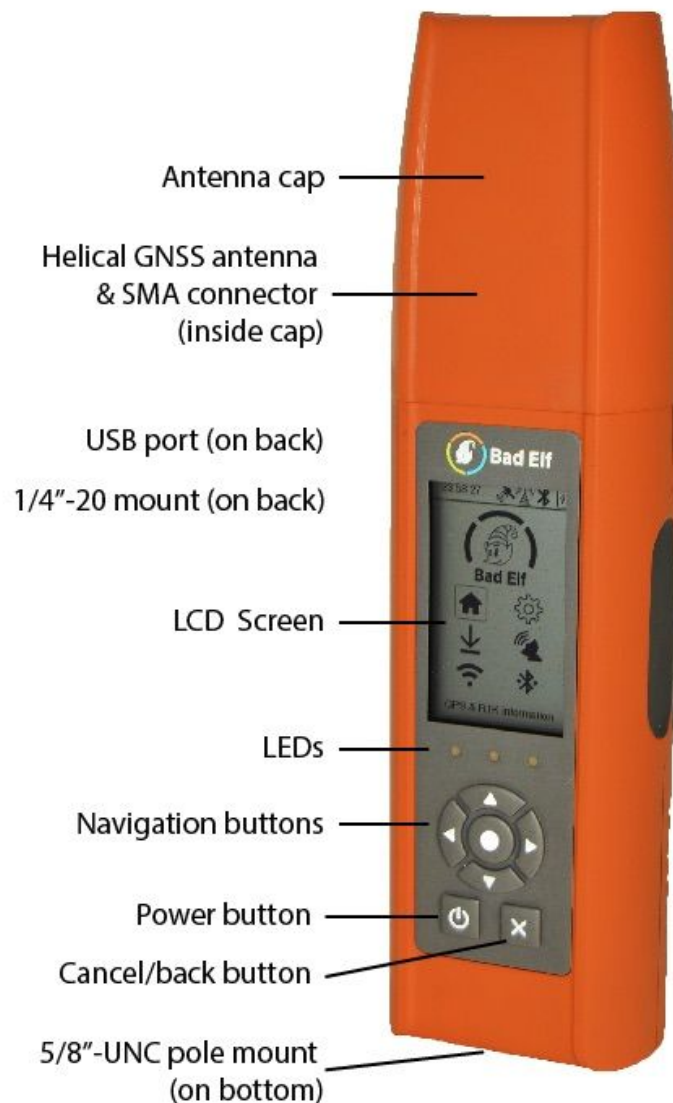


Bad Elf Flex User Manual

Introduction

The Bad Elf Flex is an external GNSS receiver designed for field data collection when paired with a mobile phone or tablet. The hardware supports several configurations including multi-constellation, multi-frequency, and L-Band reception.

Product Overview



What's in the box

The following items are included in the standard Flex configuration:

- Rugged carrying case
- Bad Elf Flex
- Wall charger
- Vehicle charger
- 1m USB charging cable
- USB OTG adapter cable
- Pole mount adapter
- Quick start guide

Supported devices

You can connect a Flex receiver to a handheld device, phone, or tablet powered by the following operating systems:

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

Using the Bad Elf Flex

We've designed the Flex to be as simple and intuitive as possible.

Charging the Bad Elf Flex

- How to charge & charge indicators
- Operation while charging
- Compatible chargers
- Temperature - charge limitations
- Low battery - device behavior

Turning on and off the receiver

To turn the receiver on, press and hold the power button for 3 seconds. The Flex will take approximately 20 seconds to start up and begin looking for satellites.

To turn the receiver off, press and hold the power button for 3 seconds.

Status information (LCD & LEDs)

The LCD display is the primary user interface of the Flex accessory

The LEDs are used to display information at-a-glance. Their function changes depending on what mode you are in. The LCD screen will usually have a label or key that indicates what each LED represents.

By default, the LEDs are configured to show the following status information:

Left LED	Power status
Center LED	User configurable. Default: shows GNSS navigation status
Right LED	User configurable. Default: shows Bluetooth connection status

The power status LED is used to indicate the battery, charging, and operating status.

Color	Meaning
Solid Green	Fully charged
Flashing Green	Charging
Red	Battery Low
Flashing Red	Battery critically low

Connecting your mobile device via Bluetooth

The following steps will help you connect your mobile phone or tablet to the Flex receiver via Bluetooth.

Start by making sure you Flex is turned on, and within range of your phone or tablet. Then follow the instructions below:

For iPhone and iPad devices running iOS

- On your iOS Device, open the Settings app and navigate to the Bluetooth screen.
- If needed, turn Bluetooth on.

- If you have not previously paired with this Bad Elf Flex, it will appear in the “Other Devices” section. Tap the Flex in the list to start the pairing process. You may be prompted to confirm the pairing on both your mobile device and
- Once you are paired, the Flex will appear in the My Devices section. If the status shows as Disconnected, you can tap the Flex name to initiate a connection.
- Once the pairing and connection succeeds, you should see it listed as **Connected** in the list of devices on your iOS device.

For Android phones and tablets

To pair the Flex with your Android device:

1. On your Android device, go to Settings > Wireless & Networks. Make sure Bluetooth is turned on.
2. Go to Settings > Wireless & Networks > Bluetooth Settings and tap Scan for devices.
3. After a few seconds, the Flex should appear in the list of available Bluetooth devices.
4. Tap the name in the list and to start the pairing process. You may be prompted on both your Android device and Flex to confirm the pairing.
5. Once paired, you usually see the Flex show up in the list as Connected for a few seconds, before switched to Disconnected. This is normal. The Bluetooth connection will be opened/closed by whatever apps are using it.

For Windows

To pair the Flex with your Windows computer please follow the instructions below. This process will only have to be done once and does not need to be repeated in the future.

1. Select Bluetooth Devices from the icon list in the lower right hand portion of your desktop.
2. Note, 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 something like BE5500-12345678 (with your unit's serial number) in the list.
4. Select your Bad Elf receiver 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” as shown below.

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

1. Click on the icon to the left of the Bad Elf GPS #XXXXXXX
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.

Connecting your computer via USB

Use the supplied Micro-USB cable to connect the Bad Elf Flex to your desktop or laptop computer. Once properly connect you will see the charging indicator come on if the Flex is not fully charged.

Install companion app

From your phone or tablet, visit <http://bad-elf.com/app-flex> 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.

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.

Connecting an external GNSS antenna

Only use an external antenna that is designed to be used with the Flex receiver. Ensure the antenna being connected does not exceed the voltage and current limits defined in the Flex product specifications.

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.

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

Specifications

COMMUNICATIONS

USB	USB 2.0 device via Mini-USB receptacle USB 2.0 host OTG via supplied adapter
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Bluetooth	Bluetooth V4.2
Wi-Fi	Client and access point (AP) modes 802.11b/g/n

POSITIONING ENGINE

GPS	L1CA/L1P/L1C/L2P/L2C/L5
GLONASS	G1/G2/P code (P1/P2)
BeiDou	B1/B2/B3 (separate variant without L5)
Galileo	E1BC/E5a/E5b
QZSS	L1CA/L1C/L2C/L5

NOTE: constellations and frequencies are dependent on receiver 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 via Atlas	????	????
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 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	11hrs 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 Buttons LEDs Audible tones
Dimensions	10.0" x 2.75" / 254mm x 70mm
Weight	29oz / 854g
Helical Antenna Phase Center	22cm 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	GFSK, $\pi/4$ DQPSK, 8DPSK
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-86 dBm (typical)
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)	-86 dBm (typical)
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-80 dBm (typical)
Maximum Input Level	GFSK (1Mbps):-20dBm $\pi/4$ -DQPSK (2Mbps) :-20dBm 8DPSK (3Mbps) :-20dBm
Antenna	Internal antenna (shared with Wi-Fi)

WI-FI RF CHARACTERISTICS

WLAN Standard	IEEE 802.11b/g/n, WiFi compliant
Frequency range	2.4120 GHz ~ 2.462 GHz (2.4 GHz ISM Band)

Number of channels	2.4GHz:Ch1 ~ Ch11
Modulation	802.11b : DQPSK, DBPSK, CCK 802.11 g/n : OFDM /64-QAM,16-QAM, QPSK, BPSK
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 Antenna (shared with Bluetooth)

RF Disclosures

Class B Statement – Notice to Users: 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 installation. 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 receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician 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.

To maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed and operated with minimum distance between 20cm the radiator your body: Use only the supplied antenna.

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 2.0 amp 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.

Limited Warranty Terms and Conditions

Warranty

Bad Elf products are warranted to be 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's products are intended to be used only as a travel aid and must not be used for any purpose requiring precise measurement of direction, distance, location or topography. Bad Elf makes no warranty as to the accuracy or completeness of 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.

Limitation of Liability

BAD ELF'S ENTIRE LIABILITY UNDER ANY PROVISION HEREIN SHALL BE LIMITED TO THE AMOUNT PAID BY YOU FOR THE PRODUCT. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL BAD ELF OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGE WHATSOEVER UNDER ANY CIRCUMSTANCE OR LEGAL THEORY RELATING IN ANYWAY TO THE PRODUCTS, SOFTWARE AND ACCOMPANYING DOCUMENTATION AND MATERIALS, (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF DATA, OR ANY OTHER PECUNIARY LOSS), REGARDLESS OF WHETHER BAD ELF HAS BEEN ADVISED OF THE POSSIBILITY OF ANY SUCH LOSS AND REGARDLESS OF THE COURSE OF DEALING WHICH DEVELOPS OR HAS DEVELOPED BETWEEN YOU AND BAD ELF. BECAUSE SOME STATES AND JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

PLEASE NOTE: THE ABOVE BAD ELF LIMITED WARRANTY PROVISIONS WILL NOT APPLY TO PRODUCTS PURCHASED IN THOSE JURISDICTIONS (E.G., MEMBER STATES OF THE EUROPEAN ECONOMIC AREA) IN WHICH PRODUCT WARRANTIES ARE THE RESPONSIBILITY OF THE LOCAL DEALER FROM WHOM THE PRODUCTS ARE ACQUIRED. IN SUCH A CASE, PLEASE CONTACT YOUR BAD ELF DEALER FOR APPLICABLE WARRANTY INFORMATION.

Document Version

This document was published on NN XXX YYYY.

The most recent version of this document can be found at <http://bad-elf.com/flex>.

IC Caution:

- English:

This device complies with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the following two conditions: (1) This device may not cause interference, and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

- French:

Le présent appareil est conforme aux CNR d' Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et

(2) l' utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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.

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

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. 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 communications. However, there is no guarantee that interference will not occur in a particular installation.

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 receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC/IC RF Exposure Information and Statement

The SAR limit is 1.6 W/kg averaged over one gram of tissue. Device types BE-GPS-5500 has also been tested against this SAR limit. The highest SAR value reported under this standard during product certification for use at the body is 0.049W/kg and Simultaneous Transmission is 0.060W/kg. This device was tested for typical body-worn operations with the back of the handset kept 0mm from the body. To maintain compliance with FCC/IC RF exposure requirements, use accessories that maintain a 10mm separation distance between the user's body and the back of the handset. The use of belt clips, holsters and similar accessories should not contain metallic components in its assembly. The use of accessories that do not satisfy these requirements may not comply with FCC/IC RF exposure requirements, and should be avoided.