

CRUX II / BTGPS™

GPS Receiver

User Guide



EMTAC

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Warnings

Care and Caution

The Global Positioning System (GPS) is operated by the United States Government which is solely responsible for the accuracy and continued operation of the system. Accuracy of position fixes (longitude, latitude and altitude) can be affected by alterations made to the GPS satellites by the U.S. Government. Accuracy is subject to change in accordance with the U.S. Department of Defense civil GPS user policy and Federal Radionavigation Plan. Positional accuracy and time to fix time can also be affected by poor view of caused by obstructions such as

- tall buildings,
- heavy foliage,
- large cliffs and other obstructions

where GPS satellite signals are blocked and poor satellites geometry conditions result.

Judgment

CRUXII / BTGPS receiver is an excellent navigation and location awareness assist tool, but does not substitute the needs of careful steering and good judgment. Never only rely on one single tool or apparatus for positioning and navigation.

Accessories

The accessory supplied with the CRUX II / BTGPS receiver is specifically designed for BTGPS. Use of other accessory may severely degrade performance or even damage the receiver, and will void the warranty. Make sure using the accessory supplied with. DO NOT USE OTHER ACCESSORY. Do not try to open or break the receiver. There is no service accessory part inside the receiver. Open the receiver will void the warranty.

Software

Follow the operation guidance as stated and described in the user guide of the GPS application software.

The software supplied in and with the CRUX II / BTGPS receiver is solely for personal usage. Making copies only for personal use, but may not copy, modify, reverse engineer or transfer the software unless expressly provided by written agreement. The software is the property of EMTAC and/or its supplier

and is protected by international treaty provisions.

Safety

THE CRUX II / BTGPS contains Lithium-ion battery inside. Leaving the CRUX II / BTGPS in hot or cold conditions, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery inside. Always try to keep the CRUX II / BTGPS between +15°C (+59°F) and +25°C (+77°F). A CRUX II / BTGPS with a hot or cold battery may temporarily not work, even when the battery is fully charged. The performance of Lithium-ion batteries is particularly limited in temperatures below 0°C (+32°F). Temperature extremes will affect the ability of your battery to charge: allow the CRUX II / BTGPS to cool down or warm up first.

Batteries must be recycled or disposed of properly. Batteries must not be disposed of in municipal waste.

DO NOT DISPOSE OF THE CRUX II / BTGPS RECEIVER IN A FIRE!

When a charger is not in use, disconnect it from the power source. Do not leave the CRUX II /BTGPS connected to a charger for longer than 24 hours, since excessive charging may shorten its life. If left unused, a fully charged battery will discharge itself over time.

CAUTION

RISK OF EXPLOSION IF BATTERY IS REPLACED
BY AN INCORRECT TYPE.
DISPOSE OF USED BATTERIES ACCORDING
TO THE INSTRUCTIONS.

To assure product safety, the battery maker requests following statements in the instruction manual/User Guide of the equipment.

Danger

- ◆ When charging the battery, use dedicated chargers and following the specified condition.
- ◆ Use the battery only in the specified equipment.

- ◆ Don't connect battery directly to an electric outlet or cigarette lighter charger.
- ◆ Don't heat or throw battery into a fire.
- ◆ Don't use, leave battery close to fire inside of a car where temperature may be over 60°C. Also don't charge/discharge in such condition.
- ◆ Don't immerse, throw, wet battery in water / seawater.
- ◆ Don't put batteries in your pockets or a bag together with metal objects such as necklaces, hairpins, coins, or screws. Don't store batteries with such object.
- ◆ Don't short circuit the (+) and (-) terminals with other metals.
- ◆ Don't place battery in a device with the (+) and (-) in the wrong way around.
- ◆ Don't pierce battery with a sharp object such as a needle, etc.
- ◆ Don't hit with a hammer, step on a throw or drop to cause strong shock.
- ◆ Don't disassemble or modify the battery.
- ◆ Don't solder a battery directly.
- ◆ Don't use a battery with serious scar or deformation.
- ◆ Don't use battery in a corrosion environment (damage from salt water, sea water, acid, alkali, corrosion gas, etc.).

Warning

- ◆ Don't put battery into a microwave oven, dryer, or high-pressure container.
- ◆ Don't use battery with dry cells and other primary batteries, or batteries of a different package, type, or brand.
- ◆ Stop charging the battery if charging isn't completed within the specified time.
- ◆ Stop using the battery if abnormal heat, odor, discoloration, deformation, or abnormal condition is detected during use, charge, or storage.
- ◆ Keep away from fire immediately when leakage or foul odors are detected.
- ◆ If liquid leaks onto your skin or cloths, wash well with fresh water immediately.
- ◆ If liquid leaking from the battery gets into your eyes, don't rub your eyes.
- ◆ Wash them well with clean water and go to see a doctor immediately.

Caution

- ◆ Store batteries out of reach of children so that they are not accidentally swallowed.
- ◆ Before using the battery, be sure to read the user's manual and conditions on handling thoroughly.
- ◆ Thoroughly read the user's manual for the charger before charging the battery.
- ◆ For information on installing and removing from equipment, thoroughly read user's manual for the specific equipment.
- ◆ Batteries have life cycles. If the time that the battery powers equipment becomes much shorter than usual, the battery life is at an end. Replace the battery with a new same one.
- ◆ Remove a battery whose life cycle has expired from equipment immediately.

- ◆ When the battery is thrown away, be sure it is non-conduction by applying vinyl tape to the (+) and (-) terminals.
- ◆ When not using battery for an extended period, remove it from the equipment and store in a place with low humidity and low temperature.
- ◆ While the battery is charged, used and stored, keep it away from object or materials with static electric charges.
- ◆ If the terminals of the battery become dirty, wipe with a dry cloth before using the battery.

Notice

In order to help you fulfilling any warranty obligations, read comprehensively the "Warnings", "Disclaimer and Limitation of Liability", "Basic Guidelines", "Care and Maintenance", and the whole User Guide.

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Remark: The external active antenna is an optional accessory.

Basic Guidelines

SAFETY

Read the User Guide and these basic guidelines comprehensively. Breaching the regulations and rules may be dangerous or illegal. Road safety is the first priority; do not use or operate the CRUX II / BTGPS receiver while driving. Keep the CRUX II / BTGPS receiver away from high temperatures and fire. Additional detailed information is given in this user guide.(see more details in "Warnings" section)

PROPER HANDLING

Operating the GPS receiver requires a clear and unobstructed view of sky with the antenna facade pointing upward to the sky. Do not bend CRUX II / BTGPS receiver while connected to charger, bending will damage the connector, resulting in damage to the BTGPS or the charger's plug.

FIRST TIME OPERATION

A longer than normal time-to-first-fix of position may result the first time you use the CRUX II / BTGPS. Follow this user guide and consult the instructions of the host platform and GPS application software.

INTERFERENCE

GPS receivers may receive interference near cellular base-station and when in close proximity to mobile phone antennas. This interference may affect positioning and time-to-fix performance.

CONNECTORS, JACK and PLUG

The CRUX II / BTGPS has one external antenna (port) connector, and one DC power jack. Caution and care must be exercised when handling these parts. Bending or breaking these parts will severely degrade positioning performance and damage the receiver. This will void your warranty.

ACCESSORIES

Use only approved accessories supplied with the CRUX II / BTGPS. No service part inside the CRUX II / GPS receiver. (The external active antenna is an optional accessory)

SERVICE

Only qualified engineering service personnel must install or repair equipment.

SWITCH OFF

Obey all laws, regulations, rules and restrictions. Switch off the host platform and discontinue operation of the CRUX II / BTGPS receiver in hospital ICU, aircraft, gasoline station, near fuel or chemical, near blasting area, or other restricted areas.

NOTICE

Read the "Warnings" section comprehensively before operation.

1. Getting Start

Introduction

Congratulations on purchasing the CRUX II / BTGPS. This GPS receiver is the world first mobile GPS receiver integrated with Bluetooth technology. The CRUX II / BTGPS offers flexible and various location awareness applications for both consumer and corporate usages including

- Navigation and Positioning
- Find Street and Route
- Travel Route Planning
- Recreation
- Safety and Security
- Fleet Management
- Logistic
- Field-Force Management
- Enterprise Location Service (ELS)
- Location-Based Service (LBS)
- Mobile Location Service (MLS)



Figure 1

Prepare to use you CRUX II / BTGPS Receiver

To help you begin to use your CRUX II / BTGPS Receiver ("BTGPS"), read this User Guide in the first step. This User Guide explains the detail how BTGPS operates, functions, and common features of the BTGPS. A short glossary of GPS related terms and abbreviations at the back of the User Guide.

Before you begin using your BTGPS, you must complete the application software installation tasks on your host device like PAD, PDA mobile phone, MMS mobile phone, handheld PC, and portable PC hardware. For information about the hardware operation and application software installation, please refer to the documentation that accompanies each product.

For operation detail information, please consult Chapter 3. In order to get more familiar with your BTGPS, please first read Chapter 2 before starting to operate BTGPS.

GPS signal reception

The Global Positioning System (GPS) is a space-based radio-navigation system. This system consists of 24 satellites, which orbit the Earth at an altitude of approximately 17,500 kilometers, and ground control stations. Each of the 24 satellites, deployed in 6 orbital planes, circles the earth twice a day. The system satellites continuously transmit signals contain the information of time and distance in a precise formation, 24 hours a day in any weather condition, everywhere around the world. By processing the signals received, BTGPS provides users with helpful information of position, velocity, and time for navigation and location awareness purposes anywhere anytime on the Earth.

The BTGPS offers high position accuracy and fast Time-To-First-Fix (TTFF), which rely on environment circumstances where receiver located as well as initial states of the receiver. During attempting to a position fix, the receiver needs to lock on to at least 3 satellites and, uses the signal can be received as well as the data of latest position stored in the receiver's digital memory in order to compute the location of the device.

Environmental factors that influence the position accuracy and TTFF including such as tall buildings,

narrow street and passageway,
protection film on glass,
heavy foliage,
large cliffs,

and other obstructions where the satellite signals may be blocked, and, poor satellite geometry situation. Initial state of the receiver, means latest status in memory of the receiver, may mainly determine the time of TTFF. Position can be quickly fixed within only 10 seconds from a hot-start state and needs 80 seconds typically from a cold-start state. Or, might need at least 3 to 5 minutes from a completely restart-state, for example, flying a distance over 500 kilometers from initial origin.

BTGPS uses the satellite signals to calculate an exact geodetic location through triangulation method, contained in 10 meters CEP accurateness devoid of Selective Availability (SA), which is good enough for general location awareness purposes. The position data is then converted within the receiver to latitude and longitude coordinates, which is usually provided in the geodetic datum on which GPS is based (WGS 84). Position offsets of hundreds of meters or much more can result from using the wrong datum.

In addition to datum used, there are number of positioning errors can occur, limiting accuracy. The major errors including satellites orbiting error, poor satellite geometry, multi-path signals, atmospheric delay and receiver clock timing.

The indication of GPS signal reception is described in section "Indication of BTGPS operation" of Chapter 3.

Using optional external active antenna

Your BTGPS is optional equipped with an external active antenna (optional accessory) for convenience usage when operating under certain environment situation, such as inside vehicle where satellite signals are blocked. Detailed operation is described in Operation chapter. Make sure using the optional external antenna supplied by EMTAC. Use of unqualified antenna will severely degrade positioning performance or even damage the receiver. Read basic guidelines before using external active antenna accessory.

CAUTION and WARNING

The BTGPS contains a rechargeable Li-ion battery which supplies the power for the operation of GPS and Bluetooth circuits inside. Care and caution must take into account are:

- Only use the charger supplied with the BTGPS. Use other charger can damage the BTGPS and even dangerous at the risk of explosion.
- Do not expose BTGPS to high temperatures higher than 60°C (140°F) such in car under direct sunshine. Expose BTGPS to high temperatures environment can not only shorten the life of electronic devices and melt or drape certain plastics, but also can damage the battery inside the BTGPS and even dangerous at the risk of explosion.
- Do not try to open or break the receiver. There is no service accessory part inside the receiver. Open the receiver will void the warranty.

2. General Information

This chapter describes your BTGPS in details.

General features

Your BTGPS is an excellent navigation and positioning aid tool when using with mobile terminal devices("host") of Bluetooth enabled, which the host with GPS application software installed. The general features are

- Best mobile GPS receiver for consumer and corporate
- GPS receiver with Bluetooth transceiver built-in
- Provides fully interoperability with Bluetooth integrated mobile devices
- Ultra-low power consumption with Li-ion rechargeable battery built-in
- Long operation time: 8 hours under continuous mode
- LED lights indicate GPS status, Bluetooth connection and battery condition
- Embedded high sensitivity GPS active antenna and Bluetooth antenna
- External GPS active antenna(optional) for in vehicle and indoors use
- Compatible with all GPS map running on various hardware platforms
- Navigating freely without wire connection to host mobile devices-- true wire-less

In the following sections, each portion details of BTGPS are described, see Figure 2 and 3.

Portion details:

Antenna Façade

Power Switch

External Antenna Port

LED indicators

Power Jack

External Active Antenna (optional)



- A: Antenna Facade
- B: Power Switch
- C: External Antenna Port
- D: LED Indicators
- E: Power Jack

Figure 2

Antennae Facade

Your BTGPS integrated with a high sensitive 1.5GHz GPS antenna and 2.4GHz Bluetooth antenna internally, which can offer good satellite signal reception for position fix as well as data communication between BTGPS and your Bluetooth host terminal, respectively. The antenna facade area is top surface of the BTGPS, as indicated Figure 2 and 3. Keep this surface clean and clear view to the sky while operating GTGPS. Do not let this frontage surface area covered fully or partially by any object especially contains metal and/or electromagnetic wave absorption materials such as screwdriver, pen, watch, floppy diskette, CD and metal wires, thin metal foil like aluminum foil and metal-coated plastic bag, water or liquid, and carbon paper. While operation, sometimes even in non-operation state.



Figure 3

Power Switch

The Power Switch is indicated as "B" in Figure 2.

- Symbol: Power-on position of the Power Switch.
- Symbol: Power-off position of the Power Switch.

External Antenna Port

Your BTGPS is equipped with a RF connector port (MCX type) for connecting with external active antenna(optional) when operating under certain environment situation, such as inside a vehicle and where satellite signals are blocked or obstructed. The external antenna port is indicated as "C" in Figure 2. Make sure using the external antenna supplied by EMTAC. Use of other active antenna will severely degrade positioning performance or even damage the receiver. Please read basic guidelines before using the external active antenna accessory.

LED Indicators

In Figure 2, three LED lights indicate the operation status of Bluetooth(BLUE), GPS(GREEN) and Battery(YELLOW/RED) of the BTGPS.



Symbol: Blue LED Light indicates Bluetooth pair/connect status

Flashing every 1 second: BTGPS just power-on and waiting for pair/connection.

Flashing every 2 seconds: BTGPS is connected and paired with the host.



Symbol: Green LED Light indicates GPS status

Constant on: When BTGPS just power on, attempting to fix a position.

Flashing: BTGPS has a position fixed.



Symbol: Yellow/Red LED Light indicates Battery status

Red light constant on: Battery low.

Yellow light constant on: Battery under charging.

No light (off): Battery fully charged

Power Jack

When the Red LED light is constant on, you need to charge the Li-ion battery inside the BTGPS by plugging the charger's plug into the power jack which indicated as "E" in Figure 2. Make sure using the charger supplied with the BTGPS. **DO NOT USE OTHER CHARGER to charge the BTGPS.**

External active antenna (optional)

An external active antenna is an optional accessory. Just connecting this external active antenna to the external antenna port described in previous section "External Antenna Port". This active antenna is embedded magnet in the bottom for easy mounting on metal surface, be caution not put near to materials are sensitive to magnetic field, such as magnetic storage media like floppy diskette. Figure 4 is the reference photo of the optional external active antenna. Make sure using the external antenna supplied by EMTAC. Use of other active antenna will severely degrade positioning performance or even damage the receiver.



Figure 4

3. Operation Guide

Before using the BTGPS, first make sure to prepare following steps are ready for operation.

- The GPS application software is correctly installed in the host platform(s)
- The BTGPS is fully power charged
- Check the Bluetooth is ON in the host
- Identify the operation environment whether external antenna needed or not

For information about the operation of the host and GPS application software installation procedures, please refer to the documentation that accompanies each product, respectively.

In this Chapter, a step-by-step operation procedure is described.

Step-1 To install the GPS/MAP application software

Step-2 To pair/connect the BTGPS with the host

Step-3 To operate the GPS/MAP application software

Step-4 To connect with the external active antenna(optional)

Indication of BTGPS operation

To Charge the battery of the BTGPS

Step 1 To install the GPS/MAP application software

Before operation the BTGPS, make sure the GPS/MAP application software is properly and completely installed in the host platform.

To install the GPS/MAP application software, please consult and follow the operation guide described in the user guide of the GPS/MAP application software. Make sure the GPS/MAP application installed completely.

In this User Guide CD-ROM, there is the "Crux_Viiew Test Program"(trial version) for testing purpose. Please follow the step-by-step operation guide indicated and described in the CRUX_VIEW(Trial) Manual file(in .pdf format).

Note:

- (a) The Crux_View Test Program is a trial version program and only for testing purpose.
- (b) The Crux_View program is only for BTGPS used with PocketPC(PPC) with Bluetooth enabled.
- (c) Current version of Crux_View supports ARM(StrongARM/X Scale) based PPC.



Step 2 To pair/connect the BTGPS with the host

To pair and connect your BTGPS with the host platform, please consult and follow the operation guide described in the user guide(operation manual) of the host.

First, turn on the power of host and BTGPS, respectively.

- ▶ Turn on the power of the host and ready.
- ▶ Turn on the power of the BTGPS, the power switch is indicated as "B" in Figure 2. (Make sure the battery of the BTGPS is fully charged.)

Turn the power switch to  position.

-  Symbol: Power-on position of the Power Switch.
-  Symbol: Power-off position of the Power Switch.

Once the BTGPS is just power-on and before pair/connection and operation:




LED Indicator	Symbol	Status Indication
BLUE (left)		Flashing every one(1) second
GREEN (middle)		Constant on (before a position fixed) (Flashing if has a position fixed)
YELLOW/RED (right)		No light (if fully charged)



Figure 5

NOTE:

Typical examples are given in the .pdf files named "BTpair_" (and/or similar files), in this User Guide CD-ROM. Please follow the step-by-step operation guide indicated and described in the files, respectively. Figure 6 is an example indicates that BTGPS already connected with your PDA.

*Example:
This screen-shot indicates the BTGPS is connects with host.*

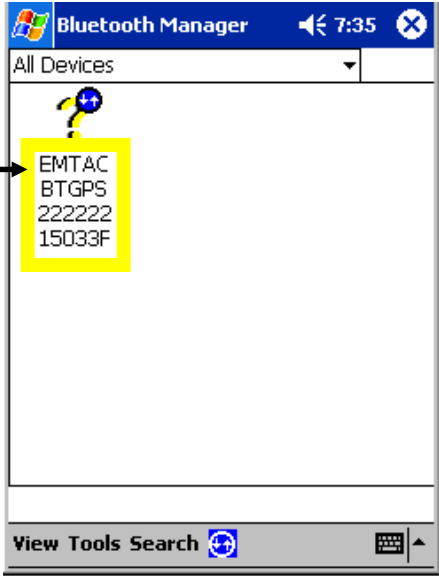


Figure 6

Step-3 To operate the GPS/MAP application software

To open and use the GPS/MAP application, in your PDA:

- Make sure your BTGPS is connected with the host via Bluetooth
- Open the GPS/MAP application on the host
- Enter into the GPS/Map application operation

You can easily use all the functions of GPS/MAP application software by following the details operation guidance described in the user guide of the GPS/MAP application software.

Step-4 To connect with external active antenna(optional)

When operating under the condition that satellite signals are obstructed or blocked such as inside vehicle. First, locate the external antenna port (MCX female) and then plug the connector (MCX male) of external active antenna(optional accessory) into the external antenna port, as indicated in Figure 7. Put the optional external active antenna on the roof metal surface of the car, or on the front top-surface of the dash board where are not affect driving safety and appropriated. Use only the active antenna(optional) supplied by EMTAC. Use of other antenna will severely degrade positioning performance or even damage the receiver. Read "Basic Guidelines" before using external active antenna accessory.



Figure 7

Connect and install the optional external active antenna in position before driving. Do not operate the optional external antenna while steering on the road. The optional active antenna is embedded magnet in its bottom for easy mounting on metal surface, be caution not put near to materials are sensitive to magnetic field, such as magnetic storage media like floppy diskette and mechanical wrist watch.

Indication of BTGPS operation status

In Figure 2 and 5, three LEDs indicate the operation status of Bluetooth(BLUE), GPS(GREEN) and Battery(YELLOW/RED) of the BTGPS, described in followings.



Symbol: **Blue** LED Light indicates Bluetooth pair/connect status

Flashing every 1 second- BTGPS just power-on and waiting for pair/connection.

Flashing every 2 seconds- BTGPS is connected and paired with the host.



Symbol: **Green** LED Light indicates GPS status

Constant on: When BTGPS just power on, attempting to fix a position.

Flashing: BTGPS has a position fixed.



Symbol: **Yellow/Red** LED Light indicates Battery status

Red light constant on: Battery low.

Yellow light constant on: Battery under charging.

No light (light off): Battery fully charged

To charge the battery of the BTGPS

When the Red LED light is light on, you need to charge the Li-ion battery inside the BTGPS by plugging the charger's plug into the power jack which indicated as "E" in Figure 2. Make sure using the charger supplied with the BTGPS as illustrated in Figure 8.



Figure 8

DO NOT USE OTHER CHARGER TO CHARGE THE BTGPS!

4. Troubleshooting

The solutions to some common problems

1. Sometimes, it looks everything is alright, but you just can not connect to BTGPS with your PDA. You should try to delete the old BTGPS icon on your Bluetooth manager software, and re-searching again.
2. Open and close your application on the standard procedures, it will make your Bluetooth connection is normal and functional. Otherwise, sometimes you have to reset your PDA and BTGPS to bring them back. (Power on and off BTGPS is the only way to reset it.)
3. Don't remember the passkey or pin code.
The pin code of BTGPS is "0183".

5. Care and Maintenance

Your BTGPS is a sophisticated product of superior design as well as craftsmanship, and should be treated with care of usage and maintenance. The suggestions below will help you to fulfill any warranty obligations. When using your BTGPS and external active antenna:

- Keep BTGPS and all accessories out of small children's reach.
- Keep BTGPS dry. Humidity, liquids and precipitation contain minerals that will corrode its connector, jack, plug and electronic circuit boards.
- Use only the supplied and approved accessories. Unauthorized accessories, antenna, modifications or attachments could damage the BTGPS and may violate regulations governing radio devices.
- Only use the charger supplied with for charging purpose. Use other charger may damage the BTGPS and even dangerous at the risk of explosion.
- Use dry and clean soft cloth to clean the BTGPS. Do not use harsh cleaning solvents, chemicals or strong detergents.
- Do not drop, shake or knock the BTGPS. Rough handling can break the connector, jack and internal electronic circuit boards. Dropping the BTGPS may break the connector and jack which will cause non-recoverable and malfunction damages.
- Do not expose to rain or high humidity environment, or even pour water on it, which will cause malfunction or non-recoverable damage.
- Do not store BTGPS in dusty, dirty areas. Its moving parts, like connector pins and clips, can be damaged.
- Do not store BTGPS in hot areas. High temperatures can shorten the life of electronic devices, and melt or drape certain plastics.
- Do not expose to high temperatures higher than 60°C (140°F) such in car under direct sunshine.
- Do not store BTGPS in cold areas. When the BTGPS warms up to its normal operation temperature, moisture can aggregate inside it, which may severely damage electronic circuit boards inside.
- Do not attempt to open the BTGPS. Unauthorized handling may damage the BTGPS.
- Do not paint on the BTGPS. Paint can clog the connector, jack, and prevent proper normal operation of the BTGPS.

Glossary

Almanac data

A set of information that transmitted by each satellite on the orbits and state of every satellite in the GPS constellation. Each GPS satellite contains and transmits the almanac data set for the entire GPS satellite system network. Almanac data allows the GPS receiver to rapidly acquire satellites shortly after it is turned on.

ACTIVE ANTENNA

An antenna that amplifies the GPS signal before it sends it to the receiver.

Altitude

The distance between the current position and the nearest point on WGS 84 reference ellipsoid, usually it is expressed in meters or feet and is positive outside the ellipsoid.

Baud

Bits per second. Also referred to as a baud rate.

Channel

Channel refers to a set of hardware in the receiver that detects locks on and continuously tracks the signal from a single GPS satellite. The more channels available, the greater number of GPS satellite's signals a receiver can simultaneously lock and track. A receiver of 12 channels is the optimized design, considering the current consumption, chip-package size and cost.

CEP - Circular Error Probable

CEP is the radius of a circle, centered at a true location, within which fifty percent of positioning solutions fall. CEP is used to achieve horizontal accuracy.

C/N₀

Carrier-to-Noise density ratio. An indication of satellite signal strength received by the GPS receiver.

COLD START

A condition in which the GPS receiver can arrive at a navigation solution without initial position, time, current Ephemeris, and almanac data.

Constellation

Constellation refers to the specific set of of orbiting GPS satellites system, used in calculating positions or all the satellites visible to a GPS receiver at one time. The pattern created by the relative positioning of a GPS satellite network is designed to achieve a very high probability of global satellite coverage even in the event of satellite outages.

dB

Decibel. A notation of relative unit such as the satellite signal strength received.

DATUM

A math model which depicts a part of the surface of the earth. Latitude and longitude lines on a paper map are referenced to a specific map datum. The map datum selected on a GPS receiver needs to match the datum listed on the corresponding paper map in order for the position readings to match.

Elevation mask

Elevation mask is an adjustable feature of GPS receivers that specifies a satellite must be a certain number of degrees above the horizon before its signals are used for positioning. Satellites at low elevation angles (five degrees or less) have lower signal strengths and are more prone to loss of lock thus causing noisy solutions.

Ellipsoid

A geometric surface which all of whose plane sections are either ellipses or circles.

Ephemeris

Ephemeris is a set of parameters used by a global navigation satellite receiver to predict the location of a satellite and its clock behavior. Each satellite contains and transmits ephemeris data about its own orbit and clock. Ephemeris data is more accurate than the almanac data but is applicable over a short time frame from four to six hours. Ephemeris data is transmitted by the satellite every 30 seconds.

The predictions of current satellite position are transmitted to the user in the data message.

Geodetic coordinate

A coordinate system whose elements are latitude, longitude and geodetic height. The latitude is an angle based on the perpendicular to the ellipsoid. Longitude is the angle measured in the XY plane.

GIS (Geographic Information System)

a computer based system that is capable of collecting, managing and analyzing geographic spatial data. This capability includes storing and utilizing maps, displaying the results of data queries and conducting spatial analysis.

Hot Start

Start mode of the GPS receiver when current position, clock offset, approximate GPS time and current ephemeris data are all available.

L1 frequency

1575.42 MHz GPS carrier frequency which contains only encrypted P code, used primarily to calculate signal delays caused by the ionosphere.

Latitude

A north/south measurement of position perpendicular to the earth's polar axis.

Longitude

An east/west measurement of position in relation to the Prime Meridian, an imaginary circle that passes through the north and south poles.

Multipath

Multipath is the reception of a signal both along a direct path and along one or more reflected paths. Multipath signals result in an incorrect pseudorange measurement.

NMEA (NATIONAL MARINE ELECTRONICS ASSOCIATION)

A U.S. standards committee that defines data message structure, contents, and protocols to allow the GPS receiver to communicate with other pieces of electronic equipment aboard ships.

Selective Availability (SA)

Selective Availability is a process whereby the U.S. Department of Defense dithers the satellite clock and/or broadcasts erroneous orbital ephemeris data to create a pseudorange error to prevent adversaries from using the extremely accurate GPS positioning data.

SPREAD SPECTRUM

The received GPS signal is wide bandwidth and low power. The L-band signal is modulated with a pseudo random noise code to spread the signal energy over a much wider bandwidth than the signal information bandwidth. This provides the ability to

receive all satellites unambiguously and to give some resistance to noise and multipath.

TIME TO FIRST FIX (TTFF)

The time it takes to find the satellites is called the Time to First Fix (TTFF). If you have not used your GPS unit for several months, the almanac data for the satellites may be out of date. The unit is capable of recollecting this information on its own, but the process can take several minutes. The time it takes after the user first turns on the GPS receiver, when a GPS receiver has lost memory, or has been moved over 300 miles from its last location.

TRIANGULATION

A method of determining the location of an unknown point, as in GPS navigation, by using the laws of plane trigonometry.

Universal Time Coordinated (UTC)

UTC is the time as maintained by the U.S. Naval Observatory. Because of variations in the Earth's rotation, UTC is sometimes adjusted by an integer second. The accumulation of these adjustments compared to GPS time, which runs continuously, has resulted in an offset between GPS time and UTC. After accounting for leap seconds and using adjustments contained in the navigation message, GPS time can be related to UTC within 20 nanoseconds or better. Greenwich Mean Time (GMT) is still the standard time zone for the prime meridian (zero longitude).

Warm Start

Start mode of the GPS receiver when current position, clock offset and approximate GPA time are input by user or by the application software. Almanac is retained, but ephemeris data is clear.

Wide Area Augmentation System (WAAS)

Developed by the United States government, WAAS is a Satellite-Based Augmentation System (SBAS) that calculates the errors in the GPS signal at several monitoring stations around the country, then transmits error correction messages from geostationary satellites to GPS receivers.

World Geodetic System 1984 (WGS 84)

The primary map datum used by GPS. Secondary datums are computed as differences from the WGS 84 standard. WGS 84 is a set of U.S. Defense Mapping Agency (DMA) parameters for determining global geometric and physical geodetic relationships. Parameters include a geocentric reference ellipsoid; a coordinate system; and a

gravity field model. GPS satellite orbital information in the navigation message is referenced to WGS 84.