*Ag*GPS EZ-Guide Plus lightbar guidance system

Frequently Asked Questions and Answers

System Overview and Components

What is the *Ag*GPS® EZ-Guide® Plus system?

The *Ag*GPS EZ-Guide Plus system is a precision guidance product, designed for farmers and growers, and custom applicators that need a simple, affordable guidance solution for a variety of in-field operations.

Why would I use EZ-Guide Plus instead of foam markers?

Field trials comparing GPS and foam marker guidance show that in *ideal* foam marking conditions, experienced operators using GPS and foam marker guidance achieve similar swath overlap and skip results. On spinner spreaders and in less ideal foam conditions, such as low visibility, wind, low humidity, rough terrain, and canopy crops, GPS swathing is more reliable and accurate than foam markers, allowing operators to get more work done in less time.

This increase in productivity allows operators of EZ-Guide Plus to reduce farm expenses due to:

- Minimizing application overlap and skip, meaning less application material is required.
- No recurring foam marker expenses such as purchasing foam and maintaining foam marker systems
- Drivers don't need to continually look to the side of the vehicle therefore they can drive faster and more precisely. This in turn reduces fuel consumption and decreases the overall time per field. Field trials comparing GPS and foam marker guidance show that in ideal foam marking conditions, operators using GPS drove 13-20% faster than when using foam.
- Because GPS works in all weather and lighting conditions, operators can avoid costly work stoppages and continue swathing in low visibility conditions such as dust, fog, and darkness.

Trimble

What makes EZ-Guide Plus the best guidance system on the market today?

EZ-Guide Plus has several advantages that make it the most attractive guidance system for purchase.

- It is incredibly easy to install, learn, and use.
- It has a unique innovative lightbar design which combines guidance LEDs with a graphic LCD screen for the easiest to use guidance, especially during turns and curves.
- The small lightbar minimizes visual obstruction.
- It uses a high-end GPS receiver for precise positioning that is WAAS and EGNOS-ready for precise DGPS positions. (See What is WAAS?)
- It is very competitively priced.
- Trimble has a number of add-on products that allow you to expand the capabilities of your system, without costly hardware replacements.
- You can upgrade EZ-Guide Plus to an Autopilot DGPS system by just adding an Autopilot steering controller and installation kit. There is no need for another display or GPS receiver to do autosteering.
- Its modular design means that the antenna is out of the way on the roof of the vehicle; the lightbar and optional remote control can be placed virtually anywhere inside the cab for optimal driver ergonomics and comfort. The lightbar can even be mounted upside-down from the cab ceiling if preferred!
- It has extensive on-board GPS diagnostics.
- Trimble has over 10 years of experience in the agriculture market, and has a comprehensive and mature product line. EZ-Guide Plus contains the distilled essence of this product line with years of iterative development behind it.

What is the standard EZ-Guide Plus system made up of?

The standard EZ-Guide Plus system is made up of the following items:

- One of the following lightbar options:
  - An *Ag*GPS 150 lightbar with integrated GPS receiver and a high-performance GPS antenna, mount, and cable
  - An *Ag*GPS 50 lightbar without integrated GPS
- Bracket and suction cup ready for mounting on the vehicle window
- Documentation—simple, clear documentation on a handy reference card and in a user manual
- Power cable—easily connected to a cigarette lighter power supply

In addition to the standard components, there is an optional six-button remote control, which allows faster access to the pause and zoom functions, and the Configuration menu. The remote control also allows buttons to be located closer to the operator and contains an alarm to give audible feedback to the operator during key events.

What is the *Ag*GPS 150 integrated GPS receiver?

The *Ag*GPS 150 lightbar contains a high-quality WAAS/EGNOS Differential GPS receiver.

This GPS receiver uses Trimble's latest generation GPS chips used in our new survey receivers for significantly improved accuracy and position availability in both typical and harsh conditions.

How does EZ-Guide Plus work?

*Ag*GPS EZ-Guide Plus uses GPS positions to let you define an initial reference line or curve (AB Line) for parallel swathing or guidance. The system uses GPS positions to guide you along evenly spaced swaths at your specified implement width.

The row of 35 LEDs (light emitting diodes) along the lightbar give you guidance feedback on your current position left or right of the center of the desired swath (i.e. this indicates your cross-track error). The aim is to drive so that the LEDs remain centered within the lightbar; this indicates that you are driving directly down the center of the swath.

The graphic LCD screen provides both perspective and plan views to assist with steering during turns and curved guidance, as well as status messages and is used for configuration. This greatly improves your ability to orient yourself in the field, line up on the next swath after a turn, and makes it far easier to perform contour guidance.

What experience is needed to operate EZ-Guide Plus?

No special experience is required to operate an EZ-Guide Plus lightbar. A concise, easy-to-read user guide and quick reference card gives simple step-by-step instructions on how to set up and use the system. Typically it takes no more than 15 minutes for new users to learn how to use and begin to reap the benefits of the EZ-Guide Plus lightbar system.

All functions and configuration of the EZ-Guide Plus system can be completed with just three buttons on the lightbar. The optional six-button keypad gives more flexibility and allows the lightbar to be mounted further from the operator and provides direct access to some functions.

What operations can EZ-Guide Plus be used for?

EZ-Guide Plus is ideal for agricultural guidance tasks such as application of crop protection chemicals, fertilizer, lime or manure and airseeding in broadacre operations. In broadacre row crops it can be used for tillage and stops drivers having to count rows. If you want to use EZ-Guide Plus for high-accuracy operations (row crop planting, etc.), you might need to use an external high-accuracy receiver like the *Ag*GPS 252 receiver. Lastly, you may want to consider whether Trimble's *Ag*GPS Autopilot DGPS or RTK System technology is required for optimum performance for a given application.

EZ-Guide Plus Functionality

What functionality is provided in EZ-Guide Plus?

EZ-Guide Plus provides the following functions:

- straight-line A-B guidance
- straight-line A+ guidance
- curved guidance
- multiple headland guidance and straight line guidance inside the headlands
- center-pivot field guidance
- automatic swath advance for straight, curve, and pivot patterns
- a pause and resume guidance feature; while paused, the lightbar provides navigation instructions to return to the pause location
- acreage calculation for headland fields
- end-zone indication via a flashing on-screen warning message and alarm (alarm requires optional remote control or additional external alarm)

What is A-B Guidance?

A-B guidance is the basic guidance pattern, allowing you to set two points (A and B) that define a swath, usually the first swath, on your field. EZ-Guide Plus uses this, in conjunction with the width of your boom (known as the swath width) to guide you up and down parallel, evenly spaced swaths, across your entire field.

What is A+ Guidance?

A+ guidance lets you define a new A point but keep your previous A-B line heading. If you have two fields with the same orientation, set an A-B line on the first field and then just an A+ on the second field. Also, in the dark or in thick fog, define an A-B line along a parallel service road, then use A+ to set the start of the first swath. The lightbar will provide guidance parallel to the service road, but along the swath line.

Similarly, if you have a break midway down your field (such as a service road) use A+ to set a new A point on the other side of the break. EZ-Guide Plus will retain the previous heading so that you can keep the same swath heading on both sides of the break.

What is Curved Guidance?

Curved guidance provides guidance to the previous curved swath at the swath-width distance apart. This pattern is useful when working in an irregularly shaped or terraced field and ensures evenly spaced swaths across the entire field.

What is Multiple Headlands Guidance?

Headland guidance lets you drive multiple curved headland circuits around the outside of the field as a turning area, then map an A-B Line for straight parallel guidance inside the headlands to complete the field. You can also use the Headland pattern to spiral right into the middle of the field without doing any straight swaths.

What is Center-Pivot Guidance?

Center-pivot guidance is used for guidance in a field using a center-pivot. It guides you in concentric circles around the center-pivot.

How does EZ-Guide Plus calculate acreage?

The field area is calculated automatically as you drive the field using the Headland pattern. The area calculation on EZ-Guide Plus always takes into account the width of the boom by expanding the total area out by half of a swath width from the outer headland.

What are end zones?

Also known as headlands, end zones are “no spray” zones around your field. When you set an A-B line, EZ-Guide Plus automatically computes two end-zones at each end of the field, perpendicular to the A-B line; one runs through the A point and the other runs through the B point.

Alternatively, if you use the headlands pattern, EZ-Guide Plus uses the edge of the inner headland as the end zone while you are parallel swathing. This is useful for non-rectangular fields.

How does EZ-Guide Plus tell me when I cross an end zone?

When you cross an end zone, a flashing message will appear on screen to let you know you are outside the spray zone.

You can also configure a headland warning distance so that the warning message will give you advanced warning on leaving or entering the field.

In addition, if the remote control or an external alarm is connected, an alarm will sound while the warning message is displayed.

What is the alarm used for?

The alarm in the optional remote control is used to alert the driver of significant events while using EZ-Guide Plus. If the remote control is connected, the alarm will sound on the following events:

- outside spray zone
- too far offline
- reduced GPS accuracy

What configuration items are available in EZ-Guide Plus?

EZ-Guide Plus has a number of configurable items to fine-tune its operation:

- swath width
- the information displayed on the graphic display can be customized to suit your needs
- contrast and brightness, so that the graphic display and guidance lights (LEDs) are suitable for daytime or nighttime operation
- the guidance LED mode, so you can choose whether to chase the lights or pull them to the center of the lightbar
- lightbar LED spacing, so that you can define the resolution of the lightbar guidance feedback
- the headland warning distance and the distance off-swath at which the warning is displayed
- the forward or backward offset of the boom from the antenna
- look ahead time (in seconds), used to predict the future guidance path and prevent overshooting the target swath when exiting corners.
- the mounting orientation (to invert the display if lightbar is mounted upside-down)
- status text display options to provide detailed feedback while driving
- data port settings, so you can configure GPS input, GPS output, RTCM correction input etc.
- the low accuracy warning, so you can choose whether or not to work with low accuracy GPS positions
- audible warning so you can choose to turn off the audible alarm
- the units of measure (US or metric)
- the language to operate the system
- a factory default option to restore default settings

Does EZ-Guide Plus support WAAS and EGNOS for differential GPS?

Yes, EZ-Guide Plus with the integrated GPS receiver supports WAAS and EGNOS, and is configured by default to use the WAAS or EGNOS signal. This means that on first use, the receiver will track and begin to generate WAAS- or EGNOS-corrected DGPS positions depending on where the unit is currently located, without any configuration by the user.

Does EZ-Guide Plus support other differential GPS sources?

Yes. EZ-Guide Plus with internal GPS supports external RTCM corrections. There are some low cost beacon correction receivers, or in Canada you can buy an NDGPS receiver which is ideal for this application.

The integrated receiver does not directly receive L-band (Omnistar or Thales) or radio-beacon corrections as sources of differential correction. If you want to use beacon or L-band corrections, Trimble recommend that you purchase the EZ-Guide Plus lightbar without integrated GPS and connect an *Ag*GPS 132 or *Ag*GPS 252 receiver.

Where should the operator mount the lightbar?

The EZ-Guide Plus lightbar should be placed in the operator's peripheral vision. When turning, or changing swaths, the operator relies on the lightbar to get on line. Once on line, the operator may pick a distant visual target and drive toward it. The operator periodically references the lightbar to correct off-track errors. The compact size of the EZ-Guide Plus system makes it easy to position within all cabs.

Can an operator leave the field in mid-swath and return to the same point to continue swathing while using EZ-Guide Plus?

Yes. A pause/resume guidance function allows the operator to leave the swath row, reload, and then navigate back to the exact pause location and recommence swathing where they left off. While paused, the lightbar provides navigation information back to the pause-point.

Can the integrated receiver be used for yield monitoring?

Yes, the integrated receiver is pre-configured to be able to output positions to yield monitors using the industry-standard NMEA format for GPS receivers. Because the EZ-Guide Plus lightbar has a serial port, it is possible to use EZ-Guide Plus for parallel guidance and simultaneously output positions to a yield monitor, planter, or other NMEA compatible device.

How can I configure my integrated receiver?

The settings of the lightbar integrated GPS receiver will in most circumstances, already be good for guidance. However, if for any reason you need to change the GPS settings, you can change many from the EZ-Guide Plus lightbar menu or you can use the free Trimble *Ag*Remote setup utility software.

For more information or to obtain a copy of the *Ag*Remote software, contact your nearest Trimble Reseller.

How can I view the GPS status of the integrated receiver?

EZ-Guide Plus has a GPS Diagnostics menu option which displays several screens of information from the integrated receiver, including the time, latitude, longitude, height, speed, number of satellites, HDOP, correction age, WAAS or EGNOS station ID, differential SNR, receiver settings, receiver serial number, firmware version, and update rate.

Can I use another receiver with my EZ-Guide Plus system?

Yes. You can use any other GPS receiver that outputs NMEA GGA and VTG messages. For best guidance, Trimble recommends that you ensure the receiver outputs NMEA messages at 5 Hz.

Upgrades for EZ-Guide Plus

Three upgrades are available for EZ-Guide Plus to extend its functionality to more than just a guidance system.

Upgrade #1: *Ag*GPS EZ-Map

*Ag*GPS EZ-Map, which runs on a Pocket PC* or Trimble's rugged Recon Pocket PC display, enhances your EZ-Guide Plus system by providing coverage logging, mapping, and sampling functionality.

Adding *Ag*GPS EZ-Map to EZ-Guide Plus lets you:

- Map field boundaries, subtracting non-productive areas if necessary, for accurate billing purposes.
- Collect and display application coverage so you can remedy skips before leaving the field to reduce crop damage, improve crop yields, and avoid costly callbacks.
- Connect a spray switch to control coverage logging automatically.
- Collect points, lines, and areas with attributes for mapping and scouting.
- Prepare sampling grids and navigate to the sample targets.
- Import sampling zone maps, field boundaries or background layers from a variety of software packages, such as SMS Basic, SSToolbox, ArcView, MapInfo, AGIS, ViewPoint, AgLink, AgInfo, Agvance, Farm Site, Farm Site Pro, and Patchwork Office.
- Import background images in .jpeg or .bmp format to locate fields and management zones.
- Record event attributes such as product, equipment, and soil and weather conditions.
- Create, view, and print maps using a range of GIS packages, including ESRI's ArcExplorer (included).
- Use high-accuracy RTK GPS to record topographic data. This data is suitable for display and analysis in GIS software packages.

*Requires user-supplied Pocket PC.

Upgrade #2: *Ag*GPS 170 Field Computer

The *Ag*GPS 170 Field Computer turns your EZ-Guide Plus system into the ultimate field information management solution, with enhanced guidance and powerful record-keeping, field mapping, flow control, flow monitoring, variable rate management, and soil sampling capabilities.

Adding the *Ag*GPS 170 to EZ-Guide Plus provides the following additional features:

- All the features of *Ag*GPS EZ-Map, as described above.
- Enhanced guidance options such as racetracks.
- Guidance to line and area features to form rice field levees, lay subsurface drainage, or perform land leveling.
- Use high-accuracy RTK GPS to record topographic data. This data is suitable for display and analysis in GIS software packages and for land leveling and drainage design software such as *Ag*GPS MultiPlane.
- Support for variable rate controllers, including multiple models from MidTech, Raven, Rawson, New Leader, DICKEY-john, TeeJet, GVM Transpread, Flex-Air, LH Agro as well as Krone and DGH flow meters. Record as-applied rate information to verify applications.
- The ability to import application prescription maps, field boundaries or background layers from a variety of software packages, such as SMS Basic, SSToolbox, ArcView, AGIS, AgLink, AgInfo, Agvance, and Patchwork Office.
- Save time with work orders, which allow operators to easily select predefined jobs.
- Full-color graphic display with scratch-resistant low-glare glass for viewing in direct sunlight.
- Color differentiation of sprayed vs. unsprayed areas, prescription rates, and background layers.
- Fully sealed cast-aluminum, shock-resistant, waterproof housing suitable for vehicle mounting.
- Multiple ports to interface to multiple sensors and equipment.

Upgrade #3 *Ag*GPS Autopilot

The *Ag*GPS Autopilot DGPS or RTK system turns your EZ-Guide Plus system into the ultimate automated steering system.

Adding the *Ag*GPS Autopilot to EZ-Guide Plus provides the following additional features:

- automated steering along straight swaths
- works on a wide variety of tractors and sprayers

GPS and DGPS Questions

What is GPS?

The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 orbiting satellites and their ground stations. By using a process of triangulation from several GPS satellites, it is possible to determine your position on the ground very accurately.

GPS works everywhere on earth, 24 hours a day, making it an ideal technology for use in agriculture.

How accurate is GPS?

Depending on the exact time of day and the number of GPS satellites available, a position generated from an uncorrected GPS receiver may be 40 feet from truth, although most positions are within 15 feet. There are several reasons for this range of values, mostly stemming from GPS signal delays in the ionosphere.

A process known as differential correction with DGPS receivers can correct for many of these errors. Differential GPS (DGPS) positions are much more accurate than regular GPS positions—DGPS accuracy is usually less than 3ft.

What is differential GPS (DGPS)?

Differential GPS positions are regular GPS positions that have been corrected for ionospheric and other errors using a process known as differential correction. Differential correction uses a GPS reference station—a GPS base station at a known location—to provide corrections for other GPS receivers that are at unknown locations (such as on a spray truck).

Differential corrections may be applied second-by-second in real time; these are known as real-time differential corrections. Differential corrections may also be stored in computer files and accessed later. For agricultural purposes, only real-time differential corrections are required.

There are many sources of differential corrections, such as:

- via a short-range radio link from a local GPS reference station
- via a medium-range radio link from maritime or land-based beacons
- via geo-stationary satellites

Geo-stationary satellites use multiple land-based reference stations to create a differential correction map over very large areas of the earth. Two of these systems, known as WAAS and EGNOS are free of charge and supported by the *Ag*GPS EZ-Guide Plus Lightbar Guidance System.

What is WAAS?

WAAS is the Wide Area Augmentation System, a source of differential corrections designed primarily for commercial aeronautical applications within the United States. However, because this system broadcasts signals from geo-stationary satellites, farmers can take advantage of this system for parallel swathing and other purposes.

WAAS is currently a fully functional test signal, due for formal release in 2003.

Information Regarding Satellite Based Augmentation Systems

Please note that Satellite Based Augmentation Systems (SBAS) are currently (& independently) under various stages of development. They are not considered fully operational yet. When the systems are considered operational, they will provide positioning to commercial and private aircraft to within several meters. The *Ag*GPS receivers can provide general positions derived from WAAS during testing periods. Positions created from these messages may occasionally be erroneous due to tests being performed; therefore under no circumstances must they be used for safety critical operations. Users should use caution when operating GPS receivers in SBAS mode.

How do I know if WAAS is available in my area?

The WAAS signal is available in the continental USA and southern Canada. Because the WAAS satellites are in equatorial orbits, reception improves the closer you are to the equator. The further north you are, the more chance that obstructions to the south of your field may block the WAAS signal, such as buildings or lines of trees.

What do I do if WAAS or EGNOS is not available in my area?

EZ-Guide Plus allows for guidance without DGPS corrections. Even without corrections EZ-Guide Plus will normally give sub-meter pass to pass accuracy due to the high performance GPS receiver design and antenna. However, guidance without corrections will not be as accurate as DGPS.

If you want to use DGPS corrections in an area without WAAS or EGNOS corrections, you can purchase the EZ-Guide Plus 50 lightbar without integrated GPS and use another *Ag*GPS receiver, such as the *Ag*GPS 132 or *Ag*GPS 252 for positions.

What other agricultural applications use GPS?

GPS is fast becoming a standard utility in the agricultural world. Some examples of other uses of GPS are:

- yield monitoring
- field mapping and scouting
- soil sampling
- aerial guidance
- high-accuracy automated steering
- variable-rate application and as-applied mapping