

# AgGPS EZ-Guide SL Lightbar Guidance System

## Frequently Asked Questions and Answers

### System Overview and Components

#### What is the AgGPS<sup>â</sup> EZ-Guide SL?

The AgGPS EZ-Guide SL is a precision guidance product, designed for farmers and growers who need a simple, affordable solution for a variety of guidance operations.

#### How does EZ-Guide work?

The AgGPS EZ-Guide SL lets you define a starting A-B line or curve for parallel swathing using GPS positions. Given the swath width of your boom, the system uses GPS to guide you along parallel or curved, evenly spaced swaths.

The directional lightbar gives you guidance feedback via 35 LEDs that indicate your cross-track error (the distance to the left or right of your swath line). The aim is to drive so that the LEDs remain centered within the lightbar; this indicates that you are driving directly down the swath.

#### What experience is needed to operate an AgGPS EZ-Guide 110?

No special experience is required to operate an AgGPS EZ-Guide SL lightbar. A concise, easy-to-read user guide and menu structure card gives simple step-by-step instructions on how to set up and use the system.

#### What operations can EZ-Guide be used for?

EZ-Guide is ideal for agricultural guidance tasks that would traditionally use foam markers, such as application spraying or lime/manure spreading. EZ-Guide is not suitable for high-accuracy operations such as bed preparation.

#### Why would I use EZ-Guide 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.

This increase in productivity allows operators of EZ-Guide to reduce farm expenses, which becomes apparent in several areas:

- Because of potential to minimize application overlap and skip, reduced amounts of application material are required.
- Because no foam is used, the recurring expenses of maintaining foam tanks are eliminated, and because the driver does not need to continually look to the side of the vehicle, 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 stops by swathing in low visibility conditions such as dust, fog, and darkness.

### **What makes EZ-Guide the best guidance package on the market today?**

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

- It is incredibly easy to install, learn, and use.
- It uses a high-end GPS smart antenna for precise positioning that is WAAS-ready for precise DGPS positions. (See “What is WAAS?”) The GPS antenna also supports satellite-based DGPS for areas not covered by WAAS.
- Trimble has a number of add-on products that allow you to expand the capabilities of your system, without costly hardware replacements.
- Its modular design means that the smart antenna is out of the way on the roof of the vehicle; the lightbar and remote keypad can be placed virtually anywhere inside the cab for driver comfort. The lightbar can even be mounted upside-down!
- Trimble has over 15 years of experience in the agriculture market, and has a comprehensive and mature product line. EZ-Guide contains the distilled essence of this product line with years of iterative development behind it.

### **What is EZ-Guide made up of?**

EZ-Guide is made up of the following items:

- An AgGPS 110 smart antenna – based on the successful AgGPS 114, the AgGPS 110 provides precise differential GPS positions using the free WAAS network or satellite providers for differential correction.

- An AgGPS 21A lightbar – provides guidance instructions using a crystal-clear LED array and 8-character display. LEDs light up to the left or right of center indicating which way to turn to keep on course. The display provides more detailed feedback as well as informational messages, and provides an interface for configuration.
- A remote keypad – small and mountable anywhere in the cab, the remote keypad can be comfortably placed for the operator's use. Six keys allow the operator to perform the various functions of EZ-Guide.
- Sonalert alarm – the optional alarm may be connected to give audible feedback to the operator during key events, such as driving too far off course and crossing an end-zone boundary.
- Documentation and cabling – simple, clear documentation on a handy reference card, plus a single cable to connect the system.

## AgGPS EZ-Guide SL Functionality

### What functionality is provided in EZ-Guide?

EZ-Guide provides the following functions:

- straight-line A-B guidance
- straight-line A+ guidance
- curved guidance
- multiple headland guidance and straight line guidance inside the headland
- a pause and resume guidance feature; while paused, the lightbar provides navigation instructions to return to the pause location.
- acreage calculation
- end zone indication via the approach LED.

### 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 on your field. EZ-Guide 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 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 will retain the previous heading so that you can keep the same orientation on both sides.

### **What is Curved Guidance?**

Curved guidance provides guidance parallel to the previous swath at the swath-width distance apart. This pattern is useful when working in an irregularly shaped 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 inside the headland area for straight parallel guidance to complete the field.

### **How does EZ-Guide calculate acreage?**

In a similar fashion to the AgGPS Parallel Swathing Option, EZ-Guide lets you define a custom area by simply driving around the outside of the field and pressing the Area button at turning points. The actual area is displayed each time the Area button is pressed, and it can be viewed later at any time.

### **Can EZ-Guide provide an adjusted area to take into account the boom width?**

Yes. In fact, the area calculation on EZ-Guide always takes into account the width of the boom by expanding the total area half of a swath width. If you want to calculate an unadjusted area, simply set the swath width to zero while you drive the area.

### **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 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 uses the edge of the headland as the end zone while you are parallel swathing. This is useful for non-rectangular fields.

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

As you leave the working area of the field, the LED turns red. Coming back in, the LED turns green once you re-enter the field.

You can also configure a headland warning distance so that the approach LED will turn orange when you are this distance from leaving or entering the field.

In addition, if the alarm is connected, it will sound on crossing the end-zone boundary in both directions.

### What is the alarm used for?

The alarm is used to alert the driver of significant events while operating using EZ-Guide. The alarm will sound on the following events:

- On crossing the end-zone boundary in either direction
- During parallel guidance, on driving too far to either side of the swath (distance is configurable).
- While guidance is paused, on returning to the current swath.
- On losing differential GPS positions (configurable). What configuration items are available in EZ-Guide?

EZ-Guide comes with a small set of configurable items to fine-tune its operation:

- swath width
- the 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 granularity of the lightbar guidance feedback
- the headland approach LED warning distance and the distance off-swath at which the alarm sounds
- the forward or backward offset of the boom from the antenna
- look ahead time (in seconds), used to predict the future guidance path
- the mounting orientation (to invert the display if lightbar is mounted upside-down)
- three text display options to provide detailed feedback while driving
- snap-to-swath mode, whereby you can choose to let EZ-Guide automatically snap to the nearest swath for straight swaths (ideal for most situations) or to manually move from one swath to another for guidance feedback.
- the DGPS source
- the units of measure (US or metric)
- the language to operate the system
- a factory default option to restore default settings.

**Does EZ-Guide support WAAS for differential GPS?**

Yes, EZ-Guide supports WAAS, and is configured by default to use the WAAS signal. This means that on first use, the smart antenna will track and begin to generate WAAS-corrected DGPS positions without any configuration by the user.

**Does EZ-Guide support other differential GPS sources?**

Yes. EZ-Guide supports the OmniStar and Thales (previously Racal) satellite DGPS services. Note that as for all AgGPS products, OmniStar and Thales are chargeable subscriptions.

The AgGPS 110 smart antenna does not support beacons as a source of differential correction.

**Where should the operator mount the lightbar?**

The AgGPS EZ-Guide SL lightbar should be placed in the operator's peripheral vision. When turning, or changing swath row, the operator relies on the lightbar to get on line. Once on line, the operator picks a distant visual target and drives toward it. The operator periodically references the lightbar to correct off-track errors.

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

Yes. A pause/resume guidance function allows the operator to leave the swath row, 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 AgGPS 110 smart antenna be used for yield monitoring?**

Yes, the AgGPS 110 is pre-configured to be able to talk to yield monitors using the industry-standard NMEA format for GPS. Because the EZ-Guide cabling has a serial port, it is possible to use EZ-Guide for parallel guidance and simultaneously talk to a yield monitor or other compatible device.

**How can I configure my receiver?**

Use the AgRemote screen in the free AgGPS EZ-Map demonstration software for advanced configuration and diagnostics. For more information or to obtain a copy of the AgGPS EZ-Map demonstration software, contact your nearest Trimble Reseller.

**Upgrades for EZ-Guide**

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

### Upgrade #1: Parallel Swathing Option Plus

The Parallel Swathing Option Plus (PSO+) turns your EZ-Guide SL system into an industry-standard field information system for guidance, mapping, scouting, and sampling.

Converting EZ-Guide into a PSO+ system provides the following additional features:

- More guidance patterns, including skip N (for machines with large turning circles), center-pivot, and more.
- More headland options
- A remote display and logger with 2-line 32-character display
- 16 MB CompactFlash card for storing mapping, sampling, and scouting data
- Ability to collect application coverage maps and track logging maps (breadcrumb trails).
- A copy of ESRI ArcExplorer, allowing you to create, view, and print maps.
- Optional point/line/area upgrade to quickly record map data such as weeds, trees, fence-lines, pumps and valves. Also store multiple points for navigation.

### Upgrade #2: AgGPS EZ-Map

AgGPS EZ-Map which runs on a Pocket PC\* enhances your EZ-Guide system by providing coverage logging, mapping, and sampling functionality.

Adding AgGPS EZ-Map to EZ-Guide 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 ArcView, MapInfo, AGIS, ViewPoint, AgLink, SSToolbox, AgInfo, Agvance, SMS Basic, 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.
- Configure all AgGPS receiver settings, and monitor performance on AgGPS 110, 114, 122, 124, 132.

\*Requires user-supplied Pocket PC.

### **Upgrade #3: AgGPS 160 Portable Field Computer**

The rugged AgGPS 160 Portable Computer turns your EZ-Guide system into a productive field management system, with enhanced guidance, field mapping, soil sampling and data logging capabilities.

Adding the AgGPS 160 to EZ-Guide provides:

- All the features of AgGPS EZ-Map, as described above.
- Enhanced guidance options such as center-pivot, racetracks and more.
- 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 AgGPS 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 ArcView, AGIS, AgLink, SSToolbox, AgInfo, AgvanceSMS Basic and Patchwork Office.\*
- Save time with work orders, which allow operators to easily select predefined jobs.
- Monochrome graphical display with full alphanumeric keypad, viewable in direct sunlight.

\*Requires AgGPS 160 Variable Rate Option.

#### Upgrade #4: AgGPS 170 Field Computer

The AgGPS 170 Field Computer turns your EZ-Guide 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 AgGPS 170 to EZ-Guide provides the following additional features:

- All the added features of the AgGPS 160, as described above.
- Full-color graphical 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.

#### 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 a 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 can correct for many of these errors. Differential GPS (DGPS) positions are more accurate than regular GPS positions, usually less than 3 feet static HRMS and 4-12 inches RMS 15 min pass-to-pass accuracy for a GPS receiver such as the AgGPS 110 using at least 5 satellites, PDOP = 6, SNR = 6, Elev Mask = 8.

It is important to note that GPS errors are slow to change over time. For agricultural purposes, DGPS is recommended, however because guidance is relative to your A-B line (not tied to fixed points on the earth), even regular GPS can produce acceptable results for guidance.

### 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 station that has a well-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. One of these systems, known as WAAS is free of charge and supported by the AgGPS EZ-Guide SL 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 AgGPS receivers can provide general positions derived from WAAS during testing periods. Positions created from these messages may 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 conterminous 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 is not available in my area?

EZ-Guide also supports satellite-based differential corrections. Two service providers, OmniStar and Thales (formerly Racal) sell subscriptions for their worldwide differential services.

### 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 auto-guidance
- variable-rate application and as-applied mapping



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