Z-Xtreme™ Features and Benefits

1. SCOPE

This document is for use by anyone who is buying or selling Ashtech Z-Xtreme surveying systems. The document describes the important features of the Z-Xtreme product and how these features, when applied to user needs, result in value for the buyer of GPS surveying systems. This document focuses on answering the following primary buyer questions in plain English.

- Why should I buy this system?
- What will the features of the system do for me?
- What factors should I consider before making a buying decision?

2. GPS Receiver

The GPS receiver is the physical device that tracks the satellites and computes positions. The receiver is the core of a GPS surveying system. Typical GPS receiver components include batteries, memory, serial ports and display. Typical accessories supplied with a precision GPS system include; cables, GPS antennas, data collectors and radios. Important features of the Z-Xtreme receiver are detailed below.

2.1. Satellite Tracking

Satellite tracking is a critical function of a precision GPS receiver. The relationship is similar to a total station and prism, if you can't track a satellite, you can't make measurements with it. Most of the time 5to11 GPS satellites will be available. To achieve survey accuracy (1-2 cm) the GPS receiver generally needs to be tracking at least 5 satellites above 10º. Obstructions such as buildings, can totally block satellite signal but trees may only partially block the signal. It is very important for the GPS receiver to be able to track satellites whenever possible --even when some satellites are coming through the trees. Depending on overall satellite availability, it may mean the difference between standing around and getting work done. The Z-Xtreme has excellent satellite tracking capabilities.

Feature
The receiver has 12 independent channels that track all commercially available observables (L1 CA Code, L1 Carrier Phase, L1 P-Code, L2 Carrier Phase, and L2 P-Code) from all GPS satellites in view.
Benefit

Z-Xtreme takes full advantage of up to 12 available GPS satellites. Some brands play games with the channel number. You might see 18 channels from one particular brand. What they are saying is they have 9 channels that track L1 observables and 9 channels that track L2 observables. Really, they can only track 9 GPS satellites at the same time. You might see 24 channels from another brand. They have 12 parallel channels but they break out the individual L1 and L2 observables and call it 24. Some receiver manufacturers build in 20 or more parallel channels, but with only 5 to11 GPS satellites available at any time, why pay for more channels than you will use?

Feature
The Z-Xtreme uses the patented Ashtech Z-Tracking technique to track the L2 P-Code even under DOD encryption.
Benefit
The P-Code is an important part of determining the carrier phase ambiguity, needed for real-time centimeter level positions. The P-code is encrypted by the US government. All GPS manufacturers have clever ways of tracking the encrypted P-code, but Ashtech Z-tracking™ has long been acknowledged as the best way to do it. The resultant satellite signal processed in the receiver is stronger. Think of it like audible static in a radio broadcast. Z-tracking is cleaner than other tracking methods, which enables faster RTK initializations and shorter occupation times for GPS baselines.

Feature
The satellite signal processing hardware features dual-bit analog to digital conversion.
Benefit
The benefit of this complicated feature is very straightforward. The satellite signal processed by the Z-Xtreme is more resistant to jamming. For example, interference from overhead power-lines or high power radio transmitters can be a problem for some receivers, but this will typically not be the case with the Z-Xtreme. When facing an open bid situation, a good way to show the jamming resistance of Z-Xtreme, is to request that all receivers be evaluated under high voltage power lines or next to a high power transmitter.

2.2. Power and Batteries

Feature
A single, rechargeable, Z-Xtreme battery lasts all day on a single charge.
Benefit
In the past, batteries have been one of the most troublesome parts of a GPS system. They're usually too heavy, and they run out of power too quickly. The Z-Xtreme battery weighs less than 1 lb. and it has 5.4 amp hours of capacity. This capacity coupled with the 6-watt power consumption of the Z-Xtreme means that the battery will run the receiver for nearly 10 hours at room temperature (25º C). In colder temperatures, the effective capacity is lower, but even at freezing temperatures, the battery will last over 7 hours. Some manufacturers make a big deal about power consumption but as long as the receiver battery is easy to deal with and it lasts all day, what more do you need?

Feature
The Z-Xtreme battery is removable and the battery compartment is waterproof to MIL spec 810E for wind driven rain and dust.
Benefit
The Z-Xtreme battery door is weather and dust sealed when closed. The test for MIL spec 810 includes blasting the receiver with high-pressure water nozzles from all angles for 3 hours. This is done to protect your investment when bad weather hits. The battery is removable so you don't have to haul the gear all over the place to charge the batteries.

Feature
The Z-Xtreme "smart" battery has an external capacity indicator and can also communicate its capacity information directly for display on the receiver front panel or the data collector.
Benefit
Batteries can keep the equipment running, but they can also stop you dead in your tracks if you're not careful. The Z-Xtreme developers used sophisticated "smart" lithium ion battery technology to minimize hassles and maximize system "up-time". When the battery is in the charger, a LED indicates when the battery is charged. A LED indicator on the outside of the battery itself can be used as a double-check to verify that the cell is fully charged before you leave the shop in the morning. When the cell is sealed inside the box, the battery will report its own capacity information directly to the Z-Xtreme and this information can be displayed on the front panel or the data collector in the form of power remaining percentage.

Feature
The Z-Xtreme has an external power port that can operate seamlessly with the internal battery.
Benefit
Sometimes you might want to run your Z-Xtreme for a really long time, in really frigid temperatures or maybe just run from a car battery. The Z-Xtreme has an external power port that will allow you to meet almost any power requirement. The receiver always draws power from the external port first if suitable voltage is available. If and when the receiver has to switch over to the internal battery, this switch will happen automatically, and will have no effect on the GPS tracking or data collection.

2.3. Memory

Feature
The Z-Xtreme uses an industrial grade PCMCIA Type II card for its data storage.
Benefit
This PCMCIA memory card is industrial grade, which means it can safely operate in temperatures ranging from -40C to +85C. A 16Mb size is supplied standard and upgrades up to 85 Mb are available. Z-Xtreme raw GPS data takes up less than 1Mb per 2200 epochs. That's about 3 hours at a 5 second rate and about 35min of 1-second data. A 16 Mb card gives you over 9 hours of 1 second data. Some GPS equipment bids call out large numbers like 85 or 96 Mb—that's a lot of data! Why pay for memory you don't need?

Feature
The Z-Xtreme memory card is easily installed behind a hard door with a locking mechanism that seals the compartment from water and dust.
Benefit
Sometimes data can be large, even as large as 85 megabytes! The Z-Xtreme was designed so that the data card can be easily removed, and downloaded through a PC card socket on a PC. The data transfer is more than 10 times faster than downloading through a serial port. When the PC card is installed, it is protected from rain and dust (MIL spec 810E, wind driven rain and dust) in the Z-Xtreme's secure compartment next to the internal battery.

2.4. Physical and Environmental

Feature
The Z-Xtreme housing is built to be waterproof (MIL-spec 810E for wind driven rain and dust) and resistant to impacts.
Benefit
The term waterproof is sometimes used loosely, but the Z-Xtreme can back up this statement. The Z-Xtreme was blasted with high-pressure water jets for three hours to verify that a rainstorm won't shut you down. The Z-Xtreme can be carried in a backpack or mounted on a pole so it was designed with the abuses of fieldwork in mind. A tough, rigid plastic shell is designed to protect the electronics from incidental drops or being bounced around in the back of a work vehicle.

2.4.1. Operational Interface

Feature
The Z-Xtreme has an integrated control interface that lets you perform static surveys without an external data collector.
Benefit
Handheld data collectors are necessary for some GPS surveying tasks but they come at a price. Static control surveys are an important way to keep GPS receivers in the field and making money. Not having to buy data collectors for this application translates to more profitability. The Z-Xtreme front panel interface is all you need to set antenna height, site ID, recording interval, and manipulate data files. Static surveys are a snap with Z-Xtreme

using the quick reference card stored in a slot on the underside of the receiver. The laminated card gives you all the steps for performing a static survey with the front panel menus. Now you can have more confidence sending minimally trained people out to do data collection—just make sure they can set up a tripod!

Feature
The Z-Xtreme has an integrated control interface that lets you perform post-processed kinematic surveys without an external controller.
Benefit
To add a real boost to a ZX-Solutions™ system, try using the pole mounted Z-Xtreme for collecting post-processed kinematic data. Mount the Z-Xtreme on the pole so the display is readable and the buttons are accessible. Use the laminated quick reference card stored in the receiver housing to get the receiver menus set-up for the kinematic data collection. The receiver should collect data at a 1-2 second rate and each point can be occupied for as little as 2 epochs. After everything's set-up its basically one button – one point. The Z-Xtreme will auto-increment the site ID for each new point. It's never been easier or more productive to pick-up centimeter level topo points – all without a data collector. How many points can you collect in a day?

Feature
The Z-Xtreme has an integrated control interface that lets you set up a RTK base without an external controller.
Benefit
Have you ever had to worry about transporting the data collector back and forth between the RTK base and the RTK rover during setup? Whether you are setting up the base on a known point or creating your own local system, the Z-Xtreme front panel display removes the need for a data collector to be present at the RTK base. Leave the data collector where it belongs --with the rover. The RTK base quick reference card stowed in a slot on the underside of the receiver provides step by step set-up instructions so even a relative beginner can have the system up and running in minutes.

Feature
The Z-Xtreme has mission critical status information available on its front panel display.
Benefit
The Z-Xtreme's front panel was designed to make GPS data collection easier and more mistake-proof. GPS static data collection is pretty easy but anyone who has done this kind of work for a while, has experienced a blunder. The field person may come back to the office with no antenna height, or worse yet, no data! Blunders are a part of human nature and they are never painless. The Z-Xtreme front panel is designed to minimize blunders. For the most inexperienced user, they can simply plug everything in and power up the receiver. If something is wrong with the set-up, like bad antenna cable connection or low battery, the receiver will start beeping and display a text warning. Once everything is powered up, the memory LED on the front of the box blinks green every time an epoch of GPS data is stored on the memory card. As long as the memory LED keeps blinking green, there will be data to process at the end of the day. During post-processed kinematic data collections, the satellite LED will tell the user if they have enough satellites to achieve a centimeter level solution.

When doing RTK surveys, sometimes troubleshooting radios can eat up your valuable time. With the Z-Xtreme "smart" radio LED, you'll know if you are picking up RTK messages from the base. If everything is setup correctly, Instant-RTK™ will probably be initialized by the time you get back to the data collector position screen.

Feature
The Z-Xtreme has advanced status information available on its front panel display for more experienced users.
Benefit
The following additional status information is available via the front panel display: • receiver mode • the number of satellites tracked and used to compute a position • satellite geometry (DOP) • available data memory • available internal battery power • serial port communication rate • data file names and sizes

2.5. Hardware Interface

Feature
The Z-Xtreme receiver has three independent, external full-duplex serial ports, each with 12VDC power.
Benefit
The Z-Xtreme is designed to be able to interface with external devices used in conjunction with data collection, processing and RTK. The serial ports are all full-duplex RS232 with a maximum speed of 115200 baud. This is just a fancy way of saying the serial ports support fast two-way traffic and each port is capable of powering the device plugged into it. Some GPS receivers have two ports, some have four or more. How many ports are needed for your application? For RTK rover work, one port is for the data collector and another port is for the data radio. It's possible you might need one more for some other additional device, so the most you should need is three. Sealed connectors are pricey, so why pay any more than you have to?

Feature
The Z-Xtreme housing has flanges for mounting to a pole and has a storage area for quick reference cards.
Benefit
The Z-Xtreme has ears! Not the kind of ears that hear, but the kind that provide sockets for mounting the unit to a range pole. The idea of mounting the RTK rover entirely to a pole is not new, almost all GPS manufacturers offer this system configuration. Some brands put the most of the weight at the top of the range pole, but that tends to make the system awkward to carry from point to point. The weight of the Z-Xtreme pole system is evenly distributed so it's easier to move and carry. When will other

manufacturers take the weight off the top of the pole and start doing it our way?

Quick reference cards are a good way to teach, or re-teach yourself how the Z-Xtreme buttons and menus work. The information on the card is a big help, but it doesn't matter if the cards get lost or left back at the shop, so we designed convenient card carrier in the underside of the receiver. The system is supplied with three different cards, one for static surveying, one for post-processed kinematic surveying, and one for setting up a RTK base. Each of the cards has a full menu map in addition to the application specific instructions.

2.6. Operational Capabilities

Feature
Z-Xtreme features an advanced RTK ambiguity resolution technique called Instant-RTK™
Benefit
Real-time kinematic (RTK) is a GPS industry convention meaning GPS centimeter level position solutions in real-time. Ambiguity resolution is the statistical process of determining centimeter level positions from the GPS carrier phase. This process takes some amount of time depending on the quality of the GPS equipment and the satellite environment. The concept of RTK is somewhat similar to post-processing GPS raw data, but instead of having all the data stored on your computer, GPS measurements are transmitted by wireless modem from the base to the rover second by second. Data is received and processed at the rover second by second. GPS post-processing has the advantage of looking at all the data at once; like trying to determine which point has a blunder in a closed traverse. RTK processing is more demanding; it's kind of like staking out a point with a theodolite. You stand about where you think the point is and the instrument person tells you how far away you are. Through several iterations you zero in on where the stake is supposed to go. When working with an optical instrument, having an experienced crew with good communication can be the difference between staking 100 points and staking 200. When using Z-Xtreme with Instant-RTK™, it's like you've got world-class GPS scientists and engineers working in your survey crew to "zero-in" on the centimeter solutions in a matter of seconds. GPS Real-time kinematic is the most productive way for a single person to do stake-out, but there are still some cumbersome aspects of conventional RTK. With Instant-RTK, you can let go of some of the time consuming habits, dictated by older generation GPS systems, such as carefully carrying the antenna upright when you travel from point to point. It's OK to carry the Z-Xtreme pole system horizontal on your shoulder when you walk and it's OK to lose track of the satellites. When you get to your next point, you'll probably be re-initialized before you can plumb the pole. Some RTK users have clever apparatus for vehicle mounting the rover antenna so they don't lose initialization when they travel between points. With Instant-RTK, it's OK to power the unit down and lay it in the back of the truck. When you get to the next site or the next point, turn the Z-Xtreme back on and you'll usually re-gain your initialization before you're ready to log

the point. Instant-RTK™ can change the way you think about GPS RTK.

Feature
The Z-Xtreme can record GPS data as fast as once every 0.1 second and it can output many common RTK data formats.
Benefit
Most brands of survey grade GPS receivers will record data and output RTK messages. The truth is that 1-second data is probably the fastest data-recording rate a surveyor will need. The Z-Xtreme can record ten times that rate if you like to move fast. RTK messages come in different flavors. Most manufacturers including Magellan, support their own proprietary messages and a common standard format called RTCM 2.2. As long as GPS manufacturers stay with the standard format, RTCM 2.2 enables different brands of GPS receivers to operate together. Just because Z-Xtreme and other brands are interoperable doesn't mean that you would want to mix them. The Instant-RTK™ feature of the Z-Xtreme only works with other Z-Xtremes. If you are considering other brands of GPS and fast reliable RTK initialization is important to your application, insist on a head to head demonstration before you buy.

3. GPS Antenna

Feature
Z-Xtreme surveying systems are supplied with a rugged, geodetic quality dual frequency GPS antenna called the Geodetic IV. A multi-path resistant removable ground plane is available as an option for more demanding high precision work.
Benefit
The GPS antenna is not the most important part of a system, but it shouldn't be the weak link either. The Geodetic IV antenna, which is supplied with Z-Xtreme systems, is engineered to be physically durable and completely water proof. The unit can survive being attached to a 2.0 m range pole that has been tipped over onto concrete or being submersed 1 m in hot water for 30 min. At Magellan we believe a survey grade GPS antenna is a serious tool and shouldn't look and feel like a toy. Multipath is a constant consideration in precise GPS surveying, so we engineered a 16" diameter ground plane for use with the Geodetic IV. This ground plane is removable and packable in its own padded carry case. The Geodetic IV antenna has about 38 dB of gain. Other GPS brands may have antennas more or less gain but the 38dB gain value is optimized for the Z-Xtreme receiver.

4. Surveying Systems

The receiver is the core of GPS surveying but it's the system of backpacks, poles, cables, brackets and such that enables the technology to be applied to real work. In the early days of GPS surveying, customers were so exited about the productivity gains, that they were willing to ignore the weight, size and complexity of the systems. Now that the technology has been around for 10 years or so, no one needs to be convinced about the

productivity of GPS. In today's market, customers are looking for systems that are more user friendly, efficient, and have less cost of ownership. Ashtech Z-Xtreme Ashtech ZX-Solutions™ and ZX-SuperStations™ surveying systems are designed to be easy to learn, easy to use on the job, and the most cost-effective path to professional quality results.

The ZX-Solutions™ system is designed for customers/users who want the power of Dual frequency GPS for control surveys or for post-processes kinematic, with full upgrade ability to RTK. System designers looked closely at what equipment is needed to get this work done, and what equipment that most surveyors already have. The philosophy was to streamline the equipment supplied standard with the kit, and pass that value on to the customer.

The ZX-SuperStation™ system is designed for customers/users who want fast, reliable, centimeter level positions in real-time, while minimizing complexity of operation and cost of ownership. System designers have included industry leading data collectors and data radios into the systems to ensure customers have top quality peripherals to go along with the premium technology of the Z-Xtreme.

Feature
ZX-Solutions™ systems are packaged to enable high precision static and kinematic GPS data collection and post-processing. The system is designed to provide maximum productivity with a minimum amount of cost and complexity.
Benefit
The ZX-Solutions system includes a Z-Xtreme receiver, a Geodetic IV antenna two copies of Ashtech Solutions software, batteries, cables and other parts needed for static data collection in a high impact plastic carry case. The configuration is optimized for post-process work and the only thing not included in the standard setup are tripod and tribrach but those are available as options. An optional kinematic kit can be added to enhance stop-and-go kinematic data collection. System accuracies for the ZX-Solutions configurations are: **Static Survey Accuracy** • Horizontal RMS: 5mm + 1ppm (times baseline length) • Vertical RMS: 10mm + 1ppm (times baseline length) **Kinematic Survey Accuracy** • Horizontal RMS: 1cm + 1ppm (times baseline length) • Vertical RMS: 2cm + 1ppm (times baseline length)

Feature
ZX-SuperStation™ systems are packaged to enable high precision RTK surveying. The system is designed maximize centimeter solution "up time" and minimize, size weight and complexity.
Benefit
Dual frequency GPS RTK systems are purchased to provide positions on the ground with centimeter level accuracy in real-time. Once a GPS surveying system is purchased, it is crucial that the system be put to work so it can start paying for itself. The Ashtech ZX-SuperStation is designed and packaged to provide the fastest path to centimeter

solutions. The system is shipped from the Magellan factory in a field ready configuration with the cables plugged in, so it's easy to see where everything belongs. The RTK base and rover configurations come packed neatly in individual boxes, so there's no confusion about where parts are stored. Documentation and manuals are delivered in a separate box within the main box, to help keep the paper materials and software discs from getting damaged or lost.

Once the batteries are charged and installed, the system is ready for operation. The base and rover kits both come with padded carry cases inside hard shell shipping cases so you don't have to worry about the gear in the back of the truck on that rough, dirt road to the job site. The ZX-SuperStation is loaded with features to supercharge your productivity, and raise your expectations of what a GPS system should be.

Power up the Z-Xtremes, plug in the GPS and radio antennas, then start up the Pacific Crest data radios which come pre-programmed to the same channel from the factory. Configure the RTK base using the Z-Xtreme front panel with help from the convenient quick reference card. Finally, start the TDS Ranger with Survey Pro CE software and set-up the RTK rover. By the time you return to the solution screen Instant-RTK™ will typically have your first initialized RTK solution. After the system has been used, it is designed to be "powered-down and put-away", in other words, most of the cable connections are put away intact. The next time you set up the system it shouldn't take more than five minutes. ZX-SuperStation system design focuses on efficient work flow and the Z-Xtreme receiver with Instant-RTK provides extra productivity boost throughout the day. When competitive bidding situations come up involving other GPS manufacturers, insist on a head to head field demonstration of ZX-SuperStation RTK and submittal of itemized price quotes before the buying decision is made.

Real-Time Carrier Phase Differential Accuracy

- Horizontal RMS: 1cm + 2ppm (times baseline length)
- Vertical RMS: 2cm + 2ppm (times baseline length)

5. Data Radio

Feature
ZX-SuperStation systems are supplied standard with state-of-the-art Pacific Crest PDL data radios. PDL Rover radio is available installed inside the Z-Xtreme or as a rugged external unit.
Benefit
Radios are a critical part of the RTK system. Magellan is committed to bringing customers the best performing, easiest to use radios available so Pacific Crest PDL radios are a standard part of the ZX-SuperStation system. Since 1997 Ashtech brand products have set the standard for GPS receiver and radio integration. UHF or spread spectrum radios can be internal or external to the receiver. PDL radios, which replaced Pacific Crest's earlier RFM96 model, have important performance enhancements. The over the air link rate is twice as fast, and the radios have cleaner circuitry for better range. The radios also have a button on the outside of the unit to change channels. PDL base radios can be used at 2 Watts (unlicensed in the US) or at 35 Watts (requires a

license).

6. Data Collector

Feature
ZX-SuperStation systems come standard with TDS Rangers equipped with Survey Pro CE.
Benefit
Data collectors are an essential part of RTK rover setup and operation. The TDS Ranger data collector is tough, waterproof and it runs for 40 hours on a single battery charge. The hardware is rock solid, but the software running on the data collector is the main human-machine interface. It's what you work with the most, so it's got to be good. Ashtech products have been integrated with TDS survey pro for many years, and we have a long history of working closely together. The result of this long-term working relationship is the seamless interaction between the user, the GPS receiver and the optical instrument. TDS Survey Pro allows many new GPS system users, to leverage their familiarity with the TDS software. For new users, TDS Survey Pro CE offers an intuitive touch screen windows interface, well thought out workflow design coupled with a feature-rich PC software. Magellan has worked very closely with TDS to make sure the GPS functionality is the best it can be for Z-Xtreme. Magellan is committed to providing leading edge data collector in order to minimize the time between unpacking the system and making money with it. In a competitive bidding situation with other GPS manufacturers, insist on seeing a functional demo and a feature comparison to TDS Ranger with Survey Pro CE before buying decisions are made.

7. Post-Processed Survey Software

Feature
Ashtech Solutions processing software comes standard with both ZX-Solutions and ZX-SuperStations.
Benefit
PC software for processing GPS data is a key component of (static/kinematic) systems and an important consideration for getting the most out of your RTK system. The software should provide a straightforward path from the planning of the GPS data collection through the delivery of the finished product. Post-processing software can't do the work for you, but proven expertise in field procedures and algorithmic technology does give you the best chance to get jobs done on time and deliver professional results. Ashtech Solutions is built on the workflow design and blunder detection framework of Locus Processor, which was designed for entry level GPS surveying. Dual-Frequency processing, data editing, coordinate transformations, adjustment, file exports, and report generation functionality were enhanced to give Solutions more high-end features without unnecessarily complicating the software. Ashtech Solutions is like having an GPS consultant inside your computer.

8. User Documentation

Feature
Z-Xtreme systems are supplied with a documentation set that is well organized and tailored to your application.
Benefit
Some customer support organizations will say that the problem with manuals is that no one reads them! At Magellan, we think that if you can't get the equipment up and running without thumbing through a book an inch think, it's our problem. The Z-Xtreme manuals have a couple of important improvements from other manuals. The most commonly used information, such as data collection set-up, is contained on quick reference cards. The Z-Xtreme is provided with 3 different quick reference cards; static, kinematic and RTK base, depending on the day's application for the equipment. The second line of documentation is the application specific system guides for both post-processed data collection and RTK. These documents not only contain information on how the receiver works, but how the user should work in order to get the desired result. The third tier of documentation is the technical reference manual that fully describes all the ASCII serial commands that can be used to control the receiver through the serial ports. If you get all the way through the third tier call us, maybe we can hire you as technical support specialist?

9. Warranty

Feature
Magellan Corporation provides 1 year limited warranty covering the receiver, receiver firmware and PC software.
Benefit
Ever notice how the salesman is more attentive to your questions before the sale is made? At Magellan, we think keeping existing customers is every bit as important as getting a new ones. When evaluating your next GPS equipment purchase, ask about free customer support from a live person. Magellan provides Ashtech customer support by phone during regular business hours and also via email. When considering the bottom line price of a system, ask about access to free firmware and software maintenance updates for up to one year after the initial delivery. If you don't like hearing about a new software right after you bought the old one, you should ask about a grace period after the sale for PC software upgrades. Magellan offers a free upgrade to new releases of software within 90 days of the initial delivery. Customer support and warranty are often an afterthought when gear is purchased in a competitive situation, so investigate GPS manufacturer's policies before the purchasing decision is made.

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