EZField™

Product Technical Notes // October 2008

GNSS Data Collection Software for Centimeter Post-Processing Applications

OnPOZ® Precision Positioning

EZField™

GNSS Data Collection Software
for Centimeter Post-Processing Applications

EZField, from Effigis, is powerful yet easy-to-use survey software for recording GNSS survey data

EZField runs on mobile devices under Windows Mobile. It is used along with EZSurv GNSS Post-Processor to get the best out of your GNSS data. EZField and EZSurv are the easiest combination currently on the market for post-processing centimeter accuracy positions using GNSS-L1 receivers in semi-kinematic mode. Although designed primarily for single-frequency receivers, EZField can also be used with dual-frequency receivers in OTF mode.

EZField Key features

- Windows Mobile application
- Easy-to-use interface
- Fully integrated support for centimeter GNSS-L1 semi-kinematic operation
- Full GNSS data monitoring
- Ability to record point, line and polygon features
- Usable with single and dual frequency receivers
- Fully compatible with EZSurv post-processing software
- Multiple GNSS receivers configurations and controls

Support for All Possible Survey Modes of Operation

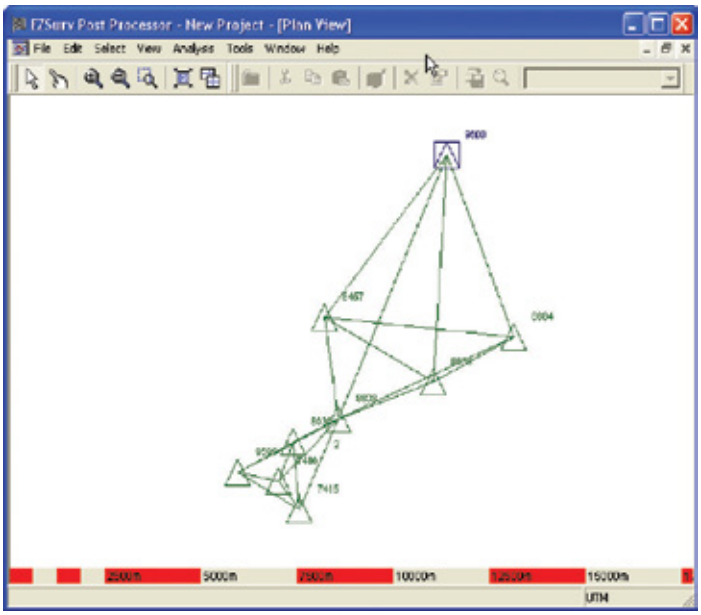
EZField supports all possible survey modes of operation. You can record data on a known location to be used as a base station to support surrounding rovers. You can record data using the static mode of operation when you establish reference sites at sub-centimeter accuracy level. With your rover units, you can use the kinematic mode of operation to collect point, line and polygon features. Finally, you can use the semi-kinematic mode of operation to compute centimeter positions while moving with your GNSS-L1 receiver.

SETTING UP A BASE STATION

These days, many base station networks are deployed in most countries. These base stations can easily be used to support submeter and sub-foot accuracy. For example, EZSurv post-processor uses an Internet connection to detect and import the closest base station data from your fieldwork location in order to start automatic processing. However, these base stations can rarely be used for centimeter accuracy using a GNSS-L1 receiver since they are not located within 10 km of your fieldwork. Consequently, EZField lets you record GNSS data in base station mode so this data can easily be imported into EZSurv and automatically recognized as valid base station data.

ESTABLISHING ACCURATE REFERENCE CONTROLS

The static mode of operation is used to establish accurate reference sites with a high level of confidence. This mode of operation is usually used when 3 or more receivers are recording simultaneously to create a network of redundant vectors. When the static mode of recording is used, data files imported into EZSurv are automatically used to compute vectors using all possible simultaneous data sets. After vector processing, a rigorous least-squares adjustment is made to the vector data set to provide the best possible coordinate set.



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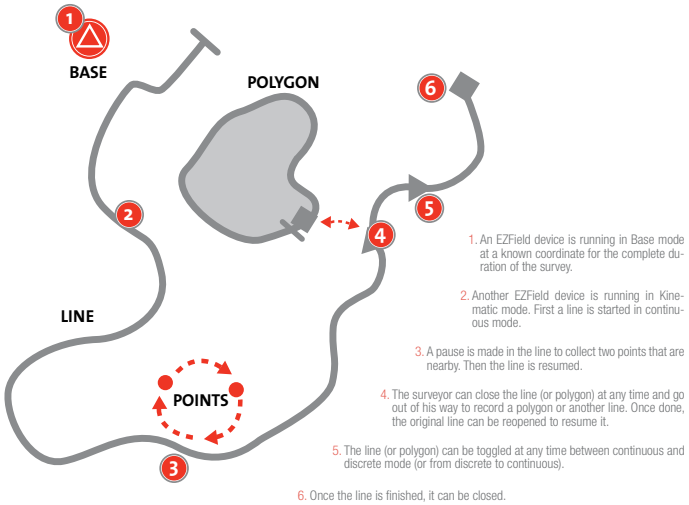
KINEMATIC MODE

The kinematic mode of operation allows users to record GNSS data while on the move. When using a GNSS-L1 receiver in a real life situation (with frequent obstructions), this will provide sub-meter or sub-foot accuracy. In kinematic mode, accuracy depends mainly on the quality of the carrier phase data. GNSS data with a lot of cycle slips (under dense canopy) will have problems generating reliable sub-meter accuracy positions. On the other hand, in some applications, where the carrier phase can keep a reliable lock on at least 5 satellites (or more) for more than 30 minutes, EZSurv will be able to output centimeter accuracy positions using an OTF-L1 algorithm without static initialization. The kinematic mode of operation can also be used with dual-frequency receivers along with EZSurv's powerful OTF L1/L2 engine that can output reliable centimeter accuracy positions.

In kinematic mode, EZField allows users to record point, line and polygon features. Lines and polygons can be paused to record nearby points. Lines and polygons can also be closed and reopened later for completion. The user interface informs you of the quality of the incoming signal (loss of phase lock, cycle slip, number of continuous recorded data items, etc.). All necessary parameters are also provided to assess satellite geometry.

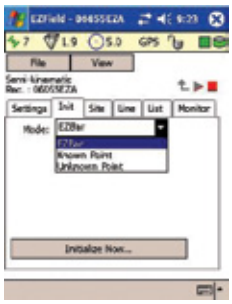
An Example of a Kinematic Survey



1. An EZField device is running in Base mode at a known coordinate for the complete duration of the survey.
2. Another EZField device is running in Kinematic mode. First a line is started in continuous mode.
3. A pause is made in the line to collect two points that are nearby. Then the line is resumed.
4. The surveyor can close the line (or polygon) at any time and go out of his way to record a polygon or another line. Once done, the original line can be reopened to resume it.
5. The line (or polygon) can be toggled at any time between continuous and discrete mode (or from discrete to continuous).
6. Once the line is finished, it can be closed.

GNSS-L1 CENTIMETER SEMI-KINEMATIC MODE

The semi-kinematic mode of operation is one of the key features of EZField. It can transform a moving GNSS-L1 receiver into a centimeter accuracy device at a fraction of the cost, compared to expensive dual-frequency systems.



The key requirement for achieving centimeter accuracy with a GNSS-L1 receiver is to initialize your survey prior to moving the antenna. Initializing a survey means determining the carrier phase ambiguities.

> Three different possibilities exist for achieving this reliably with EZField. One is to fix your roving antenna on an EZBar (initialization bar of 20 cm) for 2 minutes. The second is to set your roving antenna on a known marker (previously established by GNSS) for 2 minutes and, finally, the third is to set your roving antenna on an unknown marker for about 15 to 20 minutes depending on the Base-Rover separation (the required time to establish its precise coordinates).

Another requirement for maintaining the roving antenna's centimeter accuracy is to keep the carrier phase lock on a minimum of 5 satellites. If the lock is lost, EZField warns you to perform another initialization on the closest possible site (already visited).

EZSurv post-processing software is fully compatible with semi-kinematic files. When a base station file is imported with a semi-kinematic file, all data manipulation is done automatically to initialize the data set and provide you with the best possible solution for your roving antenna.

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The semi-kinematic mode of operation, using a GNSS-L1 receiver, could only be used with a good quality receiver, where cycle slips at the one cycle level could be detected in real-time by the receiver firmware.

EZSurv GNSS Post-Processor

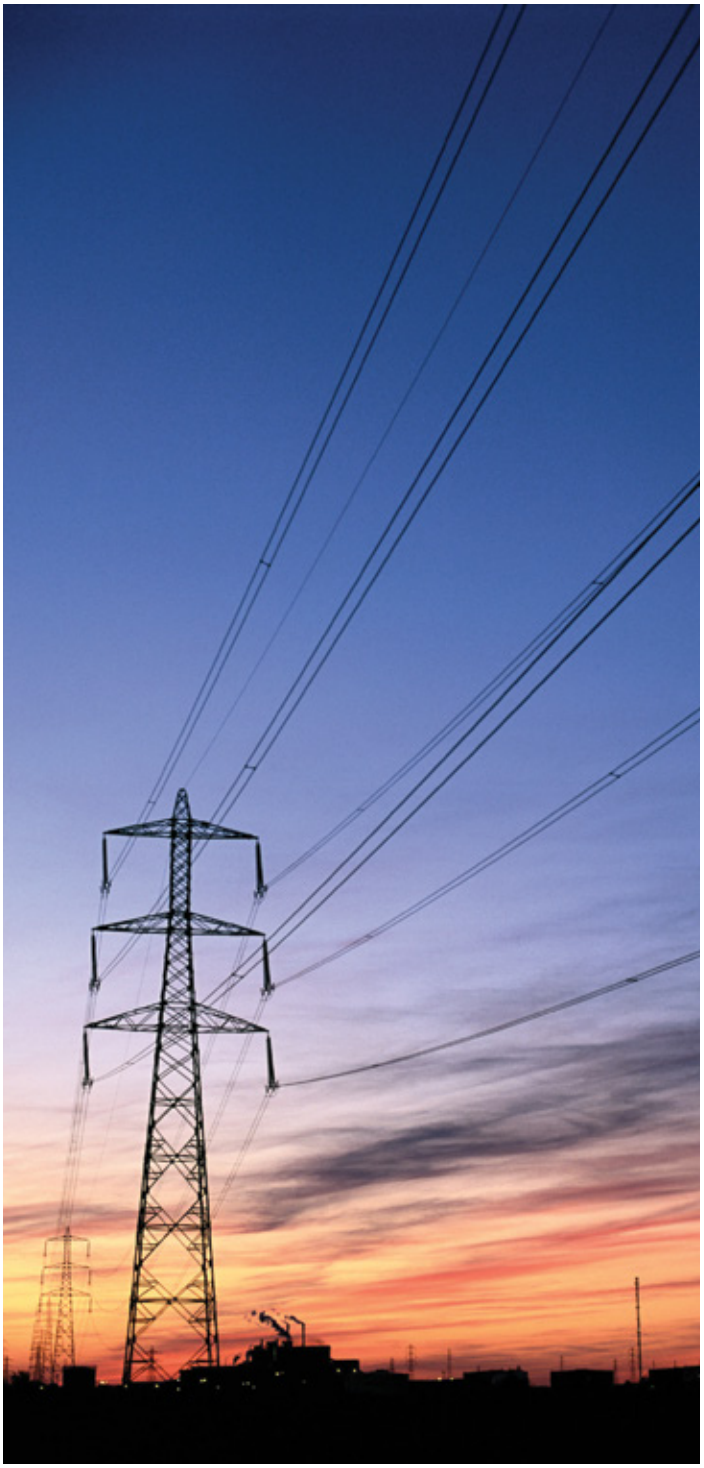
EZSurv is the companion software that easily processes raw GNSS data collected with EZField. It gives you all the flexibility you need by offering fully graphical (Plan View) and Windows Explorer (Project Manager) types of user interfaces to accommodate your preferred way of working.

The software can also be user-customized by offering a choice of manual post-processing steps or using a single keystroke to do it all in one step.

When processing your kinematic data, EZSurv can automatically search the Internet for the best GNSS base station that fits your field data. This search is performed on a number of existing GNSS networks around the world. You don't have to worry about post-processing your rover data since it's handled automatically with a single keystroke. All you need is an Internet connection. If you maintain your own GNSS network, it could be easily incorporated into the search through a LAN connection. Other networks can easily be integrated.

EZSurv uses the latest GNSS processing techniques to help you get the best accuracy out of your GNSS data. Depending on your fieldwork methodology the software will process any of the following modes:

- Static (rapid static);
- Kinematic;
- Semi-kinematic;
- OTF (for single- and dual-frequency receivers);
- PPP.



The processing engine has the following key features:

AMBIGUITY SMOOTHING

Some software allows you to use a backward process to get optimized solutions for your GNSS trajectories. EZSurv makes this task obsolete since a rigorous forward ambiguity smoothing process is used to do the same job with much less data management.

DATA INTERPOLATION

You don't have to worry about your base station's data rate since EZSurv can automatically perform a polynomial interpolation (up to 60 sec.) to fit the rate you've used in the field. Using EZSurv, you no longer have to interpolate your RINEX base station data.

EFFICIENT OUTLIER DETECTION

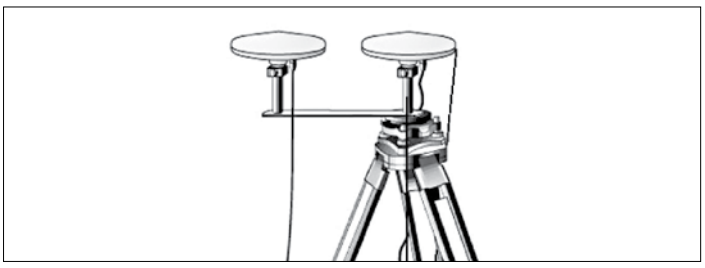
One of the key steps in data processing is the detection of bad observations that can greatly affect the quality of your results. EZSurv has efficient algorithms to detect and remove noisy data and outliers so you always get optimized results.

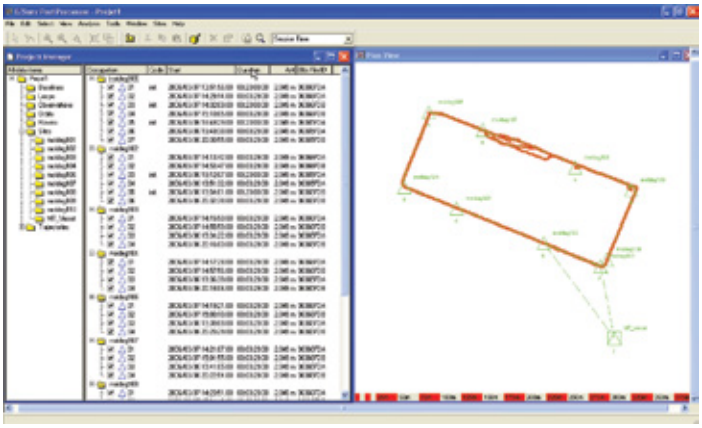
AUTOMATIC AMBIGUITY FIXING PROCESS

EZSurv relies on the well-known Lambda method to search and fix phase ambiguities, giving you a powerful tool to achieve centimeter accuracy surveys. It also has the advantage of automatically fixing solutions on the fly when your observation window is appropriate, without the need to use static sites (initialization).

FULLY ADAPTED TO PROCESS EZBAR SETUP

Any tool that can help achieve a high level of accuracy is very important for GNSS users. One of them is the EZBar setup (bar with a known fixed length), which allows you to fix phase ambiguities within less than 2 minutes when using a single frequency receiver. EZSurv automatically recognizes EZBar's file attributes during the import process so you don't have to worry about their location in your dataset.





EFFICIENT DATA SMOOTHING FOR NOISY DATA

Urban canyons and dense forest canopy are tough environments in which GNSS is often needed. To obtain acceptable results in those extreme areas, EZSurv uses a Noise Reduction System (NRS) to optimize positioning accuracy. The NRS uses Doppler and phase observations to greatly reduce the noise affecting pseudorange measurements.

NETWORK ADJUSTMENT

EZSurv's 3D network-adjustment tool allows you to choose between a fixed or weighted station type of adjustment that can be automatically or manually made in your baseline results. During manual adjustment, vectors can be included in or excluded from your network with a simple mouse-click. After adjustment, a comprehensive report is generated showing all the adjusted parameters, along with their statistical information. The plan view displays both point and baseline (relative error) ellipses and elevation error bars.

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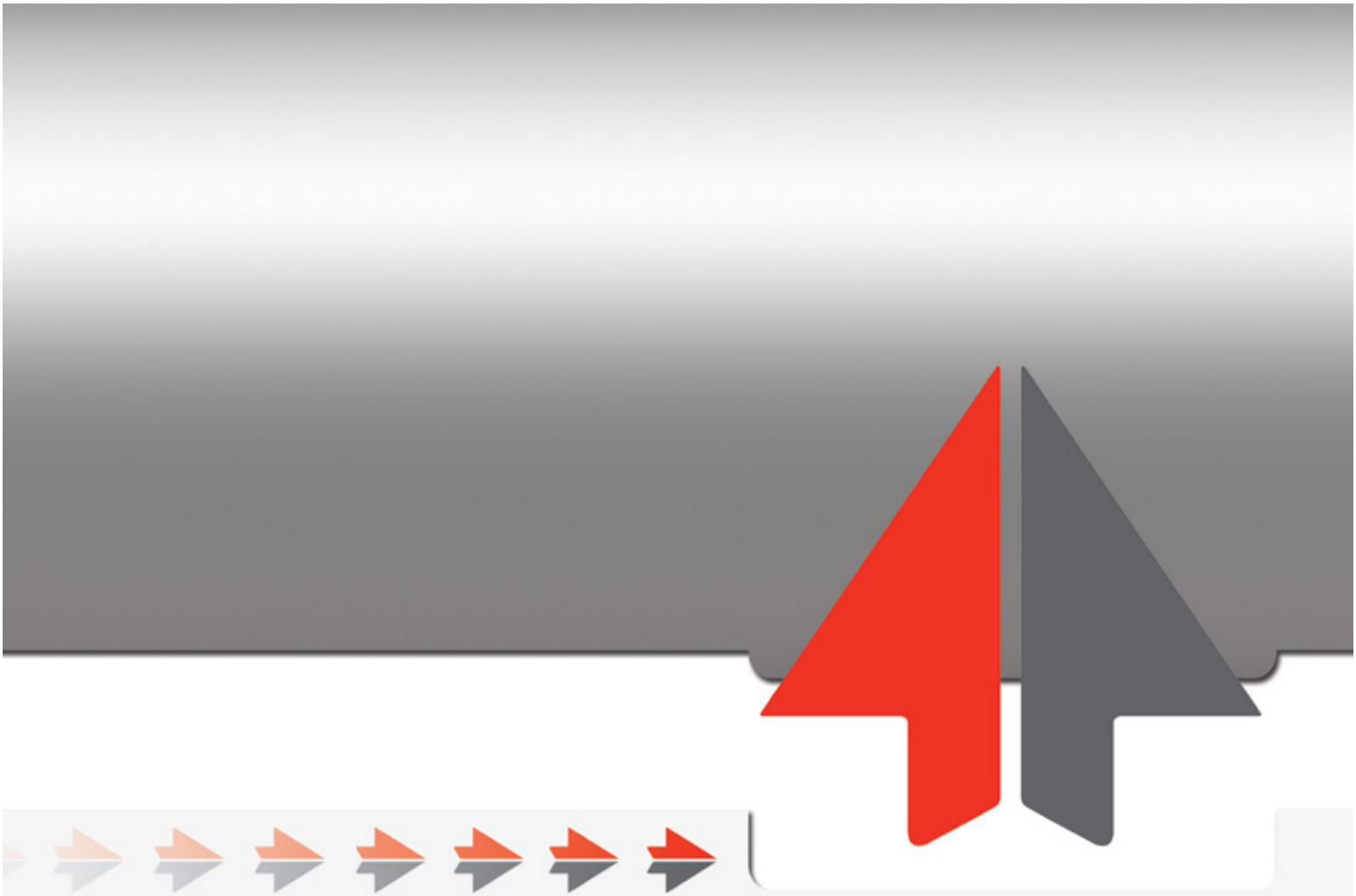
Coordinate Systems

EZField has a complete coordinate-systems interface. Over 62 standard datums and 22 standard ellipsoids are predefined. Additionally, you can create your own user-defined datums and ellipsoids. There are also over 12 different map projection templates, from which you can derive most mapping systems used around the world. The US State-Plane Coordinate System is fully supported, and local grids can be defined.

Conclusion

EZField is a proven data collection solution that transforms a low cost GNSS-L1 receiver into a powerful centimeter accuracy device. Using it along with EZSurv post-processing software, you can achieve high end results at a fraction of the cost of a dual-frequency system.



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+ 1 **514 495-0018**
+ 1 888 495-6577

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