QUICK START GUIDE TO THE TRIUMPH-LS WITH J-FIELD 2.0

Version 20160520

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Table of Contents

This ***Quick Start Guide to the TRIUMPH-LS*** contains the basic information a user new to J-Field, the field software of TRIUMPH-LS and VICTOR-LS, needs to know to get started working quickly. It is important that new users to J-Field read and understand the information in this manual before attempting to use J-Field. **To obtain good results and RTK solutions, it is most critical to understand the RTK Verification and Validation process and settings.** More information and details are provided in the ***User's Guide to the TRIUMPH-LS***. J-Field also contains its own ever-growing on-board manual with context sensitive help files for various screens. Press the hardware 

(***Help)*** button to learn more about each screen.

J-Field is rapidly being developed with new updates typically being released monthly; because of this, screenshots and features in this guide may appear differently from the latest version of J-Field. Be sure to check **www.javad.com/jgnss/** and the user forum at **http://support.javad.com** frequently to stay current on all of the breaking news and innovative developments from JAVAD GNSS. Details about new features can also be found in the ***Application Notes*** accessed from the ***Support*** menu.

Central to J-Field are four key concepts, briefly introduced here and that are discussed more fully in their respective sections:

Project - A user-defined job identifier with its own database file and folders for storing data

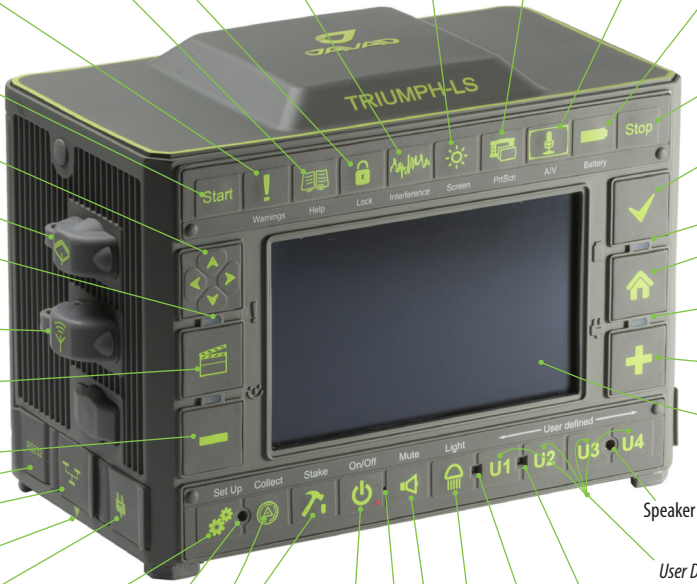
Page - Each *Project* has 10 pages that can contain points and lines and can be toggled on or off similar to CAD layers. Each *Page* has the option of having its own coordinate system.

ShapeTags - User-defined tags for points that can be assigned to create lines between points with like *ShapeTags*

Codes - Each point has a *Code* field to store commonly used point descriptions. Once a *Code* has been created, it can be recalled from the *Codes Library* or from the *Favorite Codes* list.

Anatomy - Exterior of TRIUMPH-LS

Top, Left and Front Faces



Warnings - Press when the warning LED is red to view warning messages

Help - learn more about the current screen

Lock - lock the screen to prevent accidental actions

Interference - Spectrum analyzer to check for interference in the GNSS bands

Screen - Cycle the screen to white or black backgrounds for better visibility in the sun

Print Screen - Capture a screenshot

A/V - Control sounds, volume and display

Battery - status of the battery and internal temperatures

Stop - Stop the collection of a point

Start - Start the collection of a point

Navigation buttons

External GNSS antenna port

Warning LED / Battery LED (when off and charging)

External UHF antenna port

Action - Open the *Stake Action* screen / Expand *White Box* buttons

Zoom Out / Advance to the previous page/screen

RS232 port

LAN port

Slant height measurement point

Charging port

Setup - Cycle between the *Setup* and *Advanced Setup* screens

Collect - Cycle through the collect screens

Stake - Cycle through the stake screens

Speaker

On/Off - Turn on the unit, hold down if the system is unresponsive

Built in Microphone

Mute - Mute the sound

Light - Turn on/off the flashlight

Light sensor

Proximity sensor

User Defined Buttons- Customizable to invoke desired actions / functions

Speaker

High resolution capacitance color touch screen

Zoom In / Advance to the next page/ screen

Charge Status LED

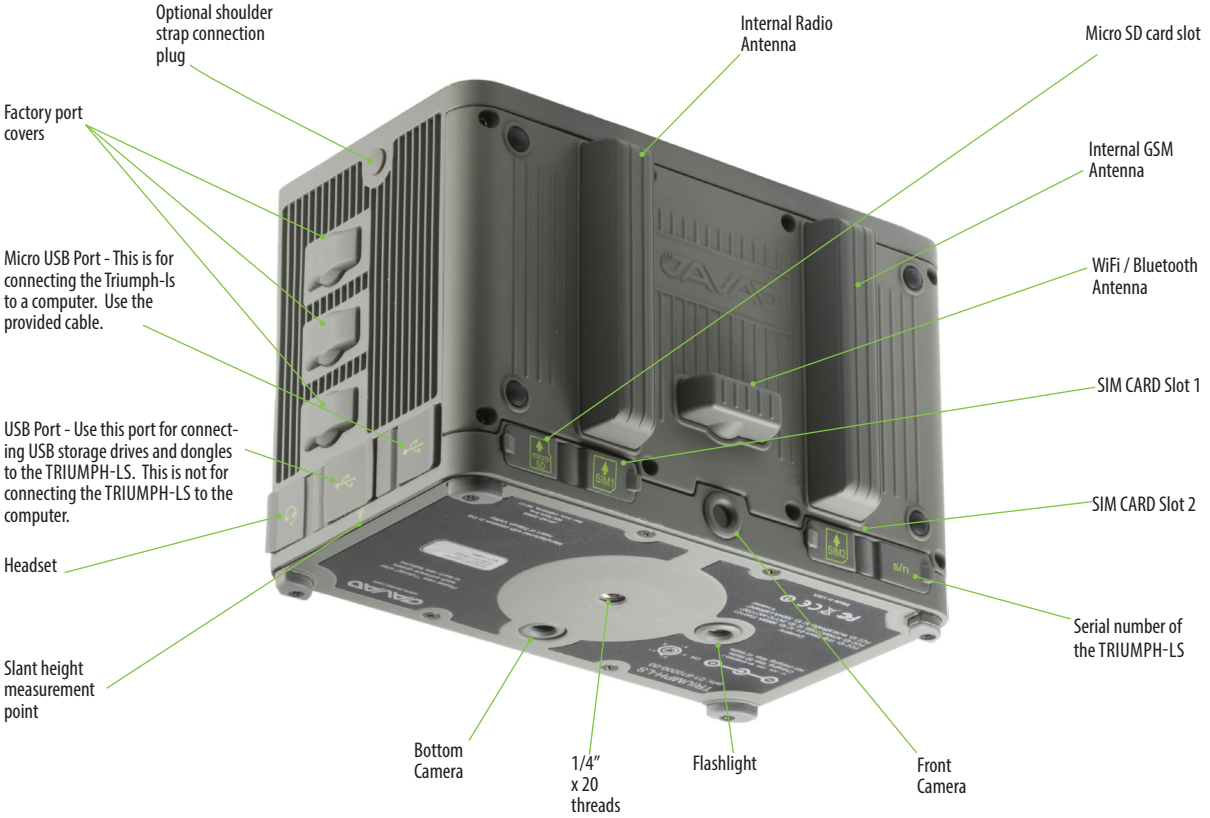
Home - Press to return to the Home screen

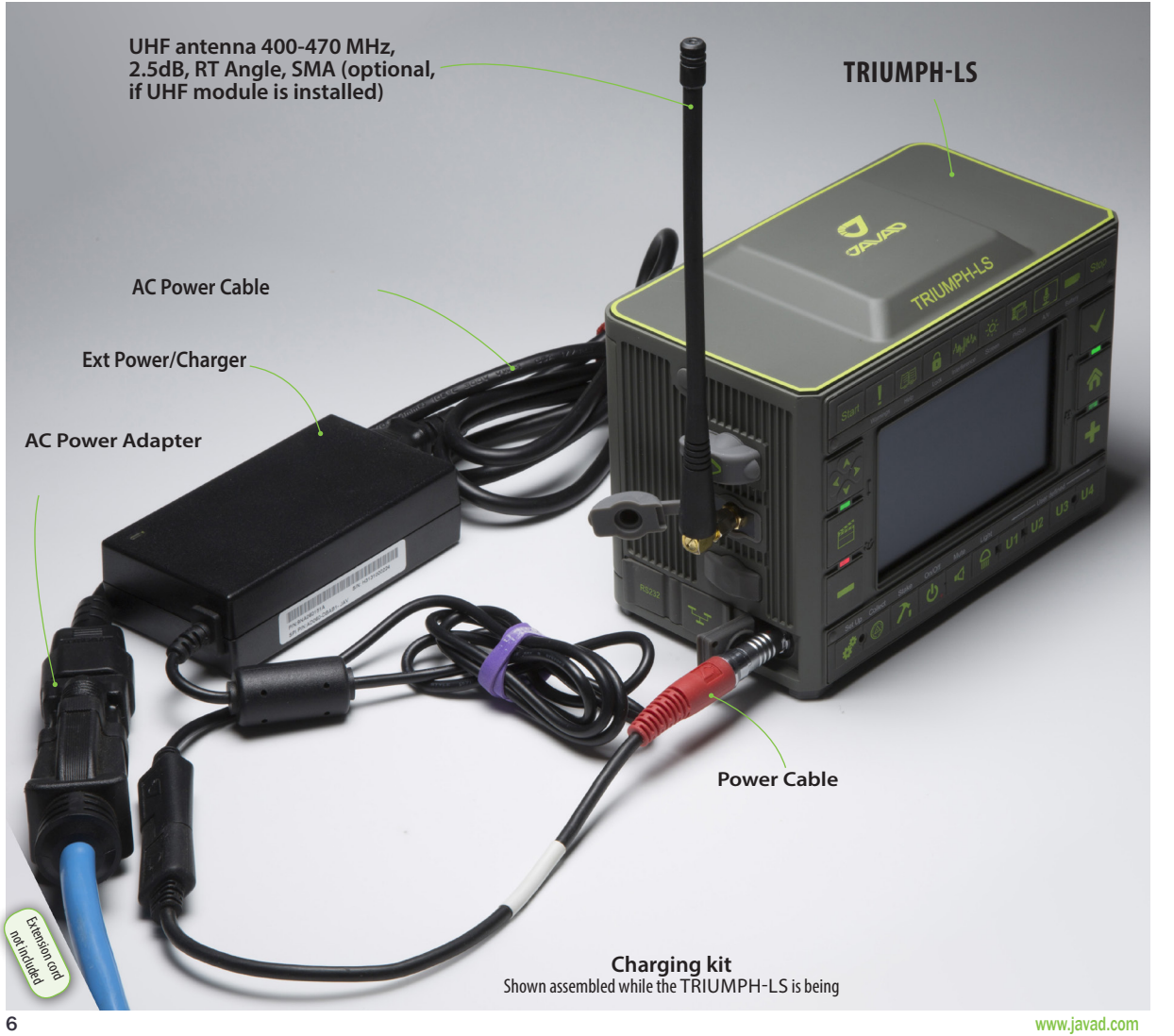
Battery status LED

Check - Used to open or select the current item/box

Anatomy - Exterior of TRIUMPH-LS

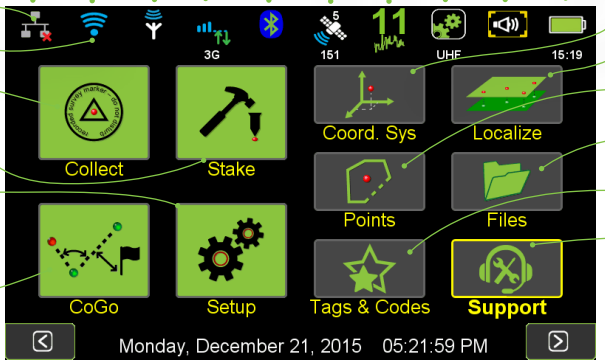
Bottom, Right and Back Faces





Charging kit
Shown assembled while the TRIUMPH-LS is being

Screen Anatomy - Home Screen 1



GNSS Interference, the numeric value is the maximum magnitude of interference among all the GNSS bands

Satellites, number of tracked satellites are shown above the icon and the Receiver Name is shown below

Setup Summary, the setup profile name is displayed below

Battery - The estimated hours : minutes of remaining battery life is shown below

Coordinate Systems - lists all the system coordinate systems, not used to set the current coordinate system

Click any icon in the top row to open its status screen

LAN

WiFi

UHF

GSM

BT

Volume

Inactive connections are gray and active connections are blue

Localize - Create localized coordinate systems

Collect - Survey points

Points -List the project points and polylines

Stake - Stake points and lines

Files - Browse the file system, import and export files

Setup - Configure the setup profiles

ShapeTags & Codes - Manage *ShapeTags*, *Codes*

Support - menu, used to request support and install updates.

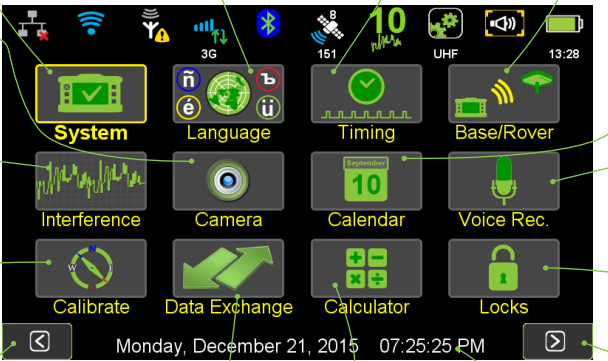
CoGo - Various CoGo Functions, DPOS and Camera Tools

Updates available

Messages Available

RAMS Connection Established

Screen Anatomy - Home Screen 2



System - Receiver details and information, etc.

Language - Specify the language

Timing - Configure clock display format, set alarms, schedule data collection

Base/Rover Setup - Start a RTK base station with a UHF or SS radio

Camera - Capture photos with the front and bottom cameras

Calendar - Manage survey projects by date

Interference - Complete GNSS spectrum analyze

Voice Recorder - Record audio notes

Calibrate - Calibration for the level and compass

Locks - Prevent inadvertent screen interactions

Previous Screen - Advance to the Home Screen 1

Data Exchange - Export / Import various data formats

Calculator - Several different calculators are available

Tap to open the *Timing* screen

Next Screen - Advance to the Home Screen 1

Charging the Batteries

The TRIUMPH-LS AND VICTOR-LS come from the factory with the batteries charged and ready to use so you can begin exploring its interface and familiarizing yourself right away while reading this manual.

Lithium Ion batteries should not and cannot be charged when their temperature is above 40° C (104° F). They charge faster when they are cool. Therefore, it's best that you turn off the unit when charging. Charging the unit when it's on will cause it to charge more slowly (up to 40° C) due to its increased temperature.

Some of the cables and their connectors used in charging the equipment may not be familiar to you. ODU style connectors are superior for a broad range of industrial power, communications and data applications that demand a precision-engineered, secure and robust solution.

When charging your receiver, be sure to line up the red dots on the connector and the charing port on the LS. Note

that the four LEDs have different meanings when the LS is on from their meanings when the unit is being charged. When the unit is on, you'll want to pay attention to the upper left LED as it alerts you of an immediate issue.

Anytime the TRIUMPH-LS displays this LED as red, press the warnings key to learn more and take any necessary corrective measures.

Help & Support

J-Field contains its own ever-growing on-board manual with context sensitive help files for various screens. Press the hardware ***Help*** button to learn more about each screen. Contact information of the Live Technical Support team members are listed in Support>Live Technical Support. You are also encouraged to submit your feedback and questions to the user's forum located at http://support.javad.com.

Turning on The TRIUMPH-LS

Powering the TRIUMPH-LS on is pretty straightforward with the underlying operating system; Windows Embedded Compact 7.0, loading first and then J-Field subsequently booting up.

There are occasions when the system might freeze. Should you experience this, simply depress the power key and hold down until the unit powers off, about 10 seconds. Any data collected up to that point will be saved.

Calibration

The TRIUMPH-LS is an advanced scientific surveying instrument. It is highly sensitive to its environment and includes a built-in magnetometer and 3-axis accelerometer.

For the visual stakeout features and the *Ahead/Back* and *Right/Left White Boxes* in the *Stake Action* screen to work correctly, the electronic compass readings need to be accurate. It is recommended to check the compass calibration before beginning work at a new location. To check the calibration, rotate the TRIUMPH-LS 360° and observe the compass readings in the *Collect* or *Stake Action* screen. There should be no twitching, quick jumps, or reversals of the displayed bearing or azimuth, just as a real compass would perform. If this is not the case, the compass needs to be recalibrated or it may not be in a suitable environment for its use. Follow the instructions on the screen to calibrate the compass. When calibrating the compass, choose an area removed from overhead power lines, parked automobiles and other ferrous materials which cause magnetic disturbance. The electronic compass works in areas that are electromagnetically uniform.

The ***Level*** calibration typically only needs to be preformed once. Follow the instructions on the screen to calibrate the level.

The level sensors are sensitive to the internal temperatures of the TRIUMPH-LS. To fine tune the level calibration, a ***Level Offset*** calibration needs to be preformed. It is located in the *Action Setup* menu. It is necessary to reperform this calibration as the internal temperature of the TRIUMPH-LS changes. If the *Correct For Tilts* option is enabled and the most accurate positions are desired, it is essential to monitor the *Level Offset* calibration and recalibrate when necessary.

The ***Camera*** needs to be calibrated if you intend to use the camera's *Visual Angle* or *Camera Offset Survey* tools. This only needs to be done once.

Updates

Keeping your TRIUMPH-LS up to date is nearly effortless; however, you do need to ensure that you have Internet access in order to download the firmware and software updates.

The TRIUMPH-LS will automatically detect nearby WiFi networks. To see the detected networks, as well as their respective signal strength, tap on the *WiFi* icon in the top row of icons on the Home screen and then at the bottom of that screen tap on Network. Select the desired access point, tap on Connect, enter the case sensitive password, if any, and the connection should be established. Once connected to a WiFi network it will be remembered and added to the Favorites and the connection to it will become automatic when it is detected.

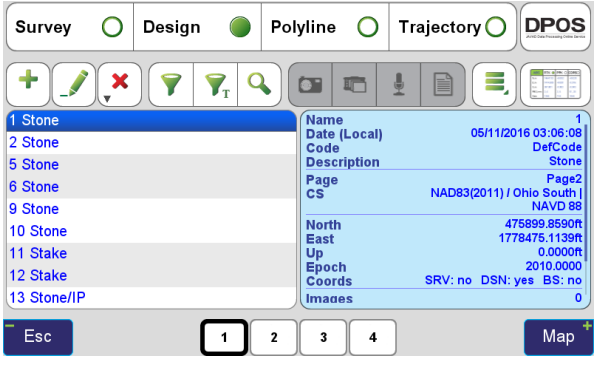
If you do not have WiFi or for some reason are unable to connect to it, but do have a wired local area network, you can connect the TRIUMPH-LS to your network using a cable connected to the LAN port and your network interface card or router. A wireless network can also be used if you have an installed SIM card data plan with sufficient data.

Once connected to the Internet, J-Field will automaticaly check for updates. The Support button will be displayed

with the update symbol (cloud and down arrow) and a sound will be played periodically when a new update is available.

Points

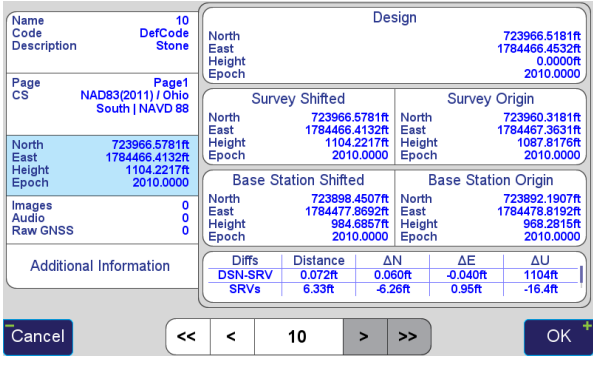
Tap on this icon to review points, alignments, trajectories in J-Field.



Points Screen Displaying Design Points

Each point record can have up to five types of coordinates that are displayed in the *Edit Points* screen:

- ***Design Coordinates*** - Imported and manually entered coordinates are populated into this field and stored in the *Project*'s database file with their native coordinate system as was selected when they were imported.
- ***Survey Coordinates*** - These are coordinates determined from GNSS observation. All surveyed points are stored with *Survey Coordinates* with WGS84 (ITRF 2008) coordinates.
- ***Base Station Coordinates*** - When a point is surveyed with RTK corrections, the base station coordinate is saved.
- ***Survey Shifted Coordinates*** - When a point's base station coordinates have been adjusted or shifted, the shifted survey coordinates are displayed along with the unadjusted survey coordinates (*Survey Origin*).
- ***Base Station Shifted Coordinates*** - When a point's base station coordinates have been adjusted or shifted, the shifted base station coordinates are displayed along with the unadjusted base station coordinates (*Base Station Origin*).



Edit Point Screen Displaying a Point with Each Type of Coordinate

In addition to these coordinate types, all post-processed DPOS and Real-Time Shifted coordinates are also stored in the database. These will be discussed more in the DPOS section of this manual.

Screen Anatomy - Points Screen

Object Type - The radio button selects which type of object is displayed in the list: Survey Points , Design Points, Polylines (and lines) or Trajectories.

Add - The add button allows new points to be added; with the Survey option selected you will be taken to the Stake Action screen.

Edit - The edit button opens the Edit Points screen (shown on the previous page) to allow the various parameters of the point to be modified.

Delete - The delete button deletes the selected object. A Long Click (tap and hold) on this button deletes all objects currently shown in the list, i.e. taking into account the general filter and name filter.

Esc - Escape to the previous screen

Filter - Filter button (see next page)

Type Filter - Type Filter button (see the following pages)

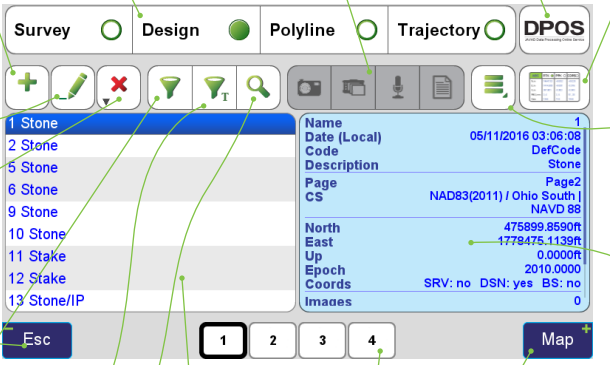
Name Filter - Name Filter button (see the following pages)

List - Point Codes and Descriptions can be displayed beside the Point Name. Formating options are found in Additional Actions>Settings>Columns>Name. Options also exist here to display icons when the point is "Shifted" and when it has "JPS" GNSS data. The "Type Filters" column option will display Solution Type, Process Type and Base Type abbreviations beside the point names.

DPOS - The DPOS button opens the DPOS screen that allows raw GNSS data to be submitted to the JAVAD Data Processing Service. Base station data can be processed with CORS data to obtain real geodetic positions and rover data can be processed with both the base station data and CORS data.

Photo, Screenshots, Audio & Notes - These buttons are active when a point has photos, screenshots, audio or notes associated with it. Tapping these buttons will preview the associated file.

Processed Point Info - This button opens the Processed Point Info screen. Here post-processed coordinates from DPOS can be compared to RTK coordinates and the desired coordinate can be selected for every point.



Additional Actions - Various additional actions are available from this menu (see following the pages).

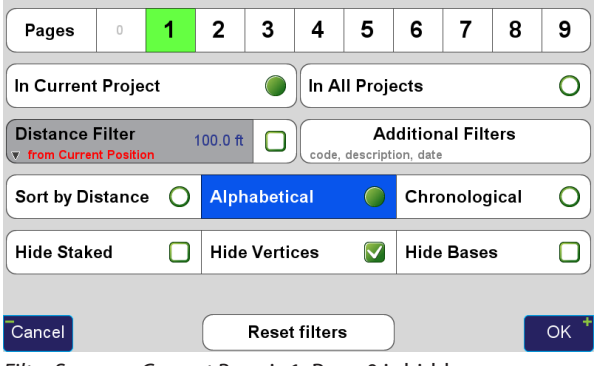
Point Information Panel - Information about the selected point is displayed here. Alternative templates for this panel are available by choosing Additional Actions>Settings>Info. The Default template is currently shown. Tapping this panel opens the Base-Rover Statistics screen.

Map- Opens the map with the currently selected point highlighted in the map

Page Numbers - Chages which page of the list to view

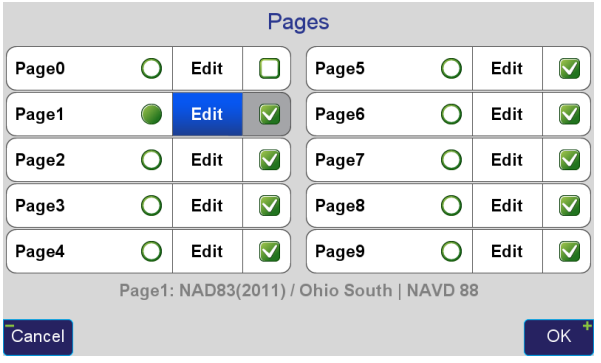
Point Filters

Points are displayed in the coordinate system of the *Current Page* in the CoGo functions and in the map. All new *Survey Points* and points created with the CoGo functions are created in the *Current Page*. The *Current Page* can be selected by tapping  (*Filter Button*) to open the *Filter* screen. The First row displays buttons for each of the 10 pages. The *Current Page* is highlighted green while visible pages are shown with bold numbers and hidden pages are shown with small gray numbers. Tap a page button to toggle it between visible and hidden. Objects in hidden pages are not display in the list of objects or on the map.



Filter Screen - *Current Page* is 1, Page 0 is hidden

The ***Pages*** screen can be open by tapping *Pages*. It displays the page names and allows it to be edited along with the coordinate system and color.

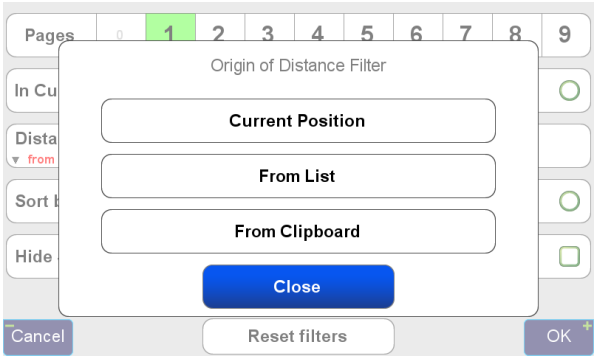


Pages Screen - *Current Page* is 1, Page 0 is hidden

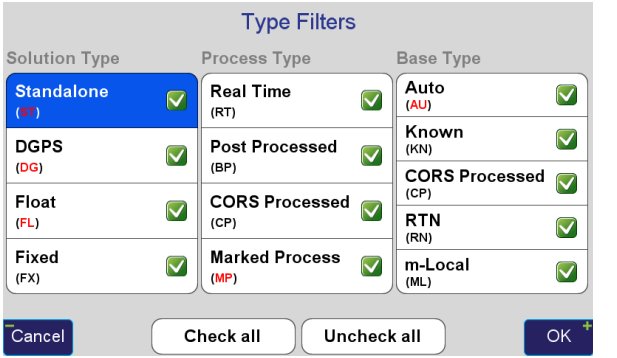
The *Current Page* is set with the toggle on the left while the visibility of *Pages* are controlled with the check box options on the right.

The ***In All Projects*** toggle will display points from all projects. This is usually not recommended as it will slow J-Field down if many points exist.

Points can be sorted in the displayed points list by ***Distance***, ***Alphabetical*** or ***Chronological***. Notice the down arrow in the corner of the *Distance Filter* button. Holding this button down will initiate a *Long Click* and present additional options for the *Distance Filter*.



Origin of Distance Filter Options



Type Filters Screen

Hide Staked hides points that have already been staked. A point is considered staked after it has been staked with a surveyed coordinate accepted for it.

Hide Vertices hides points created from imported lines from being displayed in the point's list. J-Field defines lines as connections between points so every line must have points at its vertices. For this setting to be applied the *Hide Line Vertices* option must be checked in the *Common Settings* screen when AutoCAD, DGN or Shapefiles are imported.

The  (*Type Filter*) opens the ***Type Filters*** screen. It allows points to be filter by *Solution Type*, *Processing Type* and *Base Type*.

The  (*Name Filter*) button enables/disables the name filter. When it is on, four additional fields are shown to the right: one text field and three switches captioned  ,  and  . Enter the search text in the text field and specify which switches are active (activated switches have a light blue background while deactivated switches are white):

 looks for names which begin from the search string;

 looks for names which contain the search string in the middle, but do not begin or end with it;

 looks for names which end with the search string.

Activating more than one switch combines the results:

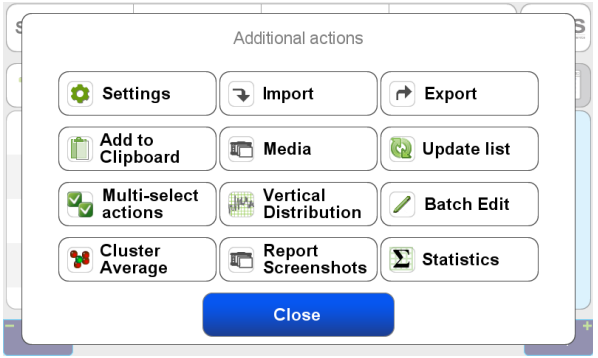
activate [... and ... searches for names which either begin with the search string or contain it in the middle.

To search for a range of numbers use the format of *number1..number2*. This format matches names which contain numbers in range between *number1* and *number2* (in the position defined by switches). E.g. if you enter *3..9* (assuming all switches are on), it will match names *3*, *Stake04a*, *Pt9*, but not names *14* or *Point19a*.

The  (*Additional Actions*) icon contains a list various options, settings and functions related to the *Points* screen. More information about the items contained in this menu can be found in each of the actions' Help screen. Of particular interest are *Settings* and *Cluster Average*.

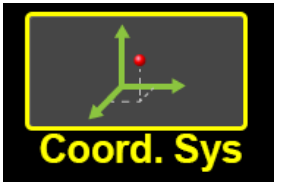
Settings has options to allow the *Point Name, Code* and *Description* to all be displayed in the left panel of the *Point* screen rather than just displaying the *Point Name*.

Cluster Average finds groups of points in a cluster and creates an averaged point from the group.



Additional Actions screen

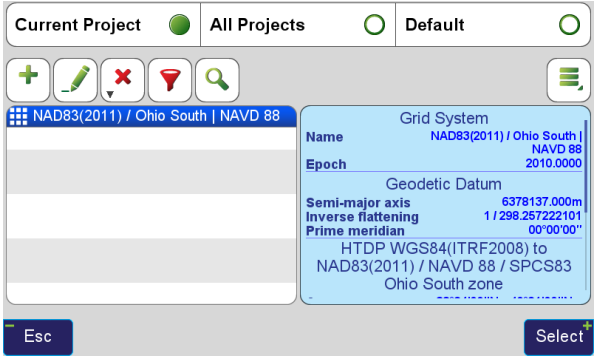
The information panel (the right blue panel) may contain more text than fits in its view. If this is the case, tap and drag the panel to scroll its contents.



Coordinate Systems

The *Coordinate Systems* screen allows you to quickly access and create new coordinate systems based on the predefined systems with just a tap on this icon.

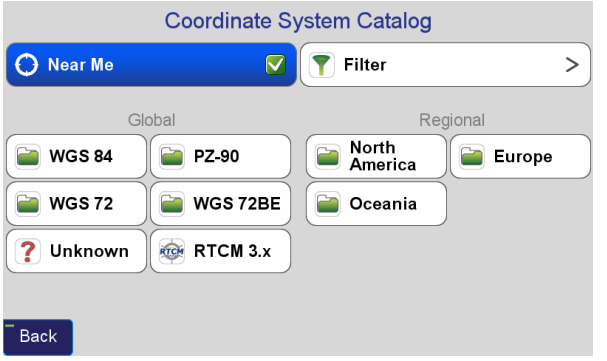
It is important to note that this screen does not set the current coordinate system for the *Project*. To change a *Project's* coordinate system choose *Project>Edit Current Project>Project Coordinate System* in the *Stake* and *Collect Prepare* screens. Each page in the *Project* can then also have separate coordinate systems, set from the *Page* and *Coordinate System* boxes in these screens.



Coordinate System Screen

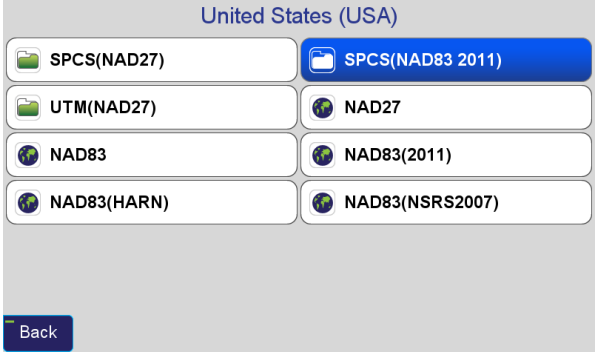
Adding a State Plane Coordinate System

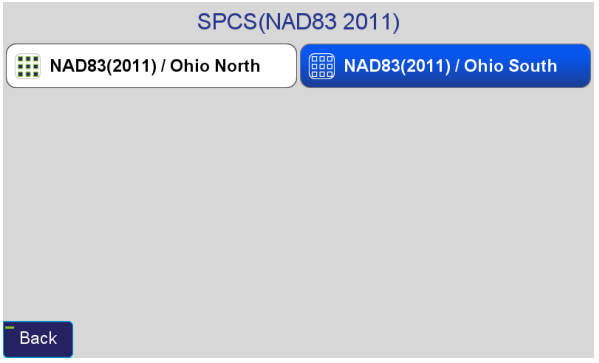
To add a new coordinate system that is currently not listed in the *Coordinate System* screen when the *All Project* button is selected at the top of the screen, tap the  (*Add*) button to open the *Coordinate System Catalog*.



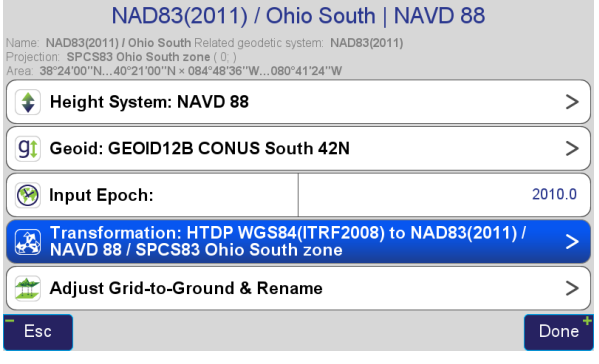
Coordinate System Catalog Screen

When selecting a Regional system for your project from the vast catalog, filter the choices to just those relative to your geographic location by checking the ***Near Me*** box. Select your Region, Country and type of coordinate system:





Select the appropriate *Height System*, *Geoid*, *Input Epoch* and *Transformation*. The typical coordinate system configurations for a US State Place Coordinate System is shown:

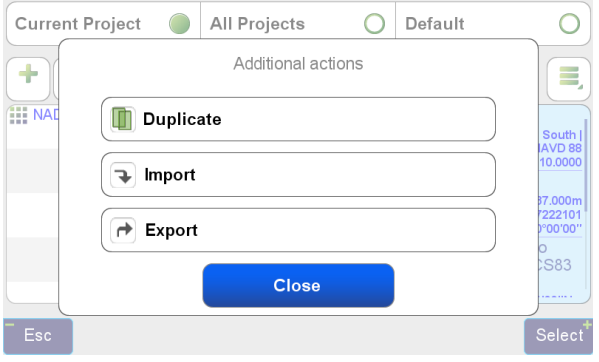


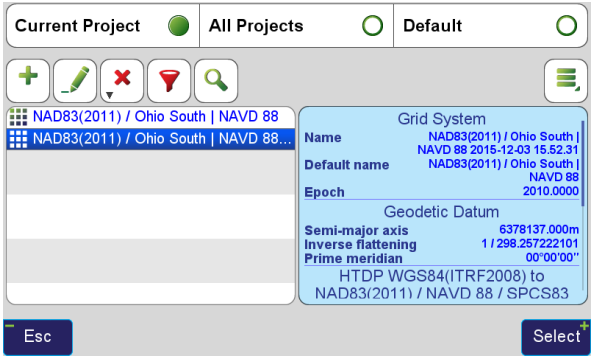
For latitudes south of 42N, "Geoid12B CONUS South 42N" should be chosen and for latitudes north of 40N, "Geoid12B CONUS North 40N" should be chosen.

It is important to remember that GNSS distances measured in State Place Coordinate Systems may not match measured ground distances exactly and typically need to be scaled to ground. For this reason you may wish to create an adjusted grid-to-ground coordinate system. Alternatively, the CoGo functions in J-Field have the ability to display and input ground distances while still working in an unmodified State Place Coordinate Systems (see the CoGo chapter of this manual for more information).

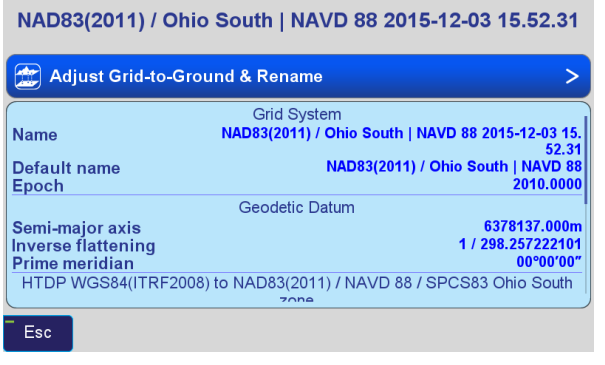
Creating an Adjusted Grid-To-Ground Coordinate System

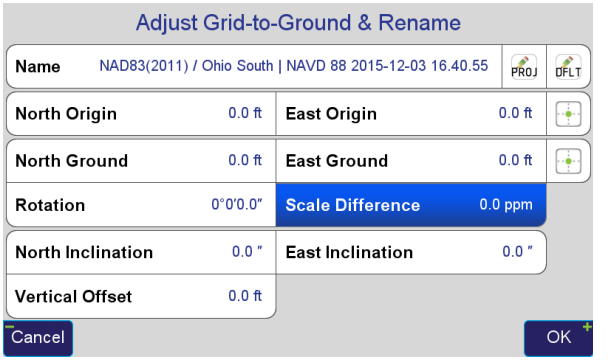
With your state plane coordinate system selected in the *Coordinate System* screen click the *Additional Actions* button  and tap ***Duplicate*** to create a copy of this coordinate system. The duplicated system will be created with the date appended to the end of its name:





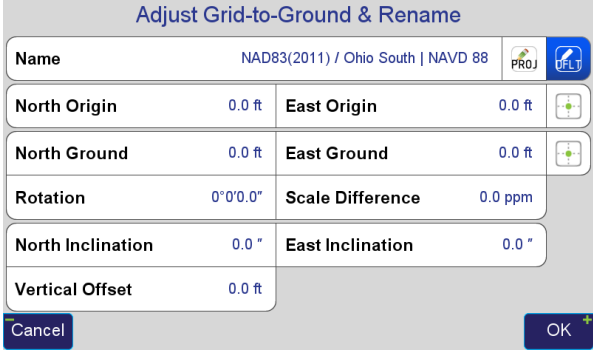
Now highlight the duplicated system and tap the edit icon and choose ***Adjust Grid-to-Ground & Rename***:



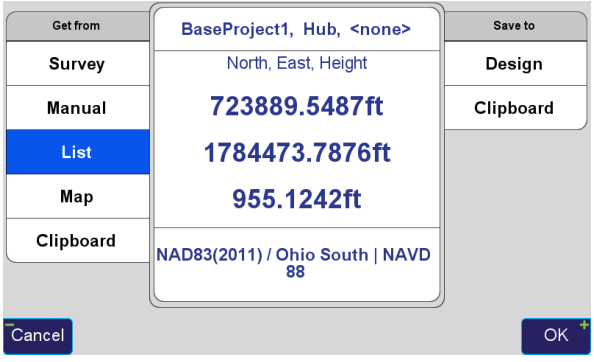


Adjust Grid-to-Ground & Rename Screen

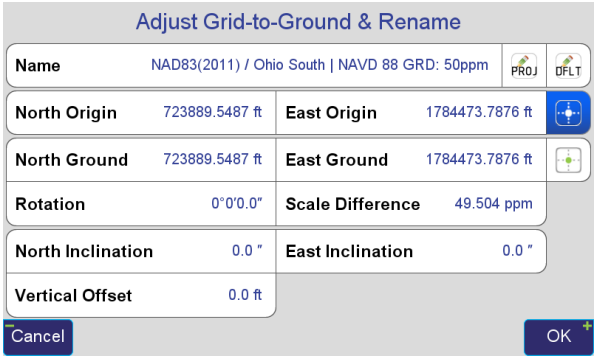
Tap the ***Default*** button DFLT to change the coordinate system name to the default name:



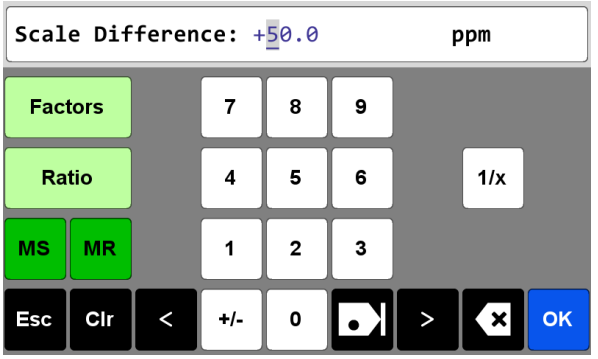
Tap the position icon beside East Origin to set origin point in the grid system for the transformation. Here the base station coordinate is chosen from the points List:



By default the ground origin point will be populated with the same coordinate and the ***Scale Difference*** is populated with the grid-to-ground scale factor calculated from that point. The scale factor rounded to the nearest part-per-million (ppm) is automatically appended to the coordinate system name:



You may also wish to round the scale difference to the nearest ppm by tapping its button and entering that value. In this screen options exist to enter a new factor as a Ratio or Ppm:

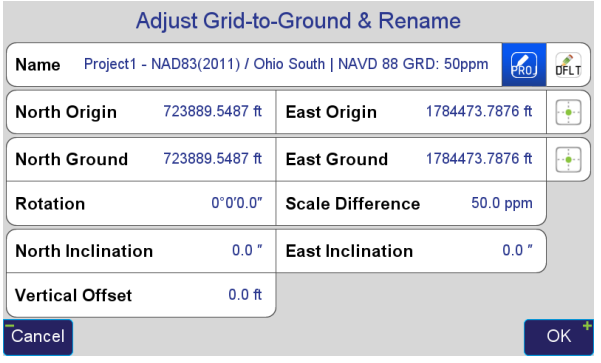


The *Factors* button will allow you to use the CoGo Scale Factor function to calculate a new scale factor if desired.

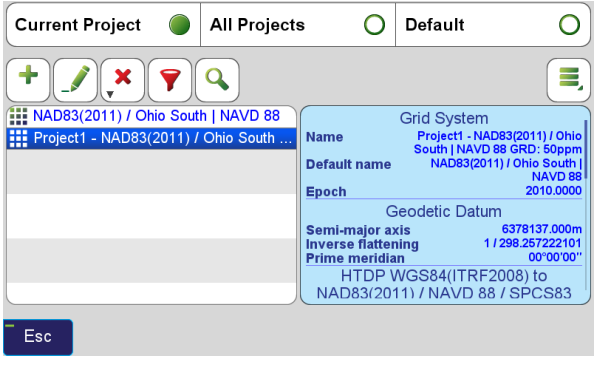
These settings will create an adjusted state plane coordinate system scaled around the base station and the base station coordinate will not change. This is useful for projects that have ground distances as would be measured with a total station and state plane coordinate system bearings since the rotation is set to 0. The coordinates will be very close to the real state plane system so that orthographic imagery and state plane referenced contours or elevation models can be loaded into your CAD drawings. You should be cautious when giving these coordinates to others as they may confuse them for real state plane coordinates. To solve this problem you may wish to subtract 100,000 from the *North* and *East Ground* coordinate values to create a (100,000 100,000) offset from the real state plane system. This can be done by tapping the *North Ground* and *East Ground* boxes.

Tap the PROJ button to add the current project's name to

the beginning of the coordinate system name:



Press *OK* and then *Apply* to create this coordinate system:



You can now use this coordinate system as the *Project Coordinate System* or just for some *Pages* if you choose.

Files and Data Exchange

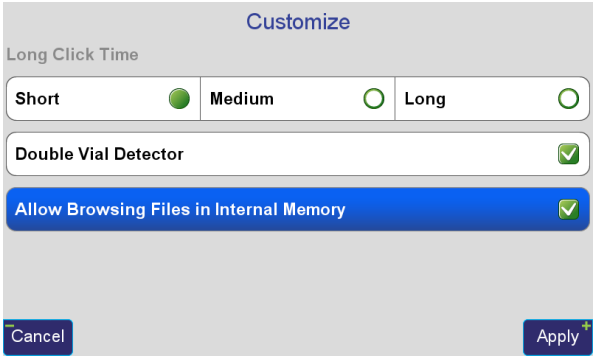
Data transfers between the TRIUMPH-LS and your PC are facilitated through using either a USB cabled connection, a USB flash drive, a cloud drive or a network drive. Using a cloud drive or USB flash drive are the simplest and recommended methods to transfer data between your PC and J-Field.

Data Base Structure and Customize Screen

Each J-Field *Project* has a "data.db" file stored in its project folder found in "Internal Memory\ VS Data\Maps". All the points and lines for a project are stored in this file. By default, the Internal Memory is hidden. To allow it to be visible in J-Field you can enable this option from ***System>Customize***.

The ***Long Click Time*** setting in the *Customize* screen controls how long a button must be held down to register as a *Long Click*. Some button in J-Field preform two actions with the second action being initiated with a *Long Click*. Buttons with these second actions typically display a small down arrow in their bottom left corner.

Check the ***Double Vial Detector*** option if you are using the Javad rover rod with a double leveling vial. This allows the downward facing camera to detect both vials.



Customize Screen

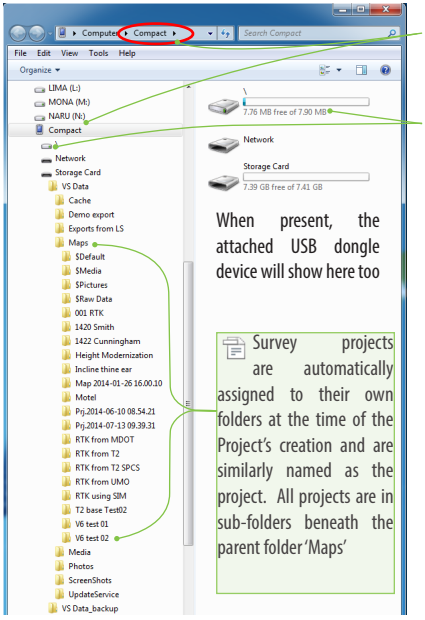
Working with WMDC

Using the provided micro USB Cable will allow you to browse the contents of the TRIUMPH-LS using Windows Mobile Device Center (WMDC); take care not to delete system files!

The first time that you connect the two devices, Windows will install Windows Mobile Device Center, a pretty straightforward process largely tailored to other types of mobile devices.

Click on 'Connect without setting up your device'

Click on 'File Management', and then 'Browse the contents of your device'



This is how the TRIUMPH-LS is seen by Windows

Windows operating system, J-Field, support files etc. are in the root directory.

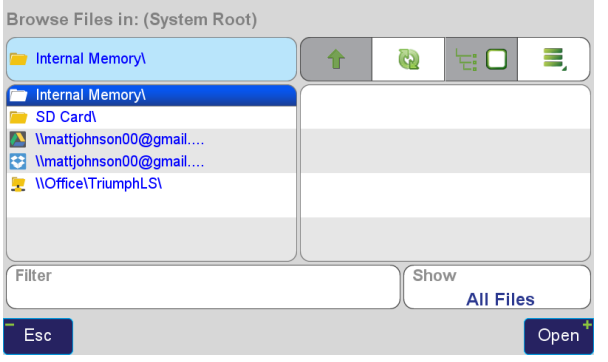
When present, the attached USB dongle device will show here too

Good practice is to use the provided microSD card for survey-related data storage including Media, Photos, Screenshots and Spectrum data.

Survey projects are automatically assigned to their own folders at the time of the Project's creation and are similarly named as the project. All projects are in sub-folders beneath the parent folder 'Maps'

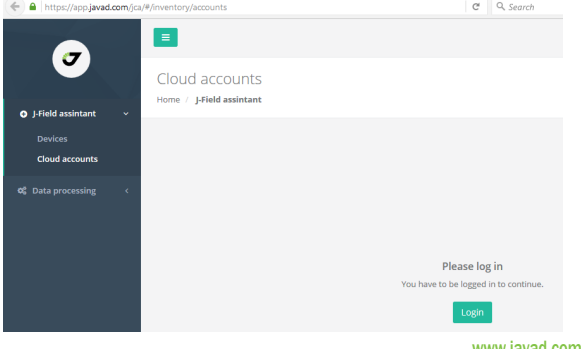
Mounting a Cloud Drive

J-Field supports Google Drive and Dropbox cloud drives.

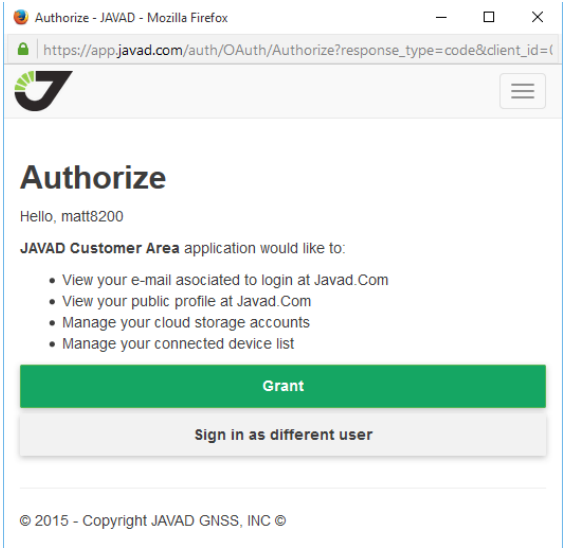


Files>Browse Files screen showing mounted Google Drive, Dropbox and a shared network folder.

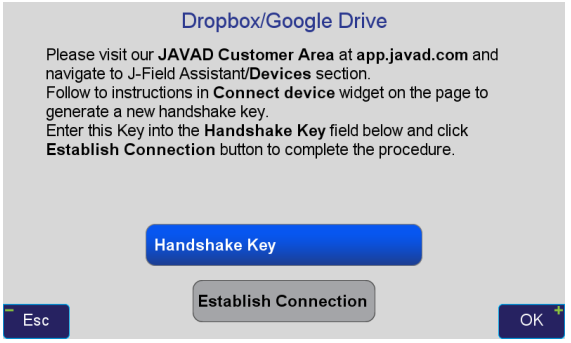
To mount a cloud drive navigate to https://app.javad.com/jca/#/inventory/devices and login from your PC's browser. If you have not setup a Javad.com login, you will need to do so.



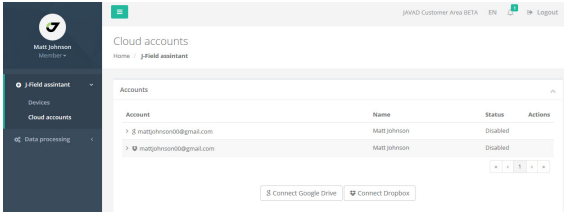
After signing in you will be prompted to Grant access.



Click Generate Key and a new alphanumeric key will appear. In J-Field open System>Dropbox/Google Drive and tap Handshake Key to enter this key. Then click Establish Connection. Note that J-Field needs to have an Internet connection established during this process.



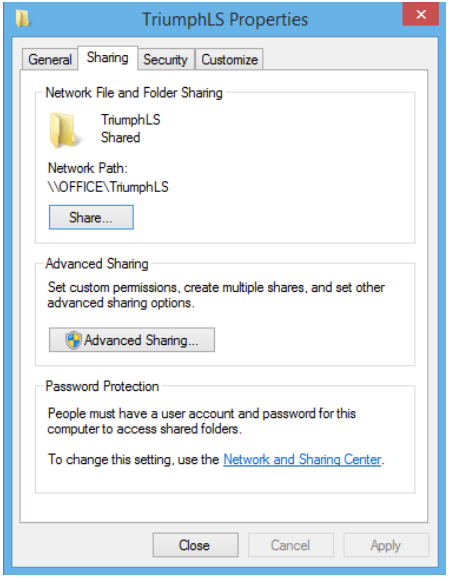
Once this is completed, return to your web browser and select Cloud accounts in the left pane. Then click Connect Google Drive or Connect Dropbox. You will be prompted for your credentials for these accounts.



After these steps are completed open Files>Browse Files and click the context menu icon  and choose Mount Cloud Drive. You should see your Google and Dropbox accounts listed if you completed the previous steps correctly. Choose the desired account and press OK.

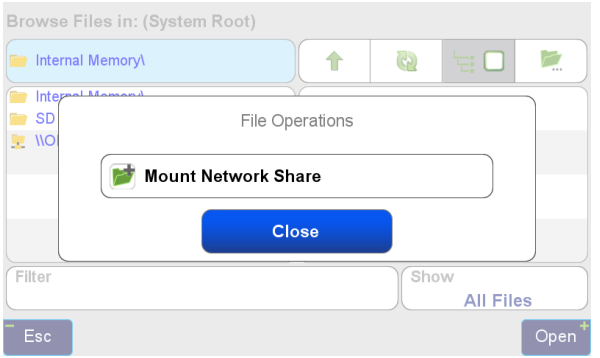
Mounting a Shared Network Folder

Mounting a shared network folder allows files to be transfered to and from J-Field while it is connected to a local network. First a folder from a PC connected to the same local network as the TRIUMPH-LS needs to be created.

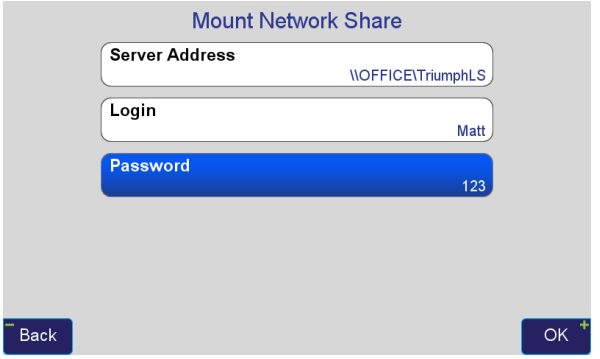


Here the folder TriumphLS was created on the Desktop. Right clicked on it, selected Properties and then enabled Sharing in the Sharing tab.

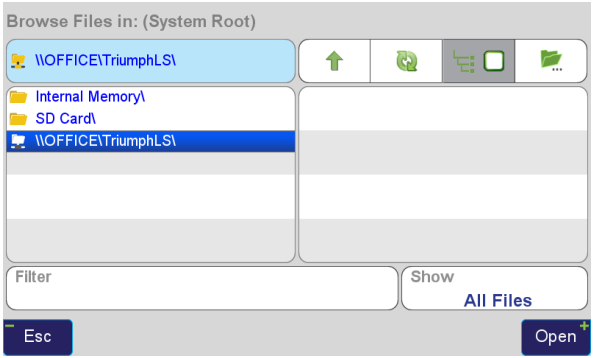
Then in the Browse Files screen, choose Mount Network Share from the File Operations menu when you are in the System Root directory.



Then enter the network path as shown above along with your Windows account name and password.



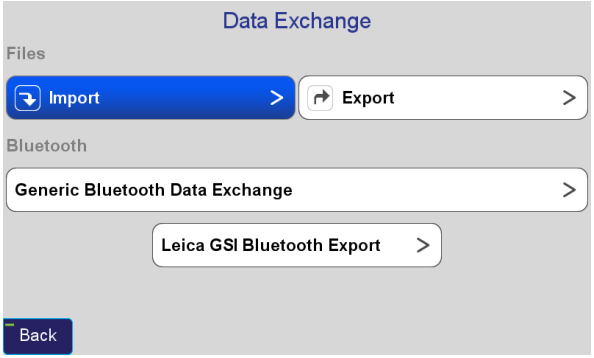
Press OK and you should now see this folder shared in the Root Directory where it can be used to import and export files.



Note that if an error message is received while trying to read the network shared folder, it may be necessary to reboot the TRIUMPH-LS to resolve this. This is a known issue with the Windows operating system in the TRIUMPH-LS.

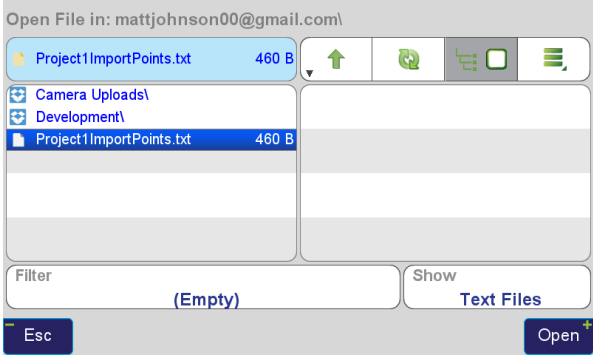
Importing Points From a Text File

To import points from a text file open the ***Data Exchange*** screen from the *Home Screen 2* or from *Files>Data Exchange*.



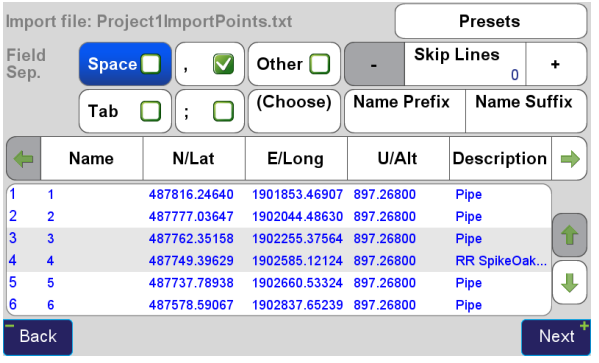
Data Exchange Screen

Navigate to the location where your file is located using the  to go up a directory and *Open* to open a folder. Then select and highlight the text file to open and choose Open. (Notice the down arrow in the corner of the *Navigate Up* button. Holding this button down will initiate a *Long Click* and navigate to the system Root directory.)

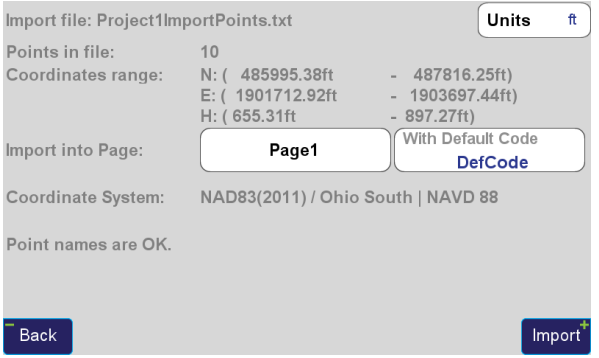


Open File Screen - Filtered to show only text files

If your text file is configured with the standard format of "PointName, N, E, H, Description" you should configure the import settings as shown below if they are not presently configured this way. The preview should display if the format is being interpreted correctly.



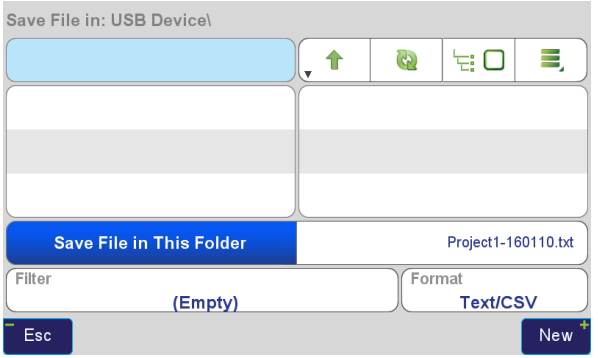
If the preview is correct, press *Next*.



A summary screen will be displayed. The points will be imported into the selected *Page* and be imported to the coordinate system of that *Page*. Tap *Import* to finish importing the points.

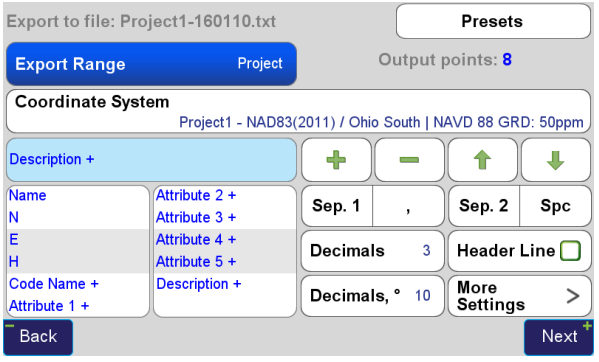
Exporting Points To a Text File

To export points to a text file open the Data Exchange screen and choose the *Export* option. Choose the format of the file type you wish to export with the box in the lower right corner, in this case ***Text/CSV***. Navigate to folder you wish to save the file. Click ***Save File in This Folder*** or the ***New*** button to proceed. If you desire to change the default filename of the file to be created, you may do so by clicking on the filename box displayed to the right of *Save File in This Folder.*



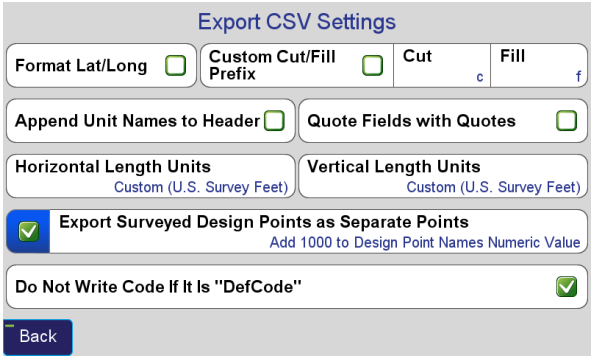
Save File Screen - Set to save a txt file in the USB drive

The *Export Formatting* screen will be displayed. It should have the default configuration to export a "PointName, N, E, H, Description" file with the description field being a merged field J-Field's *Code*, *Attributes* and *Description* fields. These fields are merged together with the use of *Sep. 2* (Separator 2) set to be a space. By default, fields are separated with *Sep. 1*, typically set to be a comma. Highlighting a field from the box on the left side of the screen and tapping *Sep. 2* will add a plus sign after the field name to indicate that it will be separated with *Sep. 2*.



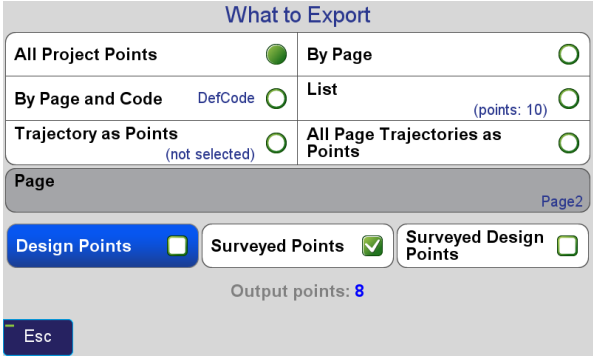
Export Formatting Screen with Default Formatting Shown

The plus and minus buttons are used to add and remove fields while the up and down arrows will change the order of fields. *Presets* allows configurations to be saved and recalled. Options are displayed to set the number of *Decimals* exported and whether to export a *Header Line*. *More Settings* opens the *Export CSV Settings* screen where options exist to specify how to format cut and fill values and *Surveyed Design Points*.



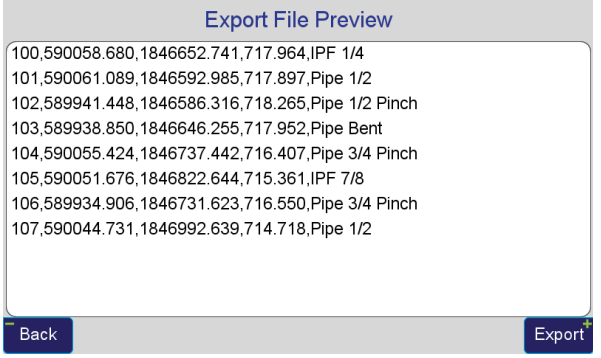
Export CSV Settings Screen

Use Export Range to choose which points to export.



What to Export Screen

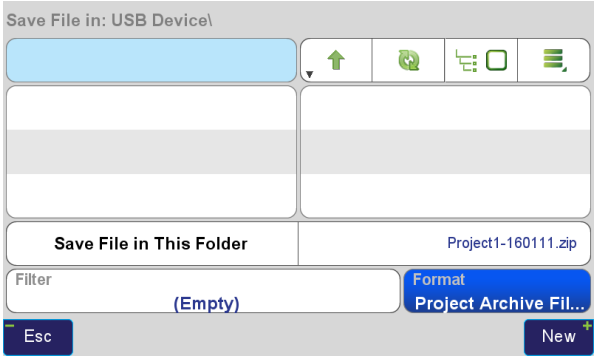
After the settings and points to export have been selected, tap *Next* to preview the formatting and points before pressing *Export* to create the file.



Export File Preview Screen

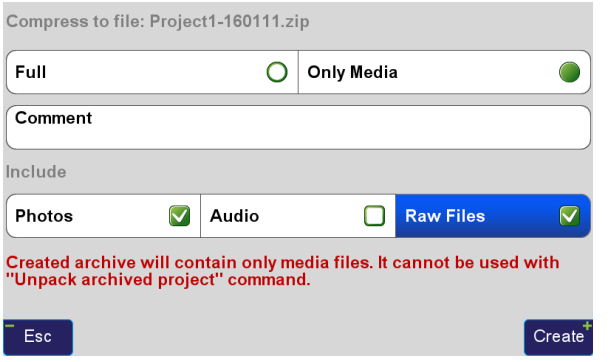
Exporting Photos, Screenshots, GNSS Data and Project Archives

To export media files that include photos, screenshots, audio files and raw GNSS data files choose the ***Project Archive File (ZIP)*** format option in the *Save File* screen. A full *Project Archive* can also be exported with this option. A Project Archive contains all the files necessary to restore the project if it becomes corrupt or deleted. It can also be used to copy the project to a different TRIUMPH-LS.



Save File Screen - Set to save a Project Archive file in the USB drive

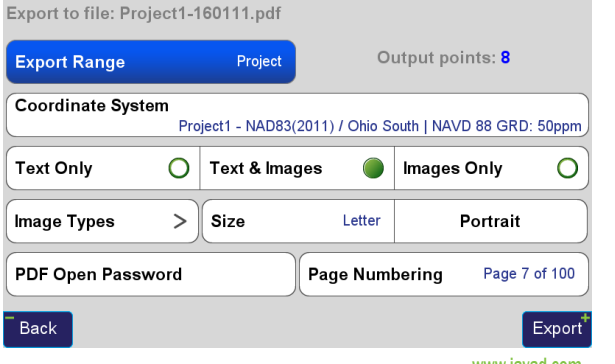
After tapping ***Save File in This Folder*** or the ***New*** button you will be presented with options to specify what type of files to export in the *Export Project Archive* screen. Use the ***Full*** option to create a backup that can be restored. The ***Only Media*** option will export only the filetypes chosen. Press *Create* to export the files which will all be contained in a zip file.



Export Project Archive Screen - Set to export only photos (screenshots included) and raw GNSS files

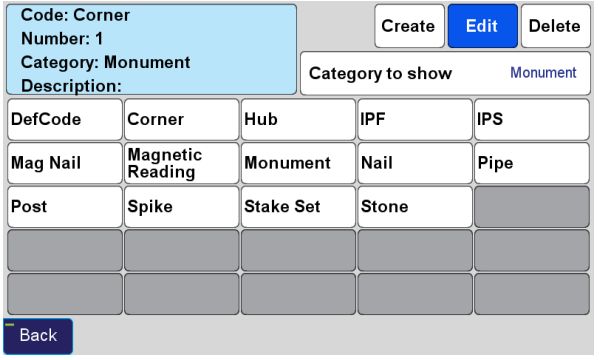
Exporting A Project Report

A report of the Project can be exported in HTML or PDF format by choosing ***HTML*** or ***PDF*** format in the *Save File* screen. The report will contain the selected points with all the details and statistics about that point. The ***Text & Images*** will be included if this option is checked. A number of options exist to format the PDF or HTML report:



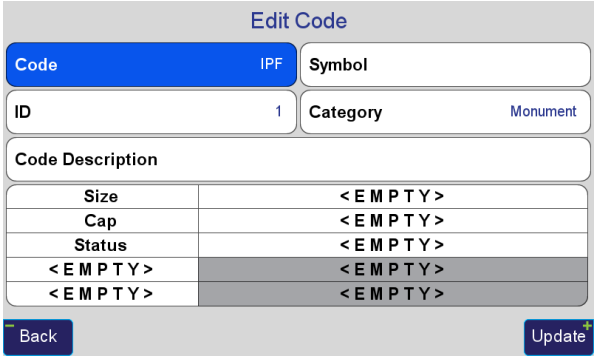
ShapeTags & Codes

Create and manage your own library of ***Codes***; alpha-numeric textual assignments to points. *Codes* can quickly be recalled from the *Favorite Codes* screen, eliminating the need to type in a point description for each surveyed point. In addition, each *Code* can have up to five ***Code Attributes*** fields. An example of a *Code* is "IPF" (Iron Pin Found). It can then be setup with *Code Attribute* fields of "Size", "Cap" and "Status" which allow these attributes to be entered and stored with each point. Choose *Tags & Codes>Manage Codes* to access the library of *Codes*.



Manage Codes Screen

Tap *Create* or *Edit* to make a new *Code* or edit an existing one. A *Symbol*, *ID*, *Category* and *Code Description* can be assigned each *Code*. If a *Symbol* is associated with a *Code*, points with that code will have the ***Symbol*** displayed on the map. The ***ID*** field is a numerical field that is not used in J-Field but is an export option for text files and may be useful with other software packages. The **Category** can be used as a filter in the *Manage Codes* screen.



Edit Code Screen

ShapeTags can be assigned to points during data collection to enable the automated drawing of lines between points with like *ShapeTags*. For example, you may want to create a *ShapeTag* of "Fence". When collecting a point along a fence, select the "Fence" *ShapeTag* to be assigned with that point. This will cause a line to be drawn on the map between that point and the previous point that also has the "Fence" *ShapeTag*.

ShapeTags are associated with a chosen *Code* when a new *ShapeTag* is created. When a *ShapeTag* is then selected to be assigned to a point, by default, the Code field for that point will be populated with the associated *Code*.

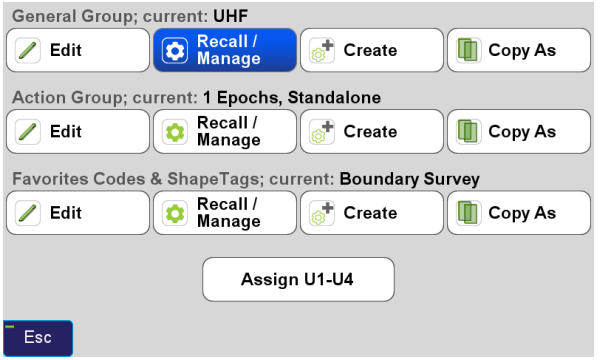
Setup

J-Field's settings are divided into 3 profile groups: the *General Group*, *Action Group* and *Favorite ShapeTags and Codes*. These groups exist so that different settings groups can quickly and easily be saved and recalled.

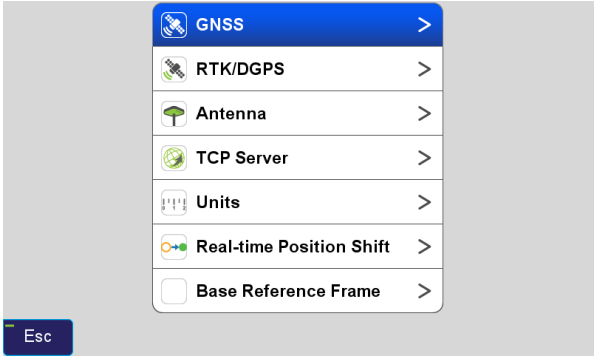
The ***General Group*** profile stores the settings for RTK corrections, i.e. the configurations for UHF radios or connection parameters to a RTN. The ***Advanced Settings*** are also stored in the *General Group* and are found as an option in the first setup screen of the *General Group*, they include the settings for the displayed units. Tap *Edit>Advanced* to access them.

The (*Set Up*) will quickly open the *Setup* screen; pressing it twice opens the *Advanced Settings* Screen.

As an example, to configure a new RTN setup you would tap ***Create*** to create a new *General Group* profile and then follow the screen prompts to enter the communication parameters and settings. See *Appendix A: Creating a RTN Profile* for detailed instructions on setting up a RTN. ***Copy As*** creates a copy of the existing profile but prompts you to enter a new name for the new profile.

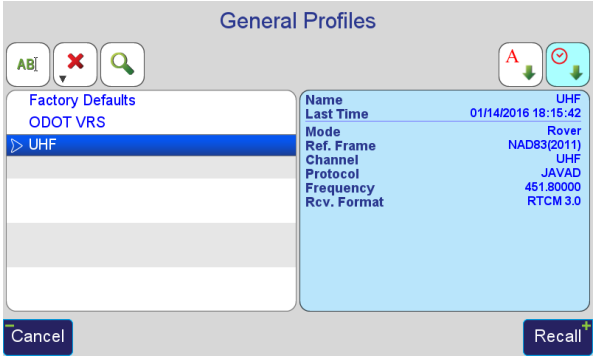


Setup Screen



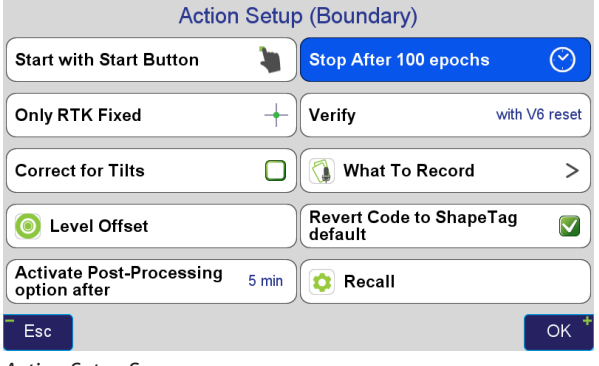
Advanced Settings Screen

Tapping the ***Recall / Manage*** button will open a list of profiles shown on the left side of the ***Profiles*** screen. Details of that profile are displayed in the information panel (the blue box on the right side of the screen). Across the top from left to right are buttons to ***Rename***, ***Delete***, ***Search***, ***Sort Alphabetically***, ***Sort by Date***.



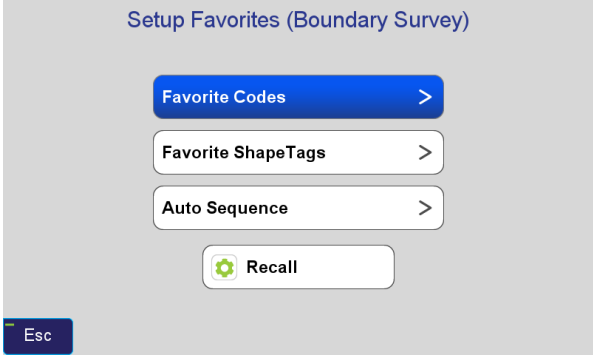
General Group Profiles Screen

The ***Action Group*** profile contains the collection settings. These include the RTK Verification and Validation settings and how many epochs to collect. These settings are discussed in the Collect section of this manual. The configuration of the *Stake* and *Collect Action* screens' *User Defined* (whitebox) *Buttons* are stored in the *Action Group* profile as well as the U1-U4 hardware button options.

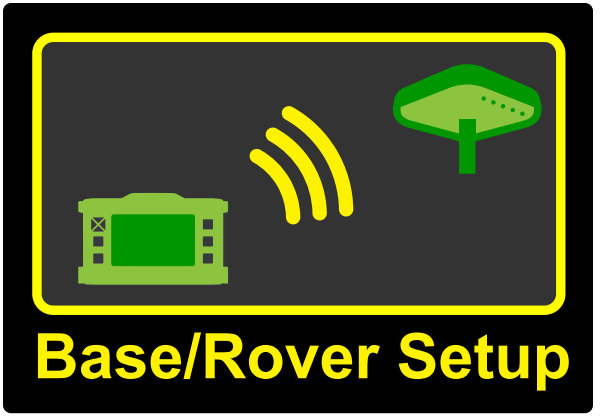


Action Setup Screen

The ***Favorite ShapeTags & Codes*** profile stores different list of favorite *ShapesTags* and *Codes*.



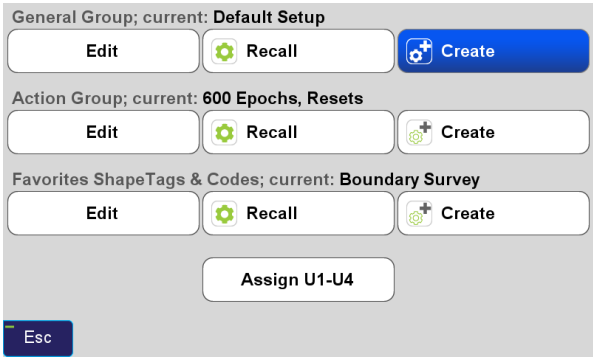
Setup Favorite ShapeTags & Codes Screen



Base/Rover Setup

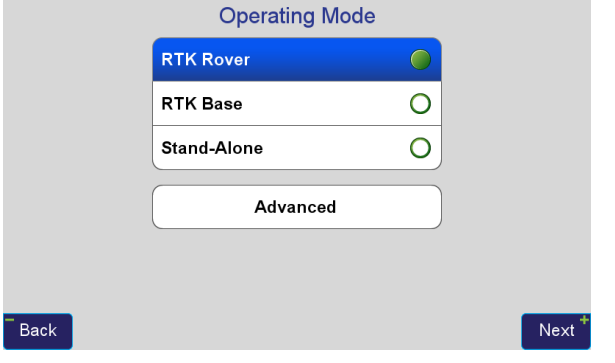
Base/Rover Setup is used to configure and start the transmission of RTK corrections via UHF or FH915 SS (frequency hopping spread spectrum) radios from your Javad Base receiver and radio to your Rover. It reads the communication parameters from a UHF or SS *General Group* rover profile and creates a matching base station profile internally. It then sends that base station profile to the base through the Bluetooth connection.

Before *Base/Rover Setup* can be used a UHF or FH915 SS *General Group* rover profile is needed. If one does not exist yet, open the *Setup* screen and tap *Create* for a new *General Group* profile:



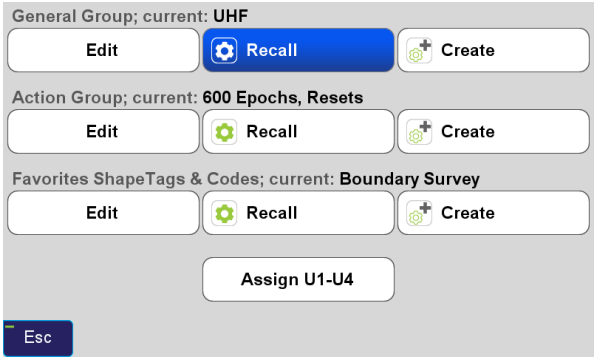
Setup Screen - Creating a new *General Group* profile

Enter a profile name ("UHF" or "FH915 SS" are suggested) in the next screen and tap *OK*. The next screen will prompt you to select the Operating Mode, choose RTK Rover:



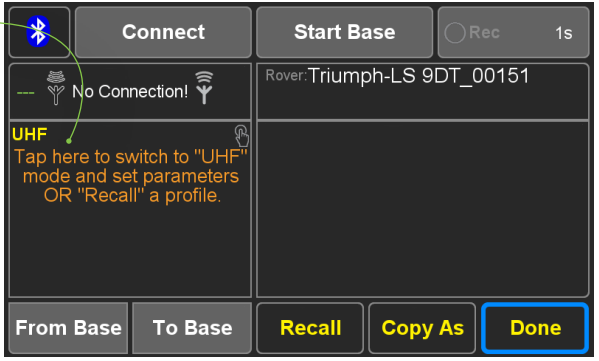
You could tap Next and continue to configure all the communion parameters but this is not necessary as they can also be configured with *Base/Rover Setup.* Press *Back* and then *Esc* to return to the Home screen.

Once a UHF or FH915 SS General Group profile has been created and recalled, tap the *Base/Rover Setup* button from the second page of the *Home* screen.

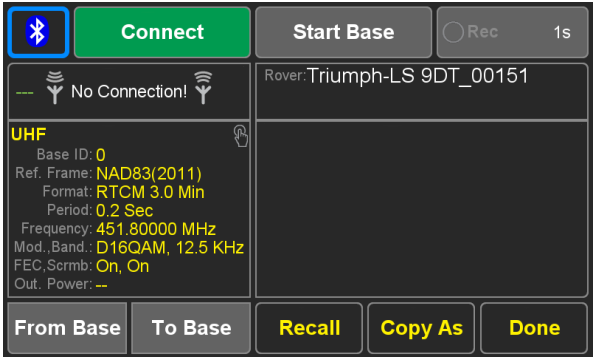


If for some reason the selected profile is not in UHF or FH915 SS mode a message will be displayed indicating so.

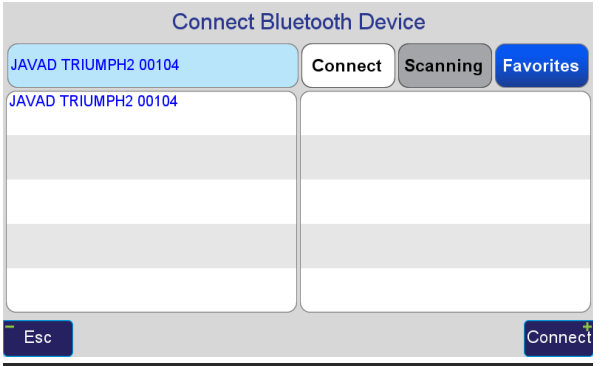
Should that be the case, tap ***Recall*** to select a UHF or FH915 SS radio profile or tap the displayed message to change the current *General Group* profile into a UHF or FH915 SS profile.



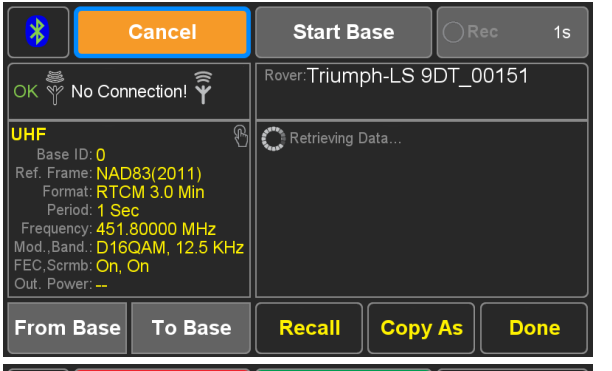
To connect the Base and the Rover via Bluetooth, tap on ***Connect***. The external radio, if using one, should be powered on prior to pressing *Connect*. Always have an antenna connected to the radio before powering it on to avoid potential damage to the radio.



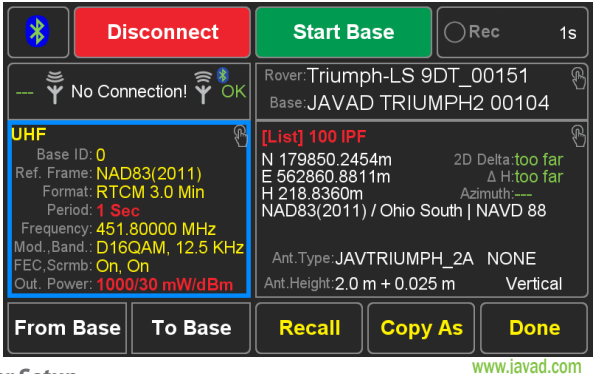
Immediately a scan of available Bluetooth devices will begin and a few seconds later will be completed. Choose the device intended to be used as the Base receiver and tap ***Connect***.



Once the Bluetooth connection has been initiated, it will take a few seconds before it has completed. During that interim few seconds, your screen may appear like what is shown on the right.



Once the existing Base and radio parameters have been retrieved the screen should look similar to this. The Rover profile radio parameters are displayed on the left panel while the current Base coordinate is displayed on the right. Radio parameters displayed in red indicate that there is a different value between the Base and Rover profile. Use ***From Base*** to update the Rover profile to the parameters from the Base or use ***To Base*** to send the Rover radio parameters to the Base before starting the Base.



Tapping the left panel opens the screen to configure the radio parameters. "RTCM 3.0 Min" ***Format*** should be used to minimize the correction data that must be sent through the radio. To start the base with ***5 Hz BEAST MODE*** corrections the ***Broadcast Period*** must be changed to **0.2 seconds**.

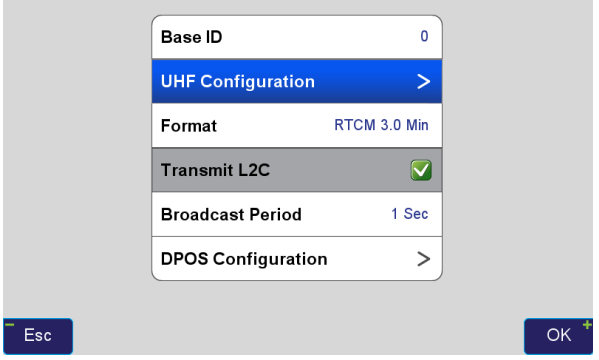
The time required to acquire a fix is inversely proportional to the rate of the corrections. By reducing the time for the RTK engines to fix, RTK *Verification* and *Validation* can be completed much quicker and surveyors can collect points in locations that previously proved to be very difficult and time consuming.

It is important to note that increasing the Broadcast Period, increases the battery consumption of the radio as well as the heat generation inside it. With the HPT435BT you may need to use the modem fan when broadcasting with an output power greater than 4 watts, depending upon the ambient temperature.

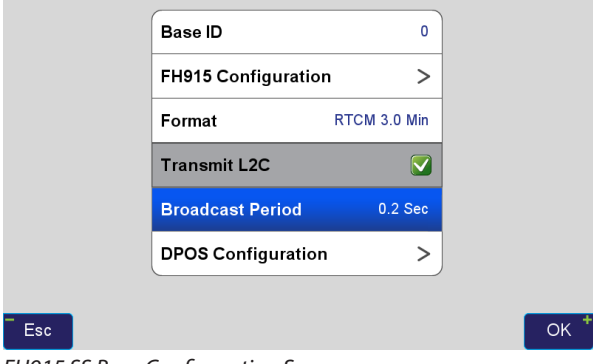
The ***Base ID*** field limits the Rover from receiving corrections if the Base and Rover profiles do not have the same *Base ID*. It can be left at its default value of 0.

Transmit L2C is always enabled. If for some reason it is not checked, it will become enabled automatically when the Base is started with *Base/Rover Setup*.

To configure the UHF or FH915 parameters tap the ***UHF*** or ***FH915 Configuration*** button.



UHF Base Configuration Screen

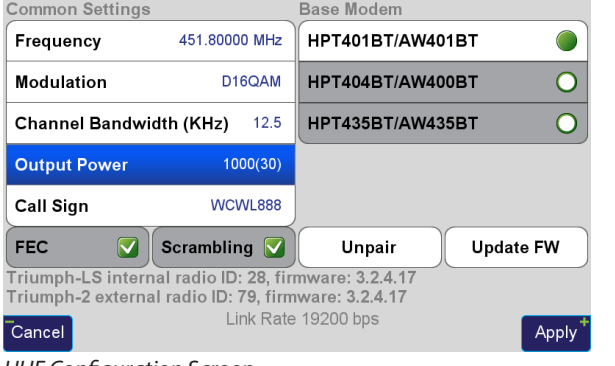


FH915 SS Base Configuration Screen

Tapping the ***UHF*** or ***FH915 Configuration*** button will trigger an immediate search for the radio via Bluetooth between the Base and the radio. If a Bluetooth enabled radio is not found to be currently paired to the Base, you will be prompted to pair the radio. This can be done via the Bluetooth option.

For UHF radios the parameters shown to the right need to be configured. The ***Frequency*** should be one of your FCC licensed (US users) frequencies. A channel with little interference should be chosen. From the *Frequency* selection screen you can *Scan* the displayed channels to check the interference levels.

A ***Modulation*** (the method the data is encoded in the radio signal) must be selected that has a sufficient link rate to transmit increased data rates with 5 Hz corrections. If ***Channel Bandwidth*** is limited to 12.5 kHz by a FCC license, **D16QAM** modulation must be used. With 2 Hz corrections (0.5 second broadcast period) D8PSK modulation can also be used. Modulations with greater link rates have decreased receiver sensitivity to demodulate the signal and the downside to choosing modulations with higher link rates is that they are more subject to interference and data loss when the signal is weak. Field test have found that D16QAM modulation decreases the working range of the radio approximately 20% as compared to DQPSK modulation.



UHF Configuration Screen

Increasing the ***Output Power*** increases radio range but also increases radio power consumption. With an antenna height 4 m (13.1 ft) and D16QAM modulation, 5 Hz RTK can

be stable up to 4 km (2.5 miles) away when terrain obstacles do not block the signal. A hill or ridge between the Base and Rover will greatly limit the range. The FCC (US) allows up to 35 watts ERP (Effective Radiated Power) to be transmitted. If you have a HPT435BT radio set to output 35 watts and are using an antenna that isn't a unity gain antenna, such as the 5 dBd gain whip antenna, you aren't in conformance with the FCC regulations and terms of your license. With the 5 dBd gain whip antenna, an *Output Power* of 10 watts or less must be used to stay under 35 watts ERP.

Your FCC assigned call sign should be entered in the ***Call Sign*** box.

The ***Unpair*** button is used to unpair the Bluetooth connection between the base and Rover. This would only be necessary if you wish to pair a different radio to your Base.

Update FW checks and installs the latest radio firmware. The versions released October of 2015 or later are needed for 5 Hz corrections to work correctly.

UHF Modem Link Rates (bps)

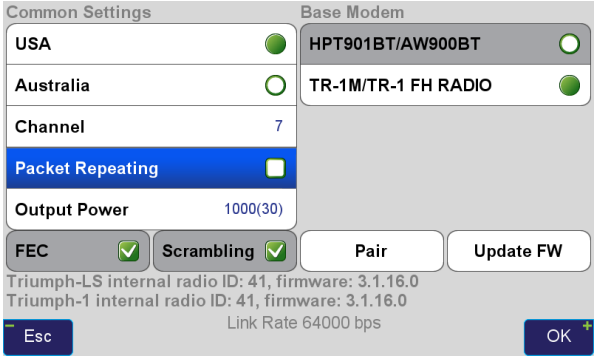
	Modulation			
Channel Spacing	**DBPSK**	**DQPSK**	**D8PSK**	**D16QAM**
6.25 kHz	2,400	4,800	7,200	9,600
12.5 kHz	4,800	9,600	14,400	19,200
20 kHz	7,200	15,000	22,500	30,000
25 kHz	9,600	19,200	28,800	38,400

FH915 SS Radio Settings

With a *FH915 SS* radio ***Packet Repeating*** must be disabled when using correction rates greater than 1 Hz.

In the US it may be best to operate on ***Channel*** 7 to avoid interference.

Field test confirm 4 km (2.5 miles) as the range at which stable 5 Hz RTK can be achieved with a *FH915 SS* radio with a 4 m (13.1 ft) antenna height. With 2 m you may achieve up to 2 km (1.2 miles), but it is dependent upon the environment.



FH915 SS Configuration Screen

Return to main *Base/Rover Setup* screen by tapping *OK* twice. Press ***To Base*** to send modified parameters to the Base. After doing this all the parameter values should be yellow.

The Base broadcast coordinate should now be set. Tap on the coordinate pane on the right side of the screen.

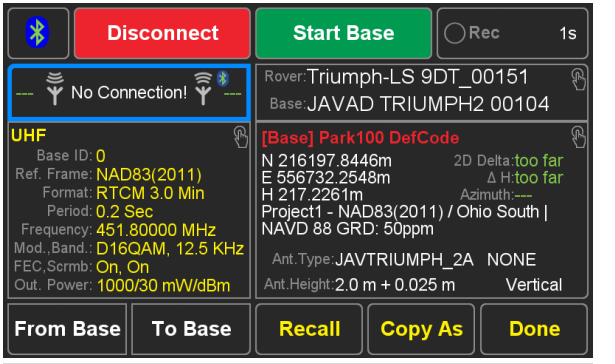
If the base is being started on a known point select that point ***From List*** or ***Enter*** the coordinates manually; otherwise use an autonomous position by tapping ***From Auto***.

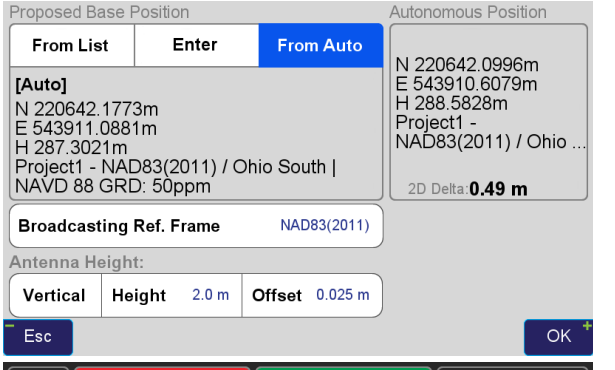
The *2D Delta* indicates the horizontal distance between the current autonomous position the base is reporting and the proposed broadcast coordinate.

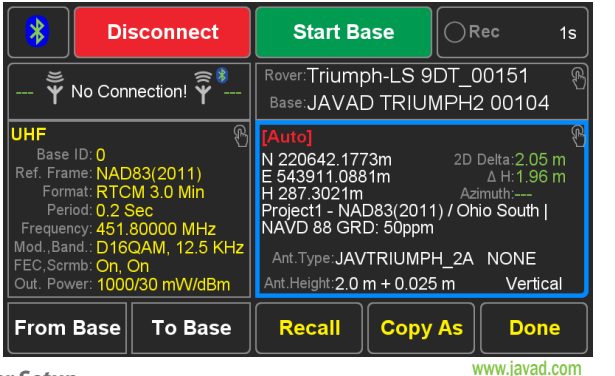
Enter the ***Antenna Height*** and ***Offset***. In this case the Base is on a 2 m pole with the thread adapter that adds an additional 0.025 m. Tap *OK* once done.

The base station raw GNSS data is always recorded and then transfered to J-Field when *Stop Base* is pressed at the end of a survey session so that it can be sent to Javad's ***Data Processing Online Service***, also known as ***DPOS***. With the *DPOS* tool found in the *CoGo* menu the raw data file can be submitted to *DPOS* and all the survey points from that base station session can be adjusted to their real coordinates so they are no longer based off an autonomous position. The recording interval can be specified along with some *DPOS* options with the ***Rec*** box.

Once the coordinates for the Base have been selected/ entered along with *Antenna Height* and radio parameters tap ***Start Base***.

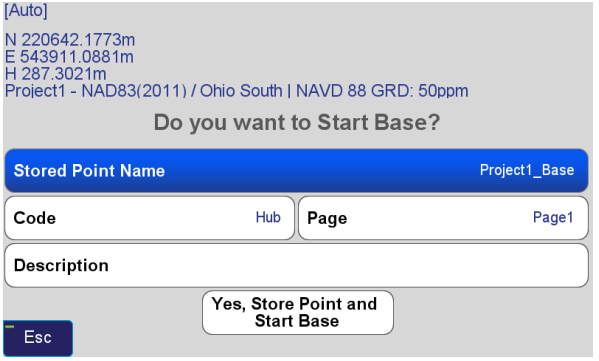




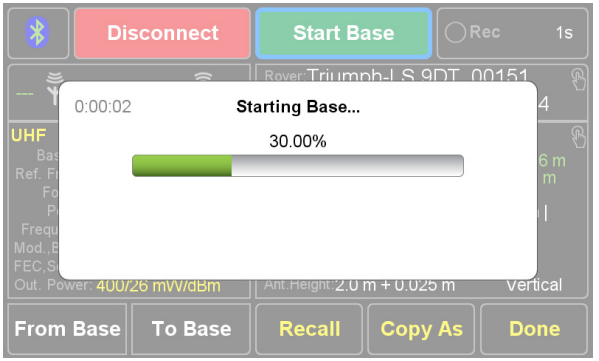


In this screen you can enter / change the name of the point being used as the base; to do so, tap ***Stored Point Name*** and enter the desired name. It is recommended the Project Name being included in the point name so that the file can easily be identified in the *DPOS* tool.

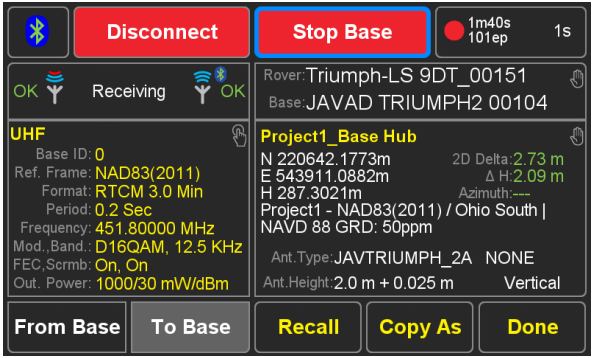
Confirm sending the coordinates to the Base with a tap on ***Yes, Store Point and Send to Base***.



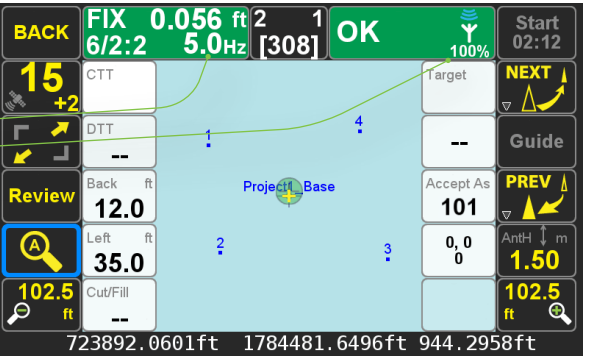
The parameters will be sent to the Base and radio and the Base should begin to broadcast, typically after about 80 seconds.



The  (transmitting) icon will indicate when the Base is transmitting and OK will be displayed to the right of it. Similarly, the  (receiving) icon will indicate when the Rover is receiving data. If the icon bars are red (as shown with one red bar), this indicates that the radio transmission is over powering the receiving radio and that the Rover is too close for set *Output Power*. If the broadcast is too overpowering, corrections will be lost and the link quality will drop.



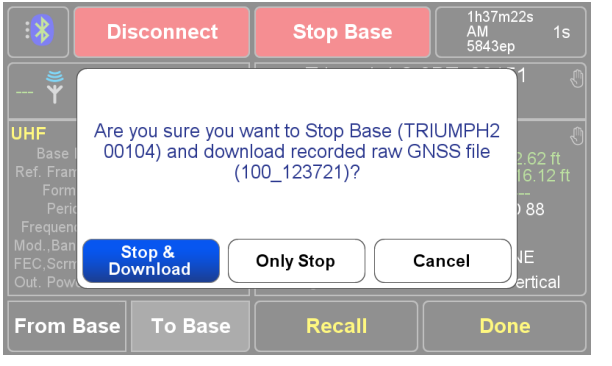
Once the Base is broadcasting you can check that the Rover is correctly receiving corrections at the set transmission rate. Open the *Collect* or *Stake Action* screen. The position solution button should display the correct incoming correction rate and the communication button should display a 100% link quality.



To check that you have started the Base correctly with the correct coordinate, you may wish to stake a point you have previously located if you have one available.

After the Base has been started you can press ***Done*** to disconnect the bluetooth or alternatively the connection will be disconnected when the distance between the Base and Rover exceeds the range of the Bluetooth communication.

After finishing surveying return to the Base again and open ***Base/Rover Setup*** to *Connect* again and stop the base with ***Stop Base***. This will display a prompt to stop the data transmissions and download the Base GNSS data into J-Field. Choose ***Stop & Download***. After the download completes the Base can be powered off, the radio can be powered off while the data is downloading without causing any problems.



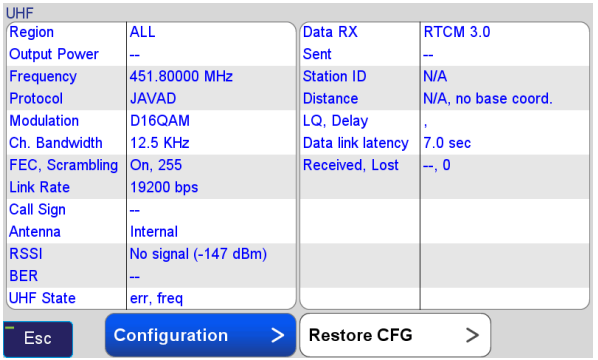
Troubleshooting Starting the Base

If for some reason problems are encountered when trying to start the Base, clearing the Base NVRAM is usually the first recommendation.

How to clear the NVRAM

1. Turn the receiver OFF with the ON/OFF button.
2. Press and hold the Record button.
3. Turn the receiver ON by pressing the ON/OFF button.
4. Wait until all the LEDs are flashing yellow (except the battery LED).
5. Release the Record button.

If the radio is transmitting, its TX LED should be flashing at the broadcast rate. If the radio is broadcasting but corrections are not being received in J-Field, check the *UHF Status* screen for an "err" listed in the *UHF State*. If an error state is displayed, press ***Restore CFG*** to restore the factory UHF configuration.



UHF Status Screen - *UHF State* "err, freq", Use *Restore CFG* to repair

Collect

Pressing the *Collect* button opens the *Collect Prepare* screen; pressing *Collect* hardware button twice will open the *Collect Action* screen.

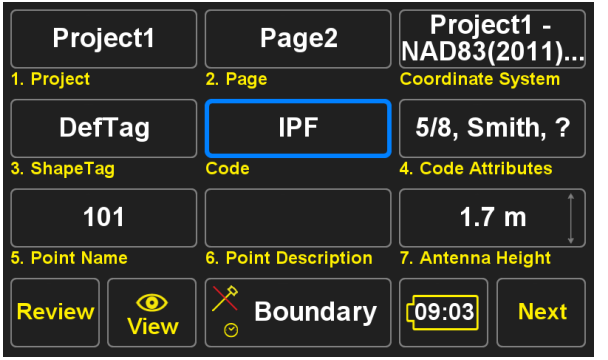
In the ***Collect Prepare*** screen, the *Project*, *Page*, *Coordinate System*, *ShapeTag*, *Code*, *Code Attributes*, *Point Name*, *Point Description*, *Antenna Height* and collection settings can be setup before beginning data collection for a point.

When collecting points, it is recommended to use the Code and Code Attributes to store information about the point being collected. The *Description* field can then be reserved for entering additional information about the point. When exporting point coordinates in Text/CSV format, these three fields can be merged into one field so that surveying software can import data with the traditional "Name,N,E,H,Description" format but with the description being the combination of J-Field's *Code*, *Code Attributes* and *Point Descriptions* fields.

The ***Review*** buttons opens the *Review* screen which is a map of the project. Here linework can be drawn on the map with the CAD functions and point data can be edited.

The ***View*** button opens a screen to configure what point attributes are displayed on the map and allows some graphical parameters to be customized.

To the right of the View button is the ***Action Setup*** button which opens a screen to configure the collection settings for points. The RTK Verification and Validation settings are configured from *Action Setup* screen.



Collect Prepare Screen

Pressing the *Action* hardware button or *Next* from the *Collect Prepare* screen opens the *Collect Action* screen.

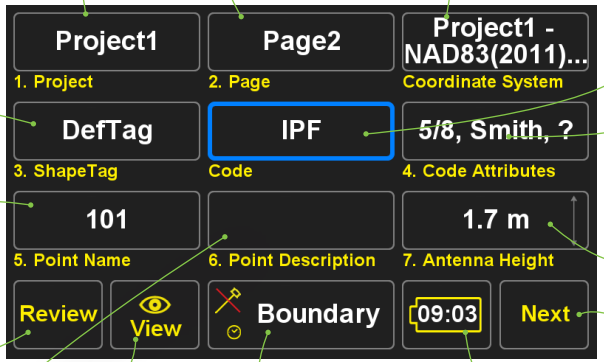
Screen Anatomy - Collect Prepare Screen

The *Project* button displays the name of the current *Project*. Tap it to open an existing *Project*, to create a new *Project*, or to edit the current *Project's* name or coordinate system.

The *Page* button displays the name of the current *Page*. Tap it to open the *Pages* screen and set the current *Page*, turn on or off *Pages* or edit a *Page* Name or coordinate system.

The *Coordinate System* button displays the name of the coordinate system for the current *Page*. Tap it to change this coordinate system.

ShapeTags can be assigned to points during data collection to enable the automated drawing of lines between points with like *ShapeTags*. "DefTag" is the default *ShapeTag* and does not create lines between points.



The *Code* button displays the name of the *Code* that will be assigned to the next surveyed point. Tap it to choose a new *Code* from your list of *Favorite Codes*.

Up to five variable *Code Attributes* fields can be used be used to store additional information about a point with this box.

The *Point Name* button displays the name that will be assigned to the next surveyed point. After a point is surveyed it will increment to the next available name.

Edit the height of the ARP (Antenna Reference Point).

The *Review* buttons opens the *Review* screen which is a map of the project. Here linework can be drawn on the map with the CAD functions and point data can be edited.

Takes you to the *Action* screen

Use the *Point Description* field to store additional information about the point.

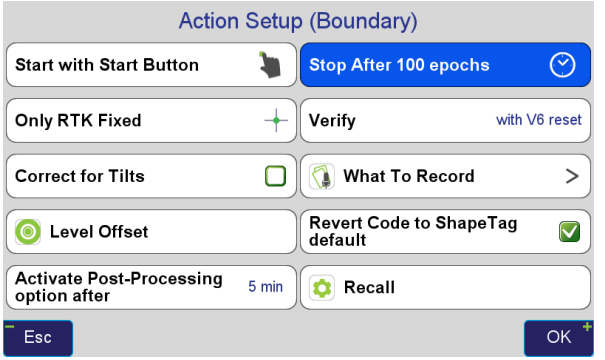
The *View* button opens a screen to configure what point attributes are displayed on the map and allows some graphical parameters to be customized.

Displays the current *Action Group* profile name group and opens the *Action Setup* screen. The rover icon displays whether tilt corrections are enabled or not (disabled above). The clock icon indicates the *How to Stop?* setting has been set to a fixed number of epochs.

Displays the estimated remaining battery life and is a shortcut to the *Battery Status* screen

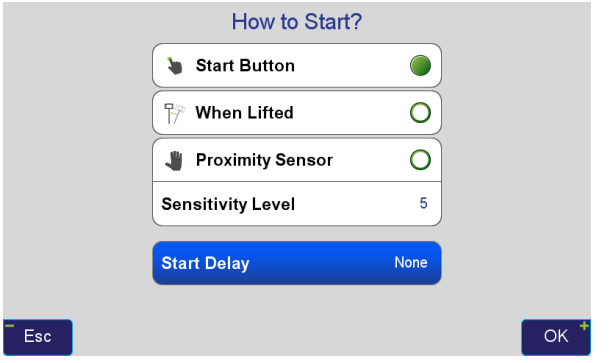
Action Profile Setup

The ***Action Setup*** screen can be opened by tapping the bottom middle button on the *Collect* and *Stake Prepare* screens. It contains all the settings related to the collection of points.

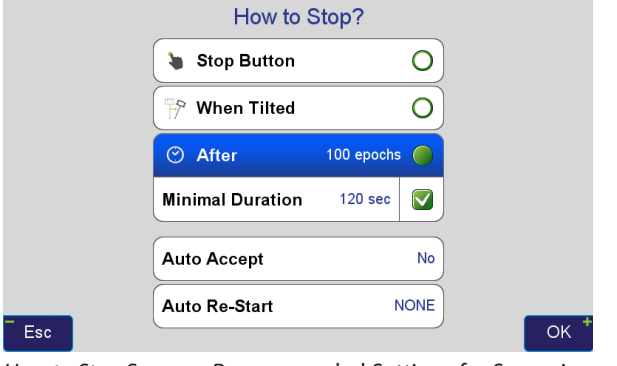


Action Setup Screen - Recommended Settings for Multipath Environments

There several different options to specify when data collection for points starts and ends, the most commonly used options being with the ***Start Button*** and after a specified number of epochs have been collected. Using a ***Start Delay*** may be useful if you need to collect a point where you cannot reach the TRIUMPH-LS. You can press Start and then set the TRIUMPH-LS up over the desired point. The starting of data collection will be delayed by the selected *Delay* period.



How to Start Screen



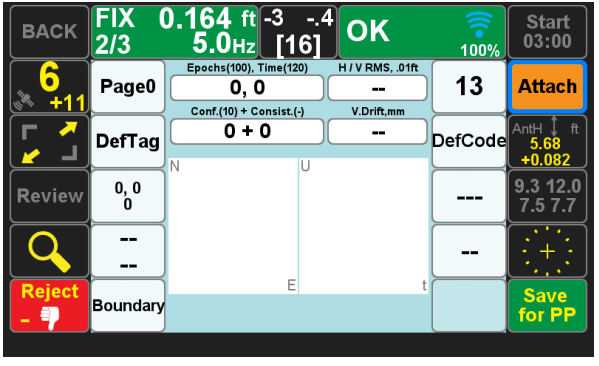
How to Stop Screen - Recommended Settings for Surveying Monuments in Multipath Environments with 5 Hz BEAST MODE Corrections

What To Record presents options to automatically capture raw GNSS data, camera images, voice recordings and screenshots. To process rover data with DPOS, GNSS data needs to be saved at 1 Hz.

Use ***Recall*** to quickly recall a saved Action Group profile. This

is useful for changing the collection settings for different environments and types of points that need to be collected.

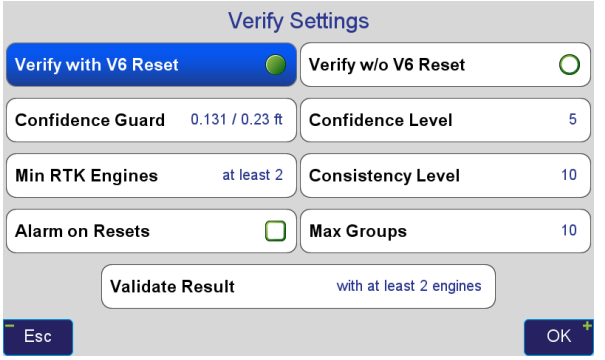
If ***Activate Post-Processing*** is enabled, raw GNSS data will always to be logged in the background when points are collected. If an RTK solution has not been accepted or rejected after the set period of time, a ***Save for PP*** option will be presented during point collection to save the GNSS data with the point for post-processing. Rover GNSS data can also be submitted to DPOS if it is recorded with the settings in What To Record.



Save for PP button displayed after a fixed solution was not able to be collected.

RTK Verification and Validation

It is very important that you read and understand the information about **RTK Verification** and **Validation** contained in this manual.



Verify Settings Screen - Recommended Settings for Multipath Environments

When located in difficult environments and under tree canopy, all GNSS receivers are prone to give bad fixed solutions that may appear to be acceptable if they are not verified. Existing methods to verify GNSS solutions include "dumping" the receiver, turning it upside down to cause the RTK engines to reset, and re-observing the point at a later time.

J-Field automates these processes with its built-in software features of *Verify* and *Validate*. ***Verify*** automatically resets the RTK engines after every fixed epoch is collected in ***Phase-1*** of its process. Epochs are placed into *Groups* or buckets during *Phase-1*. Once a *Group* has the required ***Confidence Level*** *Phase-1* is complete.

The ***Confidence Guard*** *(CG)* determines the size of the *Group* or bucket. Each *Group* contains all the epochs located within a specified radius (the *CG* value) from its center and new *Groups* are created as necessary so that all epochs fall into at least one *Group*. Each *Group* has its own *Epoch Counter*, *Confidence Level* and *Elapsed Time*. A point may fall into more than one group. The current best group is shown within [ ] and others within ( ).

The number of groups is limited by the Max Groups setting. If this number of groups is exceeded, *Phase-1* will reset and start over. During *Phase-1*, the current best group will be displayed between the square brackets **[ ]** while the other groups are displayed between parenthesis **( )**.

During ***Phase-2*** the engines are not reset and solutions which are located inside the *CG* of the selected *Group* are added to that *Group* for the remaining number of epochs that user has requested (***Epoch Number***, ***EN***) in the ***How to Stop*** screen. Solutions which are outside the *CG* of the selected *Group* will be ignored; the RTK engines are reset if the epoch falls outside a sphere with a radius twice that of the *CG*. If the number of rejected epochs reaches 30% of epochs collected so far, the whole process will restart.

Validation is the final phase of the process. With this feature enabled the RTK engines will reset one final time at the end of the observation and collect 10 additional epochs. Allowing sufficient time between *Phase-1* and the final *Validation* step will guarantee a bad solution is not allowed to be accepted. From extensive testing in the worst of multipath environments, a bad solution has yet to be accepted when *Verify* and *Validate* are enabled with *a* ***Minimum Duration*** *of* least 180 seconds. This will ensure that at least two separate fixed initiations are acquired at least 2 minutes apart. **Having at least 2 fixed initiations in agreement and acquired at least 2 to 3 minutes apart has**

been found to be the critical requirement to ensure that bad fixed initiations are not accepted. In high multipath environments the Boundary Action Profile should be used to meet this requirement and guarantee a good initiation. You must let entire collection process complete. If the process acquires fixes during Phase-2 and the RTK engines then mediately reset many times, they are not in agreement with the Phase-1 solution. The entire process will eventually reset or you can manually Stop it, Reject the point and then Start again. Alternatively, you may wish to not use the Boundary profile but rather re-observe the point at least 2 minutes later, reseting the RTK engines before collecting the 2nd point.

Confidence Level and *Consistency Level* are counters; the *Confidence Level* of a group increments each time an epoch with a new RTK initiation (Fix) is collected. It increments by values of 1, 1.25, 1.5, 1.75, 2.0, or 2.5 for 1 to 6 fixed engines, respectively. The *Consistency Level* of a group increments with every epoch collected by values of 0, 0.1, 0.25, 0.5, 1.0, and 1.5 for 1 to 6 fixed engines. The set *Consistency Level* must be met before *Phase-2* is allowed to end.

If high accuracy is needed in areas of high multipath and areas with limited views of open sky (under full tree canopy and urban canyon environments), longer observations will improve accuracy. Repeated observation can also be performed later (1 hour or more is recommended) to improve accuracy. These repeated points can then be averaged together with the *Average* function found in *Cogo Tools* or with the *Cluster Averaging* function.

Recommended Collection Settings & Default Action Profiles

Boundary Action Profile - To be used for control and boundary shots and in high multipath environments (under tree canopy, next to buildings, etc.)

- Start with Start Button
- Stop After: 100 epochs
- Minimum Duration: 120 seconds (increasing this to 180 is preferred in bad locations for additional protection from accepting points with bad fixed initiations and for better post-processing results)
- Verify with V6 Reset
- Confidence Level: 10
- Consistency Counter: 10
- Min RTK Engines: At least 2
- Validate Result: with at least 2 engines
- Correct for Tilts: Off (Rover pole must be plumbed)

Precise Topo - To be used for topographic shots where some multipath may be present. The receiver should still have at least a 50% clear view of the open sky.

- Start with Start Button
- Stop After: 10 epochs
- Minimum Duration: 10 seconds
- Verify with V6 Reset
- Confidence Level: 5
- Consistency Counter: 10
- Min RTK Engines: At least 2
- Validate Result: with at least 2 engines
- Correct for Tilts: Off

Quick Topo - To be used for rapid topographic shots in open sky environments. If it is difficult to obtain 5 engine fixed, the environment may not be well suited for this profile and the *Precise Topo* profile should be used.

- Start with Start Button or Start When Tilted
- Stop After: 2 epochs
- Verify without V6 Reset
- Consistency Counter: 0

- Min RTK Engines: At least 5
- Correct for Tilts: On*

Stakeout - To be used for staking out points (See Stake section of this manual). Staking point in areas of high multipath still requires confirming matching fixed initiations acquired at least 2 minutes apart. The Boundary profile can be used for this. After the location of the point being staked has been verified, *Verify with V6 Resets* can be turned off to quickly fine tune the location on the ground.

- Start with Start Button
- Stop After: 30 epochs
- Minimum Duration: 30 seconds
- Verify with V6 Reset
- Confidence Level: 5
- Consistency Counter: 10
- Min RTK Engines: At least 2
- Validate Result: with at least 2 engines
- Correct for Tilts: Off

In all above cases

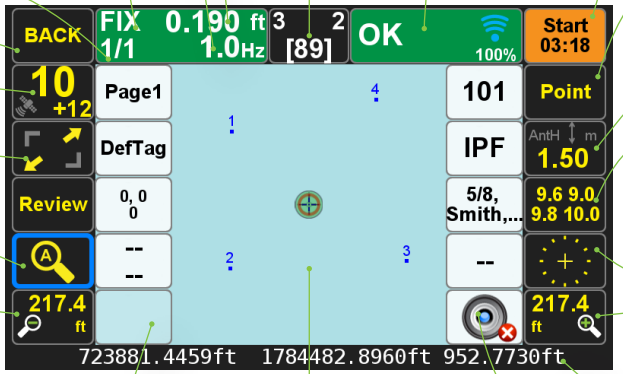
- Accept Fixed Only, RMS: All, PDOP: All
- Confidence Guard: 0.164 ft

WAAS Float - This profile can be used to quickly collect points with float solutions. SBAS tracking must be enabled to acquire WAAS (Wide Area Augmentation System, available in North America) float solutions. SBAS tracking can be enabled from the *Advanced Setup* menu (press the *Set Up* hardware button twice > *GNSS*).

If you wish to review point statistics or if you wish to edit the ShapeTag, Code, Description and/or Attributes fields after data collection, Auto Accept must be set to Off. If these fields do not need to be changed and you desire fast data collection with the Quick Topo settings, set Auto Accept to On.

*If Correct for Tilts is on, the Level Offsets must be calibrated frequently if accuracies greater than 0.10' are needed.
If the point you are attempting to locate is near the edge of a building, tree trunk or other obstruction, it often best to use one of the CoGo Offset functions. When the most accurate measurements are needed, the *CoGo Resection* function found in the *Intersections* menu is recommended.

Screen Anatomy - Collect Action Screen



Instantaneous RMS estimate of the current position solution

The current RTK correction rate being received

"FIX" (Fixed), "FLT" (Float), "CDF" (WAAS Code Differential Float) or "STN" (Standalone) solution types are indicated. Tap this box to open the RTK V6+ screen..

Shortcut to the *Action Setup* screen; the pitch (forward/back), roll (left/right), and the azimuth or bearing the unit is facing are displayed. This box turns orange if the device is tilted more that 5 ° with *Correct for Tilts* off, or more than 30 ° degrees with *Correct for Tilts* enabled. When orange it prevents accepting of epochs in all modes except trajectory.

Shortcut to the applicable RTK corrections communications screen; Currently corrections are being received through WiFi with a 100% link quality and full signal strength (as displayed by the full bars of the signal strength icon)

Begin collecting a point; the current time is displayed on the 2nd line

Number of engines fixed/number of engines required by user

Returns to the previous screen

Shortcut to *Satellite Status* screen; SV total*

Maximizes map view to full screen

Shortcut to the *Review* screen

Cycle through *AutoZoom* and *1:1 Zoom* modes

Zoom out

Shortcut to *Selection* of the type of feature being located; *Point, Line Curve, Trajectory or Shift*; choose by *Survey* or by *Offset*

Antenna Height

D-SNR loss, displays the level (in dB) of the signal strength loss and interference in the L1 / L2 GPS and GLONASS bands. Values 0-3 are desirable, 3-6 are fair and above 6 are poor.

Center map on current location

Zoom in, the scale is displayed as the distance across the bottom of the screen (between the user defined boxes).

The map displaying point and lines contained in pages that are enabled. To expand the *User Defined Buttons* press the *Action* hardware button.

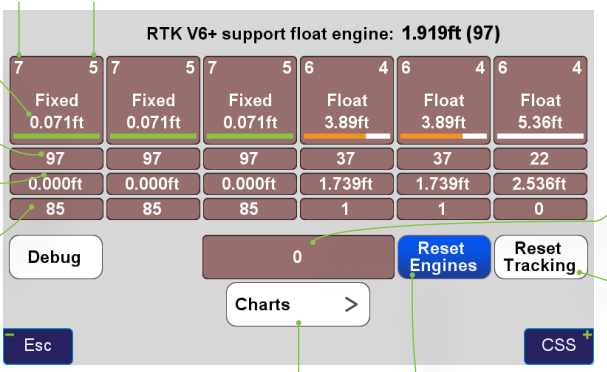
Current location in current Page

Unassigned *User Defined Button*, tap to assign

Tap once to preform the action associated with the *User Defined Button (AKA White Box)*; long click (touch and hold) to remove or change the *User Defined Button*

* Total number of SVs obsered by RTK Rover may be different from number of SVs observed by RTK Base

Screen Anatomy - RTK V6



GNSS satellite count used in given engine

GPS GLONASS

3D RMS for the current epoch in given engine

Number of seconds since the last reset for a given engine

Distance from the solution of the 1st engine

Number of fixed solutions since all engines were reset

Use this value to evaluate and compare the performance of each engine.

A user definable threshold showing allowable delay in seconds when *Extrapolation Mode* is used .

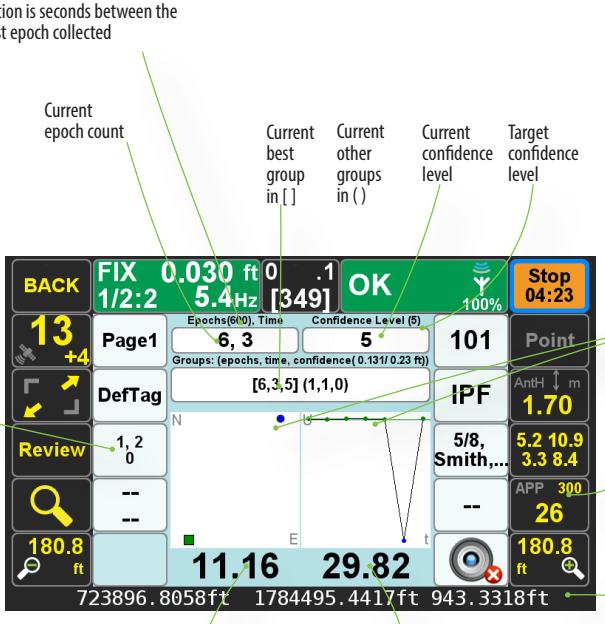
Reset GNSS Tracking

Charts plotting each fixed epoch for each engine

Manually reset engines to compel new fixed solutions when automatic verification is turned off (unchecked)

Screen Anatomy - Collect Action Screen

Screenshot after Phase-1 of RTK Verification is Completed

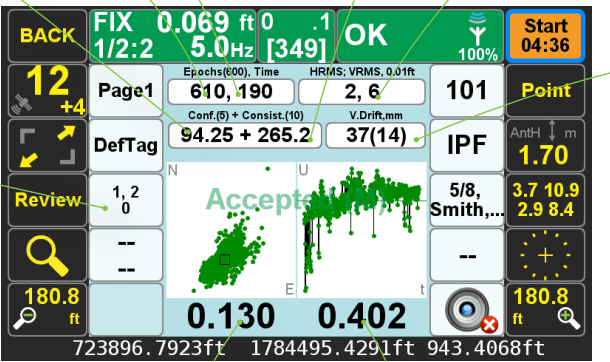


Example One: Phase-1 ONE

This Point was collected in a high multipath environment, several feet away from a 2 story building.

Screen Anatomy - Map Screen

Screenshot after Phase-2 and Validation Phase of RTK Verification is Completed

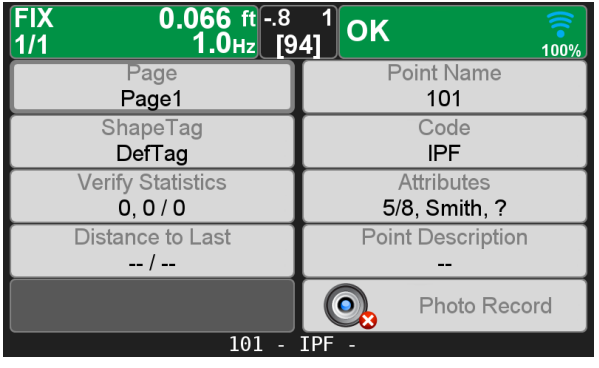


Example One: Phase-2

This Point was collected in a high multipath environment, several feet away from a 2 story building. The effect of multipath can be seen with the large vertical spread displayed in the vertical plot.

Screen Anatomy - Collect Action Screen with Expanded User Defined Buttons

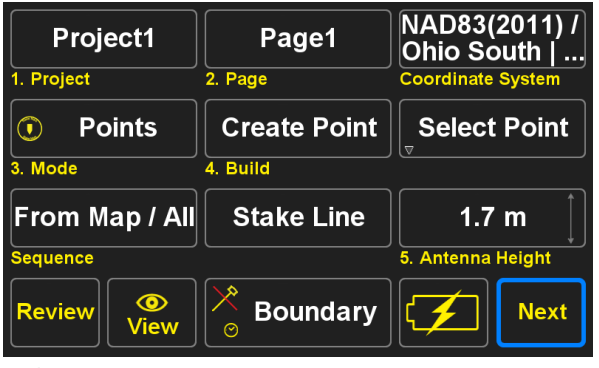
The *User Defined Buttons* are expanded by pressing the Action hardware button. The most commonly used and recommend User Defined Button options are shown below:



Many of the selected options are inputs for the same parameters in the *Collect Prepare* screen. As with every screen, more details can be found by pressing the *Help* hardware button.

Stake

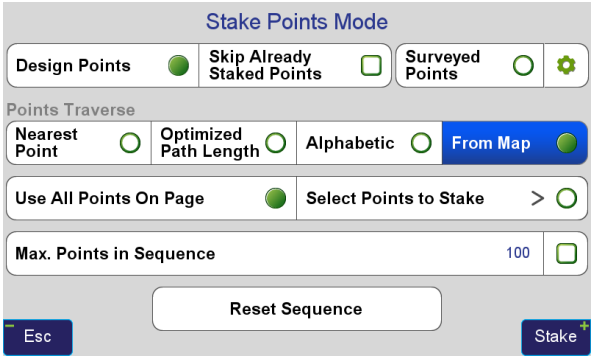
Similar to the *Collect Prepare* screen in appearance and function, the ***Stake Prepare*** screen allows you to configure the settings for staking points.



Stake Prepare Screen

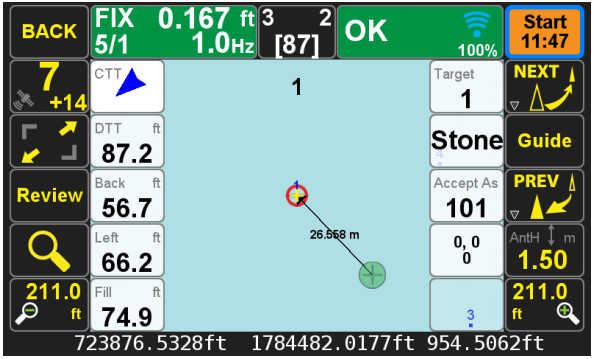
Additionally, the ***Prepare to Stake*** screen allows you to define various ***Modes*** to stake which include a ***Points Mode***, several ***Alignment Points Mode*** and ***Alignment Stake-Here Mode***.

Sequence defines the order of the points to be stake. The ***From Map*** mode is suggested mode for new users. This allows you to pan the map cursor over a point displayed in the map and tap *Next* to select that point to be staked.



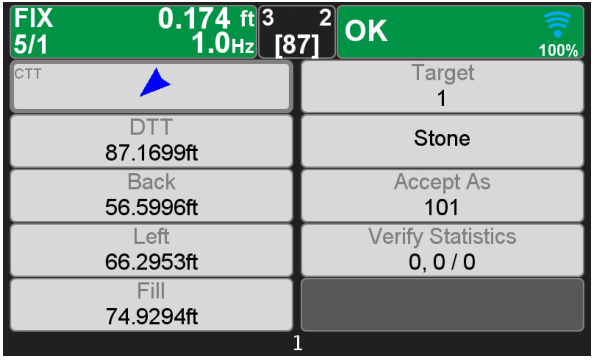
Stake Sequence Screen

The suggested *User Defined Button* options for new users are displayed in the follow two screenshots.



Stake Action Screen

When near the target point being staked tap *Start* to begin collecting data and to average the displayed offset values. When staking a point in a multipath environment, this is an essential step that must be used with *RTK Verification* to ensure the RTK initiation is correct. Choose *Accept* to store the staked coordinate or *Reject* to discard them or to adjust the position and try again.



Stake Action Expanded Screen

The *CTT* (Course to Target) *Arrow User Defined Button* option in the top left box displays the direction to the point being staked while the distance to it is displayed in the *DTT* (Distance to Target) whitebox below it. Further down are the *Ahead/Back* and *Right/Left* boxes that display the distances to the point relative to the TRIUMPH-LS. The *Cut/Fill* option is in the lower right box.

On the right side, the *Target Name* option is used as another method to select the point being staked. When it is added as a whitebox you must choose whether to "Key-in target point name" or "Select target point from list". Select the option you prefer. Below it are *Point Description*, *Accept As* and *Verify Statistics* whitebox options.

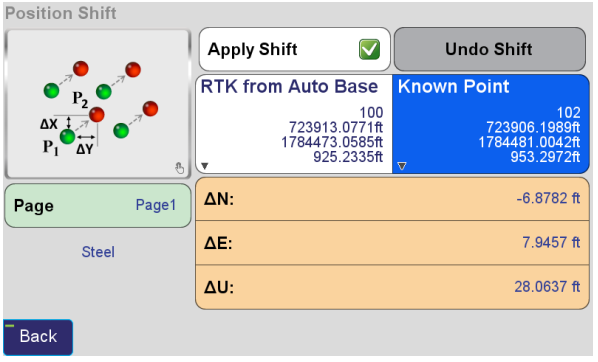
The *Accept As* whitebox is useful if you wish to store the staked coordinate of a design point as new point rather than having it stored in the design point's record. After collecting the staked design point press *Accept As* rather than *Accept* if you desire to store it as a new point.

Real-Time Position Shift

Real-Time Position Shift, allows real-time corrections to be applied to receive base station corrections. A base station can be started with an autonomous position and then corrected by surveying a point with known coordinates. The known point could be a point previously surveyed with a base station setup in a different location. This feature is useful for several scenarios:

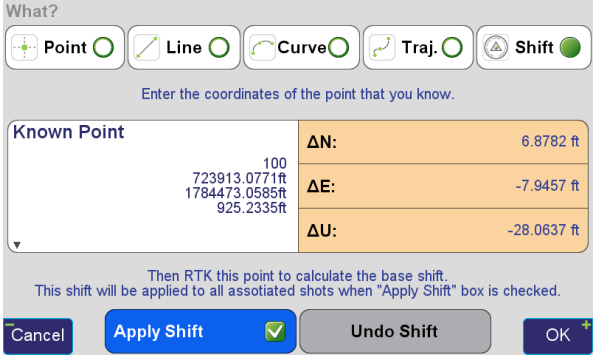
- You need to move or "leapfrog" your base station to extend the radio range into a new area.
- Your original base station point has been lost.
- You wish to save time by starting the base station with it mounted to the top of your vehicle. Setting the base station and radio up on the top of vehicle by mounting it a roof rack or using a magnet mount saves time by eliminating the need to setup tripods and can help protect the base station from disturbances or theft in undesirable locations. For the best performance, the base station should be mounted in a near level position so that phase center variations and antenna offsets are correctly applied. If you are parked on a sloped surface, a swivel mount can be used to level the receiver on the top of your vehicle. Your vehicle should be parked on solid ground where it will not move or sink.

The *Real-time Position Shift* function can be accessed from the Advanced Setup menu (press the ***Set Up*** hardware button twice > ***Real-time Position Shift***). In this screen, select a point you have collected RTK coordinates from with an autonomous base station and then the known coordinates of this point. Check the *Apply Shift* and the shift will be applied to all the RTK surveyed points found in the current project collected from this base station. This shift will continue to be applied to all the points surveyed from this base station.



Position Shift Screen

Real-time Position Shift can also be accessed from the Collect Action screen by clicking the button below the Start button and changing the collection mode to Shift. In this mode select the *Known Point* and then press *Start* from the action screen to collect a point so that the offset can be calculated. After it has been calculated you will be prompted to apply the shift.



Position Shift Screen from the Collect Action Screen

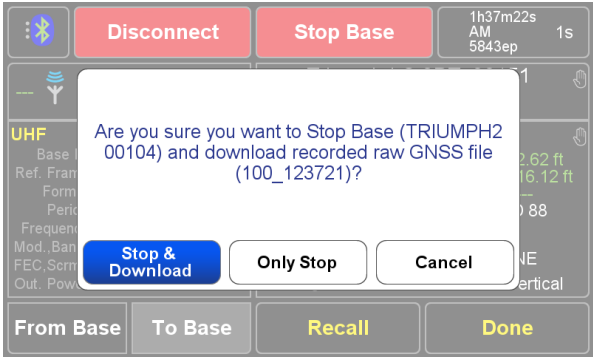
Hybrid RTK with DPOS

When a GNSS RTK base station is started by assuming an autonomous position, it is necessary and good practice to later adjust and correct the coordinates with a GNSS solution referenced from known coordinates. J-Field, has the ability to adjust the base station coordinates and associated RTK points surveyed with DPOS (Javad's Data Online Processing Service). Your raw GNSS base station data is sent to the DPOS server from J-Field to be processed with CORS (Continuously Operating Reference Station) data. DPOS then sends the adjusted coordinate back to J-Field and J-Field applies the adjustment to the base and rover coordinates.

Now with the introduction of ***Hybrid RTK*** in ***J-Field 2.0***, raw data files from the rover can also be post-processed with DPOS. Your local base station data can be used to post-process base to rover vectors; serving as an additional check for the RTK solutions and as method to obtain accurate solutions in areas where RTK corrections are lost. Rover points with raw GNSS files can also now be post-processed with CORS data.

Recording Raw GNSS Data

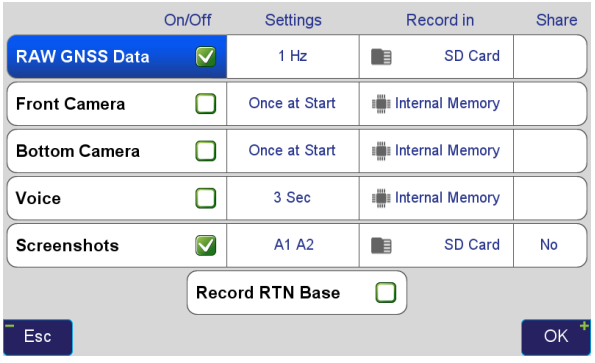
Base station data is automatically recorded when a base station is started with *Base/Rover Setup*. After done surveying connect to base in *Base/Rover Setup* and choose Stop Base. You will be prompted with several options. Choose ***Stop & Download*** so that the base data is downloaded into J-Field and can later be processed with DPOS.



Base/Rover Setup - Prompt to stop the base and download data

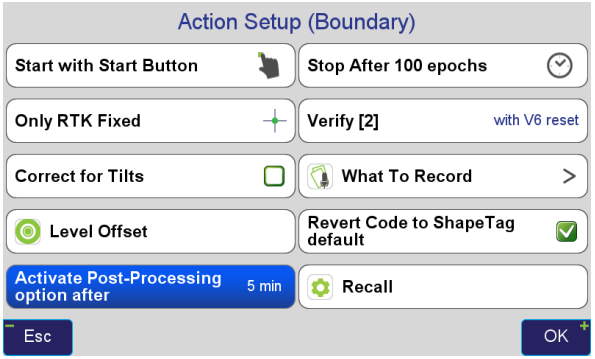
You will be prompted with several options. Choose ***Stop & Download*** so that the base data is downloaded into J-Field and can later be processed with DPOS.

Rover GNSS data is recorded with points when this option is enabled in the What To Record settings.

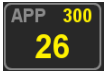


What To Record screen - Recording of GNSS Data enabled

Raw data for rover points can also be saved with the *Activate Post-Processing* option found in the *Action Setup* screen.

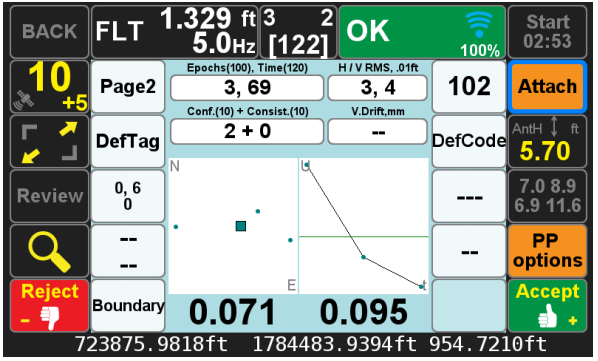


Action Setup screen - *Activate Post-Processing option after* 5 min

When this option is enabled, the 

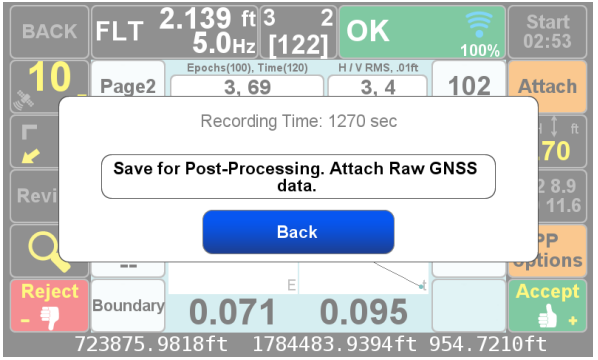
(APP) button will be display how many epochs of raw data have been recorded and how many are required in the Collect and Stake Action screens. Once the required number of epochs have been met the button changes to display 

. Then once *Stop* is tapped the *PP Options* button is displayed.



Collect Action screen displaying the *PP Options* button.

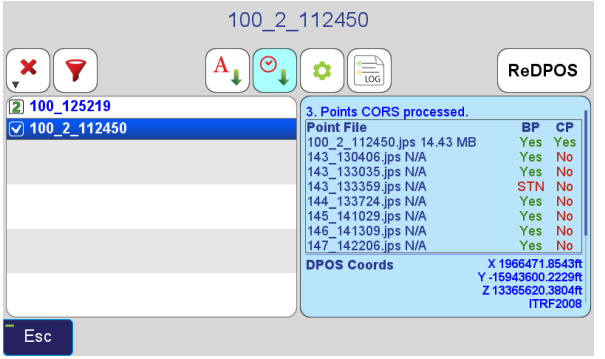
Tapping this button presents the options to save the raw data for post-processing.



Collect Action screen displaying the prompt to save raw data.

Processing Raw Data with DPOS

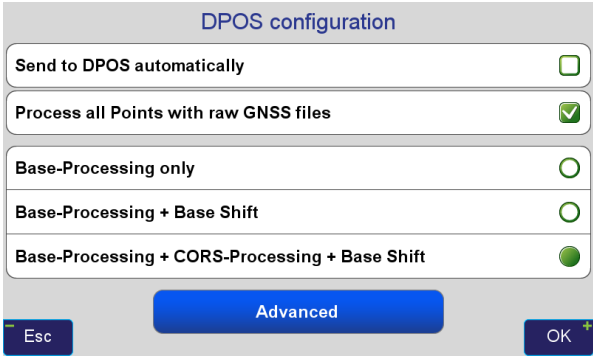
To post-process the data, open the *DPOS* tool found in the CoGo menu and select the base file you wish to process. It can also be open by tapping the *DPOS* button found in the Points screen.



DPOS - The Filter is Applied to *Show Current Project Base Files Only*

With J-Field connected to the Internet, tap the DPOS button to submit the raw data files for the selected base station session to DPOS. The blue information panel displays the status of the selected DPOS session.

The (configuration) button contains various options for DPOS processing.



DPOS Configuration Screen

Send To DPOS automatically will submit GNSS raw data to DPOS automatically when an Internet connection is available.

Process all Points with raw GNSS files will submit all rover raw data files to DPOS for processing even if they have not been marked for post-processing.

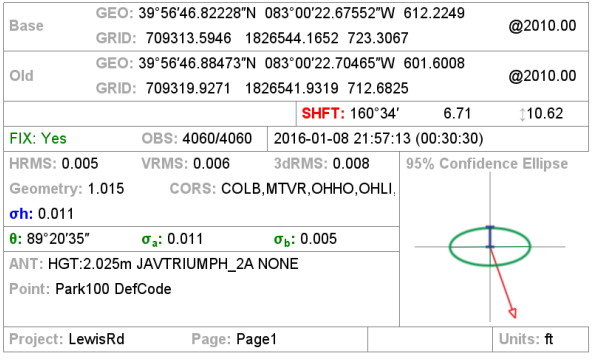
Three processing types exist to determine how to process the data:

- ***Base-Processing*** - base and rover raw GNSS data are uploaded to DPOS and base-rover vectors are then processed
- ***Base Shift*** - base station data is processed with CORS data; the base station coordinate and survey points collected from the base station session will be automatically adjusted
- ***CORS-Processing*** - rover points with raw GNSS files are processed with CORS data (including your base data if this option is enabled in the Advanced settings)

Note that as of J-Field 2.01.523, design points are not adjusted but this feature is planned for the future. All CoGo functions except *Average* create resultant points with design coordinates.

Reviewing DPOS Results

The *Base Rover Statistics* screen can opened by tapping the blue information panel. An acceptable solution should have a Fixed solution, a 3dRMS of less that 3 cm (0.10') and make use of multiple stations; if this is not the case, the data can be reprocessed again at a later time by pressing the ***ReDPOS*** button.



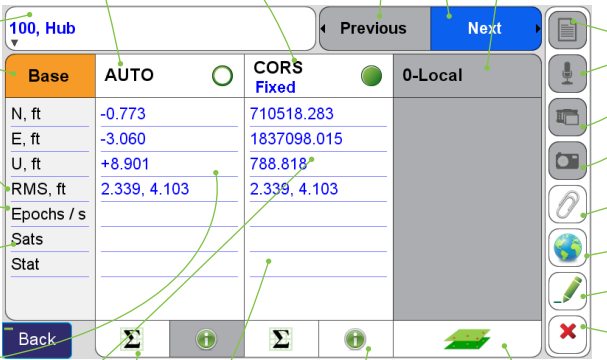
Base Rover Statistics Screen

Full DPOS results can be reviewed in the *Processed-Point Info* screen by tapping  found in the *Point* screen.

The detailed use of *Processed-Point Info* screen is explained on the following two pages.

Screen Anatomy - Processed Point Info Screen

Example of a Screenshot for a Base Point



Point Name - The name of the current point being reviewed, this box can be formated to also display the Code and Description with a long click (notice the arrow in the bottom left corner)

Use *Previous* and *Next* to cycle through the list of surveyed points

The current (radio button is selecting this column) coordinate type for the base and associated rover points is *KNOWN* (base station was started from a known coordinate). If the base station was started from an autonomous position this would be labeled *AUTO*.

M-Local - The *Multiple Local* coordinate/residuals are displayed in this column. *M-Local* coordinates shift the associated surveyed points with the same base station session to known coordinates. (This point does not currently have *M-Local* coordinates.)

The post-processed CORS solution for the base station (currently not selected as the current coordinate)

Indicates this is a Base point

Note, Audio, Screenshots and *Photos*- Tapping these button will display the point's *Note, Audio, Screenshots* or *Photos*. These buttons will only be active when the point has these attachments.

Horizontal and Vertical RMS

Number of Epochs / Duration (time between first and last epoch in seconds)

Attach - Use this button to attach new media to the point

Map - View this point on the map

Number of GPS + GLONASS satellites

Edit - Open the *Edit Point* screen

Delete - Delete this point

The current coordinates; the coordinates in the selected column will be used throughout J-Field as the current coordinates. These are the coordinates that will be displayed in map, points list, exports, etc.

Residuals from the current coordinate

Number of stations used in this CORS solution

Add M-Local - Use this button to add the current displayed point as a *M-Local* point. Once tapped, you be prompted to select or enter a coordinate. The translation from the displayed point (100 in this example) to the enter coordinate will be calculated. Multiple pairs of points can be added in *M-Local* to calculate a best fit translation; hence the term *Multiple Local (0-Local* has 0 pairs of points, *1-Local* has 1 pair, *2-Local* has 2, etc.). Select the *M-Local* coordinate (radio button set to this column) for any point to then apply this translation to the selected point and all other associated points with the base station session.

Info - The info button opens a text report for the post-processed solution shown in this column.

Base Rover Statistics - View the *Base Rover Statics* screen for the solution shown in this column.

Screen Anatomy - Processed Point Info Screen

Example of a Screenshots for a Rover Point

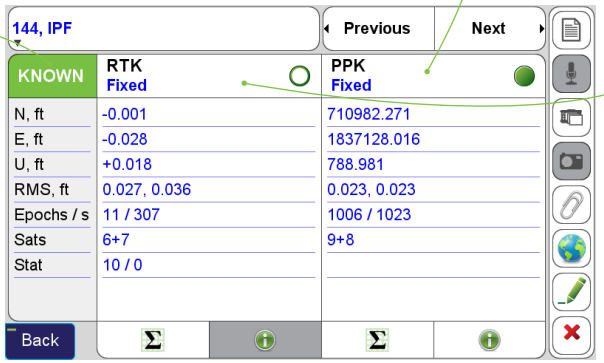
Base Type - This box is painted green when the current coordinate has the base reference from this type of coordinate. *KNOWN* indicates that the base was started from a known position. If the base station was started from an autonomous position this would be labeled *AUTO*. Tap this button to view the *ABS* coordinates (absolute coordinates, shown in the bottom screenshot).

Base-Rover Post-Processed Solution with *KNOWN* Base (current coordinate in this screenshot)

RTK Solution with *KNOWN* Base, tap this box to set the current coordinate to this coordinate. You will be prompted with several options:

Yes, For All - This option select this coordinate type for all points with associated with this base station session.

Yes, For All (Auto RTK/PPK) - This option will use an algorithm to automatically select the best RTK or post-processed coordinate for all points with associated with this base station session.



Base Type - This box is painted red when the current coordinate down not have the base reference from this type of coordinate. *ABS* (absolute) coordinates indicate that the base station coordinates are reference from a CORS adjusted solution or from local control points when the *M-Local* coordinate is chosen. Tap this button to view the AUTO/KNOWN referenced coordinates.

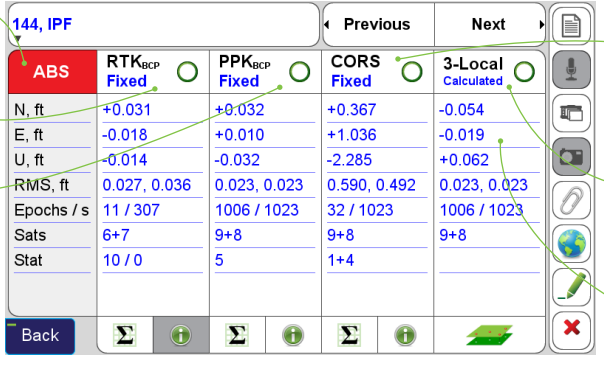
RTK Solution with *BCP (Base CORS Processed)* Solution

Base-Rover Post-Processed with *BCP (Base CORS Processed)* Solution

CORS Post-Processed Solution

M-Local Solution - 3 pairs of coordinates used in this example

Tap this column to view the setup properties of the calculated *M-Local* for this point



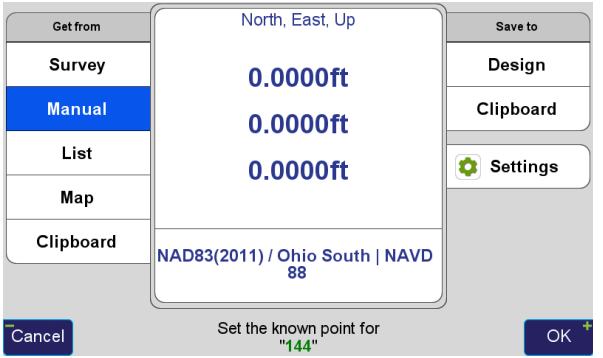
M-Local

M-Local coordinates shift the associated surveyed points with the same base station session to known coordinates. Some possible uses for *M-Local include:*

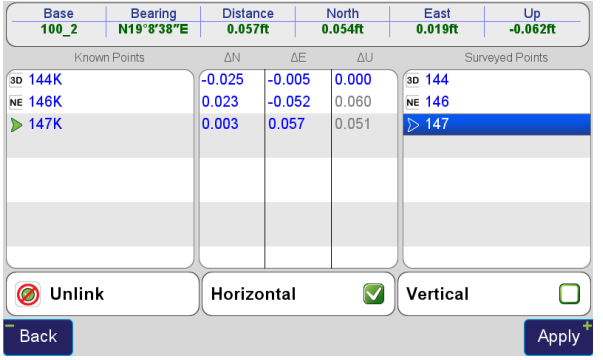
- Adjusting an autonomous base station to local control points
- Adjusting an autonomous base station to a post-processed derived position such as OPUS
- Shifting base and rover coordinates to the averaged coordinate of multiple DPOS base station sessions

Adjusting an autonomous base station to local control points

Use the  button found in the *Processed Point Info* screen (see previous two pages) to add the current displayed point as a *M-Local* point. Once tapped, you be prompted to select or enter a coordinate. The translation from the displayed point (144 in this example) to the selected coordinate will be calculated. Multiple pairs of points can be added in *M-Local* to calculate a best fit translation; hence the term Multiple Local (0-Local has 0 pairs of points, 1-Local has 1 pair, 2-Local has 2, etc.).

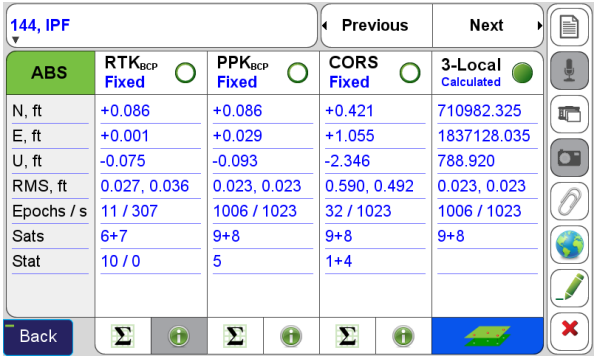


Add M-Local Point Screen - Prompted to select the known coordinate for point 144



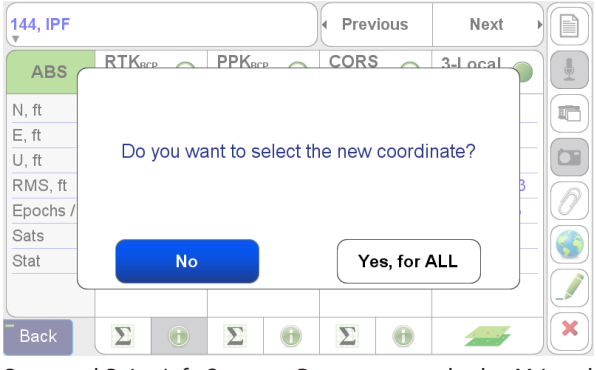
M-Local Screen - 3 pairs of points shown

The *M-Local* Screen displays the translation along the top row of the screen. Pairs of points can be used Horizontally, Vertically or only as check points. The residuals for each pair of points are shown in the middle of the screen. Be sure to press Apply to save the added points to M-Local and apply the adjustment to the associated base and rover coordinates.



Processed Point Info Screen - The M-Local coordinate is the current coordinate, 3 pairs of points exist in this *M-Local* setup

If the *M-Local* coordinate is not currently selected (radio button set to its column), select it for any point from this base station session to apply its translation to the selected point and all other associated points with the base station session.



Processed Point Info Screen - Prompt to apply the M-Local coordinates to all the associated base and rover coordinates

Adjusting an autonomous base station to a post-processed derived position such as OPUS

View the base point in the *Processed Point Info* screen and press the  button. Then choose *Manual* and enter the OPUS coordinates. After pressing OK you will be prompted to enter a point name for the newly entered coordinates. Once satisfied with the results in the *M-Local* screen hit Apply to save and apply the adjustment.

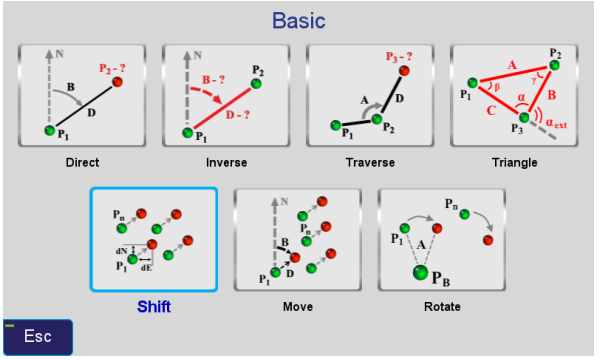
Alternatively, you could create a new design point with the known coordinates of the base station prior to entering the *M-Local* screen by tapping the  (Add) button found in the design side of *Points* list and entering the coordinates for the new point.

Shifting base and rover coordinates to the averaged coordinate of multiple DPOS base station sessions

First average the base station coordinates from multiple base sessions using the *CoGo Average* function. Next view each base station point and use the  button to setup the translations to the averaged coordinate for each base station point.

CoGo

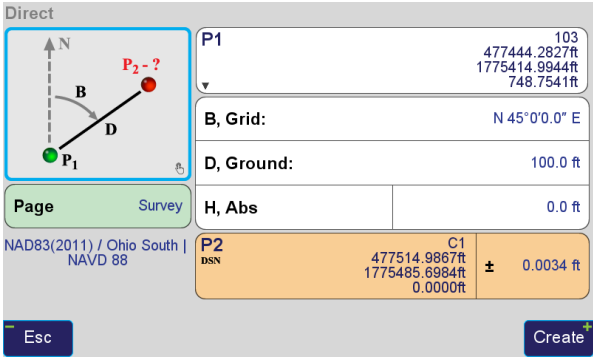
Most CoGo (Coordinate Geometry) functions in J-Field are rather self-explanatory after viewing their diagrams. *CoGo Direct*, *Inverse*, *Shift* and *Rotate* are found in the *Basic* group of CoGo functions that will be explained here.



CoGo Basic Functions

In all CoGo function diagrams, labels shown in black are inputs and labels shown in red are the resultant calculations. Input points are displayed in green and red points are resultant points created from the function.

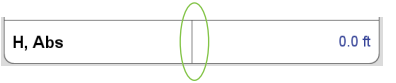
Direct



CoGo Direct

Direct calculates the coordinate of a new point (P_2) given the coordinate of a known point (P_1), bearing (**B**) and distance (**D**) from P_1.

Notice the vertical line in the white box shown between **H,Abs** and the input "0.0 ft":



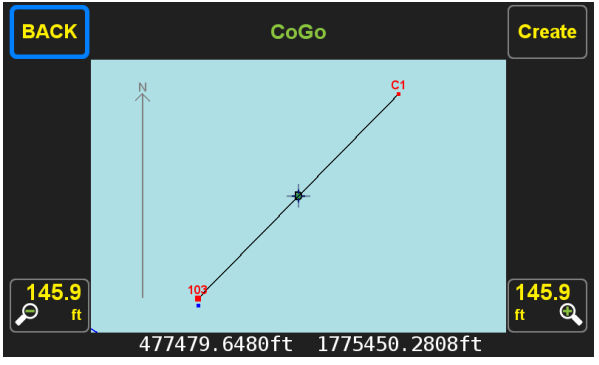
Clicking on the left side of this white box with **H, Abs** will toggle it to the other options of **H, Slope** and **ΔH**

Clicking on the right side of this box will allow for the entry of the value. This functionally is similar in all CoGo menus when you see a white box separated with a vertical line in the middle.

The resultant point is shown in the orange box. Clicking on this box will allow you to edit the Name, Description and

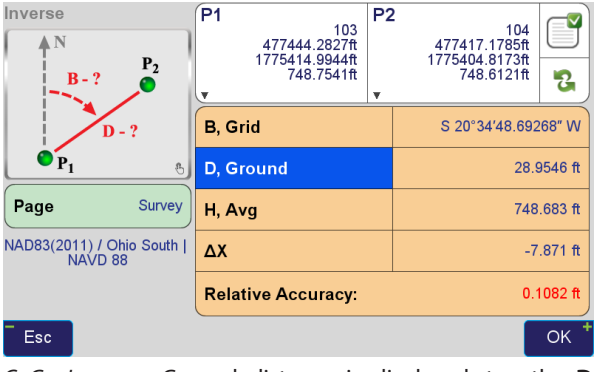
Code of this point.

Once all the inputs have been entered you may tap the diagram to preview the results in the map. If satisfied, tap Create to create the resultant points.



Preview Screen of *Cogo Direct*

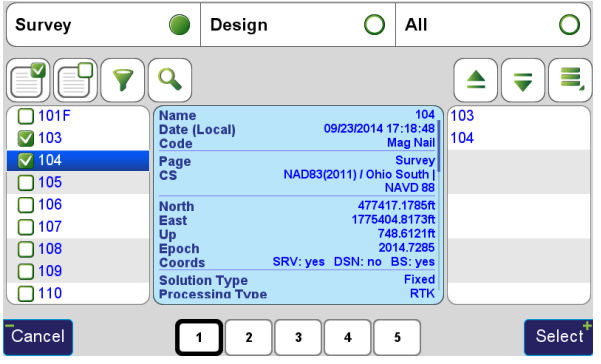
Inverse



CoGo Inverse - Ground distance is displayed, tap the **D** button to cycle through the other distance type

Inverse calculates the bearing (**B**) and distance (**D**) of a line between two known points (P_1 & P_2).

The (multi-select) button can be used as a quicker method to select both P_1 & P_2 from the point's list.

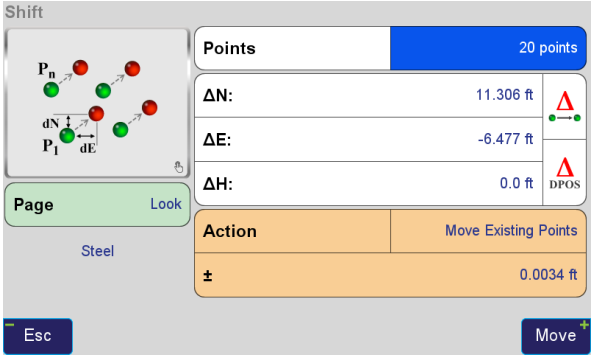


Multi-Select Screen - Selecting Points 103 and 104

P_1 & P_2 can also be entered directly from the keyboard by typing in the point names. To use this option, long click the P_1 & P_2 boxes (notice the small arrows in the bottom left corner of these boxes).

Press to switch the coordinates of P_1 & P_2. Clicking on the right side of output boxes such as **B**, Grid copies the value of the box into the selected clipboard box.

Shift

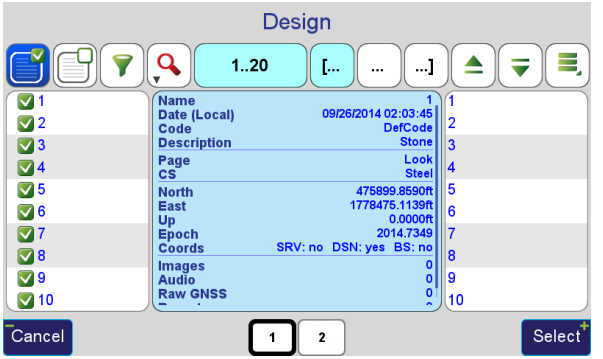


CoGo Shift

CoGo Shift and *Rotate* are useful for shifting and rotating design points to desired geodetic surveyed locations.

Upon opening the *Shift*, *Move* or *Rotate* functions you will be prompted two options: to *Create New Points* or *Move Existing Points*. The *Create New Points* would need to be chosen if the desire is to shift surveyed points. Surveyed coordinates are blocked as options to be shifted is the *Move Existing Points* option is selected. The *Create New Points* would typically only be desirable and applicable to use if some object needs to be physically relocated in the field and the new location needs to be calculated. To adjust surveyed coordinates from an autonomous base, *Real-Time Position Shift, DPOS* or *M-Shift* should be used.

The *Multi-Select* screen is used to select the points to be shifted. To select individual points in this screen, use the  (*Check Hardware*) button for easier selection of individual points.



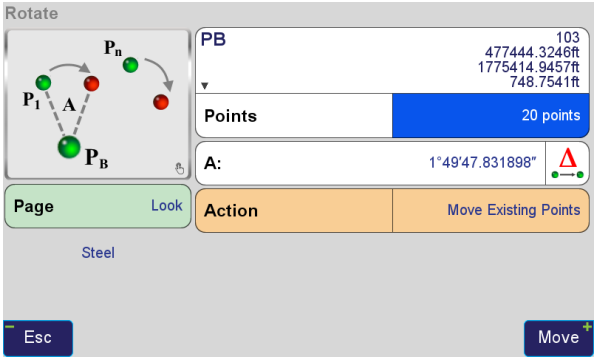
Multi-Select Screen - Selecting points 1 through 20, notice the filter used to filter the list to points 1 through 20, the select all button then is used to select all points

The  (*Delta*) button can be used to calculate the delta between two points, from the first selected point to the second selected point.

The  (*Delta DPOS*) button is used to recall the *DPOS* shift from a base station session. Use this feature to shift design points. (Automatic shifting of design points created from CoGo functions is planned to be implemented in a future version of J-Field.)

Tap the *Move* button once ready to shift the selected points.

Rotate

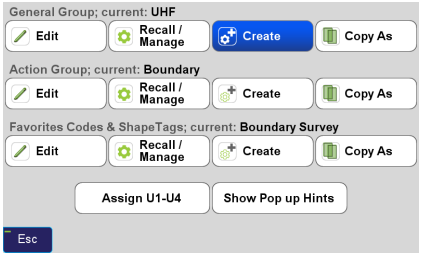


CoGo Rotate

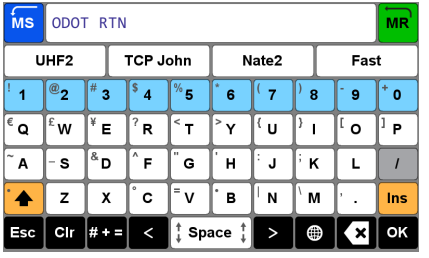
CoGo Rotate is very similar to *CoGo Shift*. Here the Δ (*Delta*) button calculates the angle between the first selected points to the second selected point with the selected **PB** coordinate as the vertex.

Appendix A: Creating a RTN Profile

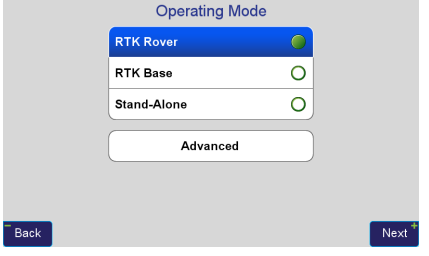
Open the ***Setup*** menu and ***Create*** a new *General Group* profile



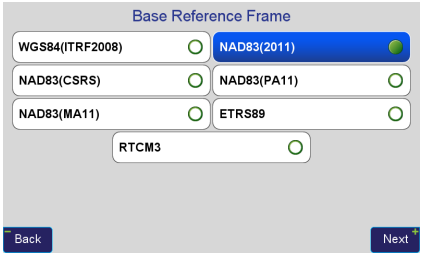
Enter a name for the new profile



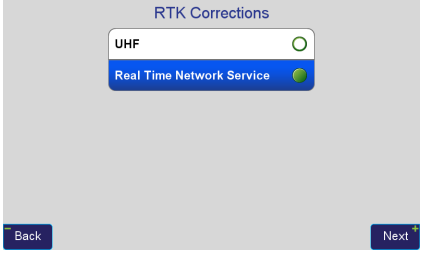
Select ***RTK Rover*** as the operating mode



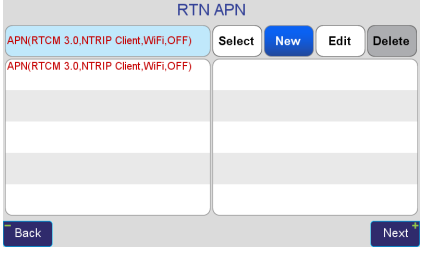
Select the base reference frame, typically ***NAD83(2011) in the US***



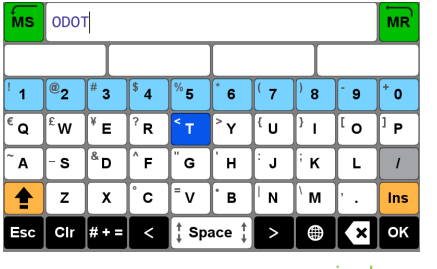
Choose ***Real Time Network Service*** as the correction type



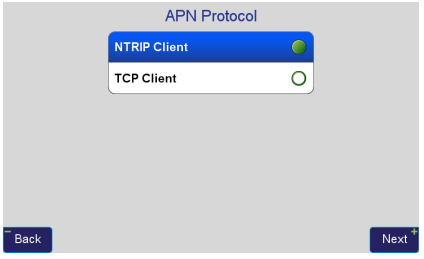
Tap ***New*** to create a new RTN APN (Access Point Name)



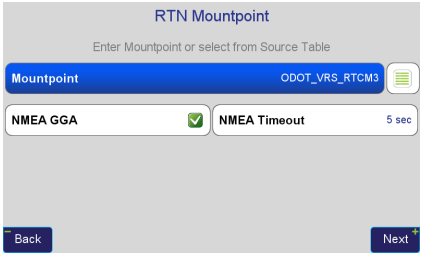
Enter a name for the new APN



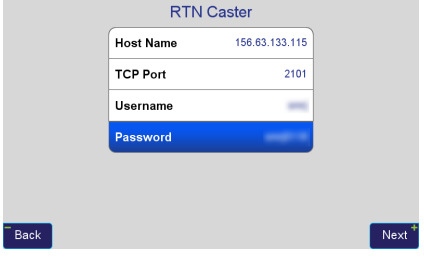
Select ***NTRIP Client*** as the APN Protocol



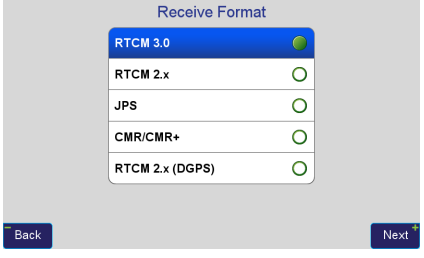
NMEA GGA needs to be enabled if connecting to a mountpoint that is a VRS (Virtual Reference Station). Tap ***Next***



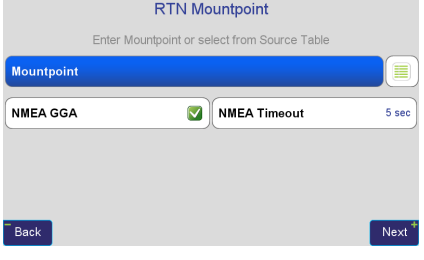
Enter the Host Name, TCP Port, Username and Password provided by your RTN administrator



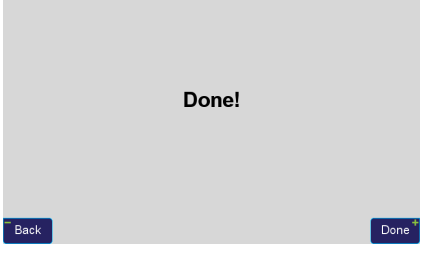
Select the format of the mountpoint and tap ***Next***



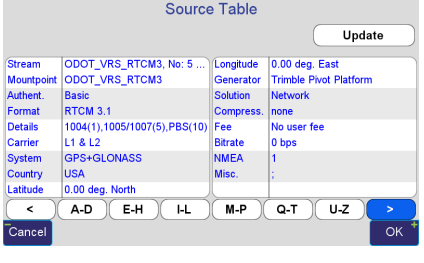
Tap the (list) button to view the list of mountpoints



Tap ***Done*** to exit the setup



Find the desired mountpoint and tap ***OK***. A mountpoint with RTCM 3 format and both GPS + GLONASS is desirable.



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