Instrument Setup Manual

Revised 9/04/14

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Instrument Setup by Manufacturer

Total Station (Geodimeter/Trimble)

The following information describes the various options available for the Geodimeter 600 and Trimble 5600 total stations. It's important to note that firmware 696-03.xx or later is required. To check firmware version, select Menu 5, 4, 1 on the instrument.

Comms
Geodimeter/Trimble default communication settings in SurvCE are 9600,8,None,1. To check these settings on the instrument, do the following:

1. Select MNU, ENT, 4 (Data com), 1 (Select device), 2 (Serial)
2. At prompt "Serial ON?", select ENT
3. Verify COM=1.8.0.9600 followed by ENT

The software allows you to run the instrument in several modes, depending on the capabilities of the instrument. Selecting a model that says DR informs the software that the instrument is a reflectorless (Direct Reflex) model, and the reflectorless EDM mode will be made available.

Settings/Search (Station)
If the instrument is not robotic or you want to operate it as a standard total station, the Station mode should be used.
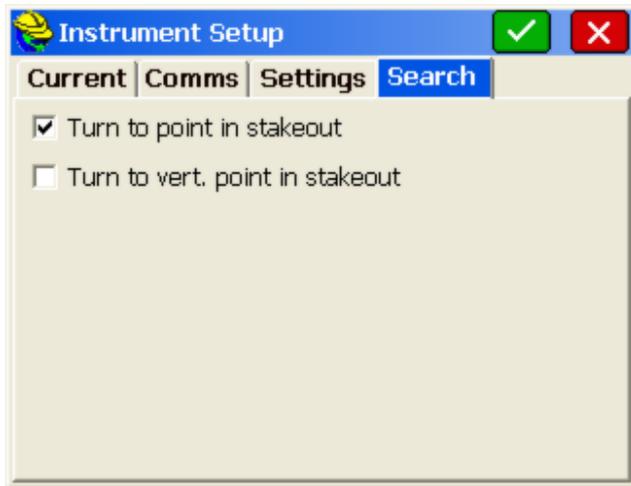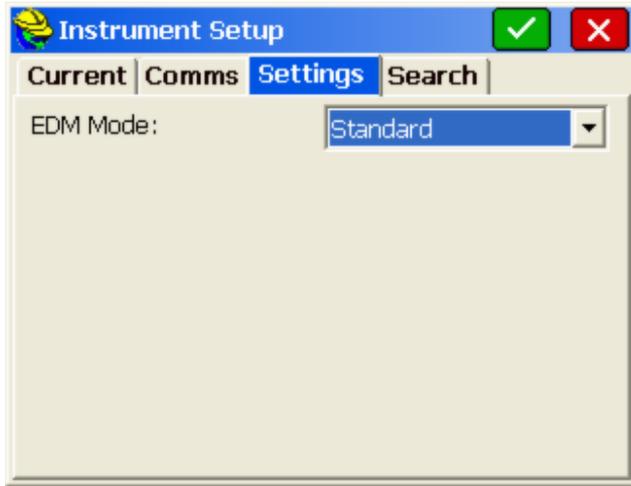
- **EDM Mode:** Allows you to specify the EDM measurement setting as one of the following types:

  Standard: Standard EDM mode.
  Fast: Fast Standard EDM mode.
  Reflectorless: Reflectorless EDM mode (DR Models).

- **Turn to point in stakeout**: Turns the instrument to the horizontal angle as computed to the stakeout location specified.

- **Turn to vert. point in stakeout**: Turns the instrument to the vertical angle as computed to the stakeout location specified. This option is not typically used unless a true elevation is known for the stakeout location specified.

Settings/Search/Remote (Direct Robotic)
This mode works exactly as the GeoRadio mode except a cable must be used in lieu of the radio. For this mode,the instrument must be robotic and be operating in the Remote mode with the faceplate removed.
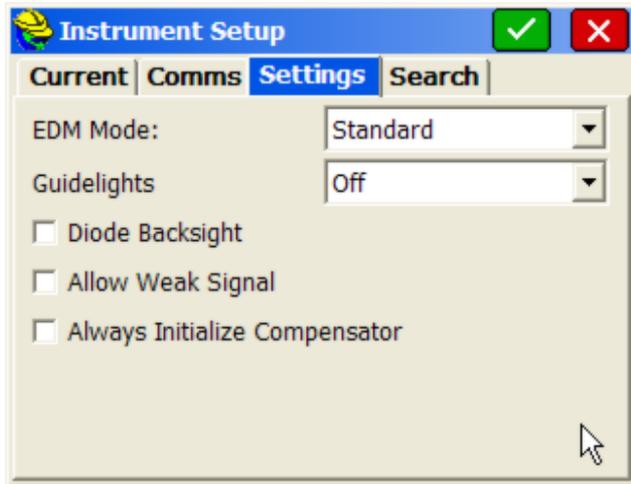
- **EDM Mode:** This selection allows the user to specify the EDM measurement setting as one of the following types:

    Standard: Standard EDM mode.
    Fast: Fast Standard EDM mode.
    Reflectorless: Reflectorless EDM mode (DR Models).

- **Guide Lights:** This sets the track lights to one of the following options:

    Off: Turns off the track lights.
    Low: Turns on the track lights on low power.
    High: Turns of the track lights on high power.

- **Allow Weak Signal:** This will allow the instrument to return a distance when the signal is weak.
- **Always Initialize Compensator:** This will reset the compensator every time the instrument is restarted.
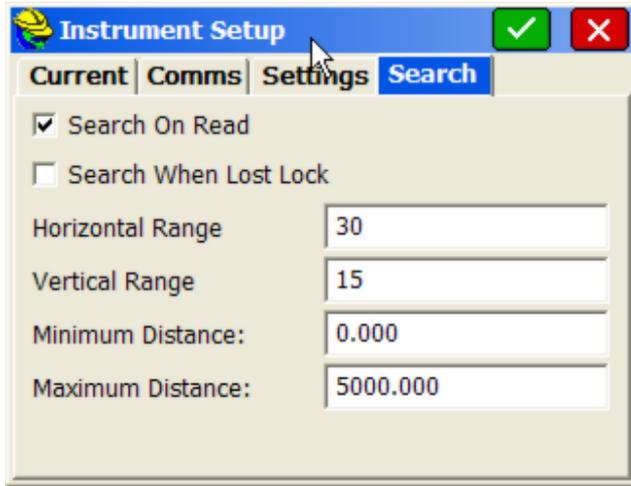
- **Search on Read:** This setting will force the instrument to perform a search before initiating a reading if the instrument is not locked on the prism.
- **Diode Backsight:** This setting allows the user to specify if the backsight has an active diode prism or not.
- **Horizontal/Vertical Range:** These input boxes allow the user to specify the range to search for the prism when a search function is initialized.
- **Minimum/Maximum Distance:** Determines the range by distance that the instrument will search for or track a prism.
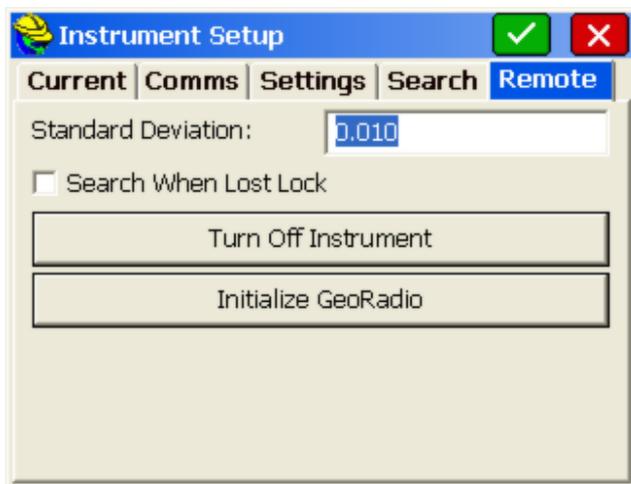
- **Standard Deviation:** Defines the allowable standard deviation of the

instrument readings.

- **Search When Lost Lock:** This setting will force the instrument to begin searching for a prism as soon as lock is lost.
- **Turn Off Instrument:** Turns off the instrument.
- **Initialize Instrument:** Turns on the instrument and initializes the instrument.

GeoRadio Settings (Remote)

These settings are accessed by selecting GeoRadio as your communication type and pressing the Configure button. This mode works exactly the same as the Direct Robotic mode, except a GeoRadio must be used in lieu of the cable. The instrument must also be robotic and be operating in the Remote mode with the faceplate removed. The only additional settings are for the GeoRadio itself.
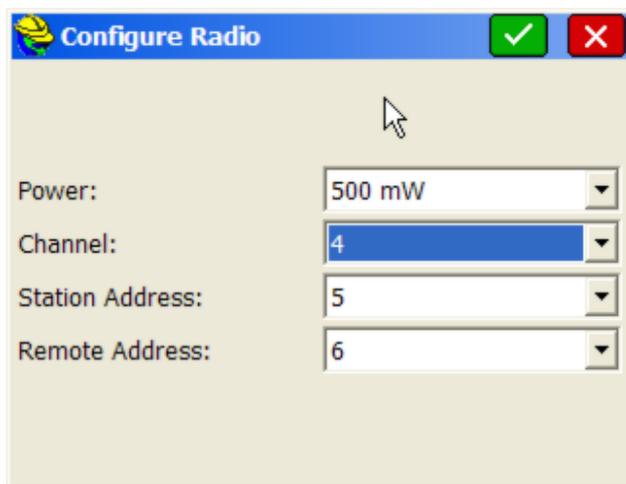
- **Channel**: Specifices the channel of the GeoRadio.
- **Station Address:** Specifies the station address of the GeoRadio.
- **Remote Address**: Specifies the remote address of the instrument's radio.

Putting the 600 in the "Remote Mode"

1. # Power the 600 on.
2. # Answer the initial questions.
3. # If you have not selected the Radio Channels and Address, do the following:
4. # Press <Menu>.
5. # <1> for Set.
6. # <5> for Radio.
7. # Select Channel (1-8).
8. # Select Station Address (1-99).

9. # Select Radio Address (1-99).
10. # Press <RPU>.
11. # Press <3> for Remote.
12. # Press <1> for OK.
13. # Press <No> for Sector.
14. # Press <No> for Measure Ref Object.
15. # Press any key when prompted. You do not have to remove the keyboard as prompted unless you are using the Direct Robotic option instead of GeoRadio. SurvCE will control the total station.

Total Station (Leica TPS Series)

This series covers most of the current Leica total stations such as TPS 100, TPS 300, TPS 700, TPS 700 auto, Builder, TPS 400, TPS 800, TPS 1000 (including TC1010 and TC1610,) TPS 1100,and TPS 1200. For the older 600 and 900, turn off ATR and use the TPS 100/300 configuration. Many of these units include the "motorized" option. Some settings may vary by model.

- **Comm Setup:** Default settings for these instruments are a baud rate: 19200, none parity, Char Length: 8 and Stop Bits:1
- **Instrument Series:** Instruments supported are TPS 100, TPS 300, TPS 700, TPS 700 auto, Builder, TPS 400, TPS 800, TPS 1000 (including TC1010 and TC1610,) TPS 1100,and TPS 1200
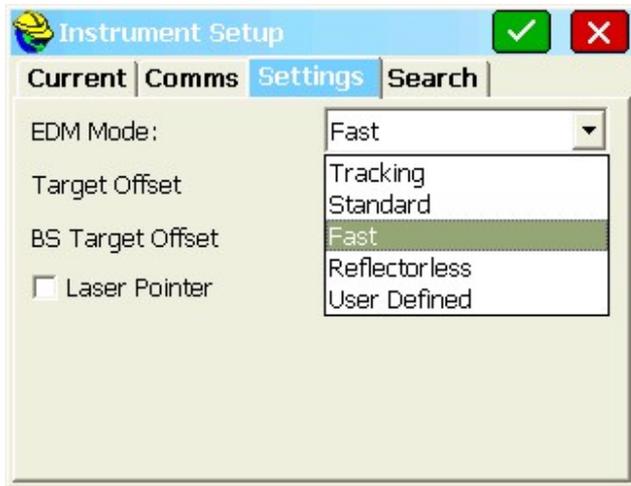
- **Read Method**: The available read methods are Fast, Tracking, User-Defined, and Reflectorless. The default setting is Fast. The "Standard" option produces a 3-second reading while the "Fast" setting produces a 1-second reading. One application of Reflectorless is to toggle between a 0 prism offset (shooting a rock face or brick wall) versus shooting a prism with a non-zero prism offset. When set to Reflectorless, the rod height and prism offset automatically change to zero. When returned to Standard, the previous non-zero prism offset is recalled, and the original rod height is restored. Turn to Point for stakeout and PowerSearch are disabled in Reflectorless mode. The Read Method (Std, Fast, Reflectorless) will appear in the upper right of the graphic screen for most types of Leica total stations, in commands such as Store Points, Stakeout Point, etc.

- **Foresight/Backsight Prism Offset**: Here is the list of standard prism offsets. Note that Leica prisms default zero to equate to -34.4 mm. So a prism offset of 34.4 equals a zero "net" offset. Whenever a prism constant is changed, a note is written to the raw (RW5) file. When you select one of the prisms from the list (Circle, Mini, etc), the value that is shown in parenthesis is the actual value sent to the instrument. i.e. 0.0 for Circular, 17.5 for Mini. If you select "30mm" or "40mm", - 4.4 and 5.6 are sent, respectively (30-34.4 and 40-34.4). You may also type in any value you choose. In this case, we will send that value exactly, unmodified, to the instrument.
  - 23.1 (360): Leica Model
  - 4.4 Mini (360)
  - 34.4 (0mm)
  - 0.0 (circle): Standard Leica round prism.
  - 17.5 (mini): Leica mini prism.
  - 34.4 (ReflTape): Equates to zero offset (wall, surface).
  - 4.4 (30mm): Other manufactures (Sokkia, Seco).
  - -5.6 (40mm): Other manufacturers.
- **Laser Pointer**: Ideal for indoor or dark evening surveying, this feature causes the instrument to emit a red beam. It is often used when doing reflectorless work and makes a red mark on the wall, floor or object being surveyed. This is usefule for confirming the position prior to the shot. The beam should not be directed into someone's vision or eye.
-
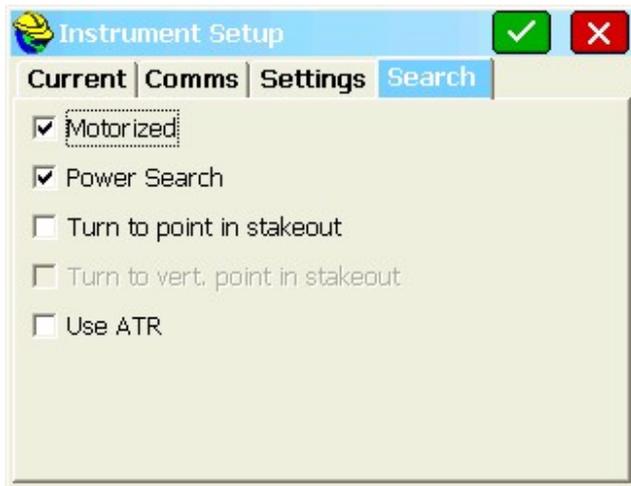
- **Motorized**: When this option is disabled, many other options will also not be available. These options are ATR, Power Search, Turn to Point in Stakeout, and Turn to Vertical point in stakeout.

- **ATR (Auto Target Recognition)**: For the TPS 700, TPS 1000 and TPS 1100, this option will find the prism after you point in the approximate direction. It searches over a fixed range of motion and detects all prism types and locks on to the exact center of the prism. Saves "dial in" time.

- **Power Search Enabled**: The Power Search option can be purchased with all motorized Leica total stations. This option activates the "PowerSearch" button in the "banner line" at the top of the survey and stakeout screens. When Power Search is pressed, the total station will typically find the prism in 10 seconds regardless of the direction it is initially pointed. If it has found one prism and you hit "Power Search" again, it will leave that prism and find the next one. If you have only 2 prisms on the job (foresight and backsight), it will conveniently rotate from the foresight to the backsight and back again each time it is pressed.

- **Turn to Point in Stakeout**: This option should always be enabled with a motorized total station. In stakeout (with the exception of slope staking), the program knows the angle and distance to turn. When enabled, this feature will automatically rotate to correct horizontal angle for the stake point. When on, the associated "Turn to Vertical Point in Stakeout" option will also be made available. Turn to Point in Stakeout is disabled when in Reflectorless mode, since staking out should require the certainty of a prism placed vertically over the target point.

- **Turn to Vertical in Stakeout**: When auto-turning to stakeout points, you have the option to turn horizontally but not vertically. If "Turn to Vertical" is disabled, you would need to manually dial in the vertical position of the prism in stakeout. However, if rod heights are unchanging, this feature can be enabled, and will turn the gun to the correct vertical position as well, factoring in the current rod height setting.

For Leica TPS equipment that offers the reflectorless option, screens such as Store Points and Stakeout now have a handy icon which, when toggled, switches from non-reflectorless to reflectorless and back. The button appears in both the graphics and text modes of these screens. Rod heights and prism constants will automatically be adjusted when switching from one mode to the other.

Leica 1200 Robotic
The new Leica robotic total station requires the activation of the "Extended GeoCOM" option before it will allow the use of third party data collection software (i.e. SurvCE or Carlson Field).

- **Activation Information:** The following information was provided by Leica in document Su11-05G.

  TPS1200 Instruments (TCA, TCP, TCRA, TCRP) require a special key code to operate in Robotic mode when using an AllegroCE/RCS running SurvCE

Version 1.5. The following table lists the part number for the code:

Product	Part Number	Description
TPS1200	734754	GeoCOM Robotics License

Note: When ordering a TPS1200 Robotic Instrument, AllegroCE/RCS and SurvCE, you must order part number 734754 – this is a no charge item.

- **Procedures for Checking Activation Status:** A simple way to determine whether the "Extended GeoCOM" option is activated is to enter the Robotics dialog of SurvCE and attempt a power search. If the instrument communicates, but the power search feature fails, the "Extended GeoCOM" option is not activated. If you suspect that this is the case, you can verify that the feature is on in the instrument using the following steps:
  o Power on the instrument.
  o Select the "User" button on the keyboard.
  o Select the F3 button for "STAT".
  o Select list item number 3 for "System Information".
  o Use the down arrow key to scroll to the bottom of the "Instrument" page.
  o Verify that "Extended GeoCOM" is on.

- **Defining the Port:** The Leica 1200 needs to know that you intend to use the GeoCOM interface through the external port. The following steps will set the Leica to communicate with SurvCE:
  o Power on the instrument.
  o Select "Config".
  o Select menu item 4 for "Interfaces".
  o Arrow down to "GeoCOM Mode" and select F3 for "Edit".
  o Select F5 for "DEVCE".
  o Select "RS232 Geocom"
  o Select F3 for "Edit" and verify the communication settings.
    ▪ Baud Rate: 19,200
    ▪ Parity: None
    ▪ Data Bits: 8
    ▪ Stop Bit: 1
  o Select F1 for "STORE".
  o Select F1 for "CONT" and verify the following option on the GeoCOM Mode page:
    ▪ Use Interface: Yes
    ▪ Port: Port 1
    ▪ Device: RS232 GeoCOM

- Protocol: RS232 GeoCOM
    - o Select F1 for "CONT".
    - o Verify that the only device active is RS232 GeoCOM and select F1 for "CONT".

- **Prediction Settings:** The Leica 1200 has several prediction modes for when the instrument has lost lock. The following are the recommended settings while using SurvCE:
    - o Select 3 for "Manage".
    - o Select 5 for "Configuration Sets"
    - o Pick New or Edit (Recommend New for First Time)
        - New - Input Name, Desc and Creator Initials then F1 Store/Cont
    - o Select F1 for "CONT" 8 times until the "Automatic Prism Search" screen appears.
    - o Select the down arrow one time and set "After Prediction Search With:" to "No Search" by tapping the right arrow key one time.
    - o Select F1 for "CONT".
    - o Select F1 for "CONT" 2 more times until the "Interfaces" screen appears.
    - o Select the down arrow key to highlight GeoCOM mode and press F5 for "Use". Make sure no other mode is set. To toggle off any other mode highlight and press F5 for "Use" to toggle off.
    - o Select F1 for "CONT" 5 times to save and exit to the Main Menu.

TC1010/1610
For the Leica TC1010/1610 series instruments, it's important that the following settings are true:

- **Communications Settings (SurvCE & Instrument):** 9600,7,even,1
- **Communication Mode:** Make sure you set the instrument to communicate RS232 mode, not module.

SurvCE Settings
- **Instrument:** Leica TPS Series
- **Instrument Series:** TPS 1000/1100
    Make sure all of the toggles in the settings dialog are off.

Total Station (Leica Robotic)

This series covers most of the current Leica standard total stations including the TPS 1000, TPS 1100 and TPS 1200 series. For best results, set the instrument to Geocom Online mode. From the Main Menu, go to Configuration/Communication Mode/GeoCom Online Mode.

Comms
The default communication settings are baud rates 19200, Parity None, Char Length 8, and Stop Bits 1.
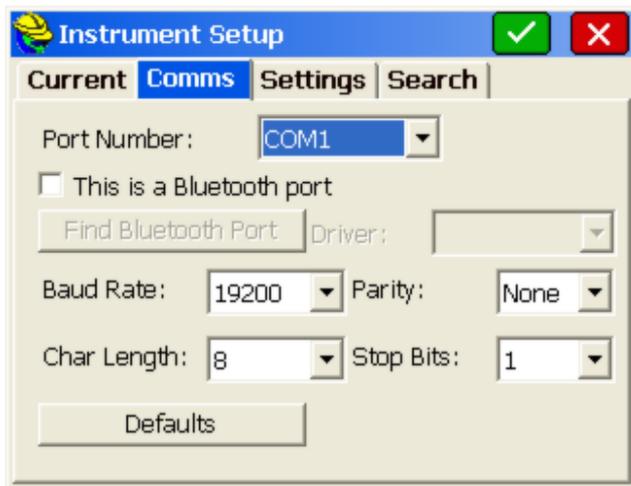
- **Wireless Connection:** Using the Juniper Allegro CE/RCS, a built-in radio modem and internal antenna is included which permits wireless communication with the robotic total station when using the RM2410 radio. This wireless connection is through the Leica propriety radio and does not involve Bluetooth per the Comm Setup screen. The Comm port for the internal radio on the Allegro is COM 3. For one-man operation, the pole and prism become "freed" from wire connection and can be placed anywhere for a shot or reading, with the process driven "remotely" by the data collector communicating with the robotic total station.

Settings/Search
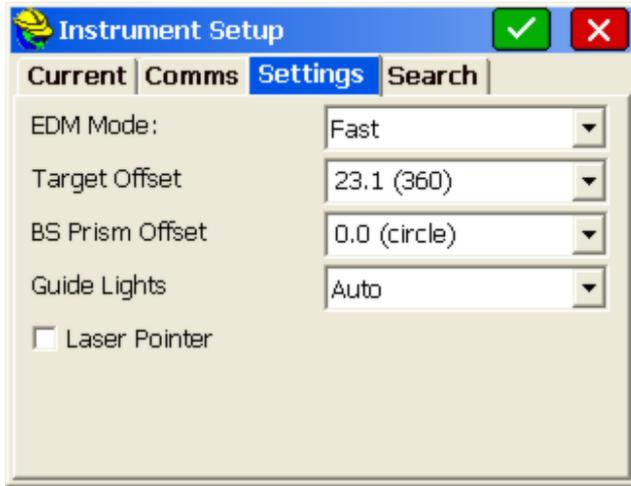
- **EDM Mode:** Available methods are Standard (1.5 to 2 seconds), Fast, and Reflectorless. In all modes of data collection, you are in "Rapid Tracking" mode. Clicking that icon goes to the "No Distance" or "Tracking Only Mode" (no distance measurements). Avoiding taking distance measurements will save battery usage. So the "Dist" button refers to the selectable mode you will "go to," not the mode you are currently in. In Rapid Tracking mode, the store icon will always take a "Rapid Tracking" shot, and pressing enter will take a Rapid Tracking shot if Enter is configured to Store only (to mimic the store icon). Pressing the read icon will always cause configured reading to be taken, as will Enter when set to Read and Store. The next figure shows the Rapid Tracking mode, which follows the movement of the prism by taking rapid distance measurements, much like RTK GPS.

- **Foresight/Backsight Prism Offset**: This drop down menu provides a list of standard prism offsets. Note that Leica prisms default zero to equate to -34.4 mm. So a prism offset of 34.4 equals a zero "net" offset. Whenever a prism constant is changed, a note is written to the raw (RW5) file. When you select one of the prisms from the list (Circle, Mini, etc), the value that is shown in parenthesis is the actual value sent to the instrument. i.e. 0.0 for Circular, 17.5 for Mini. If you select "30mm" or "40mm", we send - 4.4 and 5.6 respectively (30-34.4 and 40- 34.4). The user may also type in any value they choose. In this case, we will send that value exactly, unmodified, to the instrument.
  - 23.1 (360): Leica Model
  - 4.4 Mini (360)
  - 34.4 (0mm)
  - 0.0 (circle): Standard Leica round prism.
  - 17.5 (mini): Leica mini prism.
  - 34.4 (ReflTape): Equates to zero offset (wall,

surface).

- 4.4 (30mm): Other manufactures (Sokkia, Seco).
- -5.6 (40mm): Other manufacturers.

- **Guide Lights**: This setting causes the instrument to show flashing lights. This makes it easy to tell when the instrument has turned towards you in tracking mode. Can be set to Off, On, or Auto.

- **Laser Pointer**: Ideal for indoor or dark evening surveying, this feature causes the instrument to emit a red beam. It is often used when doing reflectorless work and makes a red mark on the wall, floor or object being surveyed. This is usefule for confirming the position prior to the shot. The beam should not be directed into someone's vision or eye.

- **Power Search Enabled**: The Power Search option can be purchased with all motorized Leica total stations. This option activates the "PowerSearch" button in the "banner line" at the top of the survey and stakeout screens. When Power Search is pressed, the total station will typically find the prism in 10 seconds regardless of the direction it is initially pointed. If it has found one prism and you hit "Power Search" again, it will leave that prism and find the next one. If you have only two prisms on the job (foresight and backsight), it will conveniently rotate from the foresight to the backsight and back again each time it is pressed.

- **Work Area:** This will define a limiting area for searching. This can speed up both the standard ATR Search and the PowerSearch. The Work area angle ranges apply to both searches. The Show button will show the two positions of the search window, first by moving immediately to Position 1. You will be prompted to press OK to see Position 2. Having defined a "window" of searching, Center will move that window to a new center position. You will be prompted to "Sight on Centered Position and Press OK". The Define button prompts you to shoot the lower left and upper right positions, which

are then displayed above under "Work Area". If the Work Area is set to start at 0.0000 horizontal, for example, searching would send the instrument to the backsight point.

● **Use ATR:** When this feature is enabled, ATR (Auto Target Recognition) will be used when configured to standard or fast reading. When running the robotic in remote mode with ATR turned on, and when performing a "Set Angle and Read" in the backsight screen (a standard measured backsight), the ATR connection will be taken into consideration, so that the angle set is relative to the center of the prism, not necessarily the crosshairs of the instrument. The "Set Angle" and "Check Angle" functions will still be relative to the crosshairs.

Work Area Settings

More settings appear when you press the "Work Area Settings" button from the SEARCH tab.
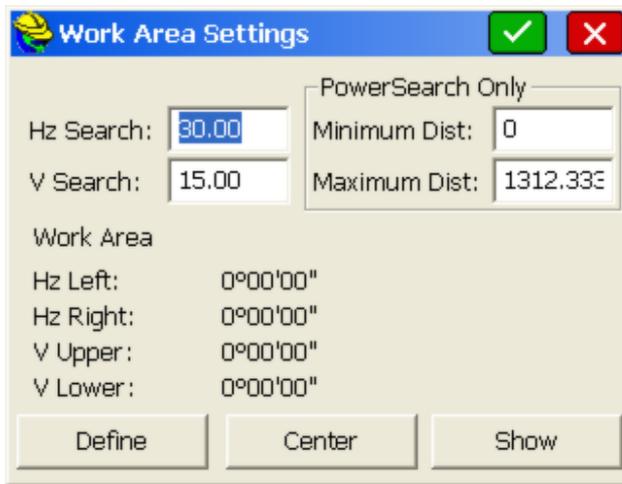

The upper left of the screen controls the ATR Search, and the upper right controls the PowerSearch. The Work area angle ranges apply to both searches. The Show button will show the two positions of the search window, first by moving immediately to Position 1. You will be prompted to press OK to see Position 2. Having defined a "window" of searching, Center will move that window to a new center position. You will be prompted to "Sight on Centered Position and Press OK". The Define button prompts you to shoot the lower left and upper right positions, which are then displayed above under "Work Area". If the Work Area is set to start at 0.0000 horizontal, for example, searching would send the instrument to the backsight point.

Tracking

The instrument can also easily switchin between tracking and non-tracking mode from the store points screen by toggling the icon of the man in the upper right hand corner. In the image below, we are in tracking mode.
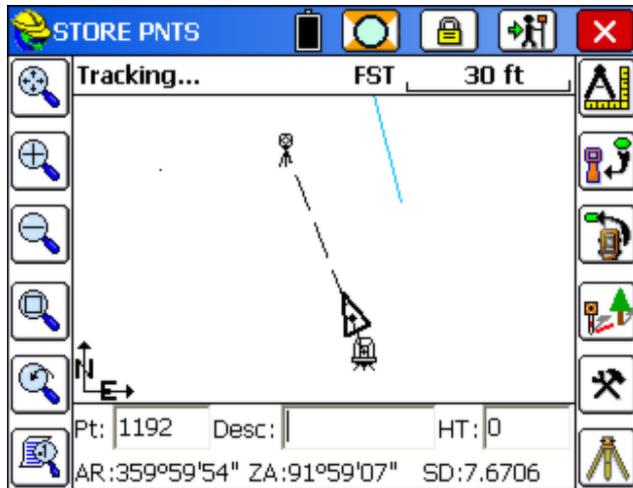
Next the icon has been toggled to non-tracking mode, which can be energy saving. No distances are taken in this mode.
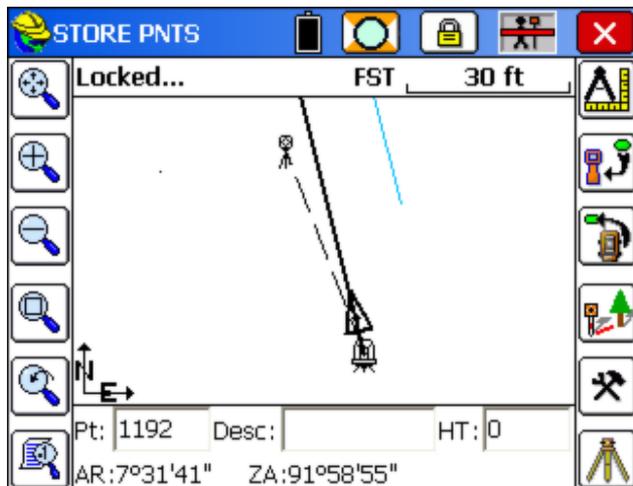
- **Tracking and Reflectorless:** If you switch to reflectorless mode while the instrument is tracking, the instrument will be put in standby mode to allow

use of the tangent screws. For all Leica robotic total stations and for the Leica 1200 Direct (TPS Series), the timeout for reflectorless mode is 30 seconds. You always have the option to Cancel from a reflectorless reading and if you do, the measurement will not be automatically re-initialized.

Leica 1200 Robotic
The new Leica robotic total station requires the activation of the "Extended GeoCOM" option before it will allow the use of third party data collection software (i.e. SurvCE or Carlson Field).

- **Activation Information:** The following information was provided by Leica in document Su11-05G.

  TPS1200 Instruments (TCA, TCP, TCRA, TCRP) require a special key code to operate in Robotic mode when using an AllegroCE/RCS running SurvCE Version 1.5.

  The following table lists the part number for the code:

Product	Part Number	Description
TPS1200	734754	GeoCOM Robotics License

  Important Note:
  When ordering a TPS1200 Robotic Instrument, AllegroCE/RCS and SurvCE, you must order part number 734754 – this is a no charge item.

- **Procedures for Checking Activation Status:** A simple way to determine whether the "Extended GeoCOM" option is activated is to enter the Robotics dialog of SurvCE and attempt a power search. If the instrument communicates, but the power search feature fails, the "Extended GeoCOM" option is not activated. If you suspect that this is the case, you can verify that the feature is on in the instrument using the following steps:

  - Power on the instrument.
  - Select the "User" button on the keyboard.
  - Select the F3 button for "STAT".
  - Select list item number 3 for "System Information".
  - Use the down arrow key to scroll to the bottom of the "Instrument" page.
  - Verify that "Extended GeoCOM" is on.

- **Defining the Port:** The Leica 1200 needs to know that you intend to use the GeoCOM interface through the external port. The following steps will set the Leica to communicate with SurvCE:

- o Power on the instrument.
- o Select "Config".
- o Select menu item 4 for "Interfaces".
- o Arrow down to "GeoCOM Mode" and select F3 for "Edit".
- o Select F5 for "DEVCE".
- o Select "RS232 Geocom"
- o Select F3 for "Edit" and verify the communication settings.
  - Baud Rate: 19,200
  - Parity: None
  - Data Bits: 8
  - Stop Bit: 1
- o Select F1 for "STORE".
- o Select F1 for "CONT" and verify the following option on the GeoCOM Mode page:
  - Use Interface: Yes
  - Port: Port 1
  - Device: RS232 GeoCOM
  - Protocol: RS232 GeoCOM
- o Select F1 for "CONT".
- o Verify that the only device active is RS232 GeoCOM and select F1 for "CONT".

- **Prediction Settings:** The Leica 1200 has several prediction modes for when the instrument has lost lock. The following are the recommended settings while using SurvCE:
  - o Select 3 for "Manage".
  - o Select 5 for "Configuration Sets"
  - o Pick New or Edit (Recommend New for First Time)
    - New - Input Name, Desc and Creator Initials then F1 Store/Cont
  - o Select F1 for "CONT" 8 times until the "Automatic Prism Search" screen appears.
  - o Select the down arrow one time and set "After Prediction Search With:" to "No Search" by tapping the right arrow key one time.
  - o Select F1 for "CONT".
  - o Select F1 for "CONT" 2 more times until the "Interfaces" screen appears.
  - o Select the down arrow key to highlight GeoCOM mode and press F5 for "Use". Make sure no other mode is set. To toggle off any other mode highlight and press F5 for "Use" to toggle off.

o Select F1 for "CONT" 5 times to save and exit to the Main Menu.

Troubleshooting: If your Leica robotic total station has any communication issues, it is typically a matter of verifying firmware and configuration settings. Investigate and note down the firmware version of the various components on your instrument.

Total Station (Leica/Wild Older Models)

- **Data Collector Model:** Many of the older instrument could be set to operate as different models. These include T1000, T1600 and T2000 modes. Set SurvCE to match your instrument. Two different models are available for T1000 with a one-row keyboard, and T1000 with two-row keyboard. Choose the appropriate one.

Total Station (Nikon)

Nikon 310/500 Series
This configuration covers such instruments as the Nikon 520, 521, 522 and 552.

Although the Nikon total stations have their own configuration, they also can be set to Sokkia emulation. If set to Sokkia emulation, they should be configured as Sokkia Set. In this mode, you can turn on the "2-way" communication mode. This enables the Nikons to "turn to zero" in stakeout (set out) mode. In this setting, when you stake point 10 and the angle right to turn is 75 degrees, 15 minutes, the instrument panel will display 75 degrees, 15 minutes, and as you turn towards the point, the display will count down to zero. So without looking at your data collector, you watch the screen until you obtain zero degrees — this means you are on target. In a sense, the performance of the Nikon total stations is enhanced in Sokkia emulation mode.

Nikon 800 Series
The 800 Series configuration will also apply to the older 700 series. To use that product the user must select SET mode on the instrument and have the connection speed set at 1200 baud then select the Nikon 800.

Trimble TS415
Users who own this instrument can use SurvCE by selecting the Nikon 800 Series configuration.

Total Station (Pentax)

Pentax PTS3 Series
For Pentax instruments, select the "PTS3" checkbox if you are using a PTS3
series instrument.
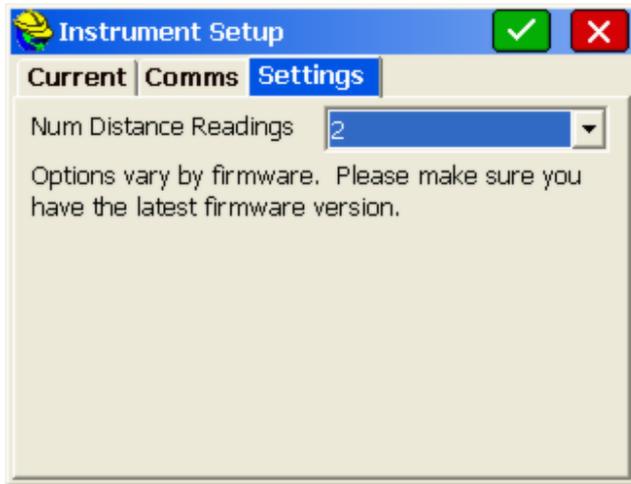
PTS3 instruments will first send out the last reading before sending the current
reading. For some users, you may wish to choose to record the 3rd reading for
the most accuracy.

Pentax ATS Series
The following information outlines the settings for the Pentax ATS Series
instruments.

This information was compiled using an ATS-105.

1. Power up the Unit & Level it up.

2. Set the baud rate in the instrument. Hold down the Blue "S" key and press the number 6 key in the upper right. This will open the Configuration Menu for Baud Settings.

3. Set the baud rate in SurvCE by selecting the Equip tab, and then select the Comm Setup button. SurvCE defaults to 1200 / None / 8 / 1. Match the Baud, Parity, Char Length & Stop Bits with whatever the instrument is currently set to.

4. Connect the data collector, hold down the Blue "S" key and press the "F5" button. This puts the Total Station into Remote Mode for use with external data collectors. [RM] blinks in the upper left corner.

NOTE: SurvCE has advanced options for setting the Read Method, Number of Readings & use of the instrument lights. Not all models or firmware support these features. If these options do not work, you might be able to update the firmware, or manually adjust the settings using the instrument.

Total Station (Sokkia Set)

The following information describes the various options available for the Sokkia Set total stations.

- **1-Way vs 2-Way**: The 1-Way option mimics the operation of most total station instruments using SurvCE. The 2-Way option has the one big advantage of sending the angle to turn into the instrument during stakeout, so that looking at the instrument panel, you "turn to zero" to aim at the target point. It is recommended that Nikon instruments be run in Sokkia Set emulation mode, enabling the 2-Way communication.
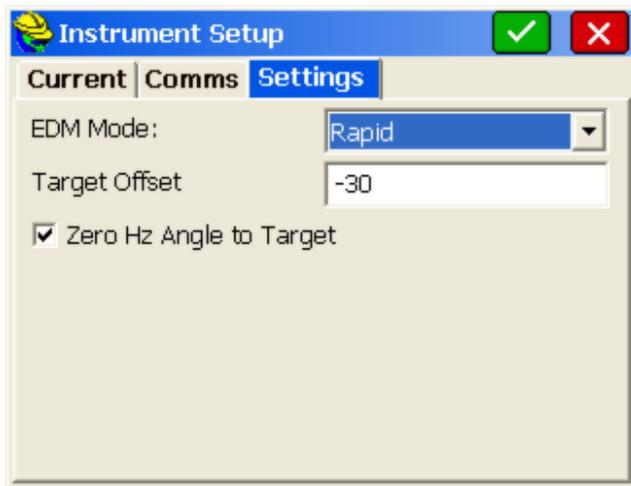
- **EDM Mode:** Available methods are rapid and fine.
- **Target Offset:** Enter the prism offset here.
- **Zero Hz Angle to Target**: This option specifies whether or not SurvCE will set the horizontal angle of the total station to zero in the direction towards the stakeout point. When stakeout is completed, the horizontal angle is set back to the original value. This option only applies to Sokkia total stations or to total stations such as Nikon which have a "Sokkia emulation" mode.

The driver applies to all current Sokkia total stations, including the 110M when used in manual mode. It also applies to many non-Sokkia instruments which have a Sokkia or "Set" emulation mode, including Nikon, Pentax and Topcon. The advantage of Sokkia emulation is that the Sokkia driver includes a "2-way" setting

that will upload configuration settings into the instrument such as units, prism constant and the backsight circle. Most important, for stakeout, the "2-way" setting will upload the angle to turn, so that you turn to zero to get on target. The Sokkia Series 30R is reflectorless.

The "On" key is the upper right, which takes you to the "Measure" screen where it is ready to work with SurvCE. Commands would not be accepted, for example, if you were in the "Config" screen. Use the instrument to activate reflectorless mode, and in SurvCE, be sure to set target height to zero. The gun will control prism offset in non-prism modes

Sokkia Motorized Series

This driver is necessary to utilize the motorized features of the motorized instruments. For example, in stakeout, it will turn to the point automatically. The motorized features will turn to the appropriate horizontal and vertical angle in most commands when the instrument is set to "Remote" mode.

Note that baud rates on motorized instruments must be set to 9600 in remote mode but are typically set to 1200 baud in direct mode. Change on the instrument and in SurvCE, Equip, Com Setup. The Settings options for the motorized instruments are shown below:
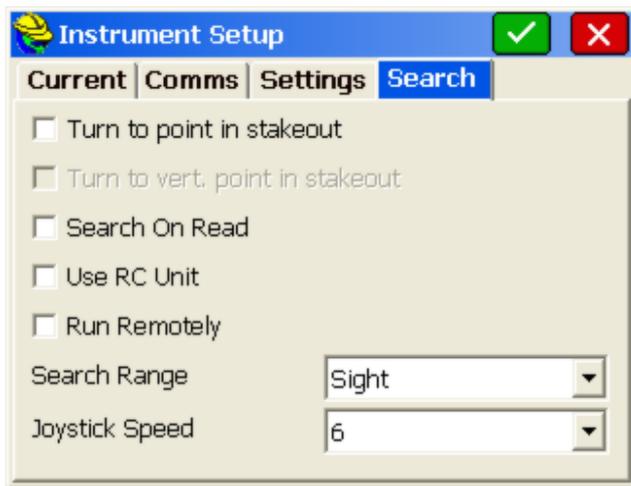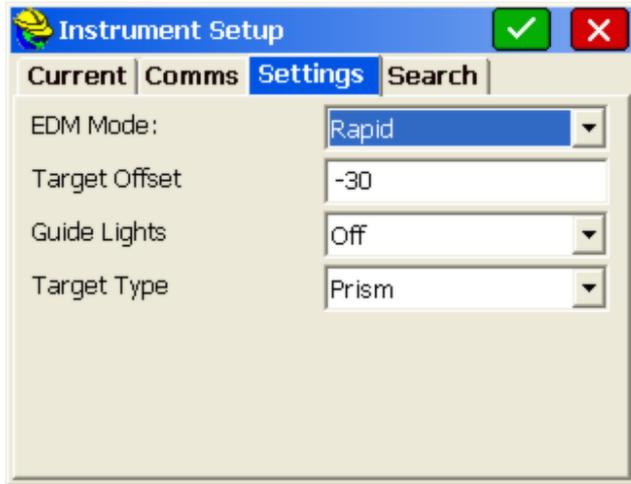
Joystick speeds are 1 to 6 (for arrow key response turning gun). For reference 6 is approximately 6 degrees per arrow press. Search types are Sight (field of view of gun, or 1 degree, 30 minutes or 10 meters at 100 meters), H Wide, V Wide and HV Wide. The wide views are 6 times field of view. Auto Search before Read finds the prism center exactly before taking a measurement (useful in Set Collection, for example, and in Stakeout). Run Remotely sets the left and right turning of the gun, referenced from the pole, and not from the instrument. This is distinct from left and right referencing for stakeout which refers to movement of the rod. For the Sokkia instruments with RMC search device, there are 2 buttons in the joystick screen for RC Search: "RC Left" and "RC Right". Left and right

will be determined by the Run Remotely setting.

Total Station (Sokkia Robotic)

The following information describes the various options available for the Sokkia Robotic total stations.

The instrument "Measure" screen should be shown on the total station in order to work with SurvCE. Commands will not be accepted, for example, if you were in the "Config" screen.

Note that baud rates on the Sokkia robotic must be set to 9600. The Settings options for the Sokkia robotic are shown below:
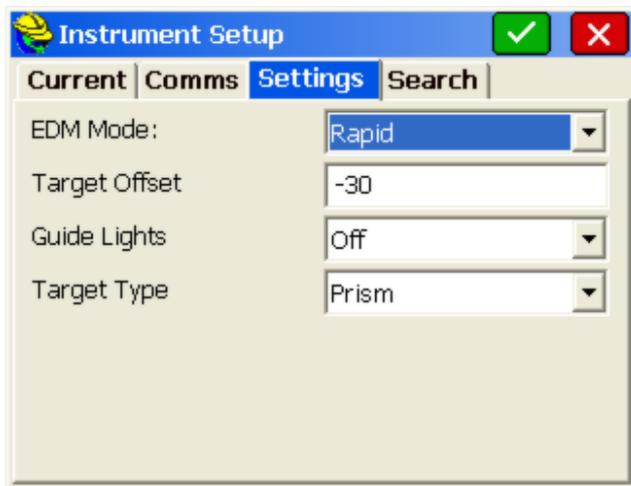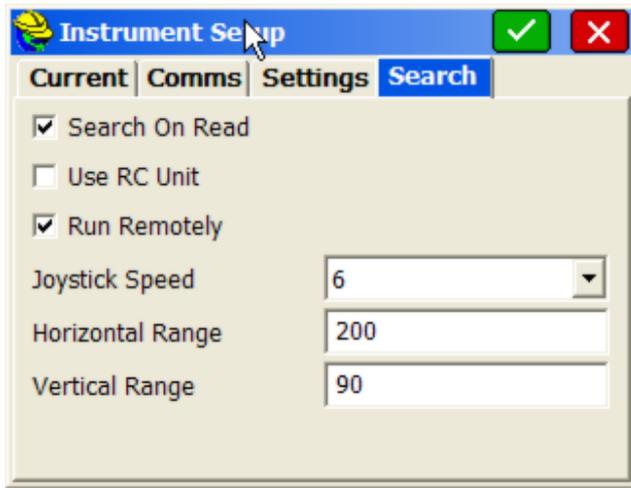
Joystick speeds are 1 to 6 (for arrow key response turning gun). For reference 6 is approximately 6 degrees per arrow press. Search types are Sight (field of view of gun, or 1 degree, 30 minutes or 10 meters at 100 meters), H Wide, V Wide and HV Wide. The wide views are 6 times field of view. Auto Search before Read finds the prism center exactly before taking a measurement (useful in Set Collection, for example, and in Stakeout). Run Remotely sets the left and right turning of the gun, referenced from the pole, and not from the instrument. This is distinct from left and right referencing for stakeout which refers to movement of the rod. Use RC Unit will enable the RMC search option in SurvCE.

Total Station (Spectra Focus 30)

Prerequisites for Operation: The Focus 30 Robotic Total Station from Spectra must be used on the Spectra Ranger or TSC3 data collector with built-in radios for communication. To run with SurvCE or FAST Survey (provided by Spectra), a license must be obtained from Spectra.

Focus 30 Selection: Find the Focus 30 in Equip Menu, Total Station.
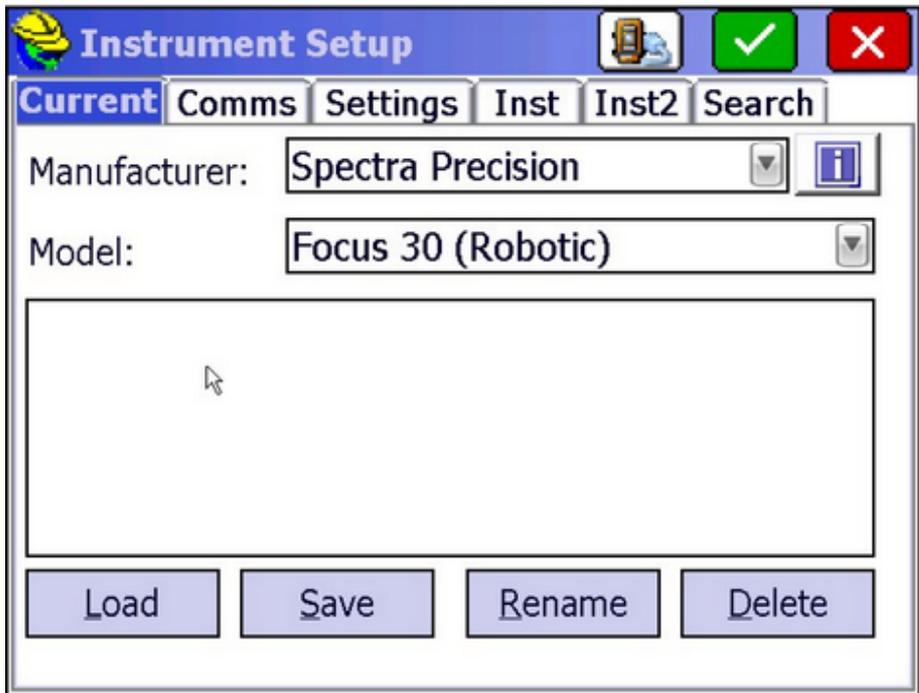
Internal Radio Setup: The standard mode of operation is to configure to Internal Radio. This is done using the Comms tab as shown below:
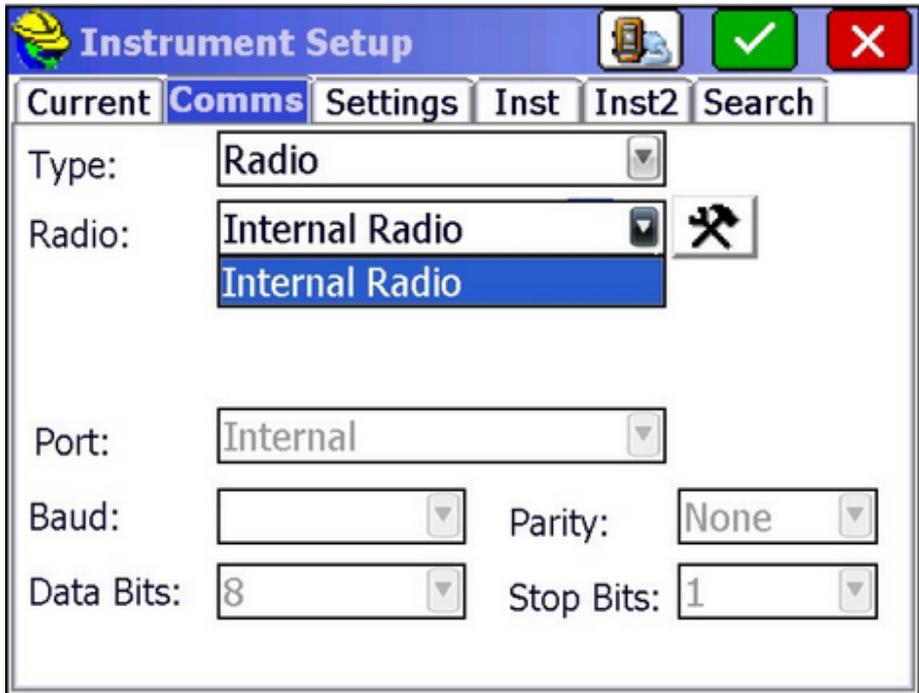
The radio channel and Network ID selected in SurvCE and FAST Survey must match the radio channel and Network ID set on the Focus 30. To set these in SurvCE or FAST Survey, click the Tools icon opposite the Internal Radio selection above, to obtain the following screen and settings:
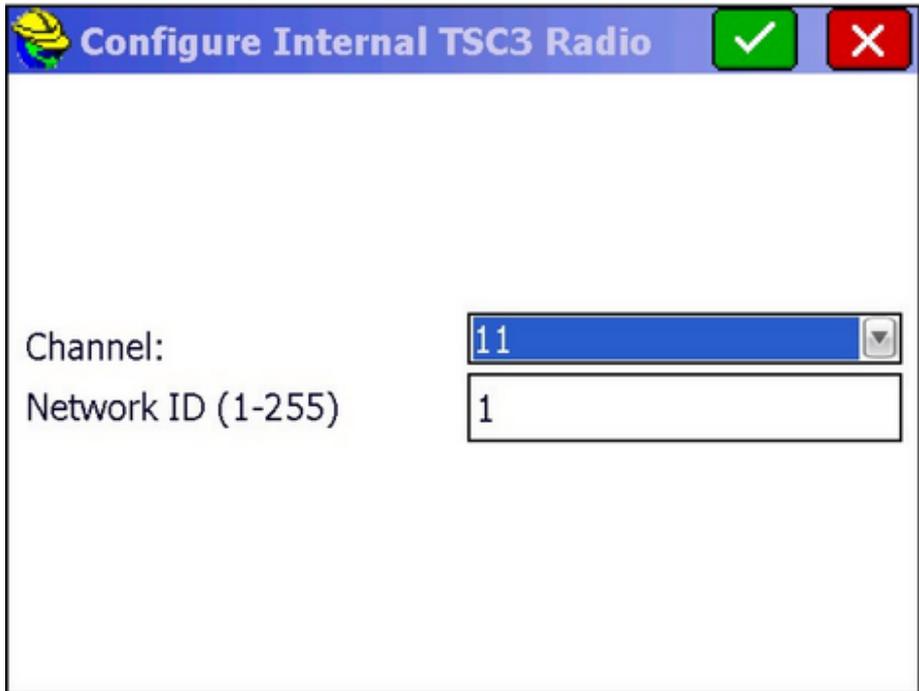
On the Focus 30 instrument, set the Radio Channel and Network ID but turning the instrument around to the second face (smaller display), as shown below:

Pressing the key to the right (looks like Enter key) allows changes such as

changing the Radio Channel.

Using the USB option: The USB option appears below. When selected, no other options appear on the screen.
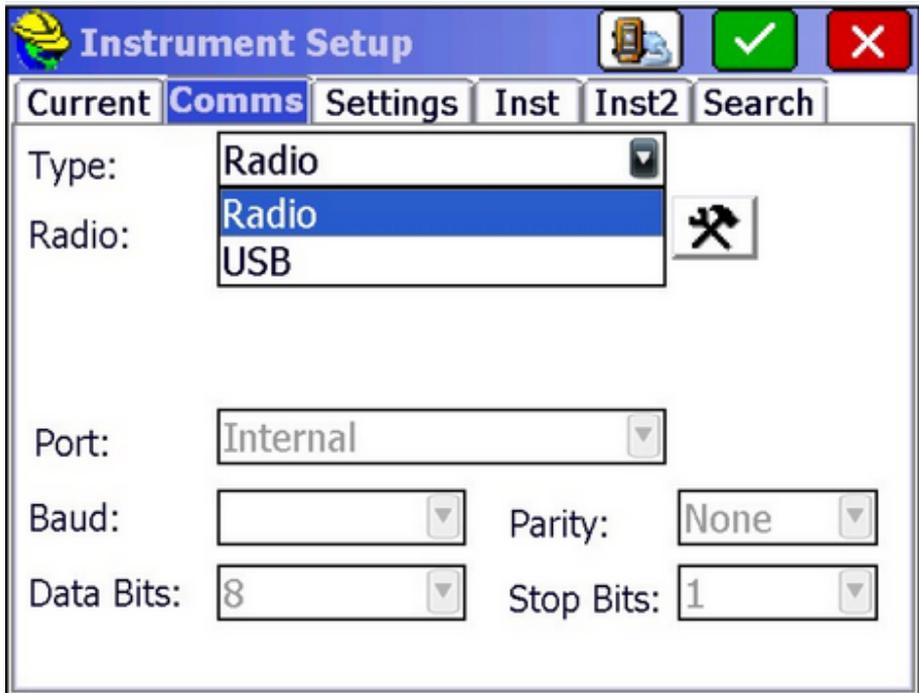
Connecting by USB instead of the Internal Radio requires more setup steps on the Spectra Focus 30 instrument, as follows:

1. Arrow-key down to "Instrument Details"

2. Press and hold enter key till scroll bar shows additional item added.

3. Arrow-key down one more to "Service Menu"

4. Press enter key

5. Arrow-key to USB Interface and press enter

6. If "Always On" is not selected already, arrow-key to it and press enter.

7. Use "Exit" to leave submenus then main menu

GPS Prism Search: The Spectra Focus 30 can benefit from the GPS Prism Search feature described in its own chapter in the SurvCE Manual. This feature is found within the Search Tab in the Total Station command, whenever a robotic total station is selected. As long as the data collector has L1 GPS capability with NMEA output or if you are connected by Bluetooth to a GPS NMEA receiver (like a Garmin 10), then you can configure in the Search Tab to "assist" the prism search with a GPS-based search. Particularly where you are far from the robotic total station, the vector to the data collector is so similar to the vector to the prism that the total station will locate the prism when it turns to the data collector's GPS position. For more information on this method, see the chapter "Total Station Prism Search by GPS" within the Total Station section of the SurvCE User's Manual.

Total Station (Topcon 800/8000/APL1)

The following information describes the various options available for the Topcon 800/8000 total stations.

Carlson SurvCE supports the Topcon 800 series (800, 802, 800A, 8000, 8200), when running in direct mode (measurements taken from the instrument, no radio connection to the prism). All 800 series instruments are motorized. The Topcon 8000 is a reflectorless unit. The Topcon 800A is motorized but not fully robotic. The 800AR is motorized and robotic. The Topcon 802 refers to a "2-second" version of the 800 series, for example.

To operate either direct or remote, press the Power button to turn the instrument on. After you level, the instrument will go through a motorized self-test. You obtain a 6-icon menu. To run direct, press F2 for Standard. This puts you in the measure screen. Note that in Direct mode, the Topcon 800 typically expects 1200, E, 7, 1 for communication, but 9600, N, 8, 1 in Remote mode. Note that the Topcon 820 and 8200 are a new series of instruments, where Topcon 822 indicates a "2-second" version of the 820 series. Running Direct, the Topcon robotic instruments that have the reflectorless option offer a handy, one-click reflectorless off-on icon at the top of the screen, as shown above in the discussion of the Leica TPS series where it also applies.

Direct
The following settings are presented by selecting the Topcon 800/8000 Direct instrument.

- **EDM Mode:** Choose between coarse, tracking, fine and reflectorless.
- **Turn to point in stakeout**: Turns the instrument to the horizontal angle as computed to the stakeout location specified.
- **Turn to vert. point in stakeout**: Turns the instrument to the vertical angle as computed to the stakeout location specified. This option is not typically used unless a true elevation is known for the stakeout location specified.
- **Use CR/LF**: If set, this must match the settings on the instrument.
- **Auto Aim**: This forces the instrument to lock onto the prism before a configured read. This is particularly useful when turning robotic sets. Auto Aim is not available in reflectorless mode.
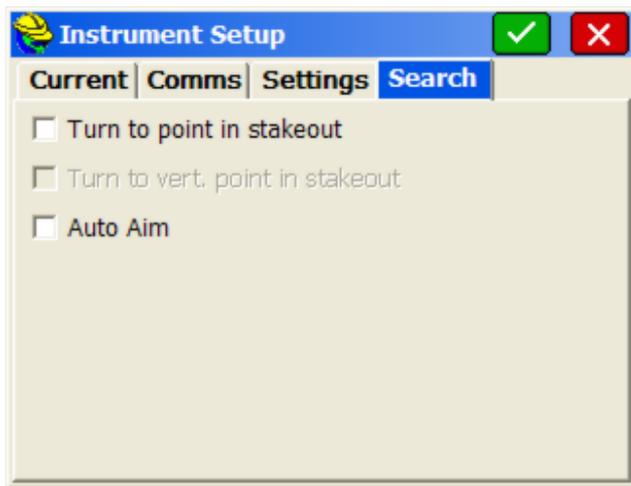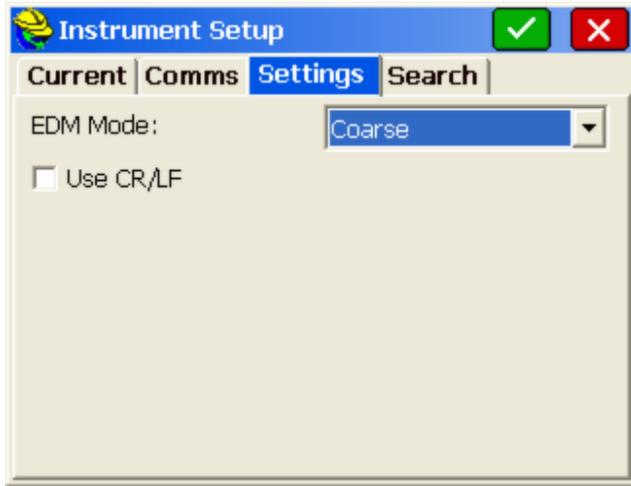
Remote

This configuration works for the Topcon 800 series running in remote mode (radio link active, equipment operation driven from the prism). The optional RC unit, mounted on the prism pole, provides a "quick lock" feature for rapidly guiding the instrument to the prism. Additionally, the RC provides an alternative to radios allowing limited remote communication between the data collector and instrument. Be sure that the RC unit is pointed directly at the instrument before executing a "quick lock."

To operate in remote mode, on the instrument obtain the 6-icon menu, press F1 for Program, F6 for More, then F3 for External Link. Press F2 to verify your currents settings, then hit Escape and press F1 to execute the remote settings.
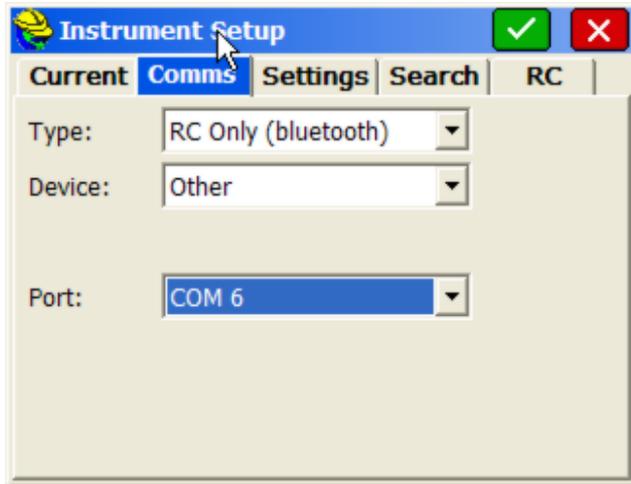
Type: Topon Remote has two types in addition to the standard Cable, Bluetooth, and Radio options. The two additional types support RC Only communication using either Bluetooth or Cable. If RC Only is selected use the RC tab (described below) to specify which type of RC unit is in use.
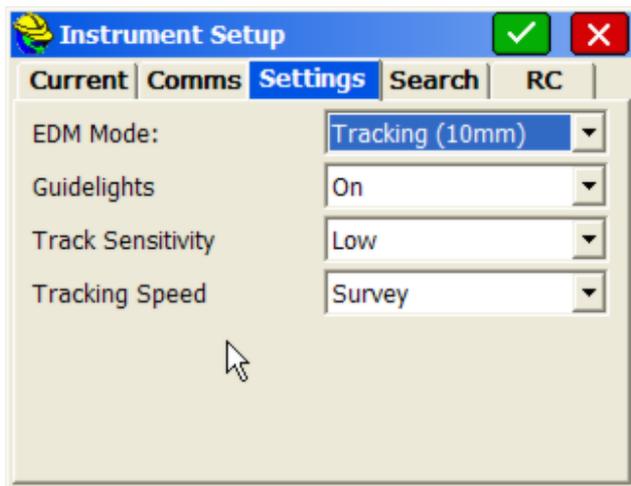
- **EDM Mode:** Choose between Fine 0.1mm, Fine 1mm, Tracking 1mm and Tracking 10mm EDM settings.
- **Guide Lights:** Turns on and off the guide lights.
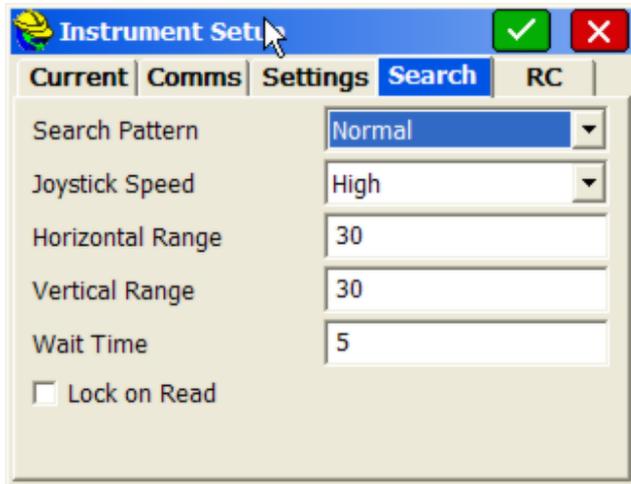
- **Lock on Read**: For the Topcon 800/8000 remote, there is a "Lock on Read" option which behaves similarly to the Auto Aim for direct mode, but is not as precise as Auto Aim.
- **Search Pattern:** Defines the pattern the instrument will search.
- **Joystick Speed:** This option defines how fast the instrument will turn when using the arrow keys to steer it.

The RC tab refers to the configuration of the RC unit. This tab allows you to specify which type of RC device is being used and whether there is a connection between SurvCE and the RC unit. If there is a connection please use the configure button to set communication parameters for the RC unit. Note that the RC "quick lock" function has a maximum range of 1500ft, while the two way remote communication is limited to 800ft.
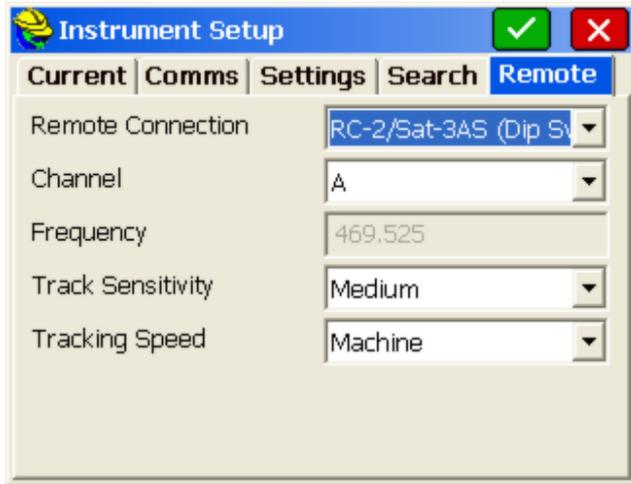
Topcon provides distinct cables for radio communication and RC communication. The "Y" cable is used with radios and RC in combination, but is not required. You can press the yellow button on top of the RC to initiate a "quick lock". The "Y" cable is not used for RC only communication. The advantages of using both radio and RC are range (works remotely over 800ft), speed (faster reading), and ease of operation.

Within SurvCE, go to Equipment, select Topcon 800 Remote, use default port and baud settings.

The recommended settings are as follows:

- **Tracking:** 10mm
- **Search Pattern:** Normal
- **Track Sensitivity:** High (best with Quick Lock)
- **Search Scan Range:** Middle (applies to APL1 only)
- **Tracking Speed:** Middle
- **Joystick:** Middle (this changes the response of the arrow keys)
- **Vertical Range:** 10
- **Horizontal Range:**10
- **Wait Time (how soon it starts searching when you lose the link):** 3 to 5 seconds (low traffic areas) and 120 (2 minutes, in high traffic areas)
- **Guide Lights**: User choice

SurvCE will track the prism in the fastest mode (10mm), then switch to configured reading when a shot is taken. Note, configured reading was also set to Tracking 10mm, which will take a nearly instantaneous shot. If configured for Fine (1mm), the shot will take 2-3 seconds. Here we have taken a foresight to point 3 and have moved in tracking mode to a new position, ready for a configured reading on point 4. "Configured Reading" shots are taken with Enter or R for Read. The "S" button will take a "fast read" or Tracking Read, no matter what the Configured Reading mode.

If using RC, Select QuickLock button. Otherwise, use arrow keys to turn the instrument, look for the 2 blinking lights (if track lights are turned on) and then tap Search. Above, we set the vertical and horizontal search ranges to 10 degrees. When you obtain lock, you will get 3 beeps from the RC, and in all cases, SurvCE will say Tracking, meaning you are locked on.

Pressing the Search icon does an RC "quick lock" search if you are configured for RC. Standby let's the instrument hold its position and stop tracking allowing you, for example, to place the rod on the ground and drive a stake, then get on line again and use Search icon to regain the link.

With robotic total stations, commands such as Turn to Angle, Set Collection (choose "robotic" sets) and Check Backsight will turn robotically.

Set Collection Notes

Set Collection works best with radio linkage (radio alone or radio with RC), but has limited functionality in RC only mode. Robotic sets use BD-FD/FR-BR observation order. Note, "non-robotic" sets can be done with a robotic total station. The "Angle Only in Reverse Face" can be toggled on for faster Face 2 readings. "Auto Turn," available for all observation orders but Robotic Set, will turn the gun automatically to all known points. An hourglass will appear when Robotic Sets is selected, during which time SurvCE initiates constantly streaming data. When in robotic Set Collection, an option to obtain the Robotic screen (search and joystick features) is available. After all sets are collected, the user is prompted whether to move to a new setup station, collect still more sets, or review the set data. Close this dialog and Set Collection is complete for that backsight and foresight.

Topcon APL1
This is an older Topcon robotic total station with excellent tracking.

It's a larger instrument often used in construction and machine control applications. It communicates only by radio with the 2ASx type radios. You must set the Com parameters on APL1. You only have to do this once.

     1.   Turn the APL1 on.

2. Press <Menu>.
3. Press <F1> for Parameters.
4. Press <F3> for COM.
5. Press <F3> for Terminate.
6. Select ETX (ONLY) and press <Ent> to accept.
7. Select F2 for Transfer Speed.
8. Select 9600 and press <Ent> to accept.
9. Select F1 for Bit Format.
10. Set to BS, S1, and NONE, Press <ENT> to accept.

Putting the APL1 in the "Remote Mode":

1. Turn the APL1 on.
2. Press <Menu>.
3. Press <F3> for Remote.
4. Press <F1> for Remote.

The total station is now in the Remote Mode.

Total Station (Topcon GTS)

Most standard Topcon total stations will work configured to Topcon GTS Series. This includes the Topcon 200,300,600,700,2000 and 3000 series instruments, and newer models such as the Topcon 230 (which uses Bluetooth wireless communication). This driver does support the reflectorless capability of the "thousand" series instruments (Topcon 2000 and 3000, for example). Typical baud rates for instruments in this group are 1200, E, 7, 1.

Topcon 200 Series
This is another option that can be tried when the GTS Series or other configuration does not communicate. It uses a different speed and mode of linkage.

Topcon 300/600/700/2000
Similar to the Topcon GTS Series, these drivers offer the reflectorless option. Typical baud rates for instruments such as the Topcon 303 and Topcon 313, for example, are 1200, E, 7, 1.

Topcon GTS 3/3B Series
This driver supports the older Topcon GTS 3 and GTS 3B standard total stations. Some of the GTS Series Topcon instruments offer Reflectorless, and in stakeout routines and Store Points (both graphics and text modes), there is a convenient reflectorless icon at the top of the screen to turn on/off reflectorless and show current status. (See discussion of Leica TPS above.)

GPS (Allen-Osbourne)

The first time into this selection, as with most other setup procedures, the program shows the Comms Setup screen.

There is no Configure Base, Configure Rover or Receiver Utilities for Allen-Osbourne. SurvCE reads the NEMA string characters and all of the setup is done on the instrument itself.

GPS (Ashtech)

The following information describes the various options available for Ashtech GPS.

SurvCE works with the following high precision, centimeter accurate RTK GPS equipment produced by Ashtech: Z12/Sensor, ZSurveyor, GG24, Z-Xtreme and Z-Max. SurvCE also works with the Ashtech Reliance USCG/DGPS RTCM sub-meter RTK GPS receivers.

Shown below is the front panel view of the Ashtech Z-Xtreme, as it appears in the top of the backpack.

Shown in the next photo is the cabling for the Z-Xtreme, looking at the back panel.

Configure Base or Rover

- **Current tab - Model:** You must specify the model of Ashtech equipment to be used.
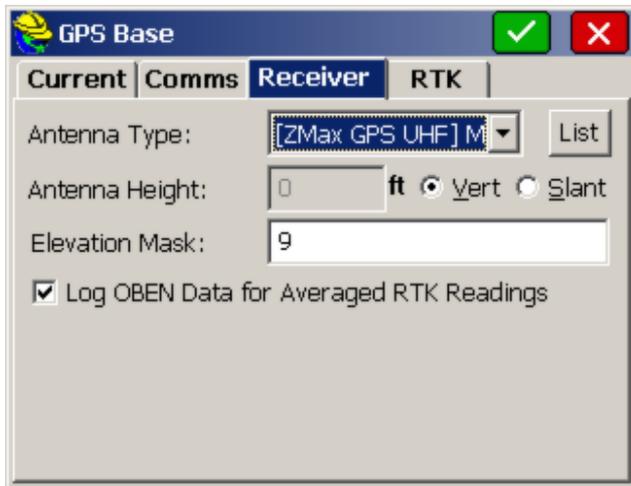
- **Receiver tab - Antenna Type**: A pull down list that includes approximately 50 different antenna types. Shown in the below photo is the Geodetic 4 antenna.

- **Receiver tab - Antenna Height**: This is entered as a "vertical" or "slant" height in the current job units. The slant height is the distance from the base of the pole or from the "hub and tack" up to a mark or defined slant measurement point on the edge of the antenna (See NGS for more details). The vertical height is measured plumb, straight down from the base of the antenna (where it screws into the antenna).
- **Receiver tab - Elevation Mask**: This specifies the cutoff vertical angle above the horizon. Any satellites below this angle will be left out of calculations.

- **Receiver tab - Log OBEN Data for Averaged RTK Readings:** This setting specifies that the software will log the standard Thales OBEN file as specified by Thales during averaged readings.
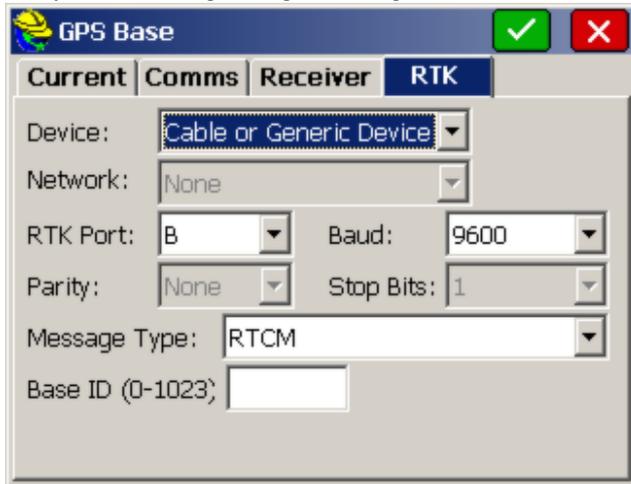
- **Ports tab - RTK Port**: You must select the data port on the GPS receiver that is connected to the radio modem. The default setting is A. Changing this setting will change the internal setting of the receiver.

- **Ports tab - Radio Type:** This allows the user to specify the various supported radios.

- **Ports tab - Message Type**: You must specify the message type. For high precision centimeter RTK GPS, set this to Ashtech (CPD). For USCG/RTCM DGPS sub-meter accuracy, set this to RTCM.

- **Ports tab - Baud**: This setting allows you to change Pacific Crest radio baud settings through the receiver. The default baud rate is 9600. (Note: If there are communication problems with either port A or B on the Ashtech ZSurveyor receiver, turn off receiver and turn it back on with both keys depressed to reset receiver to factory defaults.)

For more information on this tab, see "Connecting GPS"

Configure Rover (Parameters)
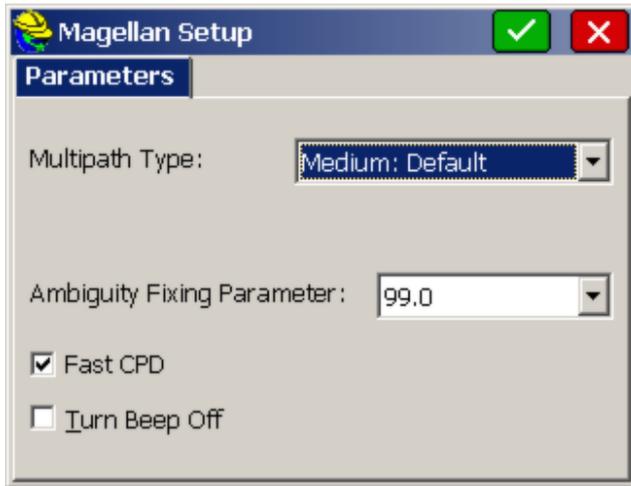
- **Multipath Type**: You must specify this setting in order to filter out interference in the satellite signals caused by nearby objects.
- **Dynamics**: This setting is applied to all Thales equipment types with the exception of the Z-Max. Here you may specify the dynamics setting. Static is selected only when the Rover receiver is stationary. The default is Walking. When set to Static, the HRMS and VRMS values (measurements of accuracy) will fall to very low numbers (high accuracy), but lock will not hold unless the antenna is motionless. Static is recommended when the antenna and pole are secured by a tripod or bipod.
- **Ambiguity Fixing Parameter**: This controls the confidence level of fixed positions. The default is 99.0. At a lower confidence interval the system solves much faster. If the system incorrectly solves the position, then the position error will be much greater than the reported RMS value.
- **Fast CPD**: This option specifies whether or not the program will allow approximating the rover's position if your position is lost briefly. Off is the default. Fast CPD is generally toggled on when Dynamics is set to Automobile.

GPS (Carlson Surveyor+ GPS)

The Carlson Surveyor+ GPS provides a new, ergonomic form factor for GPS rovers: the GPS board is in the data collector itself, and the only weight at the top of the pole is the lightweight antenna. This provides the combination of full keyboard data collection with minimal total weight, balanced at the center of the pole. The Surveyor+ GPS system is shown below:

The Surveyor+ GPS system is specially designed for use as a rover with GNSS reference systems sich as Trimble VRS, Leica Spider, Topnet, Geodetics or Geo++. Communication is typically by cell modem. Note the two LED lights above the circular arrow key button, just below the screen. The LED on the right blinks steadily when corrections are being received.

GSM vs CDMA: Most of Europe and areas outside the United States use GSM, but the U.S. is still partially GSM and CDMA. The Surveyor+ GPS system comes with a built-in GSM modem, which communicates well with AT&T and other GSM cellular providers. If you are in an area in the United States covered by providers such as Verizon which transmit CDMA, then it is recommended that you purchase a "Mi-Fi" card. As long as you turn "Wi-Fi" in the main Windows

screen, and have the "Mi-Fi" card on and in close proximity to the Surveyor+ GPS unit (eg. in your pocket, for example), the system will switch automatically to work in CDMA mode. To go back to GSM mode, simply turn "Wi-Fi" off. Wi-Fi On for CDMA operation will tend to use more battery power.
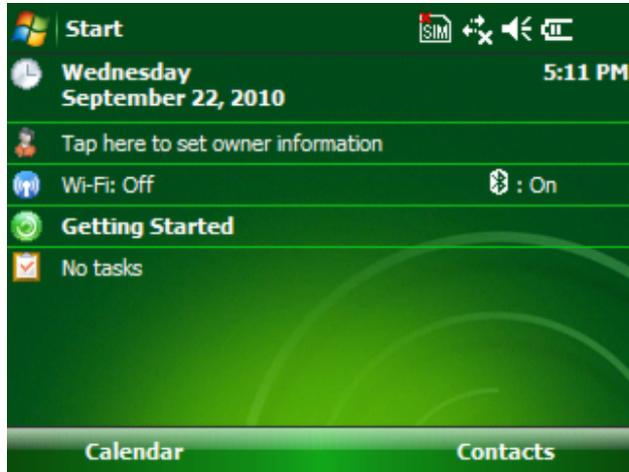
Sim Card: GNSS Reference Stations typically broadcast corrections by cell modem. This signal is picked up based on use of a Sim Card that the user must purchase for the Surveyor+ GPS system. You can sometimes save money by purchasing a "data only" Sim Card as opposed to a Voice and Data Sim Card. When you place a new Sim Card in the Surveyor+ GPS unit, you first need to take off the back of the unit (remove screws) and then insert the Sim Card. For the card to be initialized, it is necessary to do a full Reset of the Surveyor+ GPS unit by holding down the power key and selecting Reset. Just powering off and on will not reset the unit to recognize the new Sim Card, since the Power Off is similar to a "sleep mode" and holds current settings.

Power Settings: It is recommended to disable auto-sleep when running the built-in GPS system. This will prevent unexpected interruptions and shut-downs of the GPS board. To change this setting, tap Start, then Settings, from the main menu of the Surveyor+. Choose the System tab in the bottom left, then scroll down and tap the Power icon. Tap the Advanced button on the bottom left. Uncheck the box that says "Turn off device if not used for" under "On battery power". Check the box under "On External Power" and set it for 30 minutes. Then tap OK in the upper right to save your settings, and tap X to return to the Today screen.
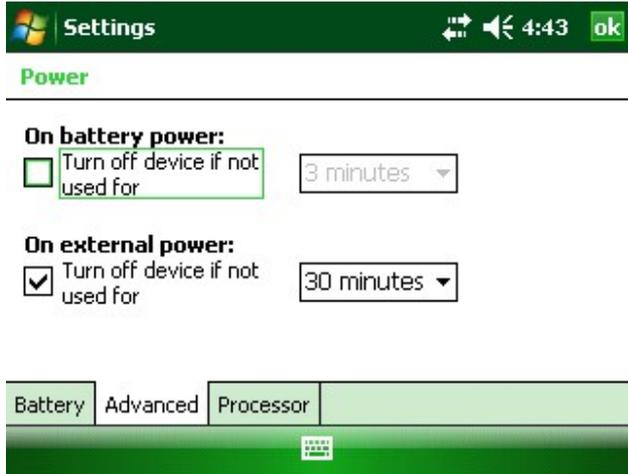
Configuring using GPS Rover: To get started, select GPS Rover in the Equip menu and verify the settings in all 4 tabs. Going to GPS Rover and simply clicking OK (green check) in the upper right is also an effective way to re-initialize all the settings and establish cell communication to the GNSS reference stations. The first two tabs (Current and Comms) will have default values that do not change when configure to the Carlson Surveyor+ GPS. The third tab governs, among other things, the antenna type. The standard configuration is shown (CSW_702-GG). Note that the Carlson Surveyor+ GPS system will work with other antennas as well. Antenna height should be entered as 2 meters if using the standard Carlson pole, but this can be entered also within actual survey commands (Store Points, Stake Points, etc.). Postion rates of 1 hertz, 2 hertz and 5 hertz are provided as options. You can Store Vectors in Raw Data for processing by Carlson Network Least Squares, similar to the processing of the raw data of angles and distances collected by total stations. This stores the vectors from the base station (individual base or virtual reference station) to the rover position.
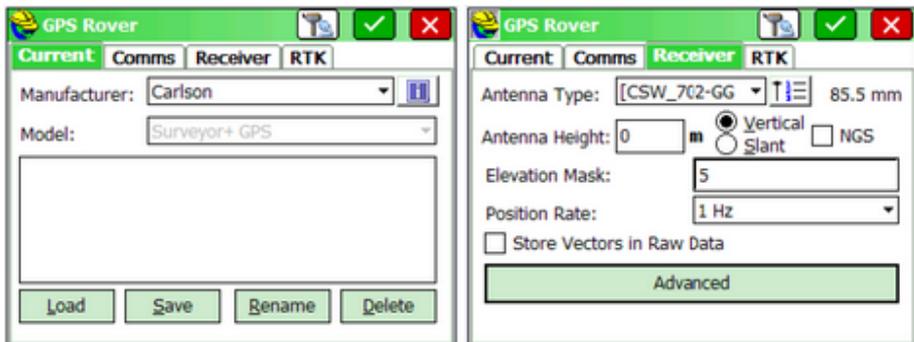
RTK Tab and NTRIP: When selecting reference stations, you are often given a choice of selecting a single station or a true connected virtual reference station system. In the latter case, for best results, it is necessary to turn on "Send Position" whereby SurvCE sends the position of the rover back to the reference stations so that they can send the best, resolved corrections to your precise location.
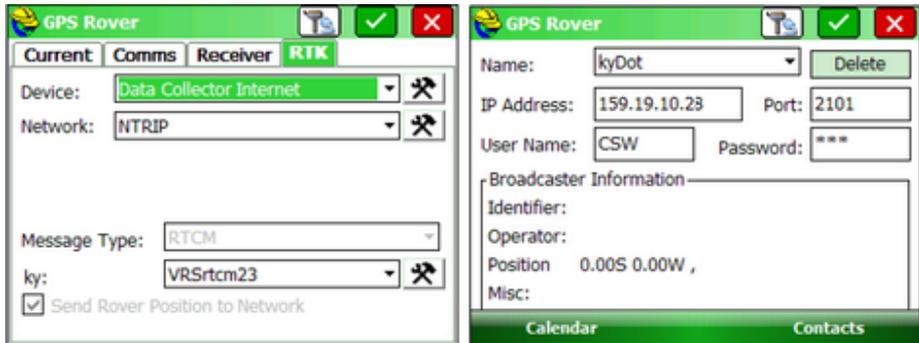
Within the RTK tab, the procedure is to select NTRIP (for most reference station networks) and then to click the tools icon to the right. This takes you to the screen where you provide a name for the GPS network (such as KYDOT) and then enter the IP address, user name and password. In almost all cases, the port is 2101. Some networks are free and others require a fee. When you click OK (or click the tools icon below Message Type in RTK tab), you are directed further to the screen below where you select either the specific, local mount point or broadcasting location (KYTI), or you select the name for the entire network, in which case your "best correction" will be provided and "Send Rover Position to Network" will default to on.

When you select the pulldown list next to "Name" above, you may be introduced to a long list of options. Many of the names may refer to individual mount points, and you may need to be advised on the name to select to get the "resolved" correction that utilizes more than one mount point. The example below shows many of the names used by the Ordnance Survey reference system in the U.K. This screen capture was taken from SurvPC, a Windows XP version of SurvCE. In this case, the full network solution is provided by the selection "RTCM30_VRS".
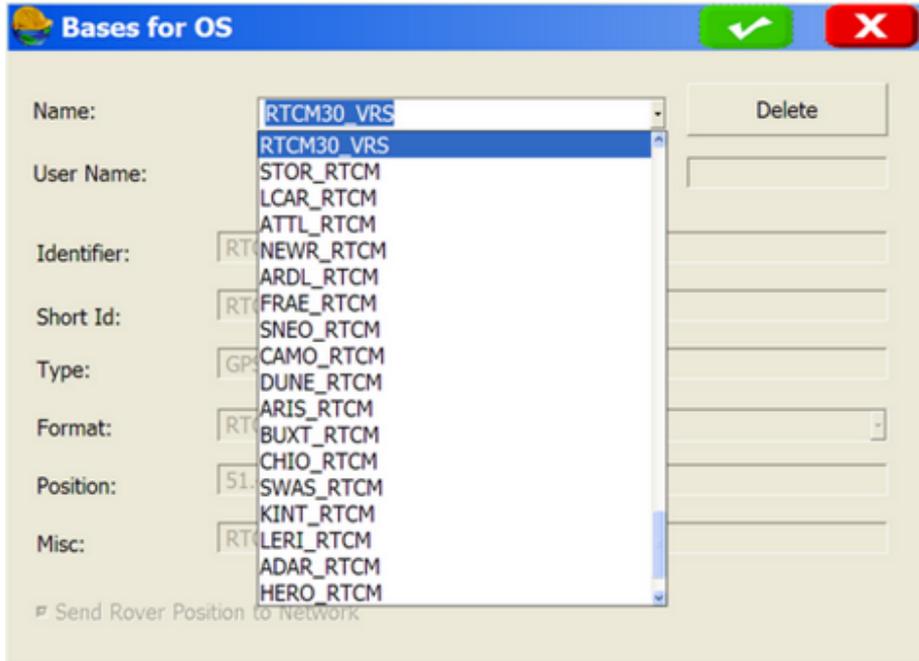
Operation and Utilities: The Surveyor+ GPS system was introduced using the NovAtel OEM V-2 GPS board. This board provides relatively quick RTK fixes and holds the fix well near trees and reduced sky environments. Within Monitor Skyplot, you will typically see a progression of messages from "Insufficient Data" (not enough satellites) to Autonomous, Float and then Fix. There are two fixes provided: Initial Fix (with *) and Confirmed or Verified Fix, which removes the *. The Verified Fix occurs when the same RTK position is found by a secondary fix calculation. Usually, the Verified Fix occurs within seconds of the Initial Fix. If the cellular modem connection is dropped, or the referenced base GPS stops broadcasting for whatever reason, latency will increase. The program is designed to auto-reconnect to the base if latency rises above approximately 10 seconds. This auto-reconnection only occurs once in a usage cycle. If it fails to re-connect the first time, and latency continues to climb, then it is recommended to either Reset the receiver within GPS Utilities or simply go to the GPS Rover command (within Equip) and click OK. If the system still does not reconnect, then you may be outside of cell modem coverage or there is an issue with the provider of base corrections (the selected GNSS system). Exiting SurvCE and powering off, then powering up again and starting up SurvCE is another technique to help rule out any internal condition. Once a good connection is established, the "one-time" re-connect feature is active again. Note that sometimes this auto-reconnect will occur even if latency is rising while you are doing COGO or Map Screen work. The reconnecting process takes only a few seconds. When exiting SurvCE using the Surveyor+ GPS system, it is recommended that you Disconnect the Modem

first (hang up the phone!) by selecting "Disconnect" within the Monitor/Skyplot screen. Then shut down. This is not essential, but is recommended procedure.

Diagnostics: The GPRS connection to the base network can be interrupted through poor cellular reception or interference. This causes the TCP/IP connection to the NTRIP server to be dropped. When GPRS connection is restored, the TCP/IP connection takes a few seconds to be restored. The right-side LED light blinks to let you know that corrections are being received. Latency may still climb, and is not reduced to standard 0.5 or 1 second until the corrections are being used in the solution. So you may see the latency continue to climb for a few seconds after the connection is established, but the blinking LED assures you that the corrections are coming in. Then the latency will drop to below 2 seconds and fix will follow shortly after that. Most of the needed diagnostics are in the Monitor screen and LED. Monitor shows Internet Status: Connected/Disconnected/Connecting. The LED shows if corrections are coming in. Latency shows if corrections are being used in the solution. Status shows fixed mode (or float, autonomous or insufficient data). If cellular connection is not obtained, check to see if the Sim Card has expired.

UHF Operation: If cellular coverage is weak or non-existent, or if there is no accessible GNSS reference station system available, then classic base-rover operation by UHF radios may be necessary. The Surveyor+ GPS may be used as both a base and rover as shown in the graphic below. The base can be set up with a high-gain antenna and 35 watt radios and the base GPS can be another Surveyor+ GPS unit or nearly any make and model of GPS receiver. In the picture below, the base was set up with Pacific Crest PDL radios (often referred to as the "blue brick"), and SurvCE was configured to Pacific Crest PDL. The rover unit (shown at left) can be outfitted with Geomax radios as shown.

Within the SurvCE program, choose Satel 3AS or Satel Satelline for the radio type to operate the Geomax radios, as shown below:
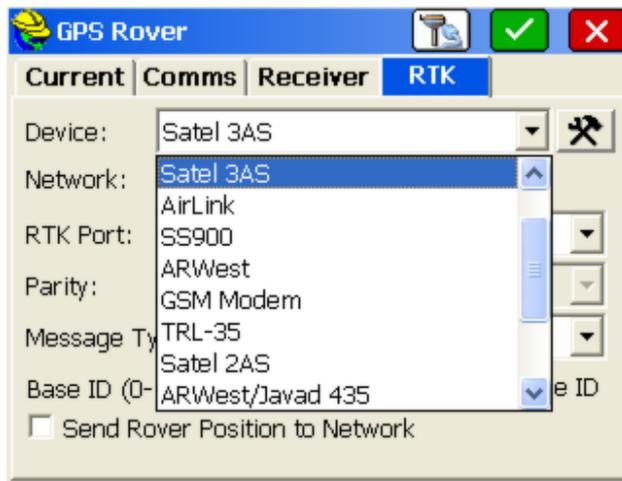
Controls are available for Power/Channel/Squelch, and the Com Port for the RTK Device should be set to Com 9 at 19200 baud. Prior to setup, use Windows Mobile procedures on the Surveyor+ to establish Bluetooth bonding to the Geomax radio, and assign Com 9.

Bridging: Another option when there is no cellular coverage, but where there is an available network, is to "bridge" the cell coverage to your location. This is typically done by setting up a receiving device on a hilltop where the cell coverage is good, which acts as a relay device to transmit the cellular message to your rover unit, as when operating in a valley or out of cell coverage. There are many formal and "do-it-yourself" systems to accomplish bridging. One such program is GNSS Internet Radio to connect to any NTRIP (Networked Transport of RTCM over IP). This program is available at:
http://igs.bkg.bund.de/ntrip/download.
This program runs on any Windows OS such as Windows XP, and will work on inexpensive laptops with built-in cellular modems, which are often used for this purpose. For bridging to a data radio, the program has the capability to provide the RTK corrections from the NTRIP server to a Com Port, which is cabled to the input of a data radio. You then enter the IP address (in the U.S., see (
http://ntrip.cors.us) . The port is entered as 2101 (universal port number for NTRIP). The output on the computer side can be IP through ethernet (local LAN IP) or a Com port. For true networked VRS systems, you may need to enter a Lat/Long position for your approximate location. PacCrest radios work well for this application. If the Trimmark III radios are used, for example, they can be linked to two additional radio repeaters, extending the signal even further to the rover GPS.

Another approach is to run GNSS Internet Radio on a virtual server, then direct the output via WAN TCP/IP (using a program called TCP-Com from TalTech) to a DB-9 port on a Sierra Wireless RavenX. The RavenX is a stand alone cellular data modem. It eliminates the notebook PC in the field.

GPS (Carlson BRx5 GPS)

The Carlson BRx5 is an integrated pole-top dual frequency GNSS receiver with internal UHF radio and GSM cell modem. It can be used as a base or rover.

It utilizes the Eclipse (TM) II OEM Board from Hemisphere. Each receiver comes with a kit of accessories as outlined below:

Item	Item	Qty (1 Unit)	Qty (2 Units)
A	BRx5	1	2
B	Antenna bracket (for upward vertical antenna mounting)	1	2
C	Antenna (model/type depends on region of use)	1	2
D	SD card	1	2
E	Batteries (rechargeable lithium-ion)	2	4
F	Power cable, external, 2-pin circular, 3 m (for base station unit)	N/A	1
G	Battery charger	1	2
H	Data cable, 9-pin to 9-pin serial, USB connector, and USB receptacle	1	2
Not shown	Pelican case	1	1

Ports: All external ports and connections are located on the bottom of the receiver, as shown below:

Port	What to connect
Data port (ODU 9-pin)	Data cable
Power port	External power cable
Mounting hole	Pole or tripod mount
Antenna port	External antenna
Serial port (DB9 female)	External serial device

The antenna can be inserted directly into the unit as shown below, or using an antenna bracket, the antenna can be positioned vertically (lower right). Sometimes a small increase in antenna height can improve reception.

BRx5 Antenna Options

Antenna Installation: To install the antenna directly into the unit:

      1. Remove the rubber cap covering the antenna port on the bottom of the unit.

      2. Screw the antenna into the antenna port until snug. Do not

overtighten.

To install the antenna using the antenna bracket:

      1. Align the bracket to fit into the recessed area on the bottom of the unit (the arrow-shaped portion with 4 screw positions shown in the graphic describing port connections).
      2. Using the two thumbscrews on the bracket, secure the bracket to the unit. Do not overtighten.
      3. Attach the bracket's antenna cable to the unit's port.
      4. Screw the antenna into the bracket's antenna port until snug. Do not overtighten.

Connecting to an External Power Source (primarily for Base GPS): The power cable has a circular connector (2-pin ODU) at one end and two clamps at the other end (red is positive and black is negative). The power supply is nominal 12-volt DC power. Consumption is less than 1 amp at 12 volts DC. Applying external power does not charge the lithium ion batteries in the battery trays of the receiver. Use a suitable battery charger to charge the batteries.

Note: The power cable is included with the two-unit base/rover kit; it is not included in the single-unit kit.
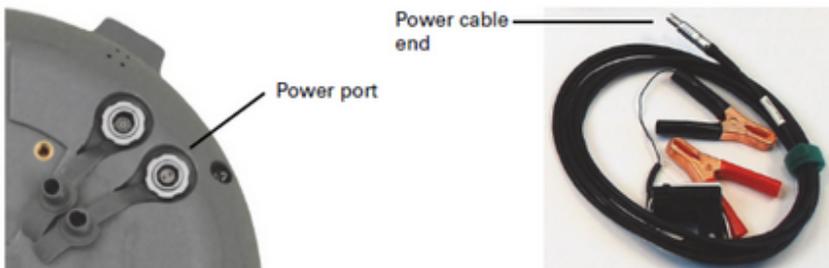
To connect the power cable, line up the red dot on the power cable end with the red dot on the power port and press into place. To disconnect the power cable, slide the cable collar (at the connector end) away from the unit and gently remove the cable.

Connecting to Data Collector: The BRx5 works well with any Windows Mobile data collector that will run SurvCE, but works particularly well with the Carlson Mini2 and the Carlson Surveyor+.   Connect the data collector to the BRx5 either using a Bluetooth connection or a serial cable connected to the data collector and the serial port on the bottom of the BRx5.

Automated Leveling: The BRx5 can display your level position, which has several advantages, including the ability to take a measurement by looking only at the data collector and confirming that your level condition is within tolerance. To configure this feature, go to the command GPS Rover in Equip, and in the Receiver tab, select the Advanced option:
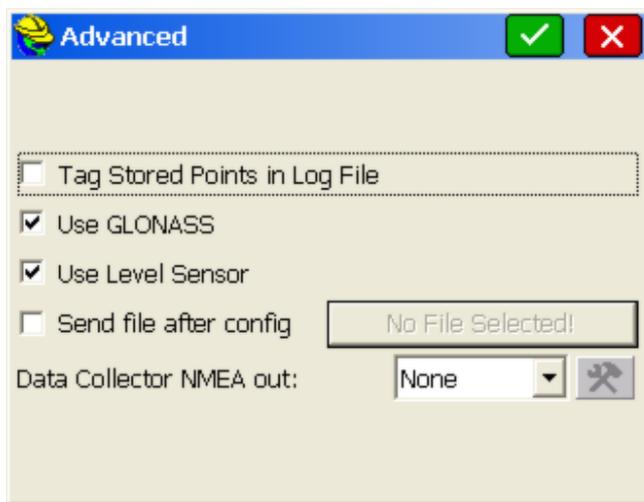
Here, turn on the "Use Level Sensor" option. The SurvCE LDL (Live Digital Level) only works with GNSS receivers with integrated digital level sensors such as the Carlson BRx5 and the Hemisphere S320. With this option clicked on, you can then set the Leveling Tolerance within the command Configure, Tolerances (in the File Menu) as shown below:

Tolerances		
HSDV Tolerance:	0.098	ft
VSDV Tolerance:	0.197	ft
PDOP Tolerance:	10.000	
Stakeout Tolerance:	1.640	ft
Level Tolerance:	0.10	ft
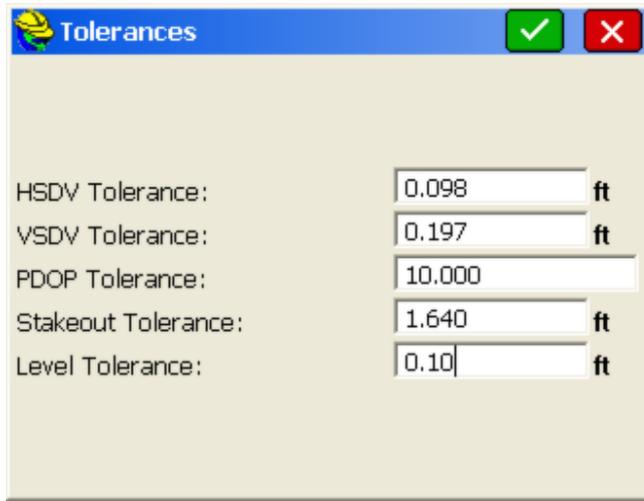
Then in all SurvCE Store Points and Stakeout commands, the LDL bubble graphics as shown below are superimposed. The GPS instrument detects the level status of the pole, and sends the information to SurvCE. The tolerance is reflected by the diameter of the larger circle. If out-of-tolerance, the inner circle crosses the outer circle and is shown in red:
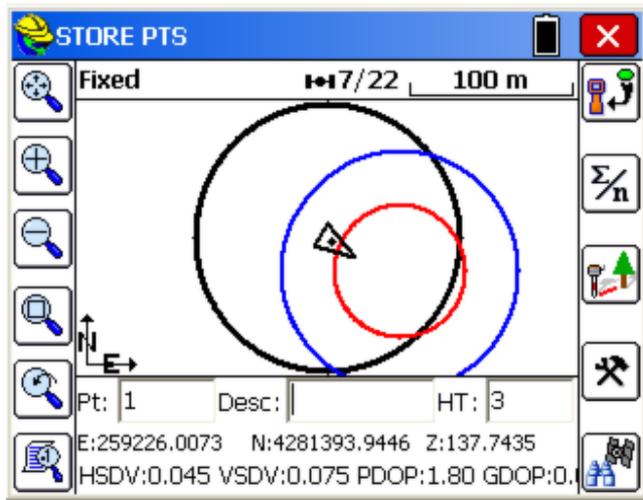
But when the tolerance is achieved, the inner circle becomes green. Then Enter or the icon for storing points can be pressed. If the tolerance is set to metric at 50 mm, then a calculation is made on the accuracy of the measurement, in this case 39 mm, within the tolerance setting.
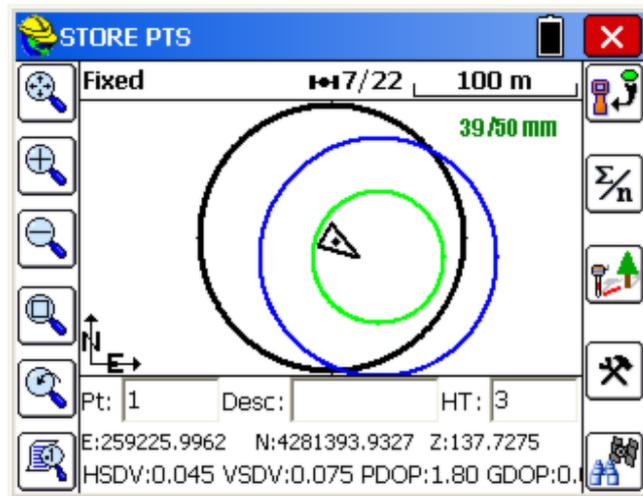
A perfectly centered bubble indicates perfectly level and would appear as shown here:
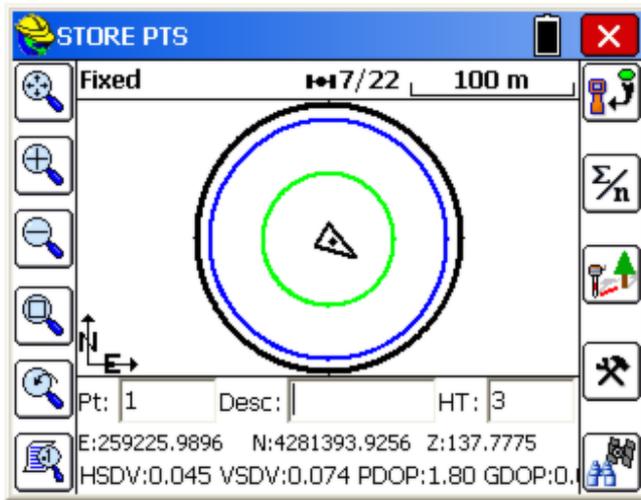
It is recommended that you face the front of the BRx5 head, so that your pole movements reflect the correct instrument orientation. But you do not need to look up. Look only at the level bubble indicator superimposed on the command. You will find that this speeds up field work dramatically and provides greater confidence in the accuracy of the GNSS measurements. A completely out-of-range for level computation would appear as shown below:
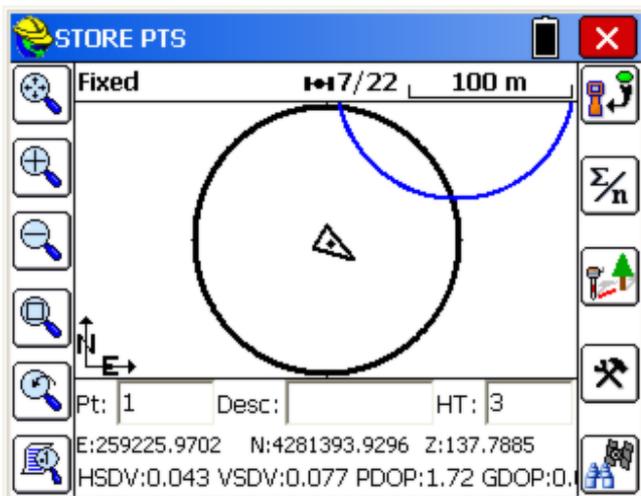
The LDL bubble indicator is turned on or off by checking the "Allow GPS Check Level" box in the View tab in the Configure section of Equipment as shown below:

GPS (CSI - DGPS Max)

This GPS system is typically used for GIS-type surveys with 1 to 3 meter accuracy. Corrections are obtained from Omnistar, WAAS, U.S. Corps of Engineers beacons, or by RTCM message string from an RTK unit. The rover setup offers the ability to set elevation mask and the DGPS Max Age.

GPS Base/Rover (DataGrid)

Using DataGrid with SurvCE

DataGrid GPS can be connected using either a bluetooth or cable connection. The GPS switches to bluetooth communications when the cable is disconnected and the receiver is powered on. DataGrid receivers communicate at a baud rate of 115200. DataGrid uses ARWest UHF radios for RTK corrections.

Connecting with Bluetooth
To use DataGrid GPS in bluetooth mode remove data cables prior to powering on the receiver. The GPS will automatically switch over to bluetooth. No PIN is required for bluetooth communications.

Radio Configuration
DataGrid uses ARWest UHF radios for RTK corrections. The base GPS has an external radio connected to a radio port on the receiver and the rover uses a built in radio. DataGrid uses one message type for RTK corrections. RTK message selection in SurvCE will show the default message selection and be greyed out. Radio channel selection displayed on the GPS unit and is selectable on the unit. Setting the radios to channel 0 will set the radio selection to an automatic mode.

GPS Base/Rover (Leica 500/1200)

Default values in Comm Setup are 9600, Parity None, Char Length 8, Stop Bits 1. These can be set by hitting "Defaults". For the GX1200 series GPS, the default baud rate is 115200.

ATTENTION:

For Leica 1200 GPS units, only firmware versions 2.12 and higher are supported!

GPS Base
This command opens the Base Configuration dialog.

- **Base Antenna:** This option allows the user to specify the antenna in use. The most common setting for the base antenna is AT502 Tripod type.
- **Antenna Height:** Input the base antenna height. The AT501 Tripod, AT502 Tripod, AT503 Tripod and AT504 Tripod settings will all prompt to "Measure to Base of 36cm Height Hook".

When the height hook is used, the Antenna Height is measured down to the hub and tack elevation from the fixed mounting position of the height hook. The measurement is typically in meters, so if you are configured to units in feet, you can enter the Antenna Height in meters with the "m" suffix, as shown above, and the program will do the conversion automatically. You can omit the "m" suffix if you are configured to metric units.

VO   Vertical Offset
VR   Vertical Height Reading
MRP Mechanical Reference Plane

Other Antenna settings for Leica GPS are AT201, AT202/302, AT202/302GP, AT303, AT501, AT501 Pole, AT502, AT502 Pole, AT503, AT504, SR299/399 Internal, AX1201, AX201 Pole, AX1201 Tripod, AX1202, AX1202 Pillar, AX1202 Pole, AX1202 Tripod and "Other". In all these cases, the antenna height is measured from the ground elevation to the base of the antenna (the "base" is where it would rest if you removed it and placed it on a table—the "base" is the lowest point).

- **Elv Mask**: This specifies the cutoff vertical angle above the horizon. Any satellites below this angle will be left out of calculations. An elevation mask of 10 degrees is typical. It is advisable to use some elevation mask between 5 and 15 degrees. Satellites low to the horizon can actually degrade the resolving of the GPS position.

- **Log Static Data to PC Card**: This option will log static data in binary form to the PC Card in the GPS receiver whether or not you choose to conduct RTK GPS work. The static data can be processed using the Leica SKI-Pro program.

- **Use Glonass**: This option will only apply for System 1200 instruments that support Glonass.

GPS Rover
This command is used primarily to set the appropriate antenna height and antenna type for the rover. Leica typically offers a 2-meter pole, so for antenna height, the most common entry is 2m or 6.5617 feet. The default antenna is the AT502 Pole.
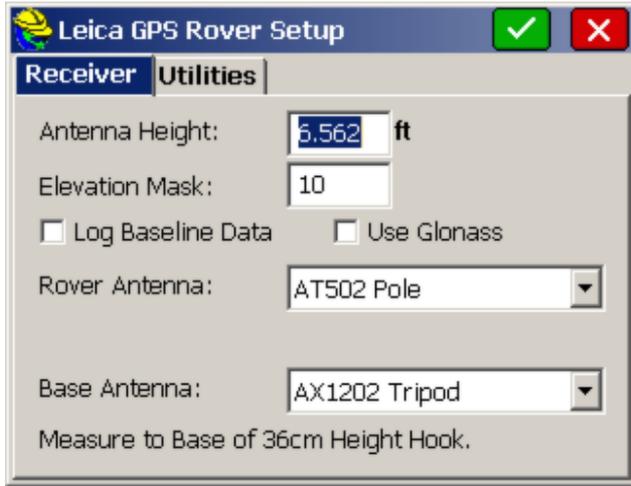
- **Antenna Height:** Input the rover antenna height. The AT501 Tripod, AT502 Tripod, AT503 Tripod and AT504 Tripod settings will all prompt to "Measure to Base of 36cm Height Hook". When the height hook is used, the Antenna Height is measured down to the hub and tack elevation from the fixed mounting position of the height hook. The measurement is typically in meters, so if you are configured to units in feet, you can enter the Antenna Height in meters with the "m" suffix, as shown above, and the program will do the conversion automatically. You can omit the "m" suffix if you are configured to metric units. Other Antenna settings for Leica GPS are AT201, AT202/302, AT202/302GP, AT303, AT501, AT501 Pole, AT502, AT502 Pole, AT503, AT504, SR299/399 Internal, AX1201, AX201 Pole, AX1201 Tripod, AX1202, AX1202 Pillar, AX1202 Pole, AX1202 Tripod and "Other". In all these cases, the antenna height is measured from the ground elevation to the base of the antenna (the "base" is where it would rest if you removed it and placed it on a table—the "base" is the lowest point).

- **Elv Mask**: This specifies the cutoff vertical angle above the horizon. Any satellites below this angle will be left out of calculations. An elevation mask of 10 degrees is typical. It is advisable to use some elevation mask between 5 and 15 degrees. Satellites low to the horizon can actually degrade the resolving of the GPS position.

- **Log Baseline Data**: This option stores raw vector data and Cartesian coordinate data for both the base and the rover and stores to the SurvCE data collector, in the "Data" directory. The file will be Jobname_SKI.ASC, depending on the name of the coordinate file. This vector file can be further processed in the Leica SKI-Pro program.

- **Use Glonass**: This option will only apply for System 1200 instruments that support Glonass.

- **Rover Antenna:** This option allows the user to specify the antenna in use.

The most common setting for the rover antenna is AT502 Pole type.

- **Base Antenna:** For best results, specify here the type of antenna used at the base.

GPS Base/Rover (Leica GIS System 50)

The Leica System 50 gets its corrections from the Corps of Engineer's beacons (free) or you can sign up for an annual subscription and pick up corrections from the Racal satellite at a rate of approximately $800 per year. You would need to order a special part with your GS50 system to read the satellite corrections. Though the Corps beacons are free, they are not available everywhere, and coverage is typically up to about 100 miles from each beacon. There are also line-of-sight issues, and you can "lose" the Corps beacons when in deep valleys, for example. Typical accuracies are 0.3 to 1 meter horizontal and 1 to 2 meters vertical. Configure Base, Configure Rover and Receiver Utilities do not apply, but the Localization command can be used to translate (1-point) or transform (multi-point) from the configured coordinate system to local coordinates. It is still important, under Job Settings, GPS tab, to set the correct Transformation (eg. NAD83) and Zone (eg. KY North) so that the Lat/Longs are converted to coordinates on the local system.

Using Navcom with SurvCE

At Left: Navcom 3040 GNSS
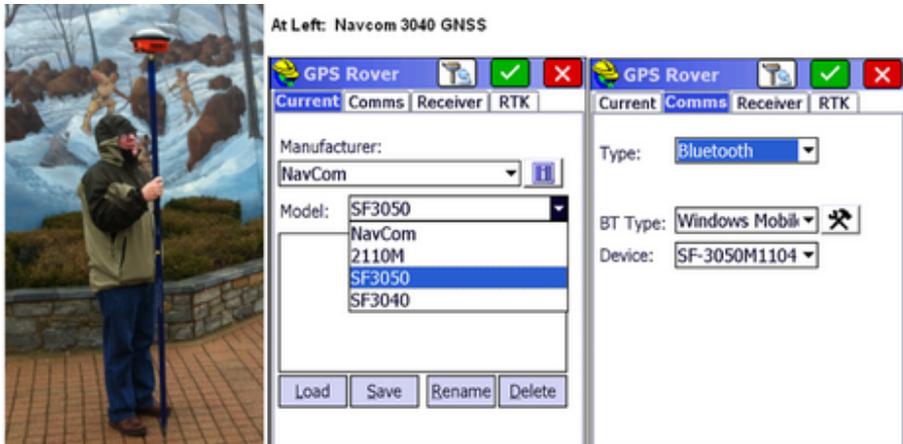
The GPS Rover screen within the Equip menu is shown above. A similar screen also appears in the GPS Base command (used typically to configure UHF radio communication from base to rover). There are multiple Navcom models available for selection, including the more recent Starfire-enabled SF3050 and SF3040.

Comms Tab

It is recommended to connect the data collector to COM1 on the original Navcom receiver. The baud rates are then searched leading to connection. Models that start with SF are capable of Starfire, but that does not mean that the Starfire license is active. Navcom SF-3040 and SF-3050 can communicate with a SurvCE data collector with either Bluetooth (BT) or Serial Port (Cable) connection. If using serial communication it is recommended that you use COM1 on the receiver. For BT, by default, the receiver does not require a PIN for connection. A user may configure the receiver to require a PIN if needed (Please see your Navcom documentation for details). Bluetooth types include Windows Mobile (default), Generic and Microsoft. It is recommended to use Windows Mobile selection. Clicking the Tools icon to the right of Bluetooth type will show a list of previously connected Bluetooth devices, from which you can select (eg. if you are changing receivers). If it is a new receiver, click the Blue icon on top of the screen to find the new Bluetooth address. If you have a clutter of old known Bluetooth devices listed, you can delete them with the "Delete Device" button.

Receiver Tab
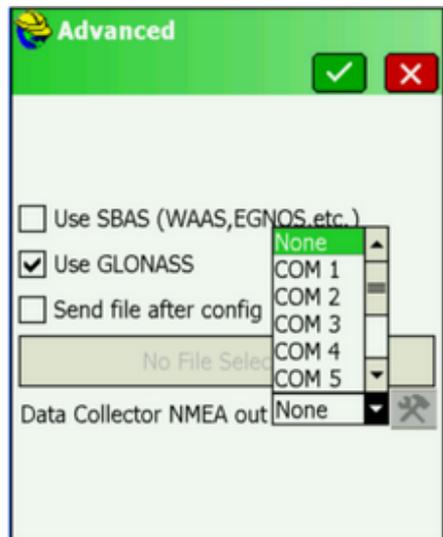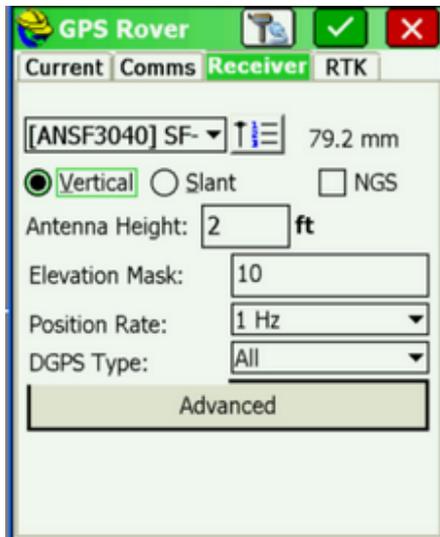
Antenna options vary with selected receiver model. The default antenna for the SF3040 is the NAVSF3040. The button to the right of the antenna type allows you to define the antenna, as shown below. The L1 offset is displayed to the right. You need to specify whether the antenna height is vertical, or slant (measured to the outside rim of the receiver head or antenna) or NGS type. The elevation mask sets the degrees above the horizon in which all satellites will be ignored. Position Rate options vary by model but are typically 1 hz, 2 hz and 5 hz. DGPS Type can be set to All, or specifically to SBAS, RTCM or Starfire. DGPS stands for Differential Global Positioning System and provides enhanced positions to GPS positions. SBAS stands for Satellite Based Augmented System and includes WAAS and EGNOS systems. RTCM is used for RTCM1 beacon systems. Starfire is a Navcom proprietary dGPS system that gives accuracies of 5cm. (See Using Starfire Section). The All option will turn on tracking for ALL dGPS types and will use the best available precision. The Advanced button allows for additional controls shown at right, above.

- Use SBAS/WAAS EGNOS will turn tracking off for SBAS satellites. The dGPS positions will not be calculated into the position.

- Use GLONASS will toggle on and off the use of GLONASS satellite system.

- Send File after Config would allow the user to send a script file of commands to configure the receiver.

- Data Collector NMEA out. This will output NMEA strings to a port on the Data Collector.

RTK Tab

Devices and Networks are configured in the top half of the dialog and the Message options are configured in the bottom section.
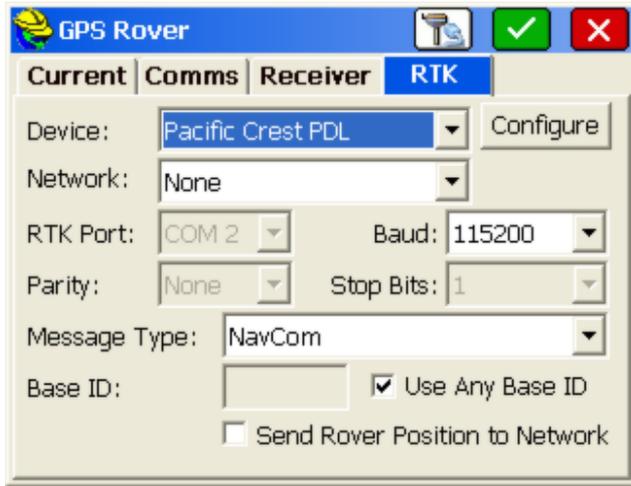
- **Device:** This list contains the supported devices that deliver or receive RTK messages, such as a radio or IP modem. If an External Radio is selected, the user will need to specify the Port, Baud, Parity and Stop Bits that the radio manufacturer requires. For internal radios, SurvCE will detect the proper settings. The extensive list of radio devices for base-rover communication is shown here with Internal UHF (top item) and Cable or Generic Device (second from top) not shown. The Internal UHF is a common setting, configured to Message type NCT. Data Collector Internet is the typical setting to access NTRIP servers for rover operation. The tools icon to the right of Device will show the ISP selected (for Data Collector Internet) and will show Channel, Squelch, Scrambling and other settings for most base-rover radio configurations.

- **Network:** This list allows you to configure and connect to various networks (e.g. NTRIP) when uising Data Collector Internet. The Nautiz X7 Handheld data collector has a built-in modem and WiFi which allows connection to the Internet. Shown below are the Network options, including Starfire over IP. When set to NTRIP, clicking the tools icon at right leads to a screen where the preferred network can be selected. When using NTRIP, choose "Data" for Port. Click the tools icon to the right of Network to choose your network. You will need to name the network, and then enter the known IP address. Port is typically 2101. Enter your User Name (this may be a required set of characters if you obtained NTRIP access by purchase or granted permission). Using NTRIP, clicking the Green Check in any of these screens initiates the connection process and will indicate "Successful" if all settings are correct and the server is broacasting.
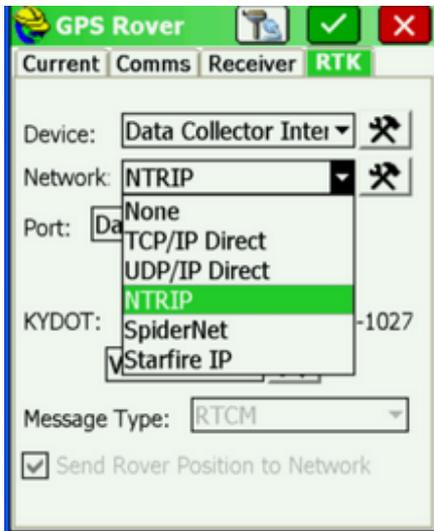
- **Configuring the Internal Radio (for Base-Rover operation):** The 3040 and 3050 Navcom GPS receivers include internal 1 watt UHF radios. To use these, set Device to Internal UHF. Clicking the tools icon to the right of Device lets you set the radio parameters. The radio supports Trimtalk, Satel, Pacific Crest GMSK and Pacific Crest 4-FSK protocols. The frequency range is 403 to 473 stepped in either 12.5 or 25 kHz. Network ID is Selectable. The radio is configurable by SurvCE. The radio details are available from the Quality tab of Monitor/Skyplot. This will show the current settings of the internal radio.

- **Message Type:** You must select the RTK message type that you wish to broadcast and receive. This is the format of the RTK message string that is either sent from the base or received at the rover. If NTRIP is selected, the NTRIP server will permit a range of Message types, such as CMR, CMR+, RTCM 2.1, RTCM 3.0 and RTCM 3.1. Some servers will have a limited selection of options. Many times if the option CMR or CMR+ is selected, Glonass will be not available. Glonass is typically available with all RTCM 3x selections. If RTCM 3.1 is selected, this message string can include the grid and geoid offsets within the string itself, which SurvCE can parse out and use in the position calculation. You have the option to click on "Use 1021-1027" when set to RTCM 3.1.

- **Base ID:** This is typically used to isolate paired devices when set to base-rover radio communication. If there is more than 1 base active, the base ID can be set. The user specifies that the base it ID 1, then the rover should be set to only listen to ID 1 so that other base station that might be in the area do not interfere.

- **Send Rover Position to Network:** This will output a NMEA GGA message for networks that require it.

Navcom Starfire

Navcom has a satellite that acts as a base broadcasting corrections that only Navcom and John Deere GPS equipment can receive. This enables 2 features proprietary to Navcom GPS: RTK Extend and QuickStart.

RTK Extend

RTK Extend enables RTK level precision during periods of RTK communication network interruptions by utilizing Starfire corrections. With RTK Extend a receiver operating in RTK mode can maintain centimeter level positioning for up to 15 minutes.

To use RTK Extend Starfire corrections must be received and converged. For more information on convergence see Starfire Quickstart Section below. When configuring the receiver select either *Starfire* or *All* options in the DGPS type combo in the *Receiver Tab*. Starfire corrections must remain on during RTK work to use RTK Extend as a backup when RTK communications fail. When RTK communications are lost SurvCE will display "RTK-X" in the Status of Monitor/Skyplot and Survey Screens.

Starfire Quickstart

RTG navigation solution requires 30 minutes or more to converge to its highest level of position accuracy. This convergence time can be significantly shortened by entering an accurate starting position for the antenna. SurvCE supports Starfire Quickstart by allowing several methods of accurate position entry. To use Quickstart in SurvCE from the Main Menu go to the ***Equip Tab*** and click button ***#4 GPS Utilities***. From the *GPS Utilities* dialog click the *Quickstart* button. The *Current Position* is the current position of the Starfire position. The buttons below allow multiple methods of entering accurate starting positions.

Present Position This button is used to enter the current receiver position from the receiver. When this button is pushed the current position of the receiver will be displayed and the user will be prompted if they want to use this position to set a Starfire position. This feature is useful to seed a position into the receiver but is it not as precise as other methods.

<u>Read From GPS</u> This uses GNSSposition averaging to get a more accurate position to seed the Starfire position.
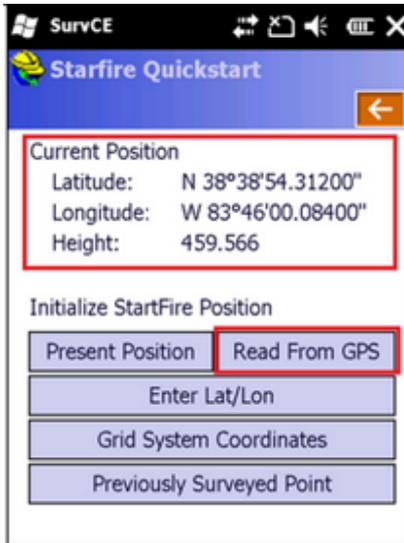
<u>Enter Lat/Lon:</u> This method requires the entry of Latitude and Longitude positions. This method requires that the position be in ITRF08 Datum. Positions not in ITRF08 datum will cause position errors.

<u>Grid System Coordinates:</u> Select a stored point in a file to use as a Quickstart position. User can use control jobs or previous surveys.

<u>Surveyed Point:</u> Select a point from the current job as a Quickstart position.

<u>Running Starfire Quickstart:</u> When the correct position is entered with a Quickstart tool, click the green check. This will start the Quickstart convergence process which will take up to 50 seconds to complete. SurvCE will count down the time remaining for the Quickstart to complete. If Quickstart is successful SurvCE will display "*Starfire Quickstart was successful*".

Starfire Rover

To use Starfire network as the source for corrections, configure the receiver with the following settings. In the *Configure Receiver Tab* select either *Starfire* or *All* options. Using option *All* will allow tracking of the SBAS satellite networks. In the RTK tab select Cable or Generic Device so that RTK corrections will not be received.
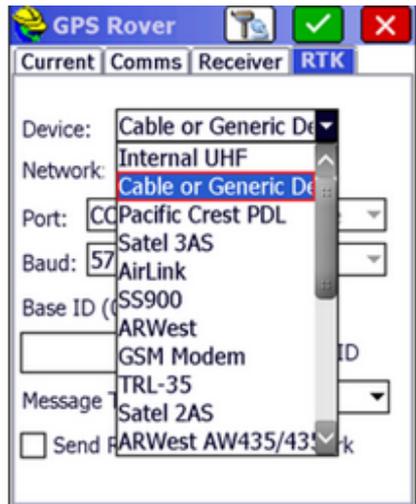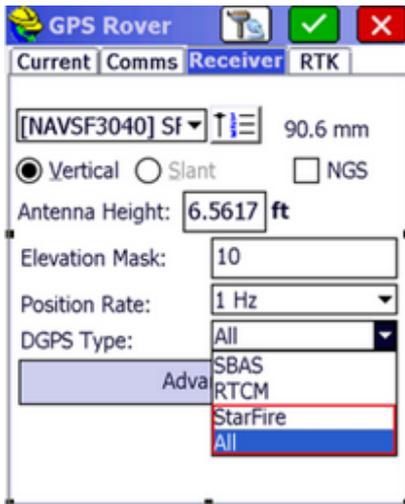
Starfire Status

Starfire Status is in *Equip Tab, GPS Utilities*. Starfire Status shows the receiver's current status of the Starfire license. The Starfire satellite in use is shown as the Current Starfire Satellite. The Satellite ID and Eb/NO (quality of signal) is shown. Authorized Starfire Satellites button will show the satellite IDs and the position in look angle and longitude.
Set Alternative Satellite--By default the Starfire satellite will be automatically selected. But it may be useful to select an alternative Starfire satellite. SurvCE allows the user to select an alternative Starfire satellite with the Starfire

Alternative Satellite tool.

Data Logging with Navcom

SurvCE supports logging raw data to the receiver. The SF-3040 logs data to an SD card which is located in the battery compartment. To log GNSS data to the receiver go to the *Survey Tab* of the Main Menu and tap button *#7 Log Raw GPS*. This will display the *Log GPS* main menu.

File Manager

The file manager will list all the files currently on the SD Card with the name, size and date created. Files can be deleted from the SD card with the delete button.

Delete File-- Files can be deleted from the SD card with the delete button. Select a file from the list and click on the *Delete File* button.

Format SD CardThe SD Card can be formatted using the *Format* button. Tap the Format button and then click yes at the warning message. This will format the SD card in a format that is compatible with the SF-3040 receiver. Warning formatting the card will delete all existing data on the card.

Start New Log

The SF-3040 automatically generates the log file name. The name contains the date and UTCtime the file was started proceeded with "datalog_" Example "datalog_2012_01_31_22_02.log". In the *Start New File* dialog the antenna type, antenna height and log interval can be adjusted.

Start Data Logging after Power Cycle: With this checkbox checked a new log file will be started after a power cycle. A log file is being written to the SD card when the data-link LED is solid green.
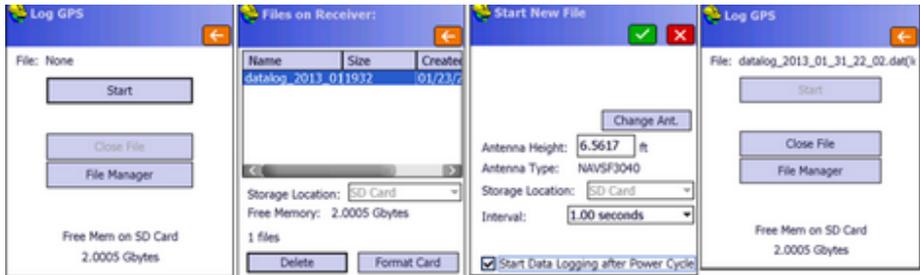
GPS Base/Rover (NMEA)

This GPS configuration is typically used to pick up the standard, commonly output NMEA string from a variety of receivers, including Ashtech MobileMapper CE, the Sokkia GPS01 Toughbook and some brands of Trimble equipment.

ASHTECH MobileMapper CE

To use the internal GPS of the MobileMapper CE unit from Ashtech, set the following:

Instrument
NMEA GPS Receiver

Communications
Port Number: COM2
Baud Rate: 57600
Parity: None
Char Length: 8
Stop Bits: 1

Configure Reading
Make sure that you toggle off the option to Store Fixed Only.

Sokkia GPS01

The Sokkia GPS01 Toughbook, for example, has an integrate L1 GPS receiver using WAAS for corrections and has accuracies of 1 to 2 meters. That same unit can be connected to real-time GPS or total stations and therefore functions as a

dual-use device, locating on-the-ground positions (Lat/Long, state plane, UTM) and permitting standard precision surveying. The GPS receiver is powered on whenever the Toughbook 01 is on, and uses COM3 as the GPS port. Note the "stabilizer bar" which effectively secures the com port connection for use in the field.

Some low-accuracy (10 to 50 meter) GPS outputs NMEA Lat/Long data by default and has no accurate "setting" or method. Alternately, certain accurate RTK brands of GPS, if setup with their proprietary equipment to run RTK, will transmit the NMEA string and allow GIS-CE to pick up the message from the rover receiver. For this reason, NMEA has no Configure Base, Configure Rover or Receiver Utilities option. It is a "plug and play" method, which will pull from the receiver whatever position it is outputting. That Lat/Long position will respond to the transformation defined in Job Settings, GPS and will also respond to any localization file to transform it further to local coordinates.

GPS Base/Rover (Novatel)

This is the driver for the original Sokkia Radian "real-time" GPS with centimeter accuracy. Sokkia Radian GPS, like all real-time, high-accuracy GPS requires a base receiver sending corrections to a rover receiver. Most commonly used GPS antenna types include the SK600 and SK502. All Sokkia GPS receivers will accept and transmit RTCM, RTCA and CMR message strings.

GPS Base/Rover (Septentrio)

Using Septentrio with SurvCE

Septentrio PolarRx2 GPS is a 48-channel dual-frequency GNSS receiver. There are several variants for this GPS line supporting different features including SBAS, DGPS and GLONASS. SurvCE supports the general GPS functions of this unit.

GPS Base/Rover (Sokkia)

Sokkia GSR 2700 IS - What do I do when I get the Bluetooth pass key prompt?
This receiver does not require a pass key. If you are prompted for one, do a factory reset on the receiver by holding the power key down until the message displayed is Factory Reset. Then turn the device off and back on again. In Carlson SurvCE, clear the receiver from the Bluetooth connections list and add it back in.

Sokkia Radian
This is the driver for the original Sokkia Radian "real-time" GPS with centimeter accuracy. Sokkia Radian GPS, like all real-time, high-accuracy GPS requires a base receiver sending corrections to a rover receiver. Most commonly used GPS antenna types include the SK600 and SK502. All Sokkia GPS receivers will accept and transmit RTCM, RTCA and CMR message strings.

Sokkia Radian IS
The Radian IS is an "integrated" GPS receiver with a fixed antenna type, the SK600. Antenna height on the integrated Radian IS with built-in SK600 antenna is measured to the base of the rubber bumper around the antenna. Sokkia provides a measuring tape that connects to the rectangular indentations for precise height measurement. A diagram of the phase center offset (antenna height) is included on the receiver. Similar "hook points" exist on all Sokkia antennas.

Sokkia GSR2600 GPS
The GSR2600 is a modular version of the Radian IS, with a variety of antenna types available. The Log Static Data routine in SurvCE will initialize the storing of raw data to the receiver. This raw data can be post-processed in Sokkia Spectrum Survey.

Sokkia Axis/Axis 3 GPS
The Sokkia Axis 3 is the current GIS-level GPS product from Sokkia and obtains corrections from Coast Guard beacons, WAAS and OmniStar. There is no subscription fee for beacons or WAAS, but there is for OmniStar. The subscription can be by month or year or any other time period (even "weekend" use). Accuracy varies on correction method used, but is typically sub-meter to 3 meters. For example, 0.5 meter accuracy (1.5 feet) is common with beacon corrections when located within 60 miles of a Coast Guard beacon. The Axis 3 is designed for GIS and environmental applications, which are effectively addressed by SurvCE through use of attributing on feature codes and through ESRI import and export features.

GPS Base/Rover (Topcon)

This configuration covers all Topcon GPS receiver types. Some of these receivers utilize Glonass satellites as well as the standard U.S. satellites. In the Configure Base routine for Topcon GPS, the firmware version of the receiver will be checked and the correct message for setting the base position will be sent according to the firmware version in use.

> **Note:** Glonass refers to the Russian satellite constellation (Global Navigation Satellite System). There are approximately 24 U.S. satellites active (more will launch over time) and there are approximately 10 Glonass satellites currently active. A full "24 satellite constellation" is anticipated by 2006 for the Glonass satellites. With a minimum of 2 Glonass satellites available or "seen" by the base and rover receivers, satellite coverage is improved, and work is sometimes possible in canopy, urban or deep pit environments where non-Glonass receivers do not have coverage. All Topcon GPS receivers have a "stat" light on the front panel that flashes green indicating number of U.S. satellites and orange indicating the number of Russian satellites.

Comm Setup

- **Port Number:** This drop list allows the user to select the communications port of the data collector.

- **This is a Bluetooth Port:** This toggle allows the user to specify that the selected port number is in fact the communications port that the Bluetooth device in the data collector is assigned to.

- **Find Bluetooth Port:** This button will auto-detect the Bluetooth port number in most devices.

- **Bluetooth Type:** Select the manufacturer of the Bluetooth device if known. Typically, Socket will be the preferred brand and often the installed brand, but if the brand is not known, select Other.

- **Baud Rate:** Set this value to match the data baud rate of the GPS serial port. Typically this will be 115200 but may also be 9600 or 38400.

- **Character Length:** Set this value to match the data Character Length of the GPS serial port. Typically this will be 8.

- **Parity:** Set this value to match the data Parity of the GPS serial port. Typically this will be None.

- **Stop Bits:** Set this value to match the data Stop Bits of the GPS serial port. Typically this will be 1.

Bluetooth
In addition to the discussion of Bluetooth (wireless) connection found under the help subject Equip - Comm Setup, there are additional trouble-shooting

considerations with Topcon Bluetooth.

- Note that the PIN for all Topcon devices is 11111.

- If the OAF file is not current the Bluetooth will not work. An OAF file is used by Topcon for the firmware of their receivers. With an expired OAF file, many features (including Bluetooth) will not work.

- Normally the Bluetooth port (usually B) must be enabled in the OAF file for the Bluetooth to work.

- It is possible to set the Bluetooth port baud rate. Normally it is 9600, 38400 or 115200. This can be checked from the "A" com port using GRIL (command manual for Topcon receivers) commands. The baud rate in the Com Setup should be the same.

Configure Base Station

- **Receiver Type**: You must select the receiver type (e.g. Hiper Lite).

- **Antenna Type:** You must select the Antenna Type (e.g. Hiper Lite). See the figure below.

- **Antenna Height**: This is entered as a vertical or "slant" height in the job units. The Vertical option is measured from the tip of the pole to the unit's ARP (For the Hiper series GPS units, this is the bottom of the unit where the pole screws in). Vertical is typically used for fixed height poles and tripods. For the Hiper series, the Slant option is measured from the point on the ground to the bottom edge of the square housing. This point is approximately 30.50mm higher than the ARP and is located at the bottom edge of the receiver's metal housing and is marked by a small arrow. For detailed information on antenna heights, please see http://www.ngs.noaa.gov/ANTCAL/.

- **Elevation Mask:** This value establishes the cutoff value above the horizon in degrees where satellites will not be considered.

Configure Base Radio

- **Radio Type:** There are two options available, PDL or Spread Spectrum. When using PDL, you must define the radio port, baud and RTK message type. When using Spread Spectrum, you only have to define the RTK message type. Most of the modern Hiper series units come with Spread Spectrum radios. When using PacCrest radios, a "TX" light blinks about every second indicating the radio is transmitting. The "RX" light would blink if you were getting interference.

- **Radio Port**: You must select the radio port. This setting on the TOPCON base and rover receiver is usually C. Data Port is always A when using a cable and B when using Bluetooth. When using Pacific Crest radios, TOPCON recommends the new PDL Pacific Crest radios. These must be set to 38,400 baud rate. TOPCON can also use Spread Spectrum radios, which work at 115,200 baud rate. The HiperLite GPS uses Spread Spectrum radios running at 57,600 baud. The standard Hiper uses Pacific Crest PDL.

- **Radio Baud:** This defines the over-the-air baud rate that the radio will use. In many cases, the user must know what the radio expects this setting to be based on the radio's firmware or pre-programming.

- **RTK Message Type:** You must select the RTK message type that you wish to broadcast.

Configure Rover Station

- **Receiver Type**: You must select the receiver type (e.g. Hiper Lite).

- **Antenna Type:** You must select the Antenna Type (e.g. Hiper Lite).

- **Antenna Height**: This is entered as a vertical or "slant" height in the job units. The Vertical option is measured from the tip of the pole to the unit's ARP (For the Hiper series GPS units, this is the bottom of the unit where the pole screws in). Vertical is typically used for fixed height poles and tripods. For the Hiper series, the Slant option is measured from the point on the ground to the bottom edge of the square housing. This point is approximately 30.50mm higher than the ARP and is located at the bottom edge of the

receiver's metal housing and is marked by a small arrow. For detailed information on antenna heights, please see http://www.ngs.noaa.gov/ANTCAL/.

- **Elevation Mask:** This value establishes the cutoff value above the horizon in degrees where satellites will not be considered.

Configure Rover Radio

- **Radio Type:** There are two options available, PDL or Spread Spectrum. When using PDL, you must define the radio port, baud and RTK message type. When using Spread Spectrum, you only have to define the RTK message type. Most of the modern Hiper series units come with Spread Spectrum radios. When using PacCrest radios, a "TX" light blinks about every second indicating the radio is transmitting. The "RX" light would blink if you were getting interference.

- **Radio Port**: You must select the radio port. This setting on the TOPCON base and rover receiver is usually C. Data Port is always A when using a cable and B when using Bluetooth. When using Pacific Crest radios, TOPCON recommends the new PDL Pacific Crest radios. These must be set to 38,400 baud rate. TOPCON can also use Spread Spectrum radios, which work at 115,200 baud rate. The HiperLite GPS uses Spread Spectrum radios running at 57,600 baud. The standard Hiper uses Pacific Crest PDL.

- **Radio Baud:** This defines the over-the-air baud rate that the radio will receive. In many cases, the user must know what the radio expects this setting to be based on the radio's firmware or pre-programming.

- **RTK Message Type:** You must select the RTK message type that you wish to receive.

Configure Rover Parameters

- **Position Update Rate:** In Configure Rover, the RTK Calculation Mode should be set to Delay, which forces a fresh reading, as opposed to Extrapolate, which will project the next reading by your direction of movement, and may apply to difficult shots in tree lines.

- **Ambiguity Fixing Parameter:** This determines how tight the ambiguities of the RTK solution must be before a fixed position is achieved. It is recommended that High be used for greater accuracy.

- **RTK Calculation Mode:** In Configure Rover, the RTK Calculation Mode should be set to Delay, which forces a fresh reading, as opposed to Extrapolate which will project the next reading by your direction of movement. Extrapolate may apply to difficult shots near obstructions such as trees or buildings.

Receiver Utilities

- **Power Cycle Receiver:** Use this button to power cycle the receiver. At times this may help if communications fail and cannot be restarted by Configure

Base or Rover.

- **Restore Factory Defaults:** Use this button to re-boot the receiver back to factory default settings.

- **Clear Non-Volatile Memory:** Use this option to clear the unit's non-volatile memory.

- **Send Command to Receiver:** This button allow the user to send command directly to the receiver if necessary.

- **Set Base/Rover Radio:** Use Set Base Radio and Set Rover Radio to be sure that both radios are on the same channel. Recommended settings are base on low "digisquelch" (low sensitivity) and rover on medium or high digisquelch.

- **Set Satellite Status:** This command enables you to "turn off" particular satellites, both U.S. and Russian. In SurvCE's Monitor/SkyPlot command, located on the Equip tab, the Sat Info screen displays the Russian satellites numbered 45 and up and the U.S. satellites numbered from 1 to 24.

- **Initialize to Known Point:** Use this option to speed up the initialization process.

Post-Processing

All Topcon GPS receivers can be used for post processing and will store raw GPS data on the on-board RAM in the receiver. The post-processing can be activated by the Log Static Data command found in the Survey menu of SurvCE. On every receiver, you can also activate logging purely through hardware by holding down the FN key, watch the light turn orange to green, then release. To turn off by hardware, press FN until the light turns off. Since SurvCE will prompt for antenna height, type and other parameters, it is recommended that software be used to initiate logging. Topcon logging files typically start off with the word "Log" followed by the date, and are post-processed using Topcon Tools. Topcon Tools will output a Rinex ASCII file of the logging data for use with programs such as NGS's OPUS.

GPS (Trimble) 🗼

Trimble 4000 GPS

The Trimble GPS 4000 is an older series of GPS receiver. The panel on the receiver itself can be used on the Trimble 4000 to configure for RTK. There is no Configure Base or Configure Rover in SurvCE for the Trimble 4000.

```
┌─────────────────────────────────────────────┐
│ Trimble 4000 Utilities            [ Close ]   │
│                                               │
│        ┌───────────────────────────┐          │
│        │      Power Cycle          │          │
│        └───────────────────────────┘          │
│        ┌───────────────────────────┐          │
│        │    Re-Solve Position      │          │
│        └───────────────────────────┘          │
│        ┌───────────────────────────┐          │
│        │  Re-Solve w/ Power Cycle  │          │
│        └───────────────────────────┘          │
│        ┌───────────────────────────┐          │
│        │     Factory Restart       │          │
│        └───────────────────────────┘          │
│        ┌───────────────────────────┐          │
│        │     Clear All RAM         │          │
│        └───────────────────────────┘          │
│        ┌───────────────────────────┐          │
│        │     Check Battery         │          │
│        └───────────────────────────┘          │
└─────────────────────────────────────────────┘
```
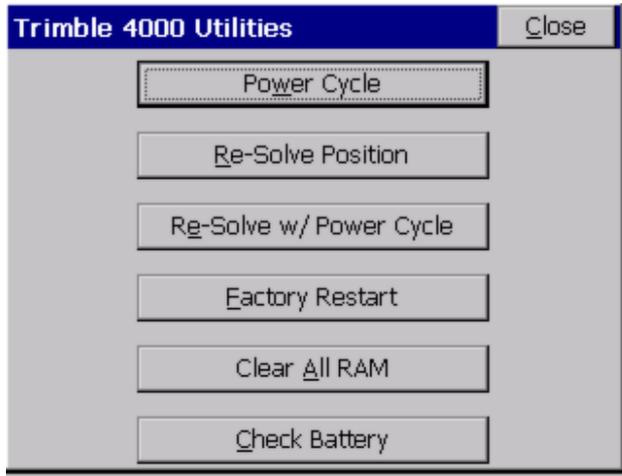
Trimble GPS General (4700, 5700 and 5800)

This configuration is used for most current brands of Trimble GPS, including the Trimble 5700 and Trimble 5800. The Trimble 5700 is often used as a base in conjunction with the Trimble 5800, which has the wireless "Bluetooth" communication feature. To use the Bluetooth feature, the Trimble TSCe is outfitted with an adapter on one of its serial ports which includes the internal radio. For use with SurvCE, the standard serial cable is recommended. To use the cable, disable "Bluetooth".

The Trimble 5800 with Zephyr antenna has a panel that includes an On-Off button at right.

There are three LCD lights. From left, the first round light is yellow and flashes or pulses at 1 per second when sufficient satellites have been acquired for RTK, and flashes quickly when insufficient satellites are available. The second round light is a pulsing green light indicating radio linkage. When the pulse is intermittent, radio connection is being interrupted. The third, rectangular light is green and indicates battery status. It is steady on when there is sufficient battery power.

Note on the Trimble 5700 that the power on-off button is on the right, the next two buttons to the left show the usage of battery 1 and an optional battery 2. Three LCD lights appear along the bottom left of the 5700 panel. The middle button pulses red and is a satellite indicator: steady 1 second pulse means good satellite reception and fast pulsing means insufficient satellites. The LCD to the left is steady on amber if static data is being logged to the receiver. When you configure the base with the Trimble data loggers, you can set it to do RTK with PPInfill, which will do both RTK and static logging. SurvCE can be used to configure the base or will drive the rover when the base has been configured by the Trimble data logger. A typical antenna usage would be the Zephyr Geodetic for the base (mitigates multi-path) and the Zephyr for the 5800 rover. Consult your Trimble reference manuals for more detailed information.

Trimble Pathfinder
This is another "GIS-level" receiver, which typically gets corrections from either a Beacon or a dedicated satellite in space (Racal), and has an approximate accuracy of 1 meter. An option to read OmniStar has been added. There is no Configure Base or Receiver Utilities option, but there is a Configure Rover option.

Carlson Supervisor

SurvPC is nearly the same software as SurvCE but is designed for the PC platform. The Carlson Supervisor is a Mil-spec computer manufactured by Handheld that is the perfect full Windows 7 PC platform for field data collection. The 7" screen (1024x600 resolution) is bright in full sunlight and all the large buttons and keys of SurvCE become even bigger when running SurvPC on the Handheld. One of the advantages of the Supervisor is large RAM for storage (2 GB DDR2 RAM and 64 GB SSD solid state hard drive). It uses an Intel Ultra Low Power Atom Z530 chipset with a 1.6 GHz processor. Mounts for pole mounting are available from Carlson Software, for use with total stations or GPS. The Supervisor includes an internal u-blox GPS, WAAS/EGNOS capable (2.5 m unassisted, 2.0 m assisted). Carlson also provides the "Super G" or Supervisor + GPS, using a built-in NovAtel OEM 615 board. It has the same form factor but is an all-in-one GPS system, needing only a cable connecting to the GPS antenna. This system is perfect for working with virtual reference stations--the perfect one-person field surveying tool.

Image Overlays: This command within the Map screen, **Tools** pulldown, works differently on the Supervisor with SurvPC. Unlike with SurvCE, where images must be pre-processed and "tiled" using Carlson X-Port (a free utility), the Supervisor using SurvPC can directly load georeferenced .tif and .jpg files, up to

a size of 10 mb.

Direct Load ESRI .MXD and Microstation .DGN Files: SurvPC and the
Supervisor, within the command File, Job, have the option to directly load ESRI
.MXD files (ArcMap Docs),
including the associated "geodatabase". This requires either the version of
SurvPC with the built-in ESRI engine or that ArcMap 9.1, 10.0 or 10.1 (or later)
be loaded on the Supervisor or field PC itself. SurvPC will also load large .dgn
files and run them natively. The option to select these forms of files appears in
the top of the screen as shown below:
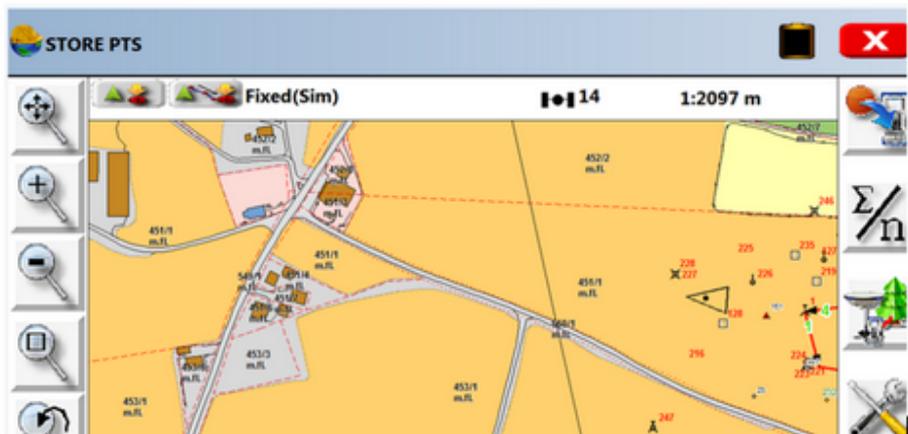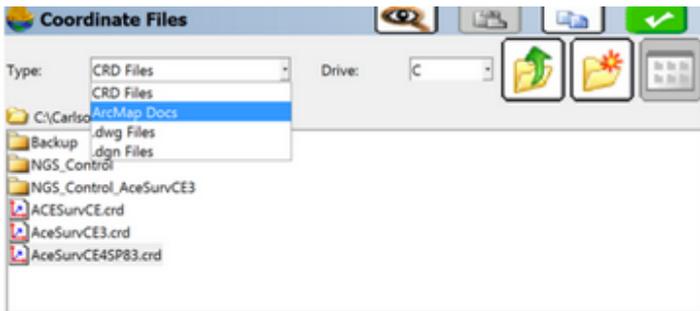
Shown below is SurvPC conducting snap-based stakeout (to screen elements)
working native in a Microstation .dgn file:
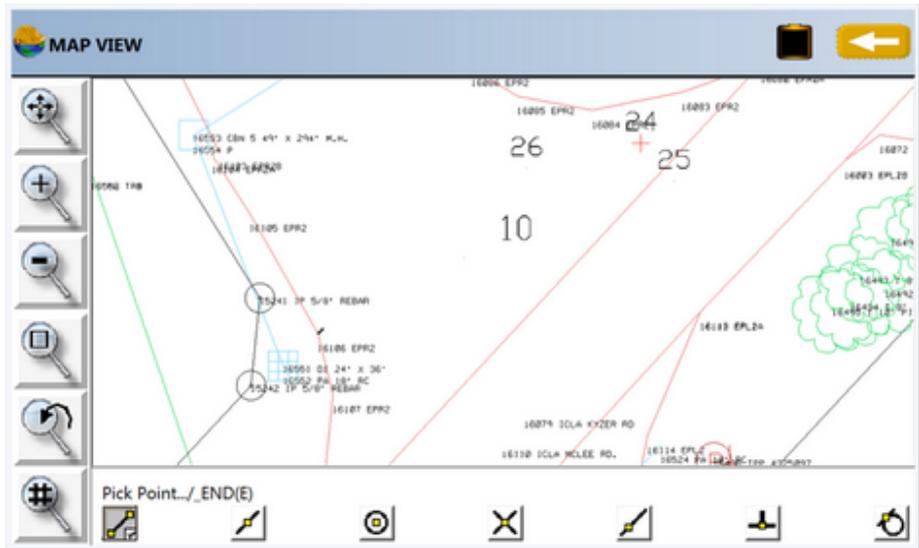
Virtual Keyboard: The Supervisor comes with its own virtual keyboard that is less optimized than the Carlson virtual keyboard within SurvPC. Therefore, when running SurvPC, click on the Virtual Keyboard option within Equip-Configure and disable or "minimize" the built-in Supervisor keyboard. This is done by the following procedure:

1. Tap on the middle left of the screen and bring out the virtual keyboard. It is typically recessed and can be pulled out from the left side of the screen.

2. With the built-in Supervisor keyboard displayed, pull down the Tools and then select Options at the top of the keyboard:

3. Set the Options to as shown below to control how it opens.
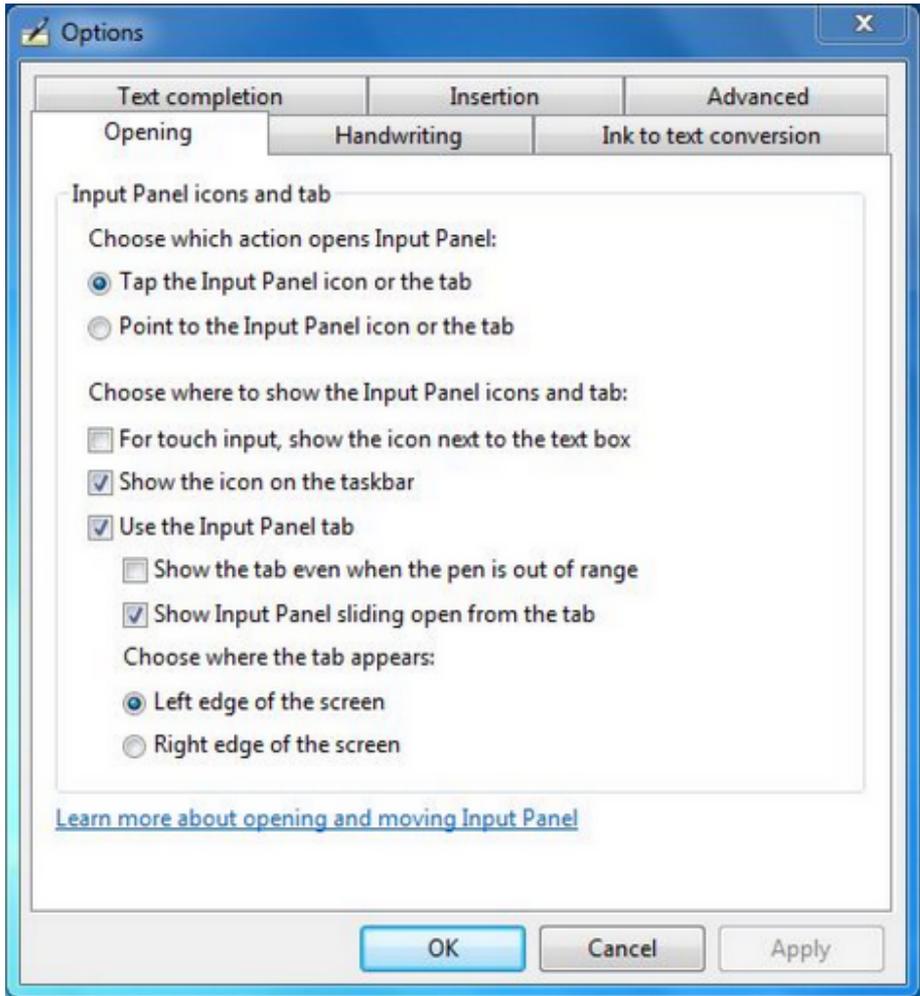
This docks a little icon at the bottom of the screen with a tablet and a pencil, and using this icon, you can bring up the Supervisor keyboard as needed, but keeped it docked away otherwise, never conflicting with SurvPC and its larger Virtual Keyboard.

The Carlson Virtual Keyboard, by contrast, appears as follows in SurvPC:

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