Base to Rover GNSS Surveying

Overview: Use a Base and Rover survey when the cellular data signal is not strong enough for a reliable connection.

- Establish the location of the base control point using either:
  - an IaRTN via a cellular connection, or
  - an OPUS data collection and processing, and post survey adjustment.
- Use the Base w/ radio to send a signal to the Rover.

Equipment: Trimble TSC3, 2 Receivers w/ radios, Trimble Access v2015.22

Setting up Survey Job

Start a New Job using the Data Collector for the Rover
(This can be done prior to setting up the survey equipment.)

1. Turn the TSC3 controller on by pressing the green power button.
2. Press the Trimble button or Click Start... Trimble Access.
3. Click General Survey
4. Click on Jobs... New Job
5. Input the new Job name,
6. Set Template as nrcs-gps
7. Click Linked Files if you want to select coordinate files that have existing points to be referenced into this project.
8. Tab down to the 2nd screen and type in the operator name & any other notes
9. Click Accept.

Option A - GPS Control Point Surveying using IaRTN

For use when IaRTN coverage will reach the base location

Set up the Rover GPS to determine the position of the control point using IaRTN.

10. Turn on R8/ R10 that will be used as the Rover. (External radio antenna is not needed at this point.) Turn the TSC3 controller on by pressing the green power button.

11. Enable the internal or external cellular connection:

<table>
<thead>
<tr>
<th>For systems using a Mifi device</th>
<th>For systems using the internal connection</th>
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<tbody>
<tr>
<td>a. Turn on Mifi Data cellular device.</td>
<td>i. Click the Trimble Access button</td>
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<tr>
<td>b. Click the Trimble Access button</td>
<td>ii. Click Internet Setup</td>
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<td>c. Click Internet Setup</td>
<td>iii. Select Connect using: Phone/Modem</td>
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<tr>
<td>d. The display should show “Internet Connection (WiFi) Established”</td>
<td>iv. Click Connect</td>
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<tr>
<td>• If not refer to the notes for TSC3 Wireless Hookup to Jetpack.</td>
<td>v. Wait for display to change to “Internet Connection (Internal Modem) Established”</td>
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<tr>
<td>e. Press ESC.</td>
<td>vi. Press ESC</td>
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</tbody>
</table>

12. Click General Survey
13. Controller will connect to GPS unit via Bluetooth. Watch for satellites beneath the battery level on the right side of screen. If having problems connecting to the rover GPS, see Setting GPS Bluetooth Connections.

**Capture Observed Control Point**

14. **Click Measure... Iowa RTN... Measure Points.**
15. If asked select the **RTCM3_XX** Identifier. **Click Enter**
16. The Controller will initialize the GPS survey. Watch for **RTN:Fixed** to appear and for the Vertical precision to get down to around 0.10 ft.

17. Take a Control Point using the Rover:
   - **Input** the **Point Name** for the TBM 1 (e.g. 501), **Code** = tbm 1
18. **Method = Observed control point**
19. **Antenna Height = 2m**
20. **Measured to = Bottom of antenna mount**
21. Set up bipod on benchmark and **Click Measure**
22. Once the 3 minutes of data collection has occurred click **Store**.

Repeat for additional control points.

**Recheck Control Points**

23. Before ending the survey, **return to the control points** and take a 2nd shot on those points. Compare the coordinates to the earlier results.

**Quit out of Survey**

24. **Click Measure... End GNSS Survey**
25. **Click No** to Power Down Receiver.
26. Remove the Rover GPS from the Control Point
27. **Press ESC. Click Yes** to Shut Down General Survey.

Turn off the mifi device and put it away.

If using internal connection
   - a) **Click Internet Setup**
   - b) **Click Hang Up**
   - c) **Press ESC**.

**Set Base Receiver on Control Point**

28. Set the Base GPS on the control point securely using the bipod
29. Attach the radio antennas to the Base GPS receiver and to the Rover GPS receiver. Power on both receivers
30. Setup the Rover GPS with the Data Collector Attached
31. **Click General Survey...Measure... Base-Rover... Start base receiver.** If GPS units don’t connect correctly see Setting GPS Bluetooth Connections.
32. **Antenna Height = 2m** or adjust as needed.
33. **Measured to = Bottom of antenna mount**
Base to Rover GNSS Surveying

34. Under Point Name: Press the right arrow
35. Select List
36. Select the Observed Control Point you had previously captured
37. Click Start
38. Base Started...Click Ok

Continue with Base-Rover Topo Survey

Option B - GPS Control Point Surveying using OPUS
  For use when no IaRTN data coverage is available.

Collect GPS Survey for base location
39. Set the Base GPS on the control point securely using the bipod.
40. Attach the radio antennas to the Base GPS receiver and to the Rover GPS receiver.
41. Power on both receivers. Turn the TSC3 controller on
42. Press the Trimble button
43. Click General Survey and verify that you have the correct Job open.
44. Click on Measure... Base-Rover... Start base receiver. If GPS units don’t connect correctly see Setting GPS Bluetooth Connections.
45. Broadcast format = CMR+
46. Right Arrow for the Point Name to Key In
47. Press the Here button to populate the coordinates.
48. Input a Point Name and Code
49. Click Store
50. Input antenna height = 2.0m
51. Measured to: = Bottom of antenna mount
52. Click Start
53. Base Started, Click Ok
54. To verify that the data is being collected, click Instrument... Base Mode... GNSS Functions... Import files... You’ll see a padlocked file if it is working correctly. Press ESC.
55. You will need to have the Base collect data for a minimum of 20 minutes for OPUS-RS (Rapid Static). Or 2 hours for OPUS (Static).

Continue with Base-Rover Topo Survey

Base – Rover Topo Survey

Conduct Topo Survey
56. Setup the Rover GPS with the Data Collector Attached
57. Click Measure... Base-Rover... Measure Points.
58. When Reliability reaches 100% Click Accept
59. Take normal topo shots:
   Input the Point Name for the shot (e.g. 1000), Code = g
Base to Rover GNSS Surveying

60. Method = **Topo Point**
61. Antenna Height = 2m or adjust as needed.
62. Measured to = **Bottom of antenna mount**
63. Click **Measure**
64. Once the 5 seconds of data collection has occurred click **Store**.
65. Press **ESC** when done collecting points.  
When setting additional control points set the Method = **Observed Control Point**

Conduct Continuous Topo Survey
66. Click **Measure**… **Base-Rover**…. **Continuous Topo**.
67. Method = **Fixed Distance**
68. Antenna Height = adjust as needed.
69. Measured to = **Bottom of antenna mount**
70. Distance = **50** or as desired
71. Offset = **None**
72. Input the **Point Name** for the topo shots (e.g. 3000), **Code** = g
73. Click **Start**.
74. To stop continuous topo click **End**.
75. Press **ESC** when done collecting points.

Job & Point Information (Optional but helpful)
76. To review point coordinates, click **Jobs**… **Point Manager**. Press **ESC** when done.
77. To review GPS quality of points, click **Jobs**… **QC Graph**. click **Display**… **Vertical Precision**. and press **ESC** when done.
78. To review Map of job, click **Jobs**… **Map**. Press **ESC** when done.
79. To review job details in the order of work done, click **Jobs**… **Review Job**. Antenna Height errors can be corrected or Notes can be added here. Press **ESC** when done.
80. To review or change linked files, units, or coordinate system, click **Jobs**… **Properties of Job**. Press **ESC** when done.

Note: Using the Trimble Globe Key allows the user to keep multiple items open and allows switching among tasks.
Note: Check out the Favorites button at the right side of the screen.

Recheck Control Points
81. Before ending the survey, **return to the control points** and take a 2\textsuperscript{nd} shot on those points. Compare the coordinates to the earlier results.

End Rover Survey
82. When survey is completed, click **Measure**… **End GNSS Survey**
83. **Power Down Receiver?** Click **Yes**.

End Base Survey (when using OPUS be sure to not stop too soon)
84. Click **Measure**… **End GNSS Base Survey**
85. **Power Down Receiver?** Click **No**.
Transferring receiver files for OPUS (Required for Option A; Optional for Option B)

86. **Click** on **Instrument... GNSS Functions... Base Mode...Import files ...**
87. Find to the receiver files that you want to transfer and **click** to the left of the Name to checkmark the file. [Files are named with the first 4 digits based on the last 4 digits of the receiver serial number, the next 3 digits are the calendar day of the year (e.g. Feb 20 = day 051, and the last digit is the order of receiver files collected that day (starting with 0 as the 1st file). E.g. 80110720 would be from the 8011 receiver, on day 072 of the year, and the first log file of the day.]

88. **Click** Import, **Click** Start.
89. Once files are successfully transferred **Click** Ok, **Click** ESC **Click** ESC

You will be able to download the .T02 files from TSC3 to your computer using Windows Mobile Device Manager and Explorer. This will be used to get an OPUS adjusted base point.

**Quit out of Survey**
90. **Click** ESC, **Click** Yes to Shut Down General Survey.
91. **Press** ESC or **Click** X to Close Trimble Access. **Click** OK to confirm Access shutdown.
92. Power off base receiver.

**Setting GPS Bluetooth Connections**

Settings for GPS Base-Rover mode via Bluetooth

a) **Click** on **Instrument... GNSS Functions... Bluetooth...**
b) **Set** Connect to GNSS Base = Serial Number of the Trimble R8/R10 being used as the Base
c) **Set** Connect to GNSS Rover = Serial Number of the Trimble R8/R10 being used as the Rover
d) **Click** Accept, **Press** ESC

Check to see that Bluetooth is turned on
a) **Click** on **Instrument... GNSS Functions... Bluetooth...**
b) **Click** Config
c) **Select** Mode
d) Checkmark Turn on Bluetooth
e) **Click** Ok, **Press** ESC
Creating a new Bluetooth connection to a receiver

a) Click on Instrument… GNSS Functions… Bluetooth...
b) Click Config
c) Select Devices
d) Click Add new device...
e) In the Select a Bluetooth Device list click on the Receiver that you need to create the connection to.
f) Click Next Click Next

g) Your device has been added Click Done

h) Click Ok Press ESC