

**National Park Service**  
**Inventory and Monitoring Division**



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## Summary

## Revision Log

[illegible]

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## Equipment/Materials List

- Trimble S6 total station\*
  - Battery (with extra battery and charger)
- Tripod for total station
- Trimble TSC3 data collector (handheld)\*
  - fully charged
  - Radio-link antenna (for handheld)
  - Handheld clamp and cradle (to attach to pole)
- Prism and rod (with level)
- Bi-pod for prism rod
- Tape measure
- Compass

\*Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. government.

## Total Station Setup

1. Setup the total station (TS) over the benchmark. Extend the legs of the tripod and bring it up to about chin height.
2. Fan the legs out and get the tripod relatively level (tighten the leg bolts).
3. Place the TS on top of the tripod (keep one hand on top of the TS at all times) and thread the tripod bolt into the tribrach.
  - a. Center the TS on the tripod to allow for future adjustments.
  - b. Be sure to close the TS box after the TS has been secured onto the tripod.
4. Use the optical scope on the TS to target the benchmark. If you are not directly above the benchmark carefully move the tripod so that the reticle is centered on the benchmark (placing a foot over the benchmark may help orientation).
5. Secure the tripod by stomping leg points into the ground.
6. Look through the optical scope to make sure the TS is still centered over the benchmark. If the TS is not centered, loosen the tripod bolt and slowly move the TS until it is centered (retighten the bolt).
7. Adjust the tripod legs and use the level bubble to get the TS level.
8. Turn on the TS.
9. Press Enter when the TS begins to count down to enter the precision leveling screen.
10. Turn the TS so that the front is parallel to two screws (one screw behind)
11. Center the e-bubble using the total station screws and press down.
12. Repeat until 1:10 is centered and then press Exit.
13. Turn on the TSC3 handheld data collector (TSC3) and connect it to the TS.
14. Once connected to TSC3, the TS screen will go blank and the TS is now ready to begin surveying.

# Configuring the Total Station for a Site Survey

1. Select Existing/Create a new job
  - a. In Trimble Access (Figure 1) => General Survey (Figure 2) => Jobs (Figure 3).
  - b. Select New Job if this is the first time surveying this site (Figure 4) or Open Job to select the job created during field season preparation (and skip to step 3; see SOP 1.2.13 for more information).
    - i. Job name: (PARK###\_YYYYMMDD; ex. CHAT001\_20140920).
    - ii. Set template to the last job used.
    - iii. Set coordinate system to UTM Zone xx (see Figure 5).
    - iv. Set units to meters.
    - v. Click Enter and Accept.
2. If this is the first time using the benchmark, record the TS position with the internal GPS in the TSC3 (if the reach has been previously surveyed, skip to step 3).
  - a. Use a tape measure to measure up from the benchmark to the yellow notch in the side of the total station. If the benchmark is not at ground level, measure from ground level to the yellow notch on the side of the total station.
  - b. Hold the handheld at the same elevation as the yellow notch and positioned next to the TS while completing the next step.
  - c. From the General Survey Menu (Figure 2) => Instrument (Figure 6) => Position (Figure 7) => Enter handheld height => Click Store in the lower right => Name the point (ex. BM1) => Accept
    - i. On subsequent surveys of the site, use the same coordinates for each benchmark (transferred from this job to future jobs) so that surveys can be easily compared.
3. Set up the total station position.
  - a. From General Survey (Figure 2) => Measure
  - b. Choose VX & S series survey style (Figure 8)
  - c. Choose Station Setup (uses instrument position and a backsight, Figure 9)
  - d. Check instrument level and corrections (Figure 10) => Accept

- e. Select instrument point name from list or copied from previous job (Step 2; Figure 11)
  - f. Key in the BM (benchmark) as the code and measure up from the benchmark (or ground level) to the yellow notch in the side of the total station and input the instrument height (Same value as in Step 2a above; Figure 12) => Enter => Accept.
4. Set up backsight (BS) point on a benchmark (Figure 13).
  - a. Setup the prism, rod and tripod. Attach the TSC3 to the cradle on the tripod.
  - b. Setup the rod/prism on the back sight point.
  - c. Enter the point name (BS1), code (BS), and backsight height (prism height). Point name and point code may change if using a benchmark or tie-in point as the backsight. Prism height is shown on the side of the rod. If the backsight point is not at ground level, subtract the height the benchmark/tie-in point is above ground level from the rod height. Select from list if already surveyed.
  - d. Take the azimuth from the BM to the BS point.
  - e. Make sure method is “angles and distance”.
  - f. Check target offsets by clicking on the prism icon (should be < 5mm).
5. Measure to the backsight and press enter to Store (Figure 14).
  - a. Once the point has been stored, the TCS3 unit will announce “Station Setup Completed.”
6. The TS is now ready to begin collecting data (Figure 15). See SOP 1.2.18 *Using a Total Station to Conduct a Stream Survey—Version 1.0* (McDonald et al. 2018) for details about surveying detailed transects.
7. Once all of the points are recorded be sure to Measure => End Conventional Survey (Figure 15) to save the points.



Figure 1. TSC3 Trimble Access main screen.



Figure 2. General Survey screen.



Figure 3. Job menu.

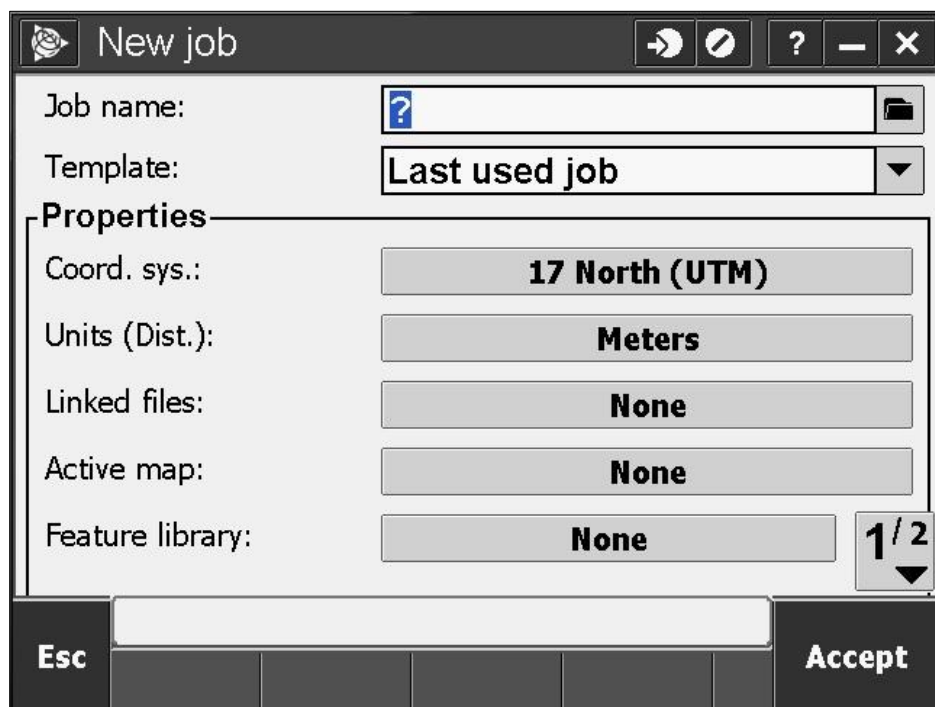


Figure 4. Create new job menu.

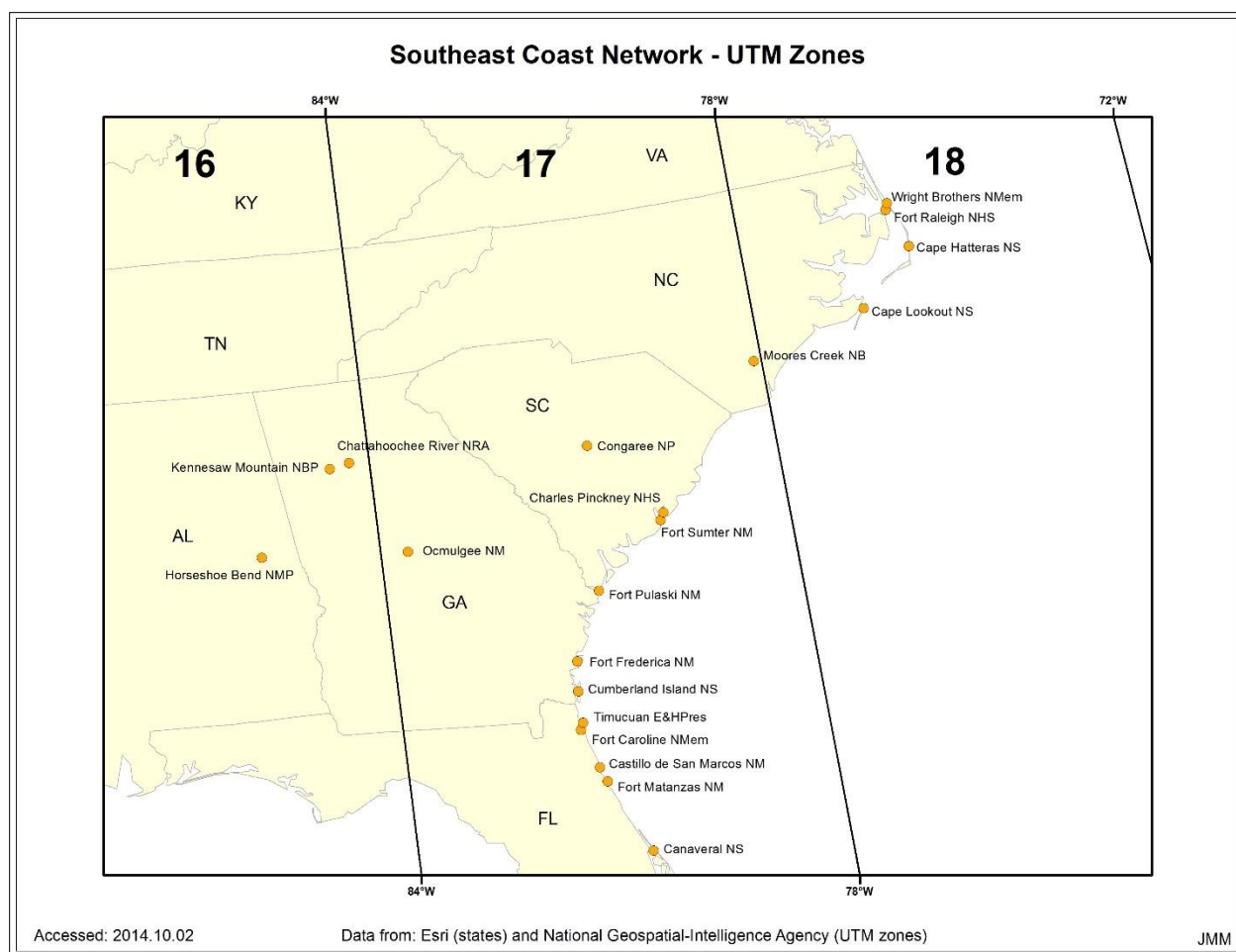


**Figure 5.** UTM zones for the SECN management units.

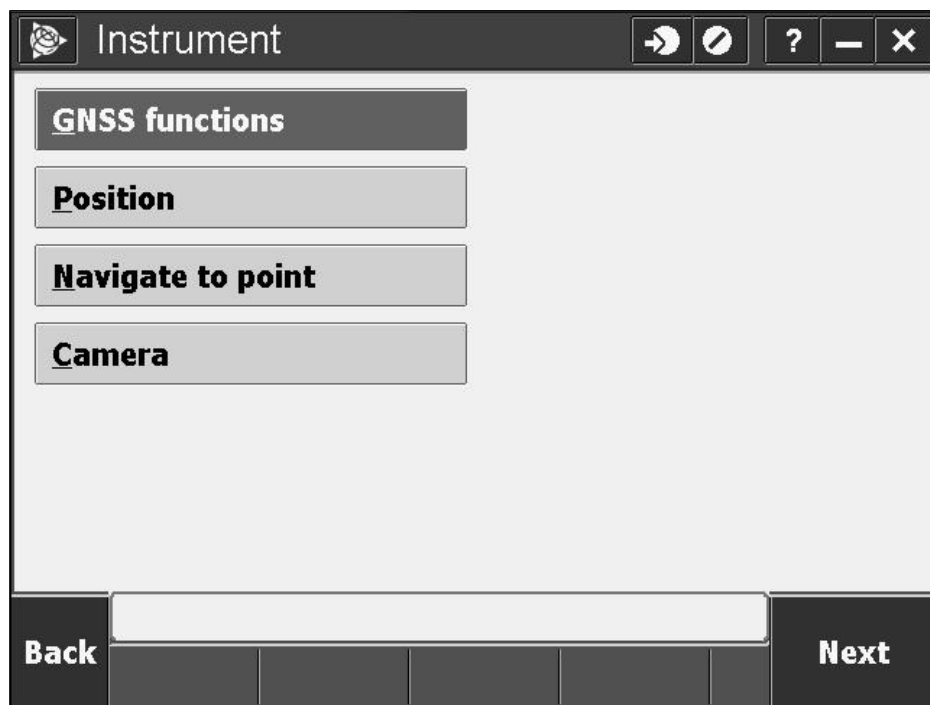


Figure 6. Instrument menu.

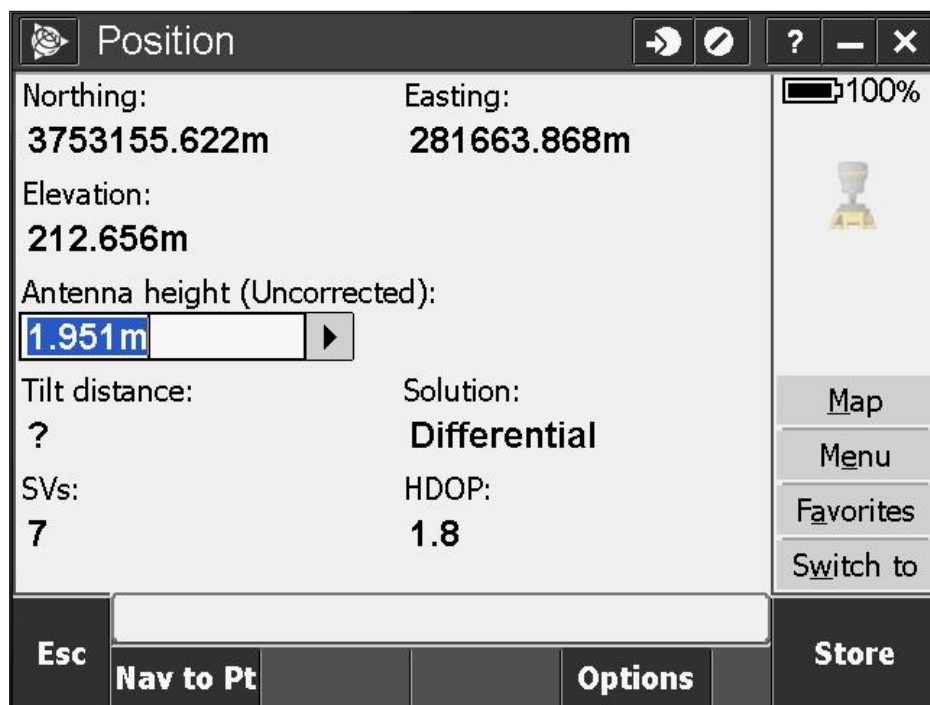


Figure 7. Position menu.

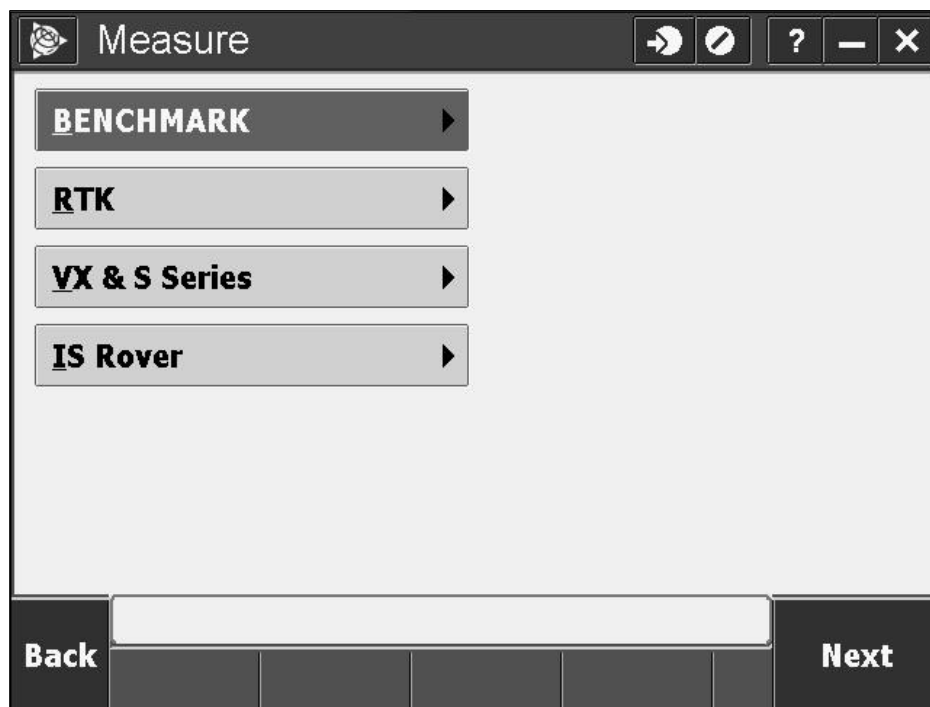


Figure 8. Measure menu.

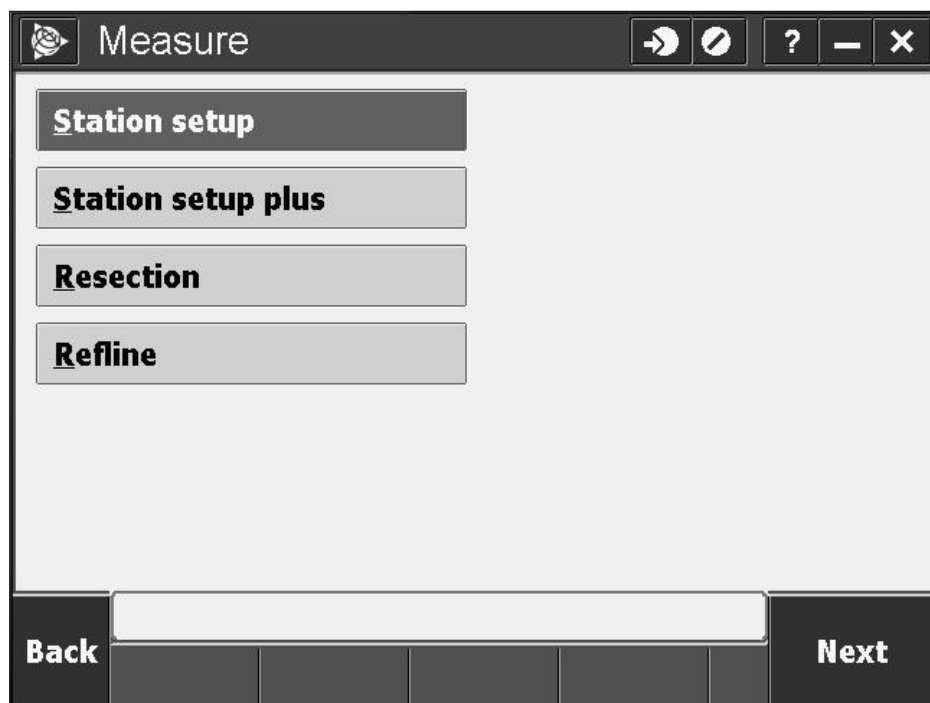


Figure 9. VX & S series menu.

**Corrections**

**Corrections**

Pressure (instrument):

Temperature:

PPM (Computed):

Curvature correction:  
☒

Refraction correction:  
☒

Refraction const.:

Show corrections on startup:  
☒

100%  
 90%  
 S  
 ?  
 +2  
 ?

Map  
Menu  
Favorites  
Switch to

HA:33°31'26" VA:78°31'30"

Esc

Accept

Figure 10. Station setup corrections screen.

**Station setup**

Instrument point name:

Code:

Height (bottom):

100%  
 90%  
 S  
 ?  
 +2  
 ?

Map  
Menu  
Favorites  
Switch to

HA:33°31'26" VA:78°31'30"

Esc

Navigate

Options

Accept

Figure 11. Station setup screen.

**Station setup**

|                                                                                                                                                                                                                                                               |                                |                                                                                                      |           |          |                     |                    |            |  |                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------|-----------|----------|---------------------|--------------------|------------|--|-----------------|
| Instrument point name:                                                                                                                                                                                                                                        | Code:                          | <div> <div>90%</div> <div>90%</div> <div> <b>S</b> </div> <div> <b>+2</b> </div> <div>1</div> </div> |           |          |                     |                    |            |  |                 |
| <input type="text" value="bm1"/>                                                                                                                                                                                                                              | <input type="text" value="?"/> |                                                                                                      |           |          |                     |                    |            |  |                 |
| Height (bottom):                                                                                                                                                                                                                                              | <input type="text" value="?"/> |                                                                                                      |           |          |                     |                    |            |  |                 |
| <div>Instrument coordinates</div> <table> <tr> <td>Northing:</td> <td>Easting:</td> </tr> <tr> <td><b>3753155.256m</b></td> <td><b>281663.705m</b></td> </tr> <tr> <td>Elevation:</td> <td></td> </tr> <tr> <td><b>213.656m</b></td> <td></td> </tr> </table> |                                |                                                                                                      | Northing: | Easting: | <b>3753155.256m</b> | <b>281663.705m</b> | Elevation: |  | <b>213.656m</b> |
| Northing:                                                                                                                                                                                                                                                     | Easting:                       |                                                                                                      |           |          |                     |                    |            |  |                 |
| <b>3753155.256m</b>                                                                                                                                                                                                                                           | <b>281663.705m</b>             |                                                                                                      |           |          |                     |                    |            |  |                 |
| Elevation:                                                                                                                                                                                                                                                    |                                |                                                                                                      |           |          |                     |                    |            |  |                 |
| <b>213.656m</b>                                                                                                                                                                                                                                               |                                |                                                                                                      |           |          |                     |                    |            |  |                 |

HA:33°31'26" VA:78°31'30"

Esc

Navigate

Options

Accept

**Figure 12.** Station setup screen after instrument location identified.

**Station setup**

|                                |                                |                                                                                                                                |
|--------------------------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Backsight point name:          | Code:                          | <div> <div>90%</div> <div>90%</div> <div> <b>S</b> </div> <div> <b>1.880</b> </div> <div> <b>+2</b> </div> <div>1</div> </div> |
| <input type="text" value="?"/> | <input type="text" value="?"/> |                                                                                                                                |
| Backsight height:              | Azimuth (Keyed in):            |                                                                                                                                |
| <input type="text" value="?"/> | <input type="text" value="?"/> |                                                                                                                                |
| Method:                        | <div>Angles and distance</div> |                                                                                                                                |

HA:33°31'26" VA:78°31'30"

Esc

Navigate

Options

Measure

**Figure 13.** Backsight setup screen.

**Station setup**

|                                        |                                        |                                                                                |
|----------------------------------------|----------------------------------------|--------------------------------------------------------------------------------|
| Instrument point name:<br><b>bm1</b>   | Height (bottom):<br><b>1.880m</b>      | <div>90%</div> <div>90%</div> <div> S<br/>1.880</div> <div> +2<br/>1.500</div> |
| Backsight point name:<br><b>bs1</b>    | Backsight height:<br><div>1.500m</div> |                                                                                |
| Azimuth (Keyed in):<br><b>0°00'00"</b> |                                        |                                                                                |

▶

Horizontal angle:

**0°00'00"**

▶

Vertical angle:

**79°41'10"**

▶

Slope distance:

**0.383m**

Map

Menu

Favorites

Switch to

Esc

HA:82°19'29" VA:111°53'45"

Options

Store

Figure 14. Backsight setup screen after position is recorded.

**Measure**

|                                |                             |
|--------------------------------|-----------------------------|
| <b>Station elevation</b>       | <b>Continuous topo</b>      |
| <b>Measure topo</b>            | <b>Surface scan</b>         |
| <b>Measure codes</b>           | <b>End conv. survey</b> ■   |
| <b>Measure rounds</b>          | <b>Integrated surveying</b> |
| <b>Measure points on plane</b> |                             |
| <b>Measure 3D axes</b>         |                             |

Back

HA:82°19'10" VA:111°53'46"

Next

Figure 15. Measure menu once the total station position and backsight have been recorded.

## Literature Cited

- Gregory, M.B., E. N. Starkey, and J. M. McDonald. 2018. Wadeable stream field season preparation—Version 1.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—1.2.13. National Park Service, Athens, Georgia. Available at <https://irma.nps.gov/DataStore/Reference/Profile/2253885> (last accessed July 2018).
- McDonald, J. M., E. N. Starkey, M. B. Gregory, and J. Riley. 2018. Using a total station to conduct a stream survey—Version 1.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—1.2.18. National Park Service, Athens, Georgia. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2254016> (last accessed September 2018).