

Southeast Coast Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 1.2.17

Setting Up and Configuring a Total Station—Version 1.1

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Summary

The following standard operating procedure (SOP) outlines the process for setting up and configuring a total station to collect accurate x, y, and z coordinate data. Total stations allow accurate spatial data to be collected and tied to a permanent benchmark. These data can be used to detect small geomorphic changes between site surveys. Many different types of total stations and surveying gear are available, and newer models will be available in the future. This SOP outlines basic steps for using the Trimble S6 robotic total station and the TSC3 data collector. These instructions do not cover detailed care and maintenance of the Trimble S6 robotic total station or the TSC3 data collector.

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
1.0	Cooper, C. S.	Specificity in transferring points between jobs using TSC3 controller.	Operational Review	1.1

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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).



Figure 1. TSC3 Trimble Access main screen.

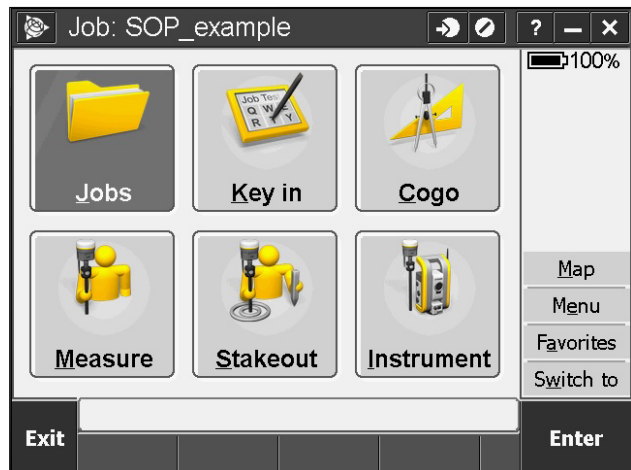


Figure 2. General Survey screen.



Figure 3. Job menu.

- 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.

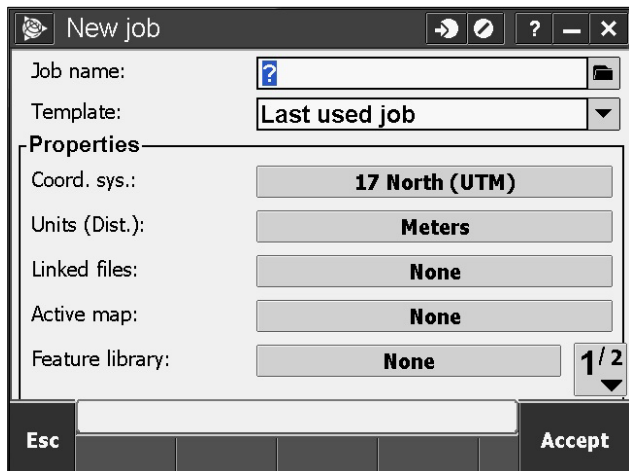


Figure 4. Create new job menu.

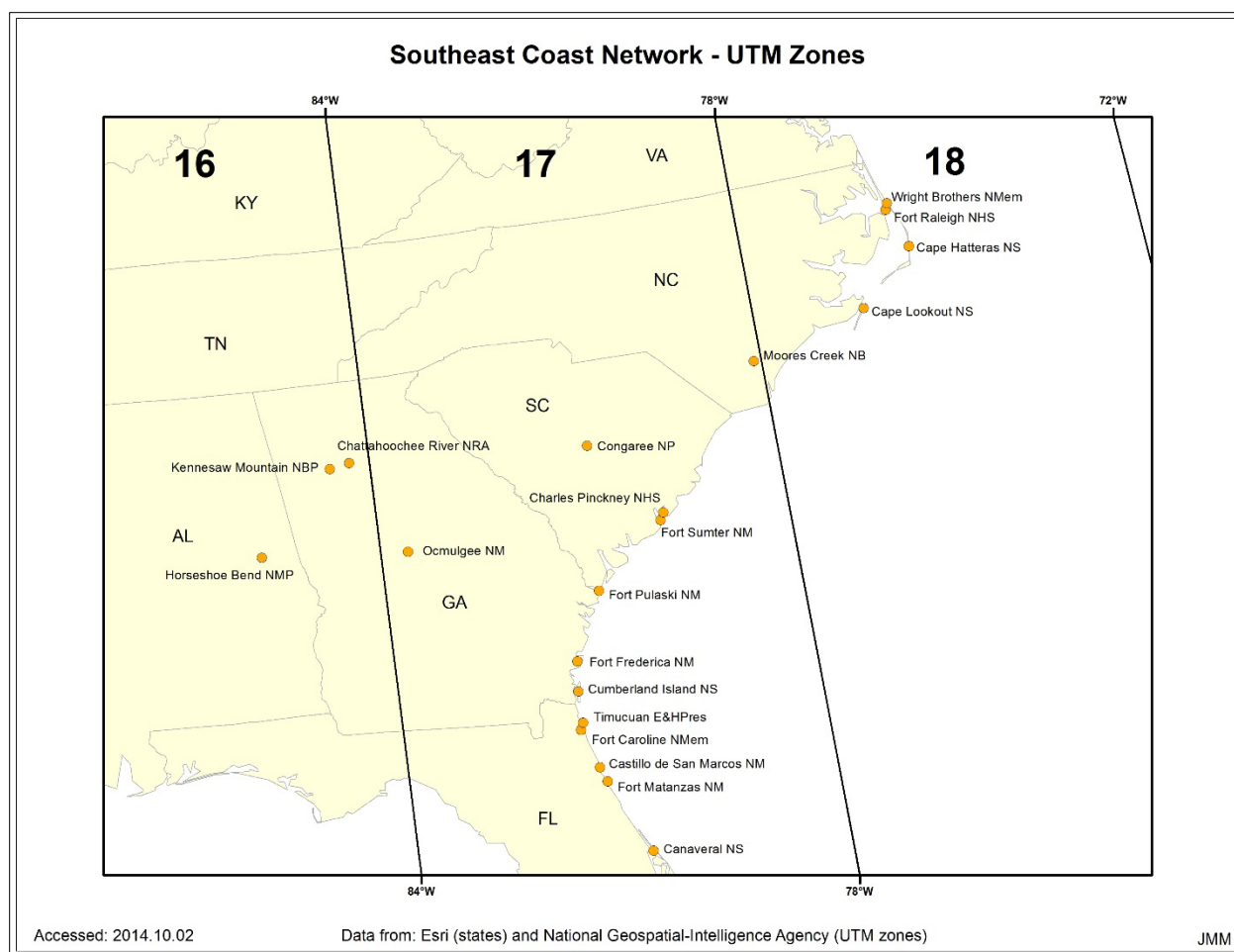


Figure 5. UTM zones for the SECN management units.

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, the same coordinates for each benchmark will be transferred from the initial job to the current job so that surveys can be easily compared. Details on the process of transferring points between jobs are found in SECN SOP 1.2.13 (Gregory et al. 2022).

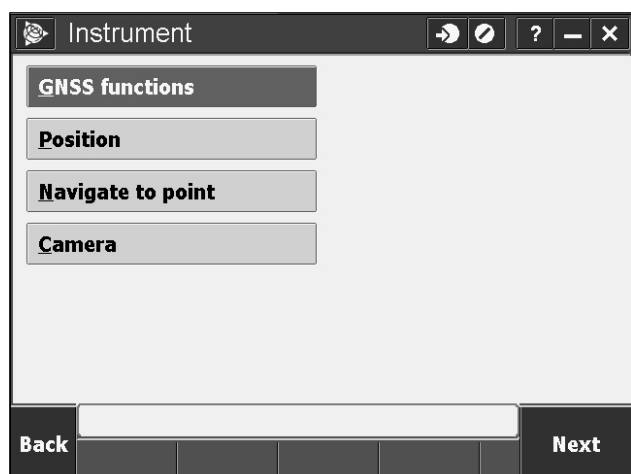


Figure 6. Instrument menu.

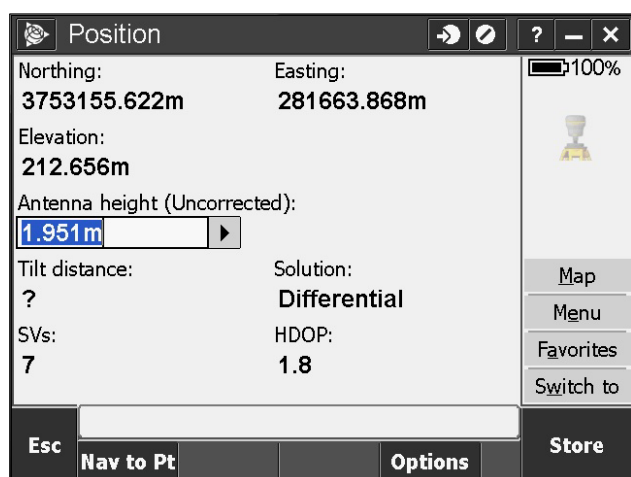


Figure 7. Position menu

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.

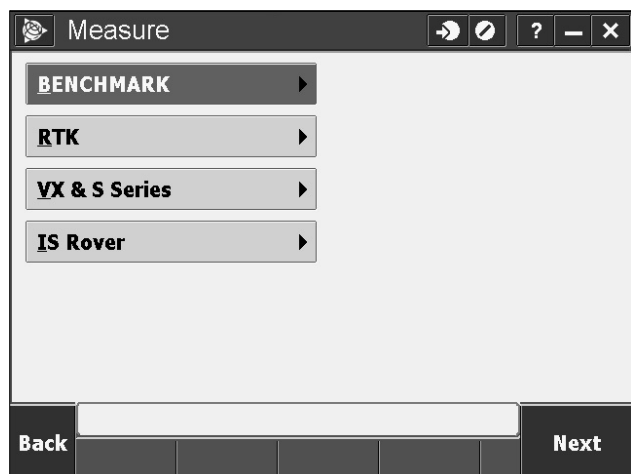


Figure 8. Measure menu.

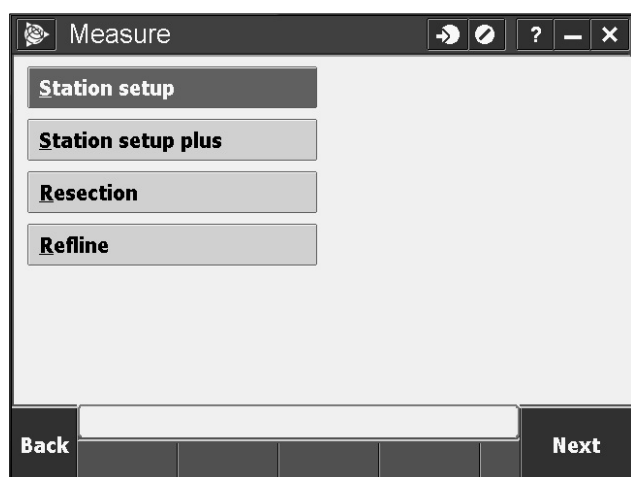


Figure 9. VX & S series menu.

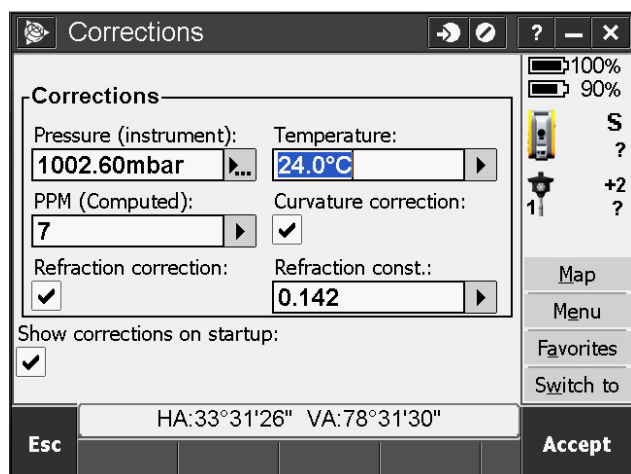


Figure 10. Station setup corrections screen.

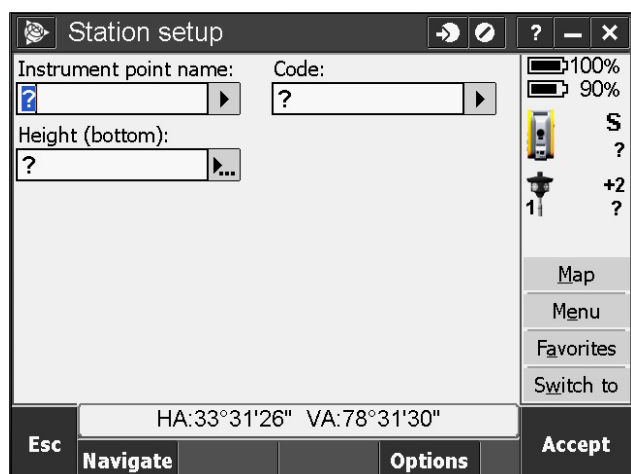


Figure 11. Station setup screen.

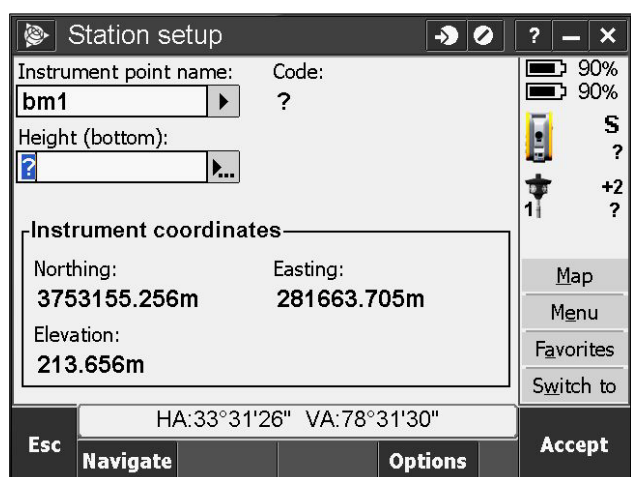


Figure 12. Station setup screen after instrument location identified.

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 < 5 millimeters [mm]).

The screenshot shows the 'Station setup' window. On the left, there are input fields for 'Backsight point name' (with a question mark icon), 'Code' (with a question mark icon), 'Backsight height' (with a question mark icon and a dropdown arrow), and 'Azimuth (Keyed in)' (with a question mark icon and a dropdown arrow). Below these is a 'Method' dropdown menu set to 'Angles and distance'. On the right side, there are two battery status indicators both at 90%, a prism icon, and numerical values '1.880' and '+2'. At the bottom right, there are buttons for 'Map', 'Menu', 'Favorites', and 'Switch to'. At the very bottom, a status bar displays 'HA:33°31'26" VA:78°31'30"' and navigation buttons 'Esc', 'Navigate', 'Options', and 'Measure'.

Figure 13. Backsight setup screen.

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.”

The screenshot shows the 'Station setup' window after data entry. The 'Instrument point name' is now 'bm1' and 'Height (bottom)' is '1.880m'. The 'Backsight point name' is 'bs1' and 'Backsight height' is '1.500m' (highlighted in blue). The 'Azimuth (Keyed in)' is '0°00'00"'. In the center, a large display shows 'Horizontal angle: 0°00'00"', 'Vertical angle: 79°41'10"', and 'Slope distance: 0.383m'. On the right, the prism icon now shows '1.500'. The bottom status bar now displays 'HA:82°19'29" VA:111°53'45"' and the 'Store' button is highlighted.

Figure 14. Backsight setup screen after position is recorded.

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. 2022) for details about surveying detailed transects.

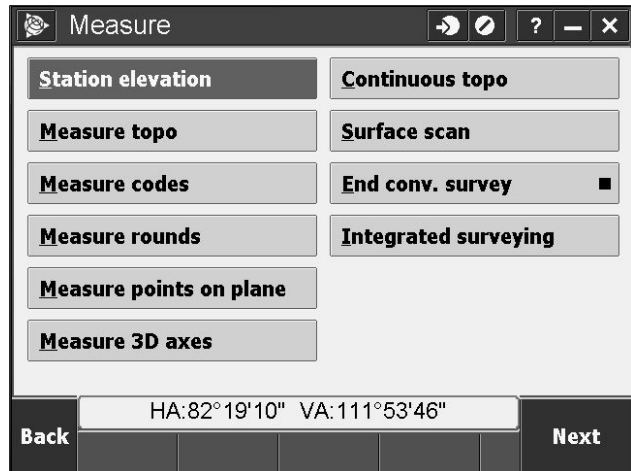


Figure 15. Measure menu once the total station position and backsight have been recorded.

7. Once all the points are recorded be sure to Measure => End Conventional Survey (Figure 15) to save the points.

Literature Cited

Gregory, M. B., E. N. Starkey, and J. M. McDonald. 2022. 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/2293666> (last accessed June 2022).

McDonald, J. M., E. N. Starkey, M. B. Gregory, and J. Riley. 2022. 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/2293670> (last accessed May 2022).