

Northern Great Plains Network

National Park Service



Setting Up and Configuring a Total Station

Stream Channel Monitoring

Please cite this as:

Thornbrugh, D. J., and J. S. Mills. 2024. Setting up and configuring a total station: stream channel monitoring. Northern Great Plains Network Standard Operation Procedure NPS/NGPN/SOP. National Park Service, Rapid City, SD.

Summary

This standard operating procedure (SOP) discusses how to set up and configure a total station for NGPN Stream Channel Monitoring (Thornbrugh et al. 2019). The procedures are adapted from the Southeast Coast Network SOP 1.2.17 Setting up and Configuring a Total Station—Version 1.0 (McDonald et al. 2018).

Revision Log

Previous Version	Revision Date	Author	Changes Made	Reason for Change	New Version
1.0	03/08/2024	A. Rosse	Provide details related to Trimble SX10/12	SECN document cited, no details of our own.	1.1

The NGPN will directly implement the peer-reviewed and approved protocols and methods in SECN's SOP 1.2.17 Setting Up and Configuring a Total Station—Version 1.0 (McDonald et al. 2018). Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2254014>

Differences in Methods

1. SECN procedure uses SX6, NGPN will rent SX10/12 as well as TSC data collector.
2. SECN procedure uses UTM's, NGPN will use State Plane coordinates for more accurate estimates of areas. Both use NAD 83 2011 Datum.

Procedures

Follow SECN [SOP 1.2.17 Setting Up and Configuring a Total Station—Version 1.0](#) from the Southeast Coast Network Wadeable Stream protocol. Use the methods and procedures as written. Take care to select the correct State Plane zone for each park:

AGFO, NIOB, MNRR Bow Creek: SPC (2600NE) Nebraska North

MORU, WICA: SPC (4002S) South Dakota South

DETO, FOLA: SPC (4901 WY E) Wyoming East

KNRI, THRO: SPC (3302 ND S) North Dakota South

All distance measurements are taken in meters.

Locations of rebar and permanent plot marks should be stored in Rebar_coordinates spreadsheets or all_points-for Ipad.xlsx spreadsheets found here on the N drive:

N:\Monitoring\Stream_Channel\PARK\GIS. These marks should be measured with a high-accuracy GNSS method using a correction service (Opus, HAS, Ntrip, or RTX satellite) for example.

Equipment/Materials List

- Trimble SX10/12 total station*
 - Battery (with extra battery and charger)
- Tripod for total station
- Trimble TSC5 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

Creating the job on the data collector in Trimble Access can be done beforehand in the office, while setting up the total station will take place at the field site.

Creating a Project, then a Job in Trimble Access on TSC 5/7 Data Collector

1. Turn on the TSC 5/7
2. Open Trimble Access



Figure 1: Trimble Access on Data Collector

3. Create new Project with Name and Reference from template. Use metric scale only with scale of 1.000000 cord. Sys. Select coordinate system from library if using an NPS data collector. Use NPS Geodetic Survey Training for more information in Appendix A. If not, consult with contractor for correct settings, See Appendix B for Field Guide to SX 10.

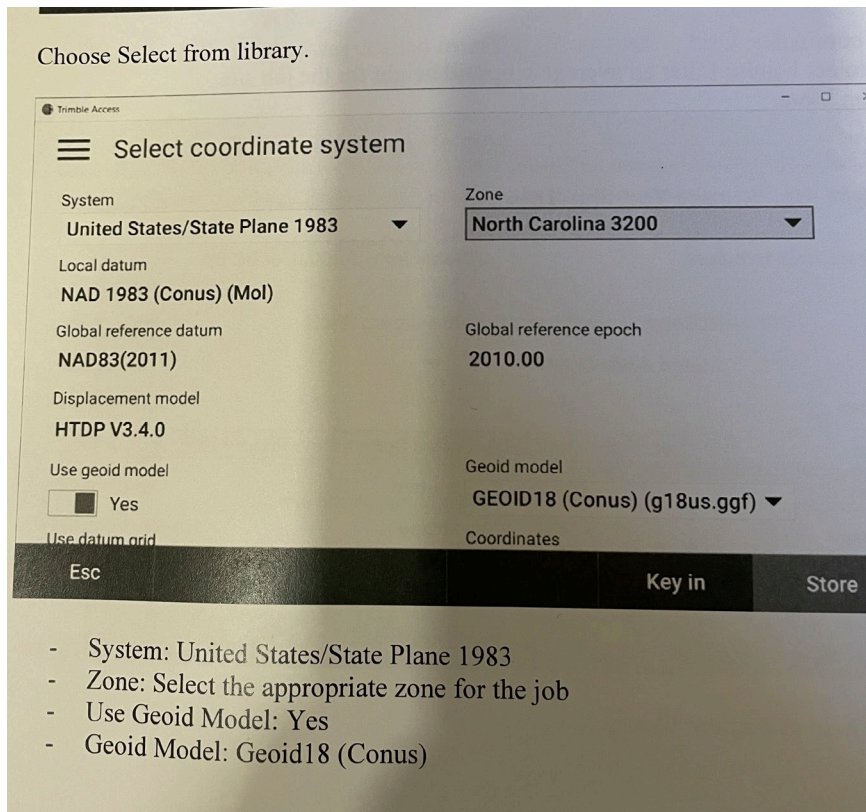


Figure 2. Settings for setting up State Plane project on TSC 5 data collector.

Use the settings for the appropriate coordinate system found in Appendix A. Once the job is created and save one can access it from any time on the data collector. The job can be created in the office beforehand.

3. Create New job (from template if possible).

7. Tap **Accept**.

← New job: SX12\SX12 Demo ☆

☒ Create from template ☐ Create from JobXML or DC file

Job name SX12 Demo

Template Default

Properties

Coord. sys.	Scale: 1.0000000000
Units (Dist.)	Meters
Linked files	None
Feature library	GlobalFeatures
Cogo settings	Ground
Additional settings	Off
Media file	Previous point
Reference	?
Description	?

Esc Accept

The new job **SX12 Demo** is created and opened.

Figure 3. Creating a new job on the data collector.

Once job file is created, you should be able to see it from the screen in Figure 4. Job and project set-up should be complete.

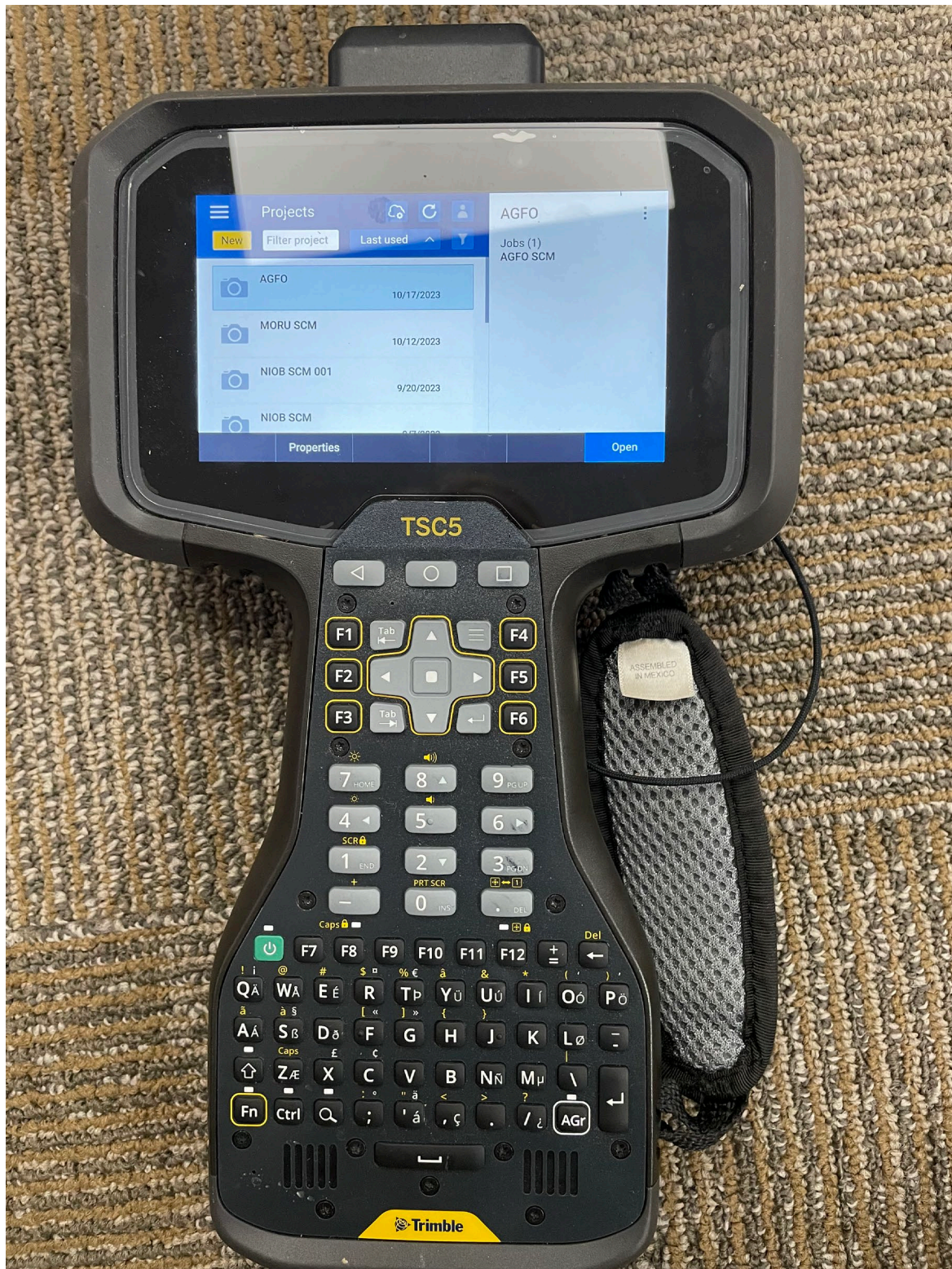


Figure 4. Job file on TSC 5 data collector.

Total Station Setup (in the field)

Setup the total station (TS) over the benchmark. Extend the legs of the tripod and bring it up to about chin height.

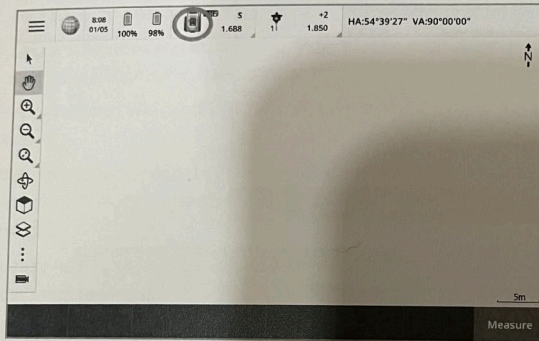
1. Fan the legs out and get the tripod relatively level (tighten the leg bolts).
2. Place the TS on top of the tripod (keep one hand on top of the TS at all times) and thread the tripod bolt into the tribrach.
 - a. Center the TS on the tripod to allow for future adjustments.
 - b. Be sure to close the TS box after the TS has been secured onto the tripod.
3. 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).
4. Secure the tripod by stomping leg points into the ground.
5. 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).
6. Adjust the tripod legs and use the level bubble to get the TS level.
7. Turn on the TSC5/7 data collector and open Trimble Access.
8. Turn on the TS, using the button on the side.
9. Let the data collector connect to the total station. It is connected with the scanner icon changes to a steady SX12 icon.

Connecting to the SX12

The Trimble Access software automatically connects to the SX12 using the configured connection settings when you power on the SX12. Once connected, the flashing instrument icon changes to a steady SX12 icon.

1. To switch between Wi-Fi and LRR connection modes:

a. Tap the SX12 icon in the status bar.



b. Tap **Connections**.

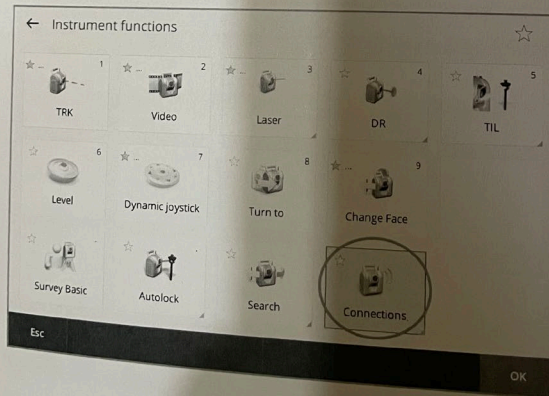


Figure 5. Connecting Data Collector to Total Station.

10. In Trimble Access, select previously created job. Then go to Measure>Sx10-12scanner>Station setup. See Appendix A for details.



Figure 6. Station setup screen on data collector.

11. Center the e-bubble on screen using the total station screws and accept when error is acceptable (sighting and trunnion should be less than $0^{\circ}-00'10''$) and e-bubble is green. Doublecheck that you are still centered over the point. If unable to level or sighting has moved off the point, repeat steps 1-11 until acceptable. Select Accept when level.

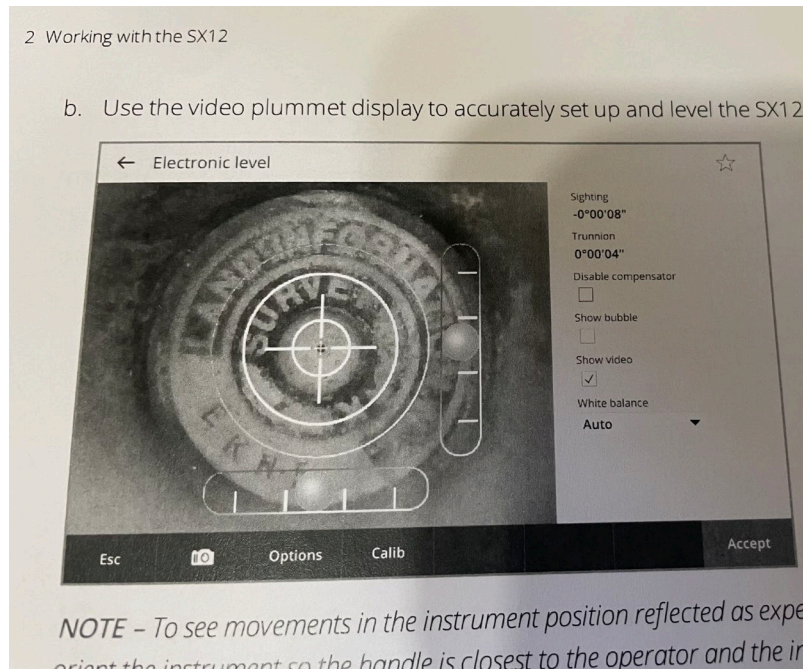


Figure 7. Electronic level displayed on data collector.

12. Enter the ambient temperature correction information. Tap Accept.

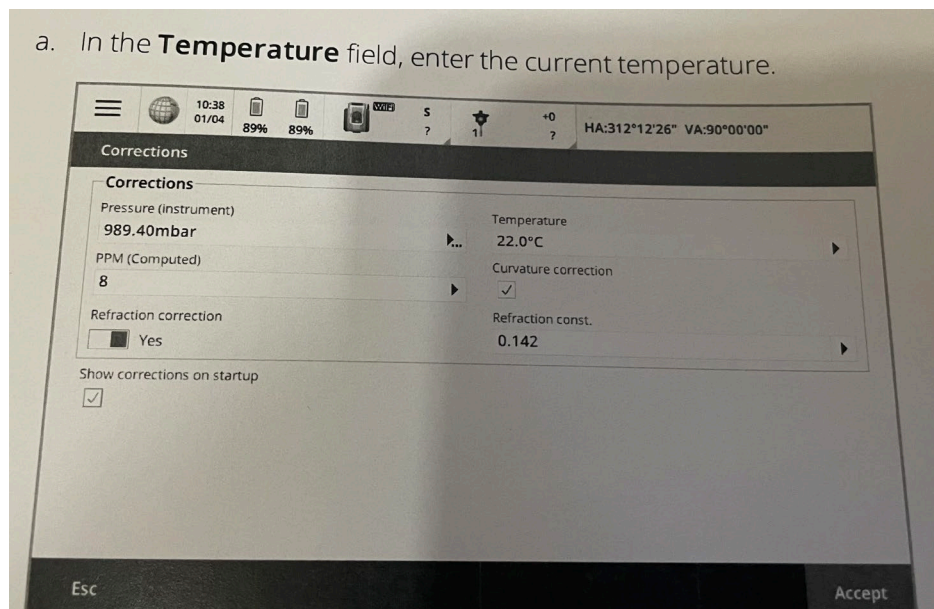


Figure 8. Temperature form on data collector.

13. Enter instrument and backsight location information. Instrument location is the location of the permanent rebar cap the total station is set up over. It should be measured with a high-accuracy method (OPUS solution, RTX, or Ntrip). Next measure instrument height. The easiest method is to measure from the center of the cap to the bottom notch on the side of the SX 10-12. Tap accept. Likewise the backsight location should be measured with a highly accurate method. Backsight height is the height of the prism pole.

2 Working with the SX12

6. Select or key in the point at which the instrument is set up:
 - a. In the **Instrument point name** field, enter the name of the point over which you have set up the instrument.
 - b. Measure the instrument height. Enter the value in the **Instrument height** field. To select the height measurement method (either true height or bottom of notch), tap .




- c. Tap **Accept**.
7. Measure the backsight point:
 - a. In the **Backsight point name** field, select the point over which you have set up the target.
 - b. In the **Backsight height** field, enter the height of the backsight.
 - c. In the **Method** field, select the method you are using to measure to the backsight. In this example, we selected **Angles and distance**.

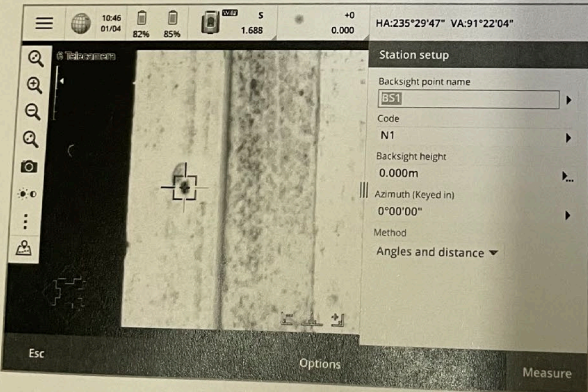


Figure 9. Instrument and backsight information.

Station set-up is complete. You are now ready to complete a survey using the total station.

Literature Cited

- McDonald, J. M., E. N. Starkey, J. W. Riley, and M. B. Gregory. 2018. Setting up and Configuring a Total Station—Version 1.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—1.2.17. Southeast Coast Network, Athens, Georgia.
- Thornbrugh, D. J., I. W. Ashton, A. R. Jarding, J. S. Mills, and K. Paintner-Green. 2019. Protocol implementation plan for stream channel monitoring in the Northern Great Plains Network: narrative version 1.0. Natural Resource Report NPS/NGPN/NRR—2019/1918. National Park Service, Fort Collins, Colorado.