# Chapter 3

The Total Station and Trimble TSC2 Setup

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A. Pre-Loaded Files

There are many types of files that can be loaded on the Trimble TSC2 data collector prior to collection or stake-out surveys. The most common files are feature code lists, project control files, design alignments, and staking files. However, it is not necessary to upload these files to conduct a survey. Refer to Chapter 7 in this manual for more information on transferring files to the TSC2.

![Image of Trimble TSC2 data collector]

Figure 3-1. The Trimble TSC2 data collector.

Throughout this chapter, the term “tap” is used to illustrate how to select various commands from the TSC2 screen with a stylus. Pressing Enter on the keypad when the desired icon is highlighted will achieve the same results.
B. Trimble Desktop Screen
When the TSC2 is turned on, the main Trimble desktop screen will be displayed.

![The Trimble desktop.](image)

Figure 3-2. The Trimble desktop.

1. Setting the Date and Time
To set or check the date and time on the TSC2, tap the stylus on the date and time as indicated by the red oval.

![Accessing date and time.](image)

Figure 3-3. Accessing date and time.
The *Settings* screen displays the current time zone, time, and date.

![Figure 3-4. Settings screen.](image)

To change any of these parameters, use the stylus to highlight a setting as indicated by the red arrow and then use the up or down arrows (red oval) to make the appropriate change.

![Figure 3-5. Adjust settings.](image)
When the settings have been changed click on the ok icon as indicated by the red arrow in the upper right portion of the screen.

![Figure 3-6. Settings changed.](image)

Click Yes to save the current settings. The data collector will then return to the main desktop screen.

![Figure 3-7. Save settings.](image)
The Total Station and Trimble TSC2 Setup

C. Total Station Setup
In a conventional survey, a station setup must be performed to orientate the instrument. First the tripod and tribrach are centered over the control point and rough leveled. The total station is then placed and locked onto the tribrach. The TSC2 data collector is then powered up and connected to the total station via cable or bluetooth.

Note: As mentioned in Chapter 2 of this manual, the data collector operations pertain only to conventional surveying. Surveying operations using the TSC2 with GPS equipment will not be covered.

Press the Trimble Function key to access the survey controller menu. The Trimble Survey Controller screen with the data collector's firmware version is briefly displayed on the TSC2 screen. Next, the Electronic level screen depicting three leveling bubbles is displayed. Turn the leveling screws on the tribrach until the digital leveling bubbles, both horizontally and vertically, are centered. After the instrument has been leveled, tap the Accept button as indicated by the red oval.

![Image of Electronic level screen]

Figure 3-8. The Electronic level screen.
Note: If a Trimble S6 robotic total station is used, then the setup procedure is complete. However, if a Trimble 5600 or older total station is used, then the dual axis compensation routine is initiated when the Accept button is tapped. The instrument will turn 180 degrees, emit an audible beep, and turn back. During this procedure, the message, *Compensating instrument*, will be displayed on the data collector screen. There is no operator involvement during the compensating routine.

![Compensating instrument](image)

*Figure 3-9. The compensating routine.*

1. **Correction Settings**
   After the leveling procedure has been completed, the *Corrections* screen is displayed. The current atmospheric conditions are updated each time an instrument setup is performed. Enter a value in the *Pressure* and *Temperature* fields and then tap *Accept*. Ambient temperature and pressure readings can be measured with a hand-held weather meter. The *PPM* (parts per million) correction constant is automatically computed and displayed.

![Correction screen](image)

*Figure 3-10. Set current atmospheric conditions.*
When the Survey Basic screen is displayed, tap Esc as indicated by the red oval to access the survey controller main menu.

![Survey Basic screen](image)

**Figure 3-11. Survey Basic screen.**

### D. Survey Styles
Specific parameters for the total station instrument are now defined. At the survey controller main menu, tap the Configuration icon.

![Survey controller main menu](image)

**Figure 3-12. Survey controller main menu.**
Select *Survey styles* from the *Configuration* menu. This option is used to set a new survey style or edit an existing one.

![Survey styles menu](image)

**Figure 3-13. Survey styles.**

1. **Edit an Existing Survey Style**  
   To edit an existing survey style, use the stylus to highlight it and tap the *Edit* button as indicated by the red oval.

![Survey styles list](image)

**Figure 3-14. Select survey style.**
Parameters for the Instrument, Topo point, and Duplicate point tolerance can now be selected. Highlight Instrument and tap the Edit button.

![Figure 3-15. Survey style parameters.](image1.png)

At the Instrument screen, verify that all of the fields have the appropriate settings.

![Figure 3-16. Instrument settings, page 1.](image2.png)
When the Instrument fields on the first page have been set, go to the next page by clicking on the 1/3 button as indicated by the red arrow.

Figure 3-17. Next page.

On the second page, check the additional parameters. When the Instrument fields have been set, go to the last page by clicking on the 2/3 button.

Figure 3-18. Instrument settings, page 2.
Tap on the *Accept* button to save any setting changes.

![Figure 3-19. Instrument settings, page 3.](image)

Highlight *Topo point* and tap *Edit*.

![Figure 3-20. Survey style parameters.](image)
At the *Topo point* screen, verify that the fields have the appropriate settings. When complete, tap on the *Accept* button.

![Topo point settings](image)

*Figure 3-21. Topo point settings.*

Highlight *Duplicate point tolerance* and tap *Edit*.

![Survey style parameters](image)

*Figure 3-22. Survey style parameters.*
At the *Duplicate point tolerance* screen, verify that the fields have the appropriate settings. When all of the fields on the first page have been set, go to the next page by clicking on the 1/3 button.

![Duplicate point tolerance settings, page 1](image)

**Figure 3-23. Duplicate point tolerance settings, page 1.**

On the second page, check the additional parameters. When these fields have been set, go to the last page by clicking on the 2/3 button.

![Duplicate point tolerance settings, page 2](image)

**Figure 3-24. Duplicate point tolerance settings, page 2.**
Tap on the *Accept* button to save any setting changes.

![Duplicate point tolerance settings](image)

*Figure 3-25. Duplicate point tolerance settings, page 3.*

After the *Survey style* parameters have been edited, tap *Store* as indicated by the red arrow to save the changes.

![Store survey style settings](image)

*Figure 3-26. Store survey style settings.*
2. Create a New Survey Style
To create a survey style, tap the **New** button as indicated by the red arrow at the bottom of the screen.

![Figure 3-27. New survey style.](image)

At the **Style details** screen, key-in a unique name in the **Style name** field. Verify that the **Style type** is set to **Conventional**.

![Figure 3-28. New survey style name.](image)
Tap the Accept button to save the new style. In this example, the survey style name "Manual" was entered. This is a style setting that allows the operator to use the Trimble data collector simulator (refer to Figure 3-31).

Figure 3-29. Accept new survey style.

At this time, the survey style parameters screen will be displayed. The Instrument, Topo point, and Duplicate point tolerance parameter settings can now be edited. Follow the instructions for setting these survey style parameters as illustrated on pages 3-9 to 3-15.

Figure 3-30. Survey style settings.
The Manufacturer drop down menu.

![Instrument settings](image1)

Figure 3-31. Instrument settings.

**E. Data Collector Jobs**

1. **Create a New Job**
   To create a new job, go to the survey controller main menu and tap on the *Files* icon.

![Files icon](image2)

Figure 3-32. Files icon.
Select *New job* from the menu.

![Figure 3-33. Create a new job.](image)

At the *New job* screen (Figure 3-34), enter the appropriate settings:

- The *Job name* setting should follow the WYDOT file naming convention. Refer to Chapter 6 in this manual for more information on file naming conventions.

- The *Coord. sys. Scale* should always be set to "1.0000000000".

- The *Units (Dist.) field* is also always set to "US survey feet".

- The *Linked files* should include the P&S project control file. The project control coordinates in the data collector files are calculated by the Photogrammetry and Surveys Section (P&S).

- The *Feature library* setting should use the appropriate feature code list. Refer to Chapter 4 in this manual for more information on feature code lists.
Enter a point name.

Figure 3-34. New job screen.

Figure 3-35. New job settings.
Tap on the *None* button next to *Linked files*.

![Linked files](image)

*Figure 3-36. Linked files.*

Scroll down to the appropriate project control file (e.g. CN14063CNTL) and tap the *Accept* button.

![Project control file](image)

*Figure 3-37. Project control file.*
The information on page 2/2 does not need to be changed. Tap the Accept button when all of the settings are complete.

2. Open an Existing Job
To work in an existing job, tap on the Files icon at the survey controller main menu. Select Open job from the menu.
Highlight the appropriate job and tap the OK button as indicated by the red arrow.

![Select job]

*Figure 3-40. Select an existing job.*

**F. Station Setup**

At the survey controller main menu, tap on the *Survey* icon.

![Survey icon]

*Figure 3-41. Survey icon.*
Select Station setup from the Survey menu.

![Station setup menu](image1)

**Figure 3-42. Select Station setup.**

When the Corrections screen is displayed, set the Pressure and Temperature values and then tap Enter. As previously discussed, the temperature and pressure readings can be measured with a hand-held weather meter. The PPM (parts per million) correction constant is automatically computed and displayed. Tap the Accept button to set the values.

![Correction settings](image2)

**Figure 3-43. Correction settings.**
1. Instrument Point
At the Station setup screen, enter a point name in the Instrument point name field. A point name can also be selected from a pre-loaded project control file. Tap the arrow next to the Instrument point name field and select List (see Figure 3-45).

Figure 3-44. Instrument point name.

Figure 3-45. Select List.
Highlight the appropriate control point from the menu and tap Accept.

![Figure 3-46. Select an instrument point.](image)

Enter a measured value in the Instrument height field, and tap Enter. Then tap the Accept button to set the values.

![Figure 3-47. Completed instrument setup.](image)
2. Backsight Point
After the instrument setup information has been completed, the backsight information is then entered in the Station setup screen.

Enter a point name in the Backsight point name field. A point name can also be selected from a pre-loaded project control file. Tap the arrow next to the Backsight point name field and select List. Next, enter a measured value in the Backsight height field and tap Enter. In the Method field (red arrow), verify that the Averaged observations option is selected.
Tap on the target icon as indicated by the red arrow to select a backsight target.

![Figure 3-50. Target icon.](image)

Use the stylus to highlight and select the appropriate target, height, and prism offset.

![Figure 3-51. Target selection list.](image)
Once the station setup procedure has been completed, carefully align the optical cross hairs on the backsight target. Next, tap on the *Measure* button as indicated by the red oval.

![Completed backsight setup](image)

**Figure 3-52. Completed backsight setup.**

**G. Review the Measurement Data**

Store the backsight measurement if it is within the tolerance limits set during the survey style configuration. See Figures 3-23 and 3-24 on page 3-14 to review the *Duplicate point tolerance* values. If the backsight measurement does not meet the tolerance limits, several components of the setup must be checked. These are:

- The stability of the instrument setup.
- The stability of the backsight setup.
- The correct point number for the instrument.
- The correct point number for the backsight.
- The correct coordinates for the instrument setup in the pre-loaded control file.
- The correct coordinates for the backsight setup in the pre-loaded control file.
- The backsight prism offset is correct.
- The height of the instrument is measured and entered correctly.
- The height of the backsight is measured and entered correctly.
- The control monuments used for the instrument and backsight setups have not been disturbed.
- Units set correctly (U.S. Survey Feet).
The *Station setup* screen after the backsight measurement has been taken.

![Station setup screen](image)

*Figure 3-53. Backsight measurement.*

Tap the right arrow as indicated by the red oval to review all of the backsight target measurement misclosures.

![Station setup screen](image)

*Figure 3-54. Measurement misclosures.*
When the measurement parameters are within the acceptable tolerance limits, tap *Store* as indicated by the red oval to complete the instrument setup.

When this process has been completed, there is an audible message “Station setup completed”. The TSC2 and total station are now ready to start a data collection or stake-out survey.

1. **Error Example**
   The $\Delta H.Dist$ and $\Delta V.Dist$ values as indicated by the red arrows are much larger than would normally be expected. This could be an indication that the selection of the instrument point setup, backsight point setup, or both are incorrect.
In this situation, the station setup should be abandoned. The error source must be identified and corrected with another setup before continuing with the assigned task. Check all of the components of the measurement listed on page 3-29. If a distance error persists, make a second setup attempt using another control point for the backsight. If a distance error occurs, record all questionable distances and notify the State Photogrammetry and Surveys Engineer.

2. Compensator out of tolerance
Occasionally, the instrument may get "bumped" by the operator or a sudden gust of wind. If the instrument is no longer "level", the Electronic level screen may be displayed (see Figure 3-57). This is an indication that the internal compensator is out of tolerance. This may also occur if a tripod is set on frozen ground and one or more of the tripod legs has settled when the ground thaws.

Reset the tripod legs or turn the leveling screws on the tribrach until the digital leveling bubbles are centered. After the instrument has been leveled, tap the Accept button. The operator will then need to exit out of the current survey. At the survey controller main menu, tap on the Survey icon and select Station setup (see Figure 3-42) to begin a new survey.

Figure 3-57. Compensator out of range.