

# Geospatial Modeling & Visualization

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## Trimble 5600 Robotic Total Station Field Operation

The following is a workflow for acquiring and downloading data using the Trimble 5600 Robotic Total Station. These instructions were written specifically for acquiring microtopographic data in the context of archaeological sites, using local coordinates.

### DATA ACQUISITION

STEP 1: Create a new job. (This can be done any time prior to data collection, such as the night before, etc.)

1. Power up the data logger and open Survey Controller software. Go to Files -> new job. Enter and name for you job and fill in the parameters.
2. To use a simple plane coordinate system that is local to your site, select a "scale factor only" coordinate system and enter a scale factor of 1.
3. Enter the distance units. You do not need to have any linked files, background files, or feature library.
4. Cogo settings should be set to "grid." Grid coordinates "increase north-east, and magnetic declination is zero degrees.
5. Fill in any other fields if you wish, such as a name for the operator.
6. If you have any pre-surveyed datums that you will use, you can key them in by choosing Key in -> points. Name the point and give it Easting, Northing and Elevation. Check the "control point" box if this is a datum or backsight point.

STEP 2: Set up the Instrument on tripod:

1. Position tripod over marker and get it centered (with fastener in the center) and as level as you can.
2. Push in the tripod legs firmly to make the tripod stable.
3. Mount instrument onto tripod. Keep one had on the instrument and use the other to hand-tighten the fastener knob to secure the instrument. Make sure the instrument is centered on the platform.
4. Check the optical plumb. If the crosshairs are not within about 2 cm of your marker you will need to move the tripod by repositioning the legs until it is close to the center. Keep one hand on the instrument while doing this and continue until your crosshairs are within 2 cm of the target.
5. After tripod legs are firmly in the ground, level the platform. To do this, use the latches on the tripod legs until the bubble is close to the center.
6. Use the fine-leveling knobs to center the bubble in the fish-eye.
7. Check the optical plumb. If the crosshairs are not centered over your target, loosen the fastener at the base of the instrument and slide the instrument to center it. If there is not enough slide room to do this, you will need to start over again at step 4.
8. If centered, use the fine-leveling knobs once again to center the bubble in the fish-eye.
9. Attach large battery pack to tripod leg connect power with a cable from any of the ports on the batter pack to the port on the underside of the instrument. Do not turn power on yet!

STEP 3: Set up the rod.

1. Assemble rod with wheel or spike bottom attachment (probably use the spike first so you can more accurately backsight) and a reflector prism on top (the one in the leather bag is best because it is not directionally sensitive).
2. Assemble radio by connecting battery to bottom and antenna to top. Attach radio to rod.
3. Attach data logger to rod with holder.
4. Connect the data logger to the radio via serial port to BOTTOM radio port.
5. Connect the prism to the radio.
6. Connect the prism to radio top port.
7. Close any applications if they are open on the data logger!!!
8. Turn on power for everything in this order: data logger, radio, prism, instrument (rubber button).

#### STEP 4: Station setup:

1. Open Survey Controller software on data logger and wait for radios to establish communication. Be patient—this could take 2-3 minutes. The level screen should appear if all goes well.
2. If needed, level again using the knobs on the instrument and watching the data logger screen. When the bubble is centered say OK and wait for instrument to calibrate itself (it will rotate around two times and beep).
3. If necessary, create a new job at this time by selecting Files ->New Job. If you are continuing from a previous day at the same site everything should already be correct for the project so just enter a new name and accept/store this. (You can use the same project file for an entire site, but due to data volume it may be better to create a new job each day).
4. From the menu screen select Survey -> 5600 -> station setup.
5. Enter the temperature and pressure (use 30 in. if you don't know the pressure) and accept.
6. Select the instrument location from a list if you previously keyed it in. Otherwise, key in the point name that the instrument is centered over and enter the height by measuring with the tent-pole measuring stick from the ground to the asterisk on the instrument's side.
7. Select from a list the point you are backsighting to, or enter a new one in manually, then enter the height of the rod. NOTE—the larger wheels add exactly 10 cm to the rod height. If using these lawn-mower wheels add 10 cm to the height listed on the rod.
8. If this is a new point, key in the azimuth. Enter.
9. Go to the backsight point, make sure target is locked, level the rod, then and measure the point (You can specify the number of readings to average by selecting the options button here). Store this measurement.
10. You should get a message that says station setup completed. Your error is displayed if this was a previously surveyed point.

STEP 5: Collecting data—this is what was decided upon for archaeological site surveys. The goal is to cover a large area quickly but also systematically. Site already has grid markers every 20 meters, so each 20 x 20 m square is surveyed in transects with flags as guidance.

1. Set up flags for yourself to guide your transects. Placing flags every 5 meters on two sides of a 20 x 20 m square works well for guidance in transects.
2. Go to Survey ->continuous topo. Select distance or time and an increment. Time and 1 second work well.
3. You can watch the data as you collect it on a map. Before starting, click on the map button.
4. Now use the switch button to go back to continuous topo.
5. Double click on the instrument icon in the upper left and select tracking mode.
6. When ready, you will need to establish line-of-sight with the instrument so it can begin tracking you. It can be done alone by waving the prism in front of the instrument until you hear the logger say "target locked." After this, slowly back away from the instrument and try to keep the target locked. Once you are about 5 meters away you can begin to move faster and walk at a normal pace. It is much easier to have someone sight you in when you are about 10 meters or more away. The sighting is effortless; as it will lock on to the target once it is close. Finally, a third option is to somehow position the rod vertically by itself 10 meters or more away and then sight it in yourself. (A bi-pod is available for the rod, and is often used for the RTK system).
7. When ready, click start and then use the switch button to get to the map.
8. Now the map will show you the points you have collected and pan with you as you go. (If it does not pan, click options and check the pan as you go option).
9. If you need to stop, you have to switch back to continuous topo and click end. You can resume again by pressing start.

NOTE: Batteries last longer than the battery gage suggests!

The batteries for the instrument are the first to die, but they do last a full 8-hour day. When the data logger shows that they are at 0% they will last for another 2-3 hours! Keep working and ignore this. When the batteries are fully drained you will get a warning on the data logger and then it will shut down. You can then use the spare battery (one single battery) with the single battery adapter for another ~2 hours of survey.

The data logger batteries last at least 12 hours.

The rod battery lasts at least 10 hours.

The rover radio battery lasts at least 10 hours.

#### STEP 5: Ending a survey, or taking a break.

1. If you are going to take a break for longer than ~10 minutes, escape out of the map and continuous topo screens.
2. Next, close the Survey Controller software. Select yes to power down the instrument and disconnect the logger from the radio when prompted.
3. The instrument and radio should be off now. Turn off the data logger and system and leave in a safe place until you are ready to survey again. If you are leaving the tripod and instrument assembled for a lunch break, etc., place the white hood over the instrument.

#### WHAT TO DO IF YOU LOSE RADIO CONTACT

You will lose radio contact (losing EDM contact will often cause you to lose radio contact) and/or tracking ability if you:

Lose line-of-sight with the instrument for more than a few seconds.

Are surveying more than approximately 150 meters from the instrument, depending on the terrain and atmospheric conditions, OR if you are trying to survey too close to the instrument (within 10 meters is tedious, and within 5 meters is impossible).

Are trying to operate in rain, fog, or very humid conditions.

### **Possible solutions to these problems:**

Set up the instrument as high off the ground as possible (it is helpful to have a stool when setting up) and on a high point with good visibility to the area you will survey.

Plan your instrument location to be within about 150 meters of the area you will survey. Also, if possible set up the instrument over a point that you will not need to survey. Finally, you will probably have to set up the instrument in more than one location to cover all the area you wish.

Wait until the air is relatively clear. Though the equipment is water resistant, the EDM does not work when the air is full mist. Also, avoid working in rainy conditions because prolonged exposure to moisture will likely damage the equipment.

To recover from a temporary loss of radio contact simply say ok to the error messages. When you are back in contact you should be prompted to level the instrument and enter other station setup parameters. Follow this as usual and then begin surveying again.

If radio contact is still not functioning, you may have to reset the instrument's radio settings. To do so:

1. Disconnect data logger and turn it off. Turn off the radio if you were using it.
2. Connect the face plate.
3. Turn on the face plate and follow the prompts (this may include leveling using the fine-leveling knobs). When screen displays "HA/VA:" you are ready to set the radio communications.
4. Using the face-plate keys, enter the following: menu, 1 (set), 5 (radio). Then press 1 (enter) as many times as necessary until you are back to the "HA/VA:" screen.
5. Turn the instrument power off and remove face plate.

### **DOWNLOADING DATA FROM TRIMBLE SURVEY CONTROLLER**

1. Install Microsoft ActiveSync to your computer (desktop/laptop).
2. Run ActiveSync via Start>Programs>ActiveSync
3. If the "Get Connected" dialogue does not appear automatically, select "Get Connected" from ActiveSync's File menu.
4. Make sure no software is operating on either the computer or the data logger.
5. Connect the data logger to the computer using the black serial port connector (has 9 pinhole connector at both ends) and select Next>.
6. ActiveSync will search for the data logger. If successful, the data logger will beep and ask if you want to connect. Click YES.
7. If this is unsuccessful try a different com port on your computer and try again. If still no success check the port setting on the data logger under My Computer>Control Panel>PC Connections.
8. If successful, ActiveSync prompts you to create a "New Partnership." Select NO.
9. You should now be connected and can explore the files on the data logger.
10. To transfer an ASCII file you first need to create it (convert from the original Trimble format) on the data logger using Survey Controller software:
  - A. Open Survey Controller and open the job where the data to be transferred is stored. (Files>Open Job).
  - B. Select Files>Import/Export>send ASCII data.
  - C. Under "File Format" select "Comma Delimited (\*.CSV, \*.TXT)"
  - D. Under "Send to" select "Trimble Data."
  - E. Under "To Name" give your data file a name.
  - F. Select the fields for each of the data components. For example: Point name: Field1, Point Code: Field5, Northing: Field2, Easting: Field3, and Elevation Field4.
  - G. Select "All Points" to convert all the points in the currently open job to ASCII.
  - H. Select "Send" (lower-right corner). After the file is completed you should get a message that says "Transfer complete."
  - I. Now you can explore the files in the controller through ActiveSync on your computer.
11. From the ActiveSync window in your controller select the "Explore" icon.
12. You can copy the file(s) you created by browsing to My Computer Disk Trimble Data. Then paste these files somewhere on your computer.

POTENTIAL PROBLEM: ActiveSync seems to take control of the port you used to download so when you attempt to download data from other devices (a digital camera, for example) your computer may not recognize it. Here is what ActiveSync Help says to do about it if this is a problem:

Free a COM port from ActiveSync:

1. Connect the other type of device, such as a digital camera, to your desktop computer.
2. In the Device Not Recognized dialog box, click Disconnect COM Port.
3. The COM port is now available. If the other device still cannot connect with your desktop computer, you may need to assign the COM port to the other device through the other device's connectivity program. For more information, see the documentation that came with that device.

Note: If the Device Not Recognized dialog box is not displayed, free the COM port in the Connection Settings dialog box. On the File menu, click Connection Settings. Clear Allow serial cable or infrared connection to this COM port.

## CHARGING BATTERIES:

### INSTRUMENT/RADIO BATTERIES:

1. Charging the instrument and radio batteries is tricky. You can only charge 4 at a time, but you have five batteries. The charger allows you to hook up four batteries at a time, but only charges one at a time. Each of the five batteries takes 2-3 hours to charge. So, you will need at least 10 hours to charge them, and will have to babysit them for the first 2-3 hours.
2. Remove the three instrument batteries from the multi-pack.
3. Plug in the POWER SUPPLY (part no. 571 906 146) to an AC outlet.
4. Connect the TRIMBLE SUPER CHARGER (part no. 571 906 145) to the POWER SUPPLY via the car-cigarette-lighter-adapter.
5. You have five identical battery charger cords that are straight (not coiled) and have identical connectors on each end. You will use four of them (the fifth is for charging the rod). Connect each of four batteries to the SUPER CHARGER. If this is done in the correct order then the green light that is farthest to the left (when you hold the charger so you can read the labels) should be on steady. If this is not the case, one by one you should unplug and replace each of the cables so that the left-most green light is the only light on. The green light means that the battery connected to that port is charging.
6. When the first battery is fully charged, the green light will begin flashing. At this point you can remove the charged battery and replace it with your fifth battery. Make sure the left-most light is green again and no other lights show. Now you can let the batteries charge until morning or about 8 hours. When all the batteries are charged each of the green lights will be flashing.

### ROD BATTERY

1. The rod battery stays hidden within the rod. To charge it, you use an adapter that connects where the prism connects when surveying.
2. Plug in the Trimble "Single battery charger 6/12" (part no. 571 906 330) to an AC outlet.
3. Use the last of the five battery charger cables (discussed above) and connect one end to the charger.
4. Screw on the POWER STICK CHARGER ADAPTER (part no. 571 126 301) to the rod where the prism is normally connected.
5. Connect the battery charger cable to this adapter.
6. When the rod battery is charged the "100%" light will illuminate. This takes only a few hours.

### TRIMBLE DATA LOGGER (Model TSCe)

1. Attach the serial port adapter. This adapter has serial port at one end, a very short cable (~3 cm) and three ports at the other end (fiber-optic cable, USB download cable, and circular power connector).
2. Attach the AC Adaptor (model no. AD-131A) to it and plug the other end into an AC outlet.
3. This data logger charges rapidly, and should be fully charged in 2-4 hours.

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