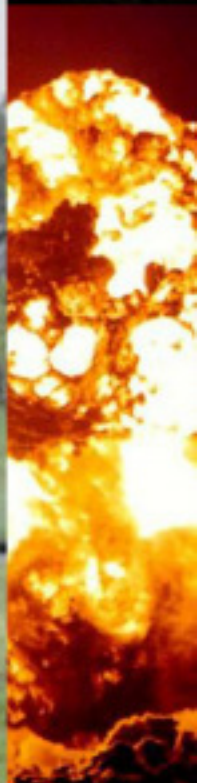




LITTLE TOTAL STATION



IN THE BIG, BIG WORLD



LITTLE TOTAL STATION IN THE BIG, BIG WORLD

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OVERVIEW

A total station is an electronic theodolite and necessary component of archaeological survey; its recorded data (X, Y, Z coordinates of a geographical location) are utilized in creating topographic maps, excavation units, and setting datum points. Total stations are unique in archaeological survey due to their capability to record points over wide range of scales and with great accuracy.

There has been debate in the realm of archaeology as to whether or not a GPS device provides more or less the same functions and data as a total station. This is due to a multitude of factors including size, cost, maintenance, and reliability; however, total stations have proven to be irreplaceable devices in archaeological fieldwork.



KEY



- 1: Handle Locking Screw
- 2: Objective Lens
- 3: Display
- 4: Leveling Screw
- 5: Base
- 6: Optical Plummet Telescope
- 7: Sighting Collimator
- 8: Telescope Focusing Knob
- 9: Telescope Grip
- 10: Eyepiece
- 11: Instrument Center Mark
- 12: Vertical Motion Clamp
- 13: Vertical Tangent Screw
- 14: Horizontal Motion Clamp
- 15: Horizontal Tangent Screw
- 16: Tribrach Fixing Lever
- 17: Battery Pushbutton



DATUM SETUP

The first step in starting field survey and excavation is to set up the primary datum point that will not be moved for the duration of the project. Choosing a datum point may or may not begin as an arbitrary point. Some sites have a previously established datum set up by a professional agency (USGS, California State Parks, etc.). Alternatively, the project team will arbitrarily choose a location on the site to set up the datum. This point might be chosen based on the center of a site, the edge of a site, or sometimes the southwest corner of a site allowing for everything to be measured north and east of the datum. Once the datum has been set and clearly marked, the total station should be used to record its exact location.



ADDITIONAL COMPONENTS

The other components of the total station and equipment that will be needed are as follows:

- Tripod
- Reflector Rod
- Compass
- Datum Stake
- Plumb Bob
- Torpedo Level
- Measuring tape (Meters)
- Some Idiot to Hold the Rod (see picture)

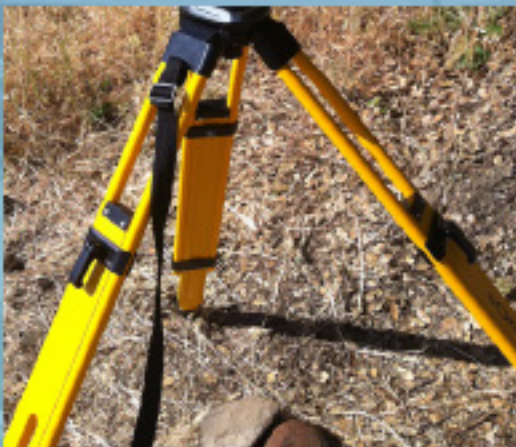


TRIPOD SETUP



The tripod is the first thing that is set up when using a total station. Every time the total station is being used, the tripod will be set up directly over the datum. On the datum stake it's important to mark (probably with a sharpie) the center point on the datum stake. A good way of setting up the tripod is to put one of the legs in the ground and not plan on moving it again, the other two legs can be moved as much as need be to get the tripod level. In the center of the tripod there is a small tripod screw – that can be used as a drop site – to look through and be sure that the tripod is center over the datum point. From this point on it's a lot of trial and error. You have the option of screwing the total station onto the tripod and working on getting it level that way, but we would suggest setting up the tripod first completely,

then proceeding to level the station on the tripod. Using a line level on top the tripod can help determine how level it is, and when a good stopping point should be. It's good to note that it's unlikely it will be perfectly level at first, so always use two faces when leveling out the tripod as well as the total station, as opposed to attempting to get all three perfectly level.



TOTAL STATION SETUP



The next step is to secure total station to the tripod using the previously mentioned leveling screw. When taking the station out of the case, always... ALWAYS keep one hand on the handle and one hand on the bottom. This equipment is expensive and you will be irrefutably reprimanded for all of your days to come if it is ever dropped. Once the station is placed on the tripod, it's possible to screw it in half way so that it is secure but there's still a little room to shift it on top of the tripod as needed to get it directly over the datum. There are two bubble levels on the station that need to be used to be sure it is actually level and centered over the datum. When trying to center the station there is a drop site that is located on the lower side of the station, which allows you to see directly down and helps to locate the datum. As long as

the tripod was set up pretty level and close to centered over the datum, it shouldn't be too far off. However that is not always the case, and like with the tripod it's a lot of trial and error. There are two knobs that should be turned inwards to work on getting the total station level. You can look through the drop site while turning the level knobs to see where you're going. The other option is to move the legs up or down, this can be done using the bubble level as a reference for deciding which way to move the legs (once the station is secured on the tripod, it's possible to take the legs out of the ground, but not suggested. It's usually best to move the tripod as little as possible). The bubble on the level will be pointing towards the leg that needs to be moved. This will probably happen a couple of times, and it's good to take each step really slow and not make any grand movements. To determine whether or not the total station is perfectly centered and level over the datum, look through the drop site and notice the two circles (you



might need to fuss with focus a little bit to see them clearly), the datum point should be perfectly inside the smaller circle. When that is completed, there is one more level on the station that needs to be tended to. If the first part of the process is done, it should already be pretty good and not much more shifting around should need to happen. Similar to using the line level to set up the tripod, it's only necessary to use two faces of the station to make sure it's level. Pick those two faces and stick with them. If those two are level, then it's good to go.



DETERMINE TRUE NORTH



The next step is to determine true north. It's ideal to have this point located a decent distance away from the total station, but be sure it will always be able to be sighted. Like the datum, this point should never have to be changed. Declination (the angle between the compass and true north) should be set on the compass for every site. Using your compass to locate true north – from your datum – should be done using the total station to line up accurately. The compass should be able to be seen on top of the total station, and with the line on the top handle of the station, true north should be able to be located. Once that is done, there should be a marker put somewhere on the point in which you've located true north and can set that angle on the total station.



INSTRUMENT SETTINGS

-BASICS-



- Turn on the Total Station (Use the  button.)

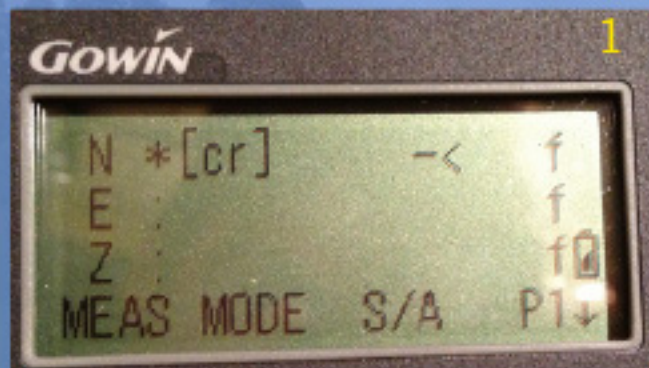
- The pictured display (1) should be shown.

- If you have not leveled the Total Station properly, you will instead get an error display (2)



INSTRUMENT SETTINGS

-MEASUREMENT IN 1000S-

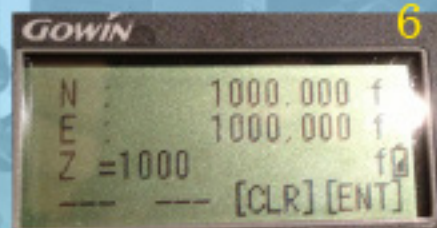
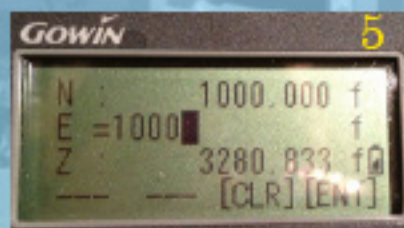
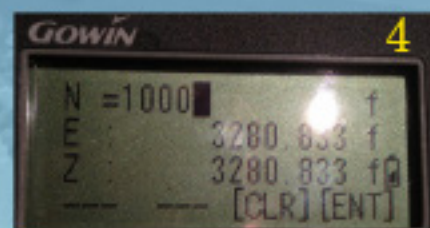
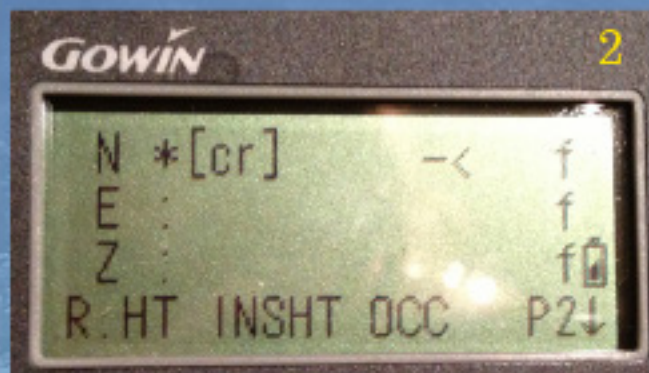


• From the Startup screen (see Basics), press **[F2]** to take you to the following screen (1).

• Press **[F4]** to cycle to the next menu (2).

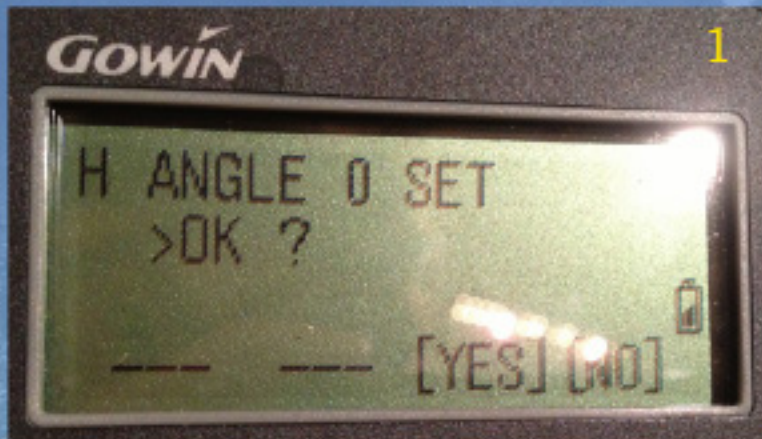
• Once on the next menu (2), press **[F3]** to take you to the screen to set the measurements the Total Station will take in 1000s (3).

• This page (3) will allow you to use the number pad to set the measurements to 1000s. Use **[F4]** to delete, the number pad to enter the numbers, and **[F3]** to enter the information into the Total Station. Do this for N, E, and Z (4, 5, 6).



INSTRUMENT SETTINGS

-0 (TRUE NORTH) SET-

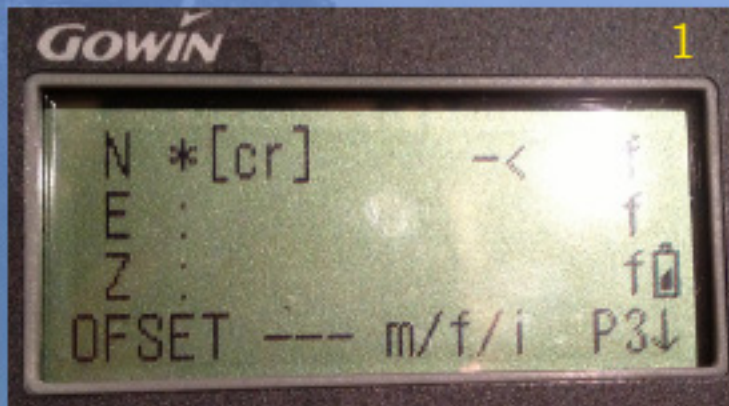


- From the Startup screen (see Basics), press **F1** to take you to the 0-Set screen (1)
- Aim the Total Station using with the eyepiece to the direction of True North.
- Press **F8** to set True North.



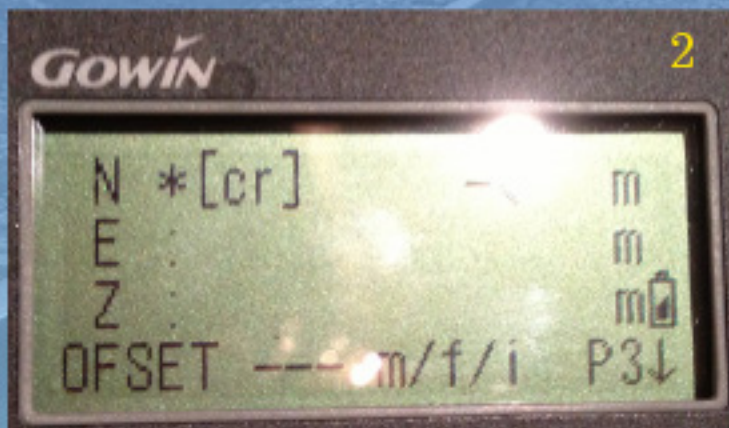
INSTRUMENT SETTINGS

-SET UNITS-



- From the P2 menu (see Measurements in 1000s, picture 2), press **[F4]** again to take you to the P3 menu (1).

- Press **[F3]** until the three letters to the right of the screen all read “m” (2)



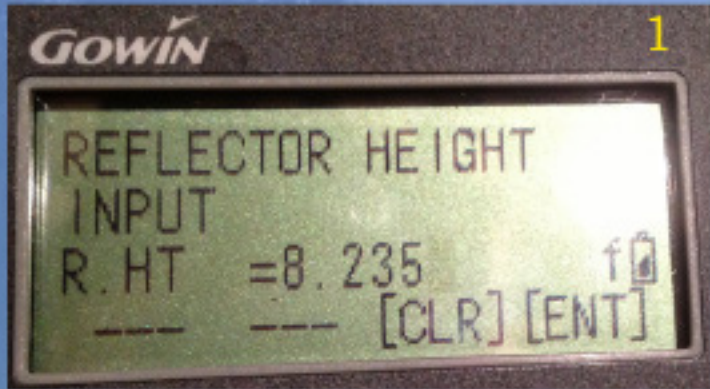
Note: This guide makes the assumption that you will be measuring your data in meters, due to the fact that most archaeological data is recorded in meters. This is not to say that one will never use feet with a Total Station, but it is rare in archaeology. If you are using feet (or inches) for your data, you can use the above method to set it to either unit in the same fashion.

Further sections of this guide show images of finding Reflector and Instrument Height that are still set in feet. There is no difference between the methods for setting either value in meters or feet. However, be certain to have set your unit of measurement before entering your Reflector and Instrument Height.



INSTRUMENT SETTINGS

-REFLECTOR HEIGHT-



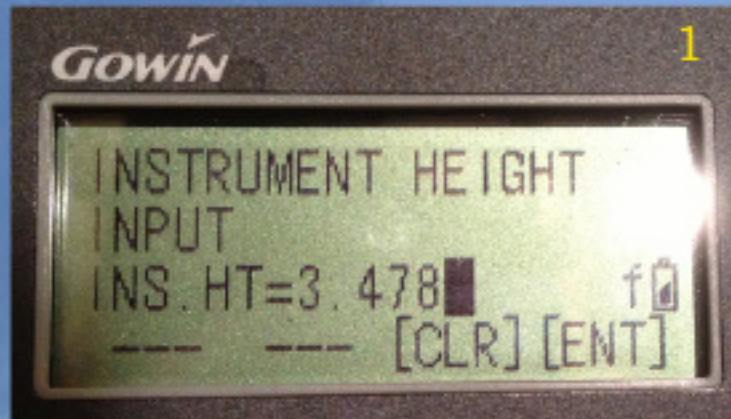
- From menu P2 (see Measurements in 1000s, image 2), press **[F1]** to take you to the Reflector Height menu (1).

- Use **[F3]** to delete any previous value, and use the number pad to insert the height of the reflector rod. To determine the height of the reflector rod, see the measurements along its extending section (2). Press **[F4]** to enter the reflector height into the Total Station.



INSTRUMENT SETTINGS

-INSTRUMENT HEIGHT-



• From the P2 Menu (see Measurements in 1000s, picture 2), press **[F2]** to take you to the Instrument Height menu (1).

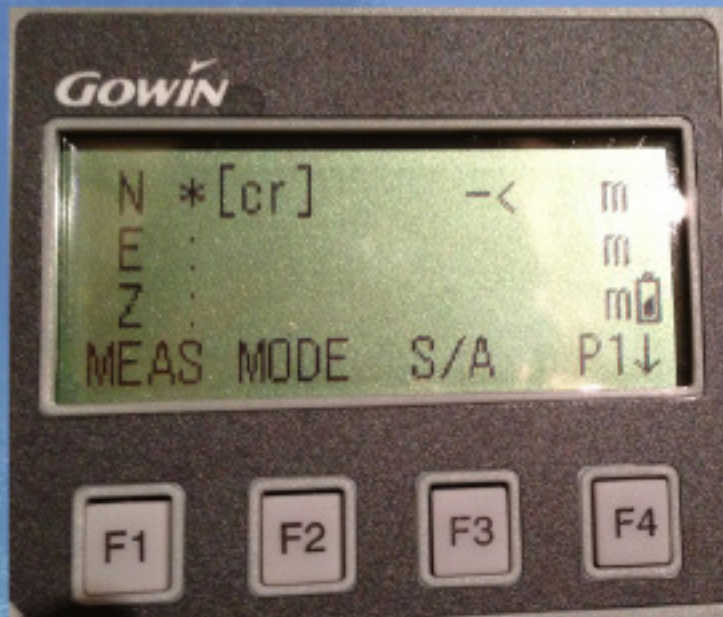
• To find your Instrument Height, you must measure from the Instrument Center Mark (see Key) down to the top of your established datum. This requires the use of a

plumb bomb, a tape measure, and a torpedo level, due to the fact that the measurement must be exact (2, 3)

• Once you have found your Instrument Height, enter it by using **[F3]** to delete any old value, the number pad to enter the Instrument Height, and **[F4]** to enter it into the Total Station.



USING THE TOTAL STATION



After all of this is done and recorded – it's important that everything is written down as well as typed into the total station – you're ready to record points. This is the simpler part of the process. One to two people will be in charge of holding and leveling the rod out in the field, and one to two people will be taking and re-

recording all points from the total station. You'll be looking through the large viewfinder to locate the prism on top of the rod. As soon as the prism is in sight, use the cross hairs in the viewfinder to focus and make sure those cross hairs are in the center of the prism. When that's been done it's best to use the Horizontal and Vertical Motion Clamps to lock the total station in place and keep it locked, any minor movement can shift it out of focus. Next you'll press **F1** and get the exact coordinates of where the prism/rod are located. And with everything else, write down all points taken.



SETTING UP A SUB-DATUM

Another thing that will likely be done in fieldwork is setting up a sub datum. The main idea to locating and setting up a sub datum is it allows you to shoot more points that are out of range of your primary datum. As previously stated, all points taken will always be relative to your primary datum, including the sub datum. First you'll need to set up the total station over the primary datum, then once you've decided where the sub datum will be, use the rod/prism to shoot in the points of the sub datum location. All of the previously mentioned steps and procedures still apply, and using that same procedure, set up the sub datum and the total station over that sub datum. From there you'll need to be able to sight the primary datum and your true north point. The person/people in charge of the rod should go to both of those locations and the person/people using the total station should record those points. The points received from the primary datum should match the originally recorded point for that datum, and the north should record back at 1000, 1000, 1000. If that doesn't match up accurately, the sub datum will need to be fixed until it does.



SETTING UP AN EXCAVATION UNIT

A total station is often and should be used when setting up a unit. It's important to use the total station to locate and map the determined corners of a unit. This process relies on the accuracy of the total station as well as on the person who is on the site with the prism rod. As soon as the total station operator has recorded a corner of the unit, the person with the prism rod must place a wooden or metal stake in the exact spot where the point end of the rod was on the ground. This process may be repeated for all or some of the corners of every excavation unit.



MAPPING

After all of this has been done, and the site has a primary datum and sub datum set, it's easy to use the total station to set up excavation units with precision, and generate a topography map with a lot of range and precision as well. To generate the topography map you'll need to first of all be sure to record and write down all points taken of the surrounding area, and will likely need to use a program called Surfer. Surfer is only compatible with PC's, but shouldn't be extremely difficult to use and can generate a wide variety of colored topography maps using the points recorded via a total station.



THE END

