

TOTAL STATION INSTRUCTIONS (TCR307)

Task #1. Setting Up Station Over an Established Fixpoint

Positioning and Leveling the Instrument

Place tripod approximately over point and mount total station to tripod. Use plumb bob to position center of unit over point. When approximately positioned, firmly place tripod legs into ground and then adjust by raising or lowering each leg. Next, level the instrument with the three thumbscrews at its base. Leveling is easiest if you rotate the instrument so that one of the thumbscrews is directly beneath the center of the display screen.

Once the bubble is centered in the bubble level, push the red button on the right side of the instrument to power it up. Next, press the fifth button from the left on the display to activate the laser plummet on the optical level. This allows precision leveling and also will help you center the instrument precisely over the fixpoint. If needed, you can raise or lower the intensity of the laser beam by pressing the up or down arrow to the right of the display.

This procedure is complete when you have securely positioned and leveled the instrument directly over the center of the fixpoint.

Programming the Instrument

Programming is necessary in order to tell the instrument its position and orientation relative to another established point on the site grid. With the instrument powered up, press the PROG button and then press it again to select the SURVEYING program. Then, press the red enter button at the bottom right corner of the display to select SET JOB. The left and right directional arrows let you toggle between jobs. Select the ARM (Fort Armistead) job by pressing the enter button twice. This tells the instrument that you wish to use the Fort Armistead grid.

SET STATION now should be highlighted. Press enter to select it. This is where you tell the instrument which fixpoint it is set up over. Use the left directional arrow to move column-wise over the existing station number and then use the up and down arrows to enter the new station number. Unneeded lefthand digits can be removed by pressing the CE (ESC) button. Once the correct digits have been keyed in, press the enter button. You should now see the coordinates (easting, northing, and height) for the fixpoint you've selected. Press the enter button twice to select it. Now, use a folding rule or rigid tape measure to determine the height of the instrument above the top of the fixpoint. The appropriate place on the instrument to take this measurement is the pivot plane of the scope, which is indicated on each side of the instrument by a small dimple just below the red Leica logo. Enter the appropriate height using the same procedure described above and then press the enter button twice to select it.

SET ORIENTATION now should be highlighted. Press enter to select it. This is where you tell the instrument the position of a second known fixpoint so that it can properly align itself to the grid. Using the left arrow, highlight <COORD> at the bottom of the screen and press enter. Now, enter the ID number for the second fixpoint and press enter. You should now see the coordinates (E-easting, N-northing, and H-height) for the fixpoint you've entered. (Make sure you have these points written down and accessible; you will need them later so you can verify that the instrument has been set up properly.) Next, press the enter button twice to select it.

You are now ready to take a backsight on the second fixpoint. To do this, have someone hold the mini prism perfectly level on the center of the second fixpoint. Rotate the instrument and sight in on the prism rod as close to the base as possible. Gross movement of the instrument and scope are accomplished by simply moving them with your hand; fine adjustment is accomplished using the knob on the right side of the instrument for horizontal adjustment and the knob on the left side for vertical adjustment. Once the vertical hairs in the scope are aligned precisely with the prism rod, press enter to select it and record the alignment. The instrument now should be properly aligned to the grid.

START now should be highlighted. Press enter to select it. Before using the instrument to take new readings, you will need to verify that the setup process was successful. To do this, take a reading on the fixpoint you used to align the instrument and compare it with its actual coordinates. The instrument is properly set up if the E, N, and H values are within 5 mm of one another. If you need to change the height of the prism, use the bottom arrow to highlight the hr (height of reflector) value and then change the digits using the procedure described earlier. (For the mini prism, the only correct prism heights when using the rod segments are 0.400 m, 0.700 m, 1.000 m, and 1.300 m.)

If the readings for the second fixpoint are off by 5 mm or less, you are ready to begin. If not, you will need to repeat the above procedure. If E and N are off, repeating only the SET ORIENTATION procedure may fix the problem. If the E and N are fine but the height is off, you may have entered the wrong instrument height and you will need to repeat both the SET STATION and SET ORIENTATION procedures. If all are greatly off, you probably have entered either the wrong station fixpoint or second fixpoint.

Task #2. Taking Readings with the Instrument

Most of your work with the total station will involve recording easting, northing, and height (i.e., X,Y,Z) data for new points. If you want the instrument to record and save a reading, take the reading by pressing the ALL button at the far left of the keypad. If you only want to display the reading without recording it, press the DIST button (second from left on the keypad). Because saving and displaying are reading are mutually exclusive tasks with this instrument, you will need to use the DIST button in addition to the ALL button if you want to record AND write down a reading.

This instrument has three display formats, and you can toggle between them by pressing the SHIFT and PgDn buttons. You normally will want to use the SURVEYING 3 page, since it displays E, N, and H readings instead of instrument angles and prism distance.

Also, keep in mind that the point ID (PtID) shown on the display is always for the reading you are about to take and not the one you have just taken.

If you accidentally press the USER button, the instrument will toggle from IR (infrared, displayed at right) to RL (reflectorless). You always want to use infrared; reflectorless is less precise and could actually give you a reading off of a twig or leaf rather than from the prism!

If you use the large prism and pole, you will need to tell the instrument. To set the instrument, press the SHIFT and DIST buttons (EDM). This will bring up the EDM screen. Highlight the value for Prism Type (which should be Mini) and press the left arrow once to change it to Round. Then press the enter button twice to select it. Remember to change it back to Mini when you are finished, because a mismatched prism and prism definition will give you a reading which is off by a few centimeters!

Finally, you need to use the orange instrument book to record and describe every instrument reading.

Task #3. Establishing a New Fixpoint

When you need to survey an area beyond where you have established fixpoints, you will need to create new ones. To create a new fixpoint, you first should go through the setup procedure (described above) on a nearby established fixpoint. Any new point you establish must be visible from this point. Pick a suitable location, give it a new fixpoint ID number which is written on flagging attached to a survey pin (gutter spike, preferably one with a dimple on the head), and then drive the survey pin flush into the ground. Then, carefully take a reading on this point using the mini prism and with the prism set as close to the ground as possible (0.4 m or 0.7 m if possible). Then, write down the readings in the instrument book. You can set fixpoints with the large prism if necessary for metal detecting or topographic mapping where precision is not as important.

Now you need to enter the new fixpoint data into the instrument. You do this through Data Manager, which you access through SHIFT PROG (MENU). If you are still in the Surveying program, you will need to back out of it by selecting EXIT (at bottom left of the display) several times. Alternately, you can simply turn off the instrument and then turn it back on. You will be out of Surveying but your instrument setup will still be good.

Once in Menu, toggle down to DATA MANAGER and press the enter button. Press the enter button again to select VIEW / EDIT DATA. Then, toggle to FIXPOINTS and press enter. A display will appear with information about the last fixpoint entered. (This usually, but not always, has the highest PtID. You can use the left and right arrows to toggle back through the fixpoint data to verify this. You can also look in the instrument book to find the last assigned fixpoint.)

To enter a new fixpoint, press the down arrow to highlight <NEW> and then press enter. Then, enter the appropriate information for the new fixpoint, using the up and down arrows to move between entries. When done, and when you are sure everything has been entered correctly, highlight <SAVE> and press enter. Then, you need to back out of the Menu by selecting <EXIT> and pressing enter four times.

Once the new fixpoint has been established and the pertinent data entered into the instrument, you can move the instrument to the new fixpoint, set up on it, and use the previous instrument fixpoint for your backsight (using the procedure described earlier).

Task #4. Downloading Data from the Instrument

You can download data from the instrument to the RLA laptop as follows. First, attach the instrument cable to the top USB port on the left side of the laptop and to the data port on the non-pivoting base of the instrument. Next, start the Leica Survey Office program by clicking on the desktop icon.

Select Data Exchange Manager from Main Tools; this will open a new window with two columns. The righthand column targets a location for the data download. For Fort Armistead data, select drive d: and then select the Armistead folder. The lefthand column specifies the location of the instrument, which should be COM4. If this selection is correct, the software will turn on the instrument, unless it is already on, and will display folders for Codelists, Jobs, and Formats. Double-click on Jobs and then double-click on Job 4: ARM. Next, select and right-click on Measurement Data. Then select Copy. A new window will appear. Change format from GSI to IDEX and then alter the filename by adding the date at the end (e.g., ARM 7-16-10.idx). Finally, click on OK. This will begin the download process. It will take longer than you think it should, and with very large files could take up to 20-30 minutes. As a rule, you should try and download data after you have recorded no more than 400-500 readings.

Downloading data does not erase it from the instrument's memory. To do this, you will need to delete it (by selecting Delete instead of Copy). Before deleting data, you should have it saved in at least two (and preferably three) places (for example, save to laptop, then save to a thumbdrive, and then email the file to yourself).

The downloaded data are in a proprietary format and must be viewed initially through Leica Survey Office using Coordinate Editor. Once in Coordinator Editor, you can copy and paste it into an Excel spreadsheet. It always is a good idea to look at the data in Coordinate Manager and make sure everything appears fine before deleting the data from the instrument.

Task #5. Recharging the Instrument Battery

The total station uses an old-style camcorder battery. One is kept in the instrument, located below the scope adjustment knob on the left side of the instrument, and another spare battery is kept in the case. Each battery has an asymmetric pattern of electrical contacts on the inside surface, making it possible to install the battery incorrectly. If you do this, the instrument simply will not turn on.

To remove the battery, squeeze the buttons on the side of the battery holder and pull it out. You should see three contacts at the top and two at the bottom. The instrument uses only the two outer contacts at the top. The battery must be properly placed and "locked" into the holder for the contacts to seat properly. A diagram on the inside of the holder shows you the position of the contacts.

To recharge the battery, attach the power cable to the charger (both located in the instrument case) and plug it into a wall outlet. Remove the battery from the holder and

attach it to the charger, matching up the contacts on the battery with those on the charger. If properly attached, the middle green indicator light will illuminate. If this does not occur, remove the battery and re-attach it. You might need to wiggle the power cable connector to get a good contact (this has been a problem in the past). The green light will be constant while the battery is charging and will blink once charging is complete.

Both batteries are fairly old and will need to be recharged every few days. If you happen to run out of power while in the field, you can use the power inverter plugged into the truck's cigarette lighter to recharge the battery. (The DC cable beneath the charger in the instrument case does not always work reliably.)

Final Notes

When sighting through the scope, you should first adjust the reticle to bring sharply into focus the horizontal and vertical crosshairs. To do this, turn the larger part of the eyepiece to focus on the prism or a nearby object. Then, adjust the reticle by turning the smaller part of the eyepiece clockwise or counterclockwise until the crosshairs are in focus.

If you get caught in the rain and the instrument or case gets wet, be sure to open the case when you get out of the field so that everything will dry out properly.

Finally, always make sure that the instrument is firmly attached to the tripod and that the tripod is firmly placed in the ground. Be particularly careful that the adjustment screws on the legs are snugly tightened (but not overtightened). They are old and sometimes do not hold their grip.

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