The Technical Side - Field Checks and Adjustments

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Your instrument is out! Is it your instrument or could your rodman have a hangover? Maybe your backsight got moved when the neighbourhood mutt decided to mark his territory. What can you do to quickly check your instrument in the field to ensure your surveys are as accurate as possible? We will give you some answers in this edition of The Technical Side.

First, we will cover some points that have been brought out in previous articles. Check your tripod. Make sure the tripod head cannot be twisted or rotated. Make sure the tripod shoes and clamps are tight. Check your tribrachs also. They should not allow the instrument or target to rotate or move up or down. While you're at it, take a look at the instrument. Make sure the tangents and clamps are operating properly and that the instrument turns freely. If someone else might have used it, make sure they didn't abuse it. You might take the time to remove any dust or other grime from the lens surface.

If making those checks doesn't reveal any problem, check your instrument. Any instrument should repeat or be able to turn back to the same point and get the same reading. Check this by sighting a well-defined point and turning the instrument 360 degrees to bring it back to the same point. You must keep turning the instrument in the same direction - if you go past the point go all the way around again. Now repeat the procedure turning the instrument in the opposite direction. The line of sight should not have moved up or down from the original point. If it did there is some sort of problem, probably with the bearings and the instrument needs to be looked at by a technician.

Another thing to check is to make sure the crosshairs are straight. If you pan your field of view across a well-defined point the crosshair should be on that point all the way across the field.

After making the above checks you can make sure your levelling vials are in adjustment. Centre the bubble in the vial and turn the instrument 180 degrees. The bubble should remain centred. Check the compensator by sighting on a rod or well defined target and taking the instrument slightly out of level. You should see your line of sight move and then settle back into the original position. If not, there is a problem with the compensator. You can peg test a level by setting up between two rods. Even if your level is out it will be out the same amount if you are the same distance from both your rods. Note the difference between the rods. Now set up close to one of the rods. You should still read the same difference in elevation that you saw earlier. If you run into any problems or don't feel comfortable with the results, take the level to a qualified technician.

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Theodolites and transits share many characteristics. The biggest differences are in the way angles are read and the accuracies of the instrument. In this article we will also group the angle measuring part of the total station in with the theodolites. Most theodolites are micrometer reading. You can check the micrometer run by turning it to 0 and setting the instrument to read over one of the degree marks on the circle. Run the micrometer to the end of its indicating range and the instrument should be reading at the next degree mark (or the next increment of measurement). Theodolites and total stations generally have a compensator that corrects your vertical angle. If you take the instrument slightly out of level the compensator should change the vertical angle reading. If you sight on a point, take the instrument out of level, and move the telescope back to the same point with the vertical tangent, the angle reading should be the same. Any problems that show up in the instrument should be inspected by an instrument technician.

A sight taken in the direct and reverse faces of the instrument should agree by a difference of 180 degrees. If not, you need to check the angle doubling. To check the horizontal doubling, line the vertical crosshair up with a well defined point at least 300 feet away. We will call this the original point. Invert the telescope only and note a point in the opposite direction. Turn the alidade portion of your instrument around to sight the original point again. Flop the telescope over again. You should be at the same point you saw when you flopped the telescope the first time. If not, your horizontal angles will not double. The vertical can be checked in a similar fashion, lining the horizontal crosshair up with a point and following the same basic procedure. You can also take a reading in the direct and reverse faces and make sure they agree. The telescope axis must be perpendicular to the standing or vertical axis. If not, the telescope will not shoot a plumb line and shots taken at a steep vertical angle will show a horizontal split. Check this relationship by depressing the telescope to a low target. Lock the horizontal motion and elevate the telescope up and pick a target. Now flop the telescope and turn the alidade around and pick up your elevated point in the reverse face of the instrument. Bring the telescope down to the original target. As in horizontal and

vertical doubling, any error observed is actually four times the actual single observation error.

Checking an optical plummet which is mounted in the alidade of the instrument is very simple to do. Set the instrument up over a point. It is not necessary to level the instrument up. You can use the tribrach level screws to aim the optical plummet at the point. Simply turn the instrument around 180 degrees and if the optical plummet is still over the point, it is in adjustment. If the optical plummet is out of adjustment in this type of instrument, an accurate positioning can be obtained by 'walking' the crosshairs around the point keeping the error uniform around the point. An optical plummet in a tribrach cannot be checked easily in the field as another tribrach, adjusting ring and overhead target are required for accuracy verification.

> *"... an accurate positioning can be obtained by 'walking' the crosshairs around the point keeping the error uniform ..."*

All of these checks can and should be performed in the field. I didn't include adjustment instructions for several reasons. First, instruments differ in adjusting procedures and we don't have space to include them all. If you need instructions for your specific instrument, feel free to call us. Second, adjustments carried out in the field are harder to do and are usually not as accurate as those done in the shop. The biggest problem is finding the well- defined points that I keep talking about. You also have problems with heat waves, atmospheric conditions, and all the other things that make surveying so darn much fun. Ideally, the best place to adjust an instrument is on a collimating stand under controlled conditions.

If you have any questions or comments give us a call at (702) 359-6671, fax them to (702) 359-6693, or send them to The Technical Side,
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