Welcome to "The Technical Side"

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Author's Note: We are honoured to have been asked to bring you information on subjects ranging from the care and feeding of instruments to the high-tech world of data collection. We will also provide useful tips for performing "field maintenance." Marty will be providing the technical information covering instruments from the top of the telescope to the bottom of the tripod. Doug will provide insights geared more to computers, data collection and battery maintenance. We would also like to provide a forum for reader questions. We will give the answers in subsequent columns.

The first topic of discussion will be determining if your instrument is operating properly. Before attempting to evaluate an instrument, we must first consider that upstanding member of the team: THE TRIPOD.

We have found over the years that the lowly tripod has caused more cussing and consternation than any other piece of equipment. In most cases, tripods will get, at best, a minimum amount of care. Since the tripod is used to provide a stable base for the instrument, it should be kept in tip-top condition.

How do you check a tripod? First make sure all of the mechanical parts such as clamps, hinges, and shoes are properly tightened. Be sure that the gibs (the round parts) are tight in the hinge clamps so they don't rotate or move up and down. Once you have determined that all of the hardware is adjusted, set up the tripod as you normally would use it. The best way to check tripod stability is to grasp the head with both hands and gently rotate it - first in one direction and then the other. If there is any movement, locate its source and adjust it out.

Since tripods lead a rough life in the back of the truck, it is a good idea to occasionally check the condition of the head surface. Remember that the head provides an accurate plane to allow lateral movement of the instrument when locating a point. If the head is not perfectly flat and free of nicks and gouges, it is almost impossible to maintain level and achieve point location. Use a straightedge to see if the top of the head is perfectly flat. If the head surface is not flat, the head either needs to be machined or replaced. Remember to protect the head with a cap, or keep the head from being damaged.

Now that we have a good stable base let's look at the instrument. Procedures and observations are going to be different for the various types of instruments. Automatic levels are easiest to check, while one-second theodolites are most difficult.

The condition of the instrument optics helps to determine the overall accuracy because they affect the operator's ability to sight properly. If the optics are smudged or dirty, or if the eyepiece and objective are not properly focused, the ability to resolve a target is impaired.

Make sure that your optics are clean by properly cleaning the outside surfaces. To avoid scratching, use a lens brush or a light-held lens tissue to wipe any large particles from the lens before using a lens cleaning solution and tissue to remove smudges or dust. Remember to use a light touch when rubbing the lens surface. After the outer lens surfaces are clean, you can check the internal surface conditions by looking back through the objective lens at a light-coloured surface. The lenses should be clean and bright, with no fogging or dust.

All instruments contain on e or more level vials to help establish the vertical axis relationship to earth centre. When the instrument is level, the bubble should be centred in the vial. Field adjustment of level vials is possible if the operator exercises a light touch and good judgement. The procedure is to centre the bubble and then rotate the instrument 180 degrees. If the bubble is not centred, take half the bubble error out with a base levelling screw that is in line with the vial, and half the error out with the vial adjusting screw. Instrument level is rechecked and, if necessary, the procedure repeated until the bubble will repeat as the instrument is turned about the vertical axis. Use care when adjusting level vial screws as they can be easily damaged by too much turning force. It is always best to refer to the owner's manual or a qualified instrument tech when in doubt.

Level accuracy in the field can be checked by "peg testing", which entails setting up two graduated targets and establishing their relationship to each other. Vertical and horizontal angles in transits, theodolites, and total stations can be tested in the field. Field adjustments can be performed, but generally are not as accurate as adjustments performed by using a collimating stand. Distance measuring accuracy is best done over a known course such as the N.G.S. Baseline at Stead. Many independent factors govern the accuracy of EDMs so we will possibly dedicate an entire column to their checking and adjustments.

Theodolites and total stations can be checked for accurate angle readings by taking direct and reverse readings of a single target on both the vertical and horizontal circles, and by "doubling" angles using two opposite targets. Any "split" can generally be negated by either mechanical or electronic adjustment depending on the type of instrument. Again, refer to the proper manual or to a qualified instrument technician for the correct procedures.

If repeated readings vary, then it is time to suspect that the unit needs to be looked at by a technician. If you suspect that the instrument is not operating properly, get it to an instrument facility for evaluation.

While we have covered instruments in general, we invite you, the reader, to bring us specific questions and topics to be discussed in this column.

The survey instrument and accessories are your "tools of the trade"; the better their condition and accuracy, the easier and more precise your work will be.