

# HOW TO CARE FOR YOUR INSTRUMENT

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While principles governing the use of surveying instruments haven't changed radically in the past 100 years, improved design and workmanship have resulted in changes in maintenance and care.

A century ago most surveyors were working days, weeks, and sometimes months, away from a repair source; and it was necessary for each surveyor to be able to perform repairs and routine service on his instrument. As instruments became more precise and sophisticated in design and construction, and urbanization spread across the country; the need for owner maintenance became impractical and unnecessary. Qualified repair facilities, such as Ellerbusch, are now available within a few hours of almost any location. Now the tide has turned and many transitmen are hesitant to perform even basic adjustments to keep their instruments in top working order. We at Ellerbusch urge all surveyors and transitmen to become familiar with the instructions supplied with your instrument, and learn to make the basic adjustments which will help keep your equipment efficient and accurate.

All instruments from Ellerbusch, whether new, used, or repaired, are expertly adjusted and ready for use in the field. As long as your instrument gives consistent and accurate measurements, there is no need to tamper with adjustment. Through preventative maintenance and proper care, your instrument should give years of trouble free service. To help you keep your instrument in the best working order we have provided the following guidelines and recommendations.

## Preventative Maintenance

The best way to keep your instrument in proper working order is to prevent difficulties. Most manufacturers include several accessories to protect your instrument from the elements and instructions as to their use. A plastic hood is an invaluable accessory to protect your instru-

ment from sudden rain or dust. If not included with your instrument, a hood may be purchased or made from a piece of plastic. Lens tissues, clean brushes, and a lint-free cloth can be used to keep lenses and moving parts clean and dust-free. If moisture gets into the telescope it is best to remove the eyepiece, cover the end with a clean cloth and allow the telescope to dry in a warm room.

## Set Up

When sighting a telescope, always turn the motion in a direction to oppose the tangent spring. Sometimes a light tapping with the forefinger on the plate will make for stability. Use care in focusing the objective to remove parallax in the telescope, and read verniers by sighting straight on, to avoid parallax.

When leveling up, first level the plate levels. These are half as sensitive as the telescope level and give you a rough adjustment. For the final adjustment, first secure the telescope using the locking lever or screws. Revolve the instrument until the telescope is directly over one pair of leveling screws.

Adjust the telescope level by turning the two opposing screws simultaneously until the bubble is centered. Turning both leveling screws "in" moves the bubble to the right; turning both leveling screws "out" moves the bubble to the left. When the bubble is centered, turn the instrument 90 degrees so it is over the other pair of leveling screws. Bring the telescope bubble half way back center, then rotate, adjust halfway back and repeat until bubble remains centered in all directions.

## Precautions

It is well to re-check any apparent maladjustment before proceeding to make any adjustment. Then follow the rules of adjustment in the proper order.

Any change in the positioning of the objective lens will change the collimation; therefore, if the objec-

tive lens is removed for any reason the collimation adjustment must be checked. It is recommended that the instrument man make certain that the objective lens is tight in the telescope and in its setting, since any movement of the lens in the telescope or in the setting will throw out the line of collimation.

A small amount of looseness in the objective slide or the focusing slide can be corrected by tightening the pinion. If the focusing slide can't be tightened, it needs to be refitted.

Another difficulty, called "walk", may be encountered when the horizontal axis is loose. To test for this, place fingernail in such a position that it touches the end of the scale and the standard simultaneously, and attempt to move the telescope from side to side. Most instruments have means of removing this looseness, and this should be corrected, otherwise side movement of the line of sight will be apparent. Sometimes the axis will wear out-of-round. To avoid this, it is recommended that the telescope be used in the inverted position frequently.

Level vials may also be a source of trouble. If a vial is loose in the case, it is almost impossible to make an adjustment. This can be detected by placing your fingernail on the vial and case and attempting to turn the vial in the case. If the vial is loose the plaster-of-paris or other material used for cement must be removed and the vial recemented.

The more sensitive the vial, the more it is affected by temperature change. Heat from the hands will cause a vial to move off center; therefore in handling the instrument take care to keep the hands away from the level vials. The same is true when a level vial is partly in the sun and partly in the shade. Some level vials may be erratic because crystals have formed inside the tube, causing jumpiness in the bubble. Crystals can be detected by the use of a magnifier, and if they are present the only solution is replacement of the level vial.

Wipe off and clean the tripod head, particularly the threads. A tripod cap placed on the tripod between use will keep the threads clean. Varnish the tripod legs, and use wax on the sliding section of an extension-leg tripod. Keep the clamp screws clean and do not drop the tripod in mud or dirt.

If possible, store the instrument at the same temperature it is being used in - it will not take as long to come to temperature and will not be so apt to fog. Fogging occurs when the instrument or lenses are colder than the air.

#### Symptoms and Causes

1. Symptom – instrument will not stay level.

Possible causes –

- Loose tripod shoes
- Loose tripod wing nut or hinge
- Hinge too tight or wing nut too tight before set-up
- Loose dowels in wide frame tripod

e. Sun strikes only one end of level vial

f. Loose vial - test by attempting to “roll” the vial in the case. Looseness will usually be apparent

g. Loose spindle or socket

2. Symptom – Hard to level or jumpy when leveling.

Possible cause–

a. Crystals in vial – examine with hand magnifier for crystals; crystals appear as small specks in clear portion of the bubble.

b. Half-ball and socket dry and /or dirty – clicking or ticking sound when leveling.

c. Loose centers – check by leveling up; press downward on plate of transit or telescope of level. If bubble goes off center and stays there, centers are loose.

3. Symptom – Instrument will not stay on line or moves off point.

Possible cause –

a. Check pertinent causes under 1 and 2

b. Tripod settlement on soft ground

c. Sun causes unequal movement of parts of instrument

d. Loose tangent or slow-motion

screws; see if they wobble

e. Loose centers

4. Symptom – Double center points are not consistent.

Possible cause –

a. “Double clamping” – some instrumentmen sight a point – clamp – use the tangent to bring on point – then clamp again “to be sure”; this will sometimes throw the instrument out of line

b. Loose objective setting in main tube

c. Objective lens loose in setting – test by pressing the edge of the objective with pencil eraser

d. Loose objective slide in external focusing type in telescope

e. Loose negative focusing slide

f. Crosshairs need adjustment

5. Symptom – “Walk” – point moves from side to side as axis tangent is turned forward and back.

Possible cause –

a. Loose axis bearing (upper)

b. Test by positioning telescope vertically-place fingernail touching end of axis and standard – move telescope sideways and movement will be detached.

#### Emergency Procedure in Case of Accident

If transit is bumped or has a fall – **HANDLE WITH EXTREME CARE.**

First, clamp all motions. Leave **CLAMPED** during initial inspection. Examine for apparent bent or broken parts: broken tangent screw heads, broken clamp screw heads, broken focusing pinion, broken eyepiece cap. Check if objective setting is loose or bent.

If your inspection shows damage, bring the instrument in for repair.

Next check to see if the vertical circle is misaligned with vernier. Under magnification the vertical circle should be flush with vernier.

Check to see if Horizontal “A” and “B” verniers show misalignment. Under magnification the verniers should be very slightly lower than the circle. If one is higher than the other, something is bent.

If there is any misalignment bring the instrument in for repair.

Second, if nothing is apparently

wrong with the axis, loosen lower clamp and rotate instrument very slowly. If binding occurs stop, clamp and bring the instrument in.

If lower motion rotates freely, clamp lower motion, loosen upper clamp and rotate upper motion very slowly. If binding occurs stop, clamp and bring the instrument in.

If binding does not occur, use the magnifier to be certain that the verniers have not caused pick-up on the limb.

Third, if all rotations are free test for bent centers as follows: Level up the instrument roughly with plate levels and complete leveling with telescope level. With telescope level centered, unclamp upper and lower motions. Hold the plate and standards stationary and slowly rotate the horizontal circle between the leveling head and plate. Observe the telescope level to see if it moves from center. Any movement will indicate bent centers and the need for repair.

Fourth, if all of the above indicate that there is nothing apparently wrong, check and perform the regular adjustments as needed. If in doubt, bring the instrument in and we will check it for you to be sure nothing is damaged. At the first opportunity the instrument should be thoroughly and completely checked in the shop. Be sure and let us know if an accident has occurred when you bring the instrument in.

Fifth, most electronic instruments have a micro processor, which controls the electronics and prevents errors in readouts. If error codes are displayed, the instrument should be serviced.

It is a good idea to have any employees report immediately an occurrence that might affect the operating condition of your instrument. Attempts to cover-up accidents can be spotted when the instrument is brought to us for repair or alignment.

**Ellerbusch Instrument Service LLC**