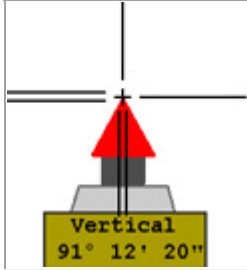
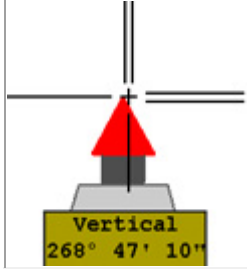


Vertical Circle Index Error.

Although most theodolites will automatically reference the vertical circle to the zenith, they still may contain a Vertical Circle Index Error. This error can be very large (minutes of arc) and thus will cause very large errors in distances, if not corrected. The instrument can be adjusted to eliminate this source of error (refer to instrument manual) or vertical angles can be corrected by adding the vertical circle index correction (VCIC) to any measured vertical angles. The VCIC for any instrument can change with time, therefore it is important to check the instrument regularly (at the start of each day) to verify the error.

Checking for Vertical Circle Index Error			
1	Point the instrument to a good target, make sure the horizontal cross-hairs are aligned on the target. Note down the vertical angle reading.		Face Left Vertical Angles - 0 to 180 degrees
2	Change Face - plunge the telescope and rotate the instrument 180 degrees. Point back to the same target and note down the vertical angle.		Face Right Vertical Angles - 180 to 360 degrees
3	Add the two vertical angles	259° 59' 30"	Total should be 360 degrees
4	Calculate Vertical Circle Index Correction VCIC = 360 - 1/2 * (FL + FR) VCIC = 360 - 1/2 * (259° 59' 30") = 15"	VCIC = +15" FL Vertical Angle = 91°12'20" + 15" = 91° 12' 35"	15" should be added to both the FL & FR vertical readings to get correct angles.

Corrected angle readings:

$$\begin{aligned} \text{Face Left:} & \quad 91^\circ 12' 20'' + 0^\circ 0' 15'' = 91^\circ 12' 35'' \\ \text{Face Right:} & \quad 268^\circ 47' 10'' + 0^\circ 0' 15'' = 268^\circ 47' 25'' \\ \text{Sum:} & \quad 360^\circ 00' 00'' \end{aligned}$$

Once a Face Left and Face Right reading have been taken and the angle corrected to allow for Vertical Circle Index error, you can adjust the theodolite (if you know how to do it) so that it read angles correctly.

As you'll see this checking is more complex as the two peg test and you don't need to do it but you must be aware how to do it.

Unlike a level where only horizontal angles are read, in a theodolite this will cause systematic errors in the horizontal as well as vertical directions. It is caused by the cross hair not being on the mechanical centre of the telescope, that is not on the horizontal and vertical axes of the instrument. The image above shows a cross section through a theodolite telescope. The reticule is shown in red, this is the glass disc upon which the cross-hairs are etched. There are procedures for detecting this error but it is eliminated during the observation process by observing both face left and face right directions. The effect of collimation error is similar to that in a level, the line of sight produced by the cross hairs is not parallel with the optical axis of the telescope.

Extract from the website Observational Tips and Technique

<http://civilweb.newcastle.edu.au/cyclops/ObsTips.htm>