Technical Bulletin M0003

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How To Use a Clinometer

No. 43830
Percent and Degree scales (±150%, ±90°). Cosines to 45° on back.

No. 43895
Percent and Topo scales (±150%, ±200´ @ 66´ baseline). Percent/Degree conversions on back.

No. 43896
Degree and Topo scales (±90°, ±200´ @ 66´ baseline). Cosines to 45° on back.

No. 43897
15m and 20m scales (±35m @ 15m baseline; ±50m @ 20m baseline, respectively). 20m Scale/Degree conversions on back.

No. 43840
Percent and Secant scales (±150%, Secant values x 100 – 100 t0 ±500). Scale/Degree conversions on back.

No. 31198
Brunton Clino Master: Scale: 0 to 90° and 0 to 150%

No. 31199
Brunton Clino Master: Scale: 0 to 200´ (66´ from object) and 0 to 150%

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How To Use a Clinometer

A clinometer can be used to measure heights of trees, poles, towers, and buildings, or to measure slopes for preliminary surveying, grade work and site drainage. Vertical angles can be measured as well for engineering and surveying projects, satellite and microwave dish installation and more. Different scales are used, depending on the application. For example, a Secant scale clinometer (No. 43840) allows you to determine correct horizontal distances and compensate for slope when using the percent scale for height measurements, and eliminate prism rotation in point sampling.

Note: Since secant scale clinometers express secant of a slope times 100, you should initially divide the clinometer reading by 100 to get the correct secant value. For example, a clinometer reading of 110 has a correct secant value of 1.10.

Clinometer Basics

How To Hold And Read a Clinometer

Keep both eyes open when using a clinometer. Use the sight eye to look through the lens at the scales while the left eye sights alongside the clinometer housing. An optical illusion is created and the horizontal sighting line will appear to project to the side of the clinometer housing. Place this sighting line on your target and read the scale.

A Note Regarding Visual Acuity

The axes of the eyes of some people are not parallel, a condition called heterophoria. In order to be sure that this doesn't affect the accuracy of readings, it is suggested that the operator check this possibility as follows:

Take a reading with both eyes open, then close the eye not looking directly into the clinometer scales. If the reading doesn't change appreciably, there is no misalignment of the eye axes, and both eyes can be kept open.

Should there be a difference in the readings, one has to keep the eye not looking directly into the clinometer scales closed and sight partly past the instrument body, making use of the optical illusion.

Determining Height Using Percent Scales

To acquire height measurements with a percent scale clinometer, stand any convenient horizontal baseline distance from an object in which you can see both the top and bottom of the object. Then sight the top of the of the object for the top % reading and the bottom of the object for the bottom % reading. Then follow a simple mathematical formula to calculate the height:

% to top - % to bottom = total % height

then

total % height x horizontal baseline distance = height.

Note the following examples as they relate to different ground circumstances and horizontal baseline distances:

Height Measurements On Level Ground And Above a Tree

Using the percent scale and horizontal baseline distance convenient for you to see both the top and bottom of the tree, follow these simple procedures. Back away from the tree the baseline distance. In this example, 80'. Sight the top of the tree and read the % scale (63%). Sight the bottom of the tree and read the % scale (-7%). Subtract the bottom reading from the top reading: 63% -(-7%) = 70%. To obtain tree height, simply multiply this percentage times your horizontal baseline distance. 70% x 80' = 56' tree height. (See Figure 1.)

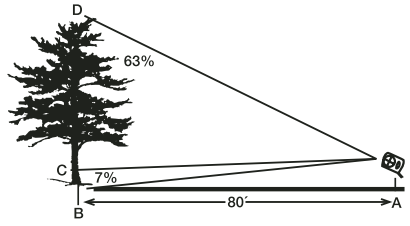

Figure 1

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Height Measurements On Sloping Ground And Below a Tree

Using the percent scale and 100' horizontal baseline (or other baseline convenient for you to see both the top and bottom of the tree), follow these simple procedures. When the base of the tree is ABOVE eye level, sight the top then sight the base. Subtract the base reading from the top reading. For example:

70% - 14% = 56%.

Then multiply 56% x 100' = 56' (tree height). (See Figure 2.)

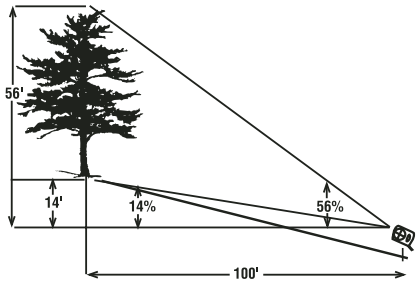

Figure 2

When the base of the tree is BELOW eye level, sight the top then sight the base. Subtract the bottom reading from the top reading. For example:

-10% top reading - (-66% bottom reading) = 56%

Then multiply by 100' (baseline) for a tree height of 56'.

Using a Secant Scale Clinometer To Determine Horizontal Distance On Sloping Ground

To find an unknown horizontal distance (C), divide the measured slope distance (A) by the secant value of the slope (B). For example:

100 ft. ÷ 1.05 = 95.24 ft. (horiz. distance). (See Figure 3.)

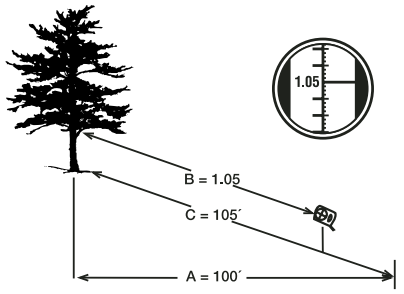

Figure 3

Using a Secant Scale Clinometer To Correct Slope Distance For a Desired Horizontal Distance

Correct slope distance (C) is determined by multiplying the required horizontal baseline distance (A) times the secant value of the slope (B). For example:

100 ft. x 1.05 = 105-ft. (correct slope distance). (See Figure 4.)

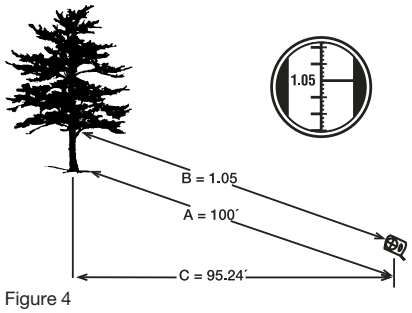

Figure 4

Using Topographic and Metric Scale Clinometers To Measure Height

The topographic scale clinometer is designed to measure heights directly in feet when using a horizontal baseline of 66'. Take readings the same way described for the percent scale clinometer. The topographic scale can also be used at a horizontal baseline of 33' or 132', but the reading must be halved or doubled, respectively.

The metric scale clinometer is used much the same as the topographic scale clinometer, in that they both read directly when at the horizontal baseline distance prescribed for them. The metric scale clinometer reads heights directly in meters.

Clinometer Scales

Each clinometer has two scales which are available in the following combinations: Percent and Degree, Percent and Topographic, Degree and Topographic, 15m and 20m, Percent and Secant, or Degree and Secant. Scales are graduated from 0-90° in 1° units; from 0 to 150% in 1% units (0 to 70%) then in 2% units (70% to 150%). Graduations in the topo scale are 0 to ±200' with a 66' baseline. Scale readings can be estimated to 10 minutes or 1/5%, when readings are made around the zero level.

Measuring Slope

To measure slope, using a percent scale clinometer, sight parallel with the ground (upslope or downslope) to a target, aiming at a point on the target that is equal to the height of your eye above the ground.

Which Scale to Use

Clinometer Scale Used	Required Baseline Distance	Clinometer Reads In
Topo	66 feet	feet
15m	15 meters	meters
20m	20 meters	meters
Percent	Any distance in feet, yards, or meters	% of baseline distance you select