EN | FR | DE | ES | FI | SV

SUUNTO
PM-5 / PM-5/1520
USER'S GUIDE

SUUNTO
REPLACING LUCK.

EN

CUSTOMER SERVICE CONTACTS

Suunto	**Oy**	**Phone**	**+358 9 875870**
		Fax	**+358 9 87587301**
Suunto	**USA**	**Phone**	**1 (800) 543-9124**
	Canada	**Phone**	**1 (800) 776-7770**
European Call Center		**Phone**	**+358 2 284 11 60**
Suunto Website		**www.suunto.com**	

TABLE OF CONTENTS

PM-5/1520

OPTICAL HEIGHT METER

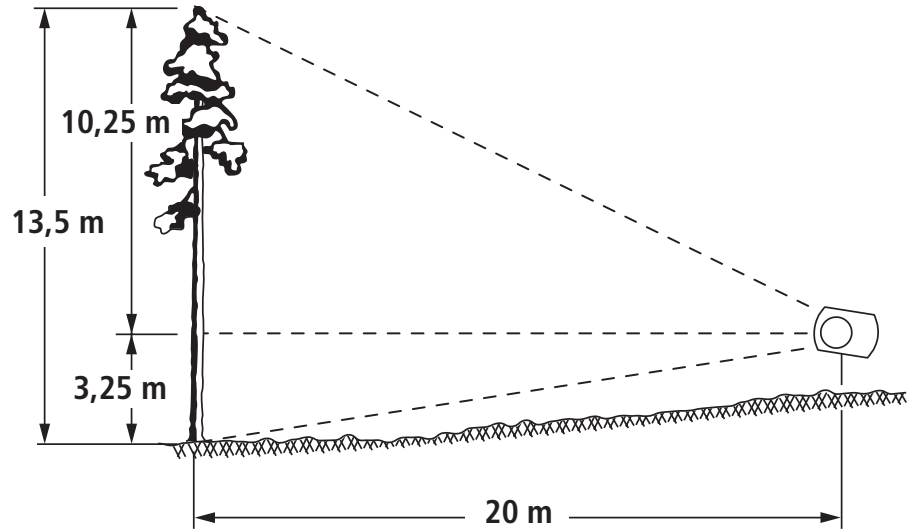
Suunto Height Meter PM-5/1520 is an instrument for measuring heights, especially heights of trees, with great accuracy and speed. The body of the instrument is corrosion-resistant anodized aluminium-alloy. The scale card runs on a special bearing in a hermetically sealed plastic container filled with a liquid which guarantees that it runs freely and stops quickly. The liquid will not freeze, retains full damping properties in working conditions and eliminates irritating scale vibrations.

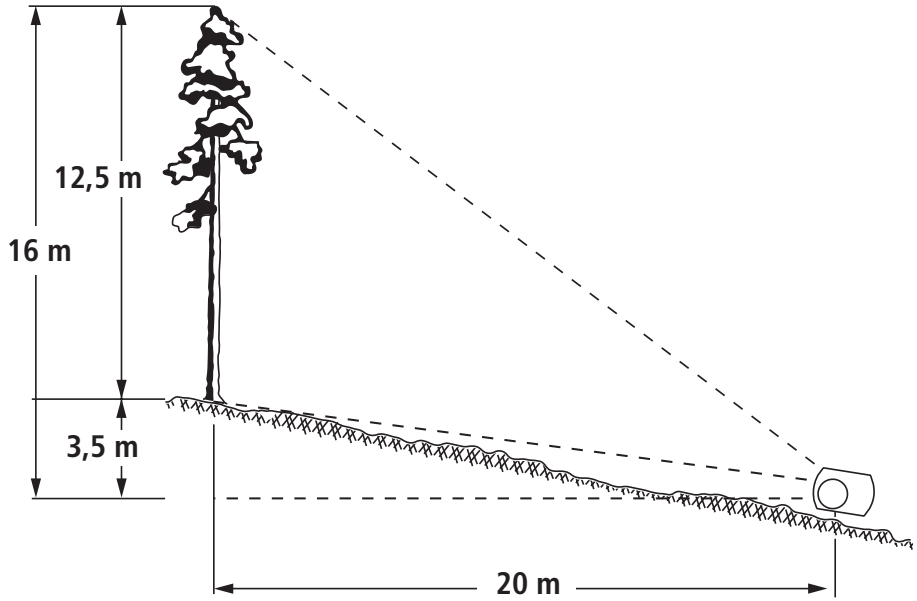
INSTRUCTIONS FOR USE

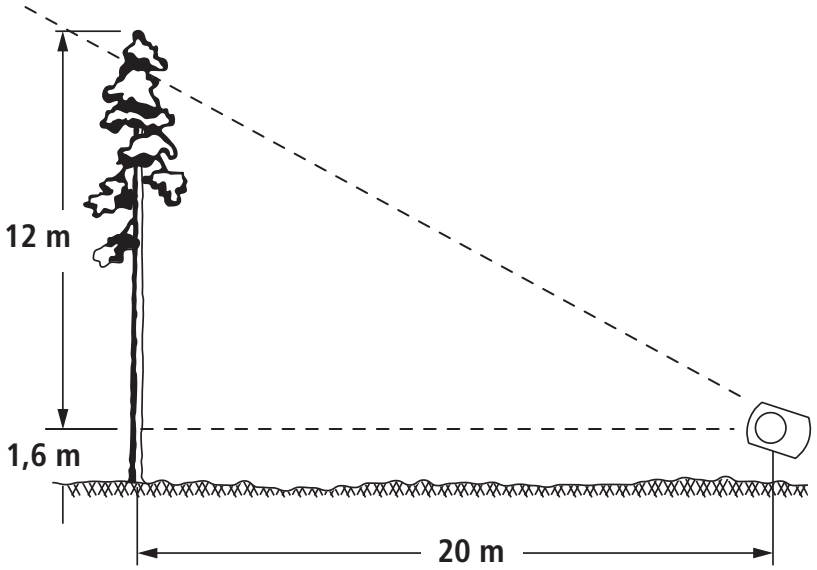
When measured from distances of 15 m and 20 m, tree heights can be read straight off the instrument's scales. The readings should be doubled when measuring from distances of 30 m and 40 m. The Suunto Height Meter can also be used to determine the angle of a gradient. This is done by taking a sighting along the line of a gradient using the 20 m scale on the left of the instrument. The reading obtained can be checked in the conversion table on the back of the instrument to obtain the angle.

MEASUREMENT OF HEIGHT

The actual measurement of the height of the tree should be done from the distance measured in the following way: the observer sights the top of the tree with both eyes open. The object sighted, the hair line and the scale will all be simultaneously visible in the instrument`s field of vision. As soon as the hairline coincides with the top of the tree, the tree height can be read off (in this example, from the 20 m scale on the left of the instrument). The reading obtained is the height of the tree measured from the eye level of the observer. The base of the tree remains to be sighted. If this is situated below the eye level of the observer, then the actual height of the tree is obtained by adding the two readings together. If it is above the observer`s eye level, the tree height is obtained by taking the difference between the two readings. In fact, in the latter case the distance cannot be measured horizontally. Thus, to get







exactly correct result you have to proceed as stated below. On level ground, the tree top readings is usually sufficient: one only has to add the height of the observer`s eye level (1,60 m in this case), which is already known.

INSTRUCTIONS FOR USE OF NOMOGRAM

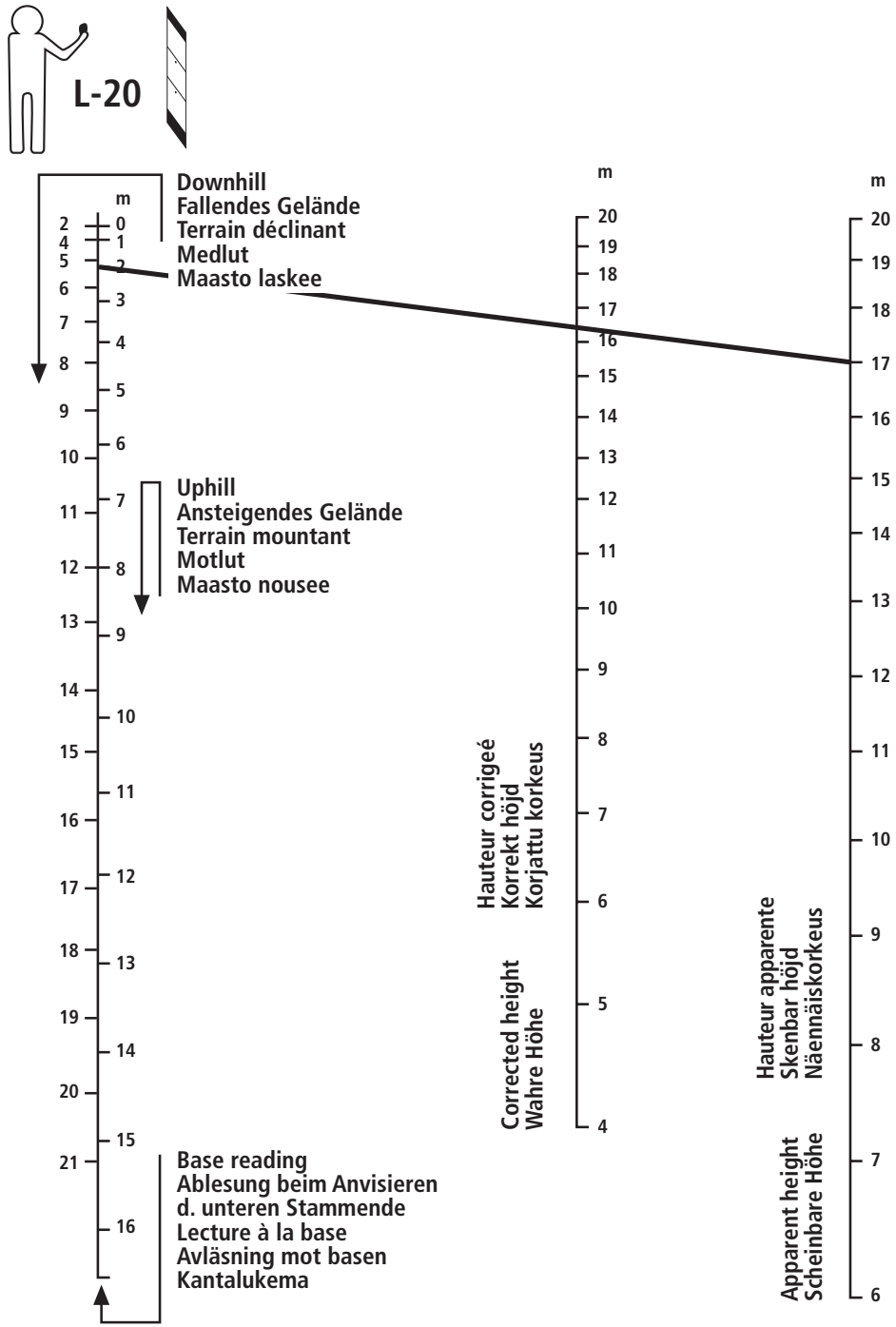
If the distance, because of very uneven ground, cannot de determined horizontally as stated above, the nomogram supplied with the instrument should be used.

ESTABLISHING THE BASIC DISTANCE

Because this instrument does not incorporate a prism, the basic distance e.g. 15 m has to be determined using a tape measure along the ground. Take the top and base readings and add or subtract them to get the apparent height. Of the four nomograms on the card, choose the one corresponding the measuring distance. Locate the apparent height on the right hand scale. On the double scale on the left, locate the reading obtained from sighting the base of the tree. Note that readings for falling and rising gradients should be taken from different sides of the scale. Connect these two points of the nomogram with a straight line. The centre scale of the nomogram now indicates the true height of the tree.

Important notice

The axes of the eyes of some people are not parallel, a condition called heterophoria. This can even vary in time and be dependent on different factors too. Therefore, in order to be sure that said phenomenon does not affect the accuracy of readings, it is suggested that the user checks this possibility before taking the actual readings as follows: Take a reading with both eyes open and then close the free eye. If the reading does not change appreciably there is no disalignment of the eye axes, and both eyes can be kept open. Should there be a difference in the readings, keep the other eye closed and sight halfway to the side of the instrument body. This will create an optical illusion whereby the hairline continues past the instrument body and is seen against the target.


L-20
Downhill
Fallendes Gelände
Terrain déclinant
Medlut
Maasto laskee
Uphill
Ansteigendes Gelände
Terrain mountant
Motlut
Maasto nousee
Base reading
Ablesung beim Anvisieren
d. unteren Stammende
Lecture à la base
Avläsning mot basen
Kantalukema
m
Hauteur corrigeé
Korrekt höjd
Korjattu korkeus
Corrected height
Wahre Höhe
Hauteur apparente
Skenbar höjd
Näennäiskorkeus
Apparent height
Scheinbare Höhe

PM-5

OPTICAL READING CLINOMETER

The sturdy pocket-size construction renders the SUUNTO CLINOMETER most suitable for every type of work. Easy for rapid reading through a parallax-free lens is incorporated into the design.

Sighting and scale reading are done simultaneously. There are no screws to turn, no bubbles to center, and nothing to adjust.

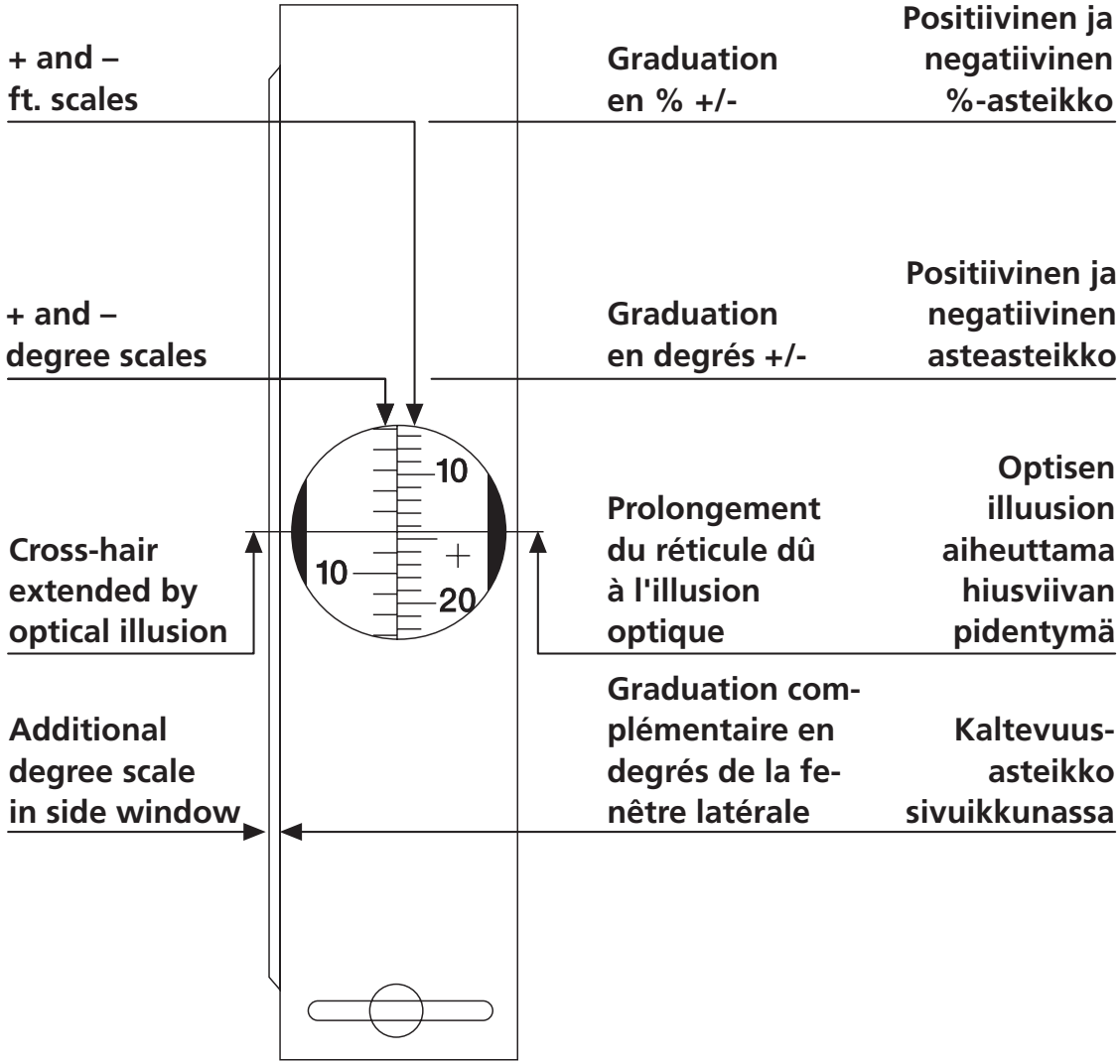
Where space is limited, as in geological and mineralogical work, the inclination of strata and other formations can be read placing the instrument along the contour or surface of the formation and reading the angle directly through the side window.

Construction features

The framework is of corrosion resistant light-weight aluminum.

The scale card is supported by a jewel bearing assembly and all moving parts are immersed in a damping liquid inside a high strength hermetically sealed plastic container. The liquid dampens all undue scale vibrations and permits a smooth shockless movement of the scale card.

The material of the container is not attacked by sunlight or water. The liquid does not freeze in the arctic or evaporate in the tropics.


+ and –
ft. scales
Graduation
en % +/-
Positiivinen ja
negatiivinen
%-asteikko
+ and –
degree scales
Graduation
en degrés +/-
Positiivinen ja
negatiivinen
asteasteikko
10
10
20
Cross-hair
extended by
optical illusion
Prolongement
du réticule dû
à l'illusion
optique
Optisen
illuusion
aiheuttama
hiusviivan
pidentymä
Additional
degree scale
in side window
Graduation com-
plémentaire en
degrés de la fe-
nêtre latérale
Kaltevuus-
asteikko
sivuikkunassa

Specifications

Weight: 120g/4,2 oz. Dimensions: 74 x 52 x 15 mm / 2 3/4" x 2" x 5/8". The optical scales are graduated in degrees from 0° to +/-90°, and 0% to +/-150 %.

A table of cosines is imprinted on the back of the instrument.

Accuracy

Can be read directly to one degree or one per cent. Can be estimated to 10 minutes or 1/5 of 1 per cent, the latter naturally applying to readings around the zero level.

AVAILABLE PM-5 VERSIONS

The basic PM-5/360 PC has been modified by fitting it with different scale combinations for special uses. Thus there is available a version with a ”new degree” or grade scale. Here, instead of the normal 360 degree division, the full circle is division into 400 degrees (g). The per cent scale there alongside is normal. The model is PM-5/400 PC.

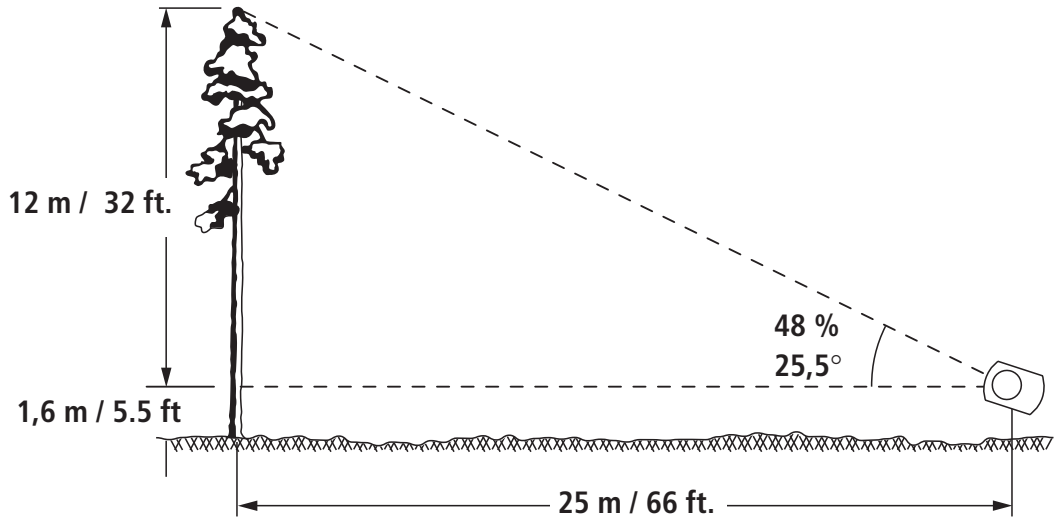
INSTRUCTIONS FOR USE

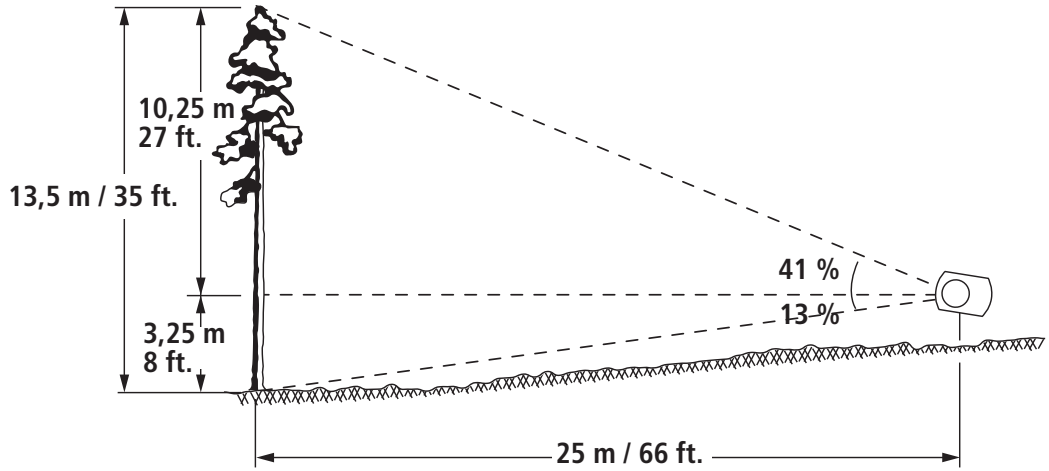
Readings are usually taken with the right eye as shown on the title page. Owing to differences in the keenness of the sight of the eyes and because of personal preferences the use of the left eye is sometimes easier. It is of prime importance that both eyes are kept open. The supporting hand must not obstruct the vision of the other eye.

The instrument is held before the reading eye so that the scale can be read through the optics, and the round side-window faces to the left. The instrument is aimed at the object by raising or lowering it until the hairline is sighted against the point to be measured. At the same time the position of the hair line against the scale gives the reading. Owing to an optical illusion the hair line (crosshair) seems to continue outside the frame and is thus easily observed against the terrain or the object.

The left-hand scale gives the slope angle in degrees from the horizontal plane at eye level. The right-hand scale gives the height of the point of sight from the same horizontal eye level, and it is expressed in per cent of the horizontal distance. The following example illustrates the procedure:

The task is to measure the height of a tree at a distance of 25 m/82 ft. on level ground. The instrument is tilted so that the hair line is seen against the tree-top (apex). The reading obtained will be 48 per cent (ca 25 1/2°). As the distance is 25 m/82 ft. the height of the tree is 48/100 x 25 m = ca. 12 m or equally 48/100 x 82 ft. = ca. 39 ft. To this must be added the eye's height from the ground, e.g. 1,6 m or 5 1/2 ft. Their sum is 13,6 m or 44 1/2 ft, the height of the tree.



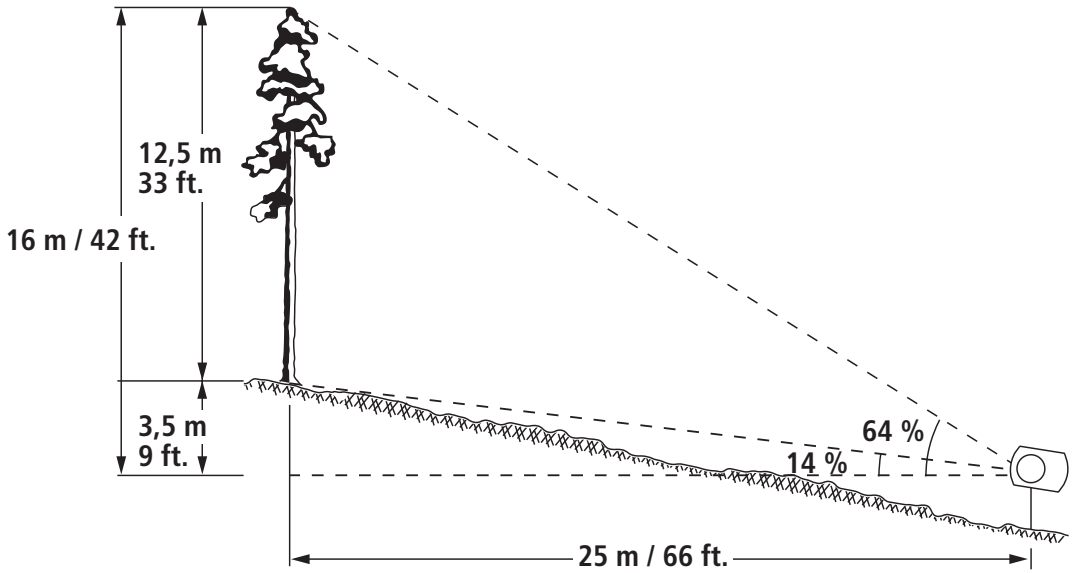


In very exact measurements, and particularly on sloping ground two readings are taken, one to the top, the other to the base of the trunk. When the trunk base is below eye level the percentages obtained are added. The total height is the sum percentage of the horizontal distance. For example, it the apex reading is 41 % and the ground reading 13 %, the total height of the tree measured from a distance of 25 m/82 ft. is (41+13)/100 x 25 m = 54/100 x 25 m = ca. 13,5 m or equally in feet (41+13)/100 x 82 ft = 54/100 x 82 ft = ca. 1/2 ft.

When the trunk base is above eye level, the base reading is subtracted from the apex reading, and the total height is the difference percentage of the horizontal distance.

For example, if the apex reading is 65 % and the base reading 14 %, the total height is (64-14)/100 x 25 m = 50/100 x 25 m = 12,5 m or equally in feet (64-14)/100 x 82 ft = 50/100 x 82 ft = 41 ft. When calculations are made mentally it is advisable to use measuring distance of 50, 100 or 200 m/ft. for the sake of simplicity.

All readings of the percentage scale are based on the horizontal distance. This means that if the distance on sloping terrain is measured along the ground an error is introduced, and this must be corrected for accurate results. The error is insignificant for most purposes at small ground slope angles but increases progressively as the angle increases.



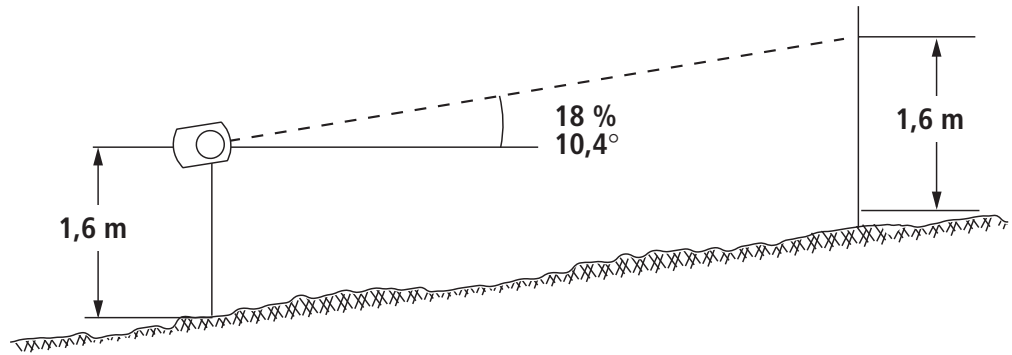
The trigonometrical correlation is

$$H = h \times \cos \alpha$$

Where H is the true or corrected height, h is the observed height and α (alpha) is the ground slope angle. With the aid of the above equation the correction can also be made in the distance. In this case h means the distance measured along the ground and H is the horizontal distance sought. If the corrected distance is used no correction in the height observed is needed. When calculating the horizontal distance by using the ground distance and the slope, it must be pointed out that an error is introduced if the slope is measured from eye level to the trunk base. Measuring the slope along the ground would be cumbersome and inconvenient. No error is introduced, however, when the slope angle is measured from eye level to sighting mark made or placed on the trunk at eye level whereby the two lines of measurement become parallel. The true angle of slope is 9 degrees.

The example shown in the following figure illustrates both methods of calculation.

Method 1. Measure the ground distance. This is found to be 25 m/82 ft. Then measure the slope angle. This is 9 degrees. Read percentages of top and ground points. These are 29 and 23 per cent.



Calculate:

$$\frac{23}{100} + \frac{29}{100} = \frac{52}{100}$$

Take 52 per cent of 25 m/82 ft. This is 13 m/42,6 ft. Multiply this by the cosine of 9 degrees.

0,987 x 13 m = 12,8 m or equally in feet 0,987 x 42,6 ft. = 42 ft.

Method 2. Multiply the ground distance by the slope angle cosine.

0,987 x 25 m = 24,6 m or equally in feet 0,987 x 82 ft. = 80,9 ft.

Add percentage readings as above and take the sum percentage of the corrected distance.

$$\frac{52}{100} \times 24{,}6\text{m} = 12{,}8\text{m}$$

or equally in feet

$$\frac{52}{100} \times 80{,}9\text{ft} = 42\text{ft}$$

This example shows that a slope angle of 9 degrees causes a correction of only 2,3 per cent but when the slope angle is 35 degrees the correction means a reduction of about 18 per cent in the observed height.

NOMOGRAPHIC HEIGHT CORRECTION

When the accompanying nomograph is used, all correction calculation becomes unnecessary. Only a ruler or some other convenient object with a straight edge is needed to obtain the nomographical solution. The nomograph is used by placing the ruler so that its edge intersects the angle scale on the left at the slope angle point and the observed height scale (on the right) at the pertinent point. The corrected height (or distance) is read at the point where the edge intersects the corrected height scale in the middle. When using a measuring distance of 100 m/ft. along the ground the correction procedure becomes very simple. No slope angle measurement is then necessary. One needs only the reading of the top point and that of the ground point. Depending on the situation their sum or difference gives the apparent height directly in feet. This is then corrected as follows: First, find on the right-hand scale in the nomograph the point indicating the apparent height. Secondly find on the left-hand double scale the point indicating the ground point reading. Thirdly, connect these points. The corrected reading will be found from the pertinent middle scale at the point of intersection. In this procedure the slope angle can be neglected as the left-hand ground point scale has been constructed so that slope angle and the average eye level height of 1,6 m/5,5 ft. have been taken into account.