

# SURVEYING-I

# Modern Surveying Chains & other Equipment

# Measuring Distance

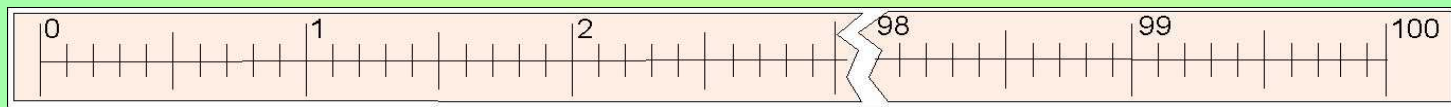
- The historical method for measuring distance is the surveying chain.
  - One of the first chains used in the U.S. was the Gunter's chain.
  - The Gunter's chain was a series of links attached to a handle which included an adjustment for wear.
  - The chain was 22 yards (66 ft) long.



# Modern Chains

❖ Modern surveying chains are three standard types.

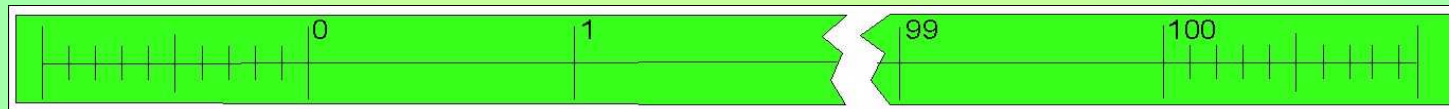
➤ Fully graduated



➤ First foot (cut chain)



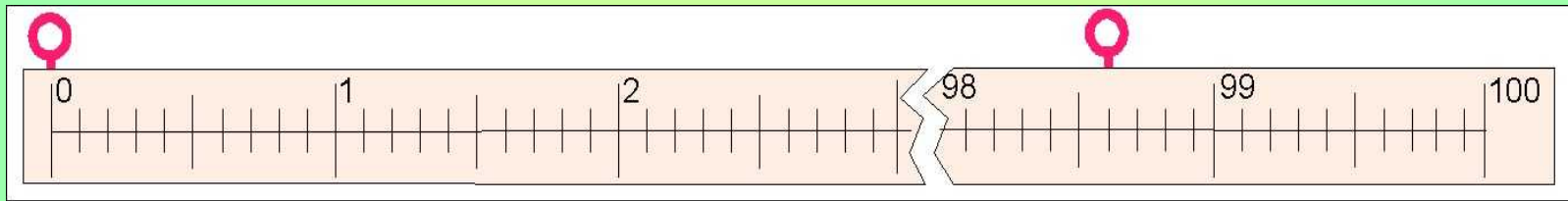
➤ Extended foot (add chain)



• Modern chains are metal strips 100 feet long.

# Reading Surveying Steel Chain

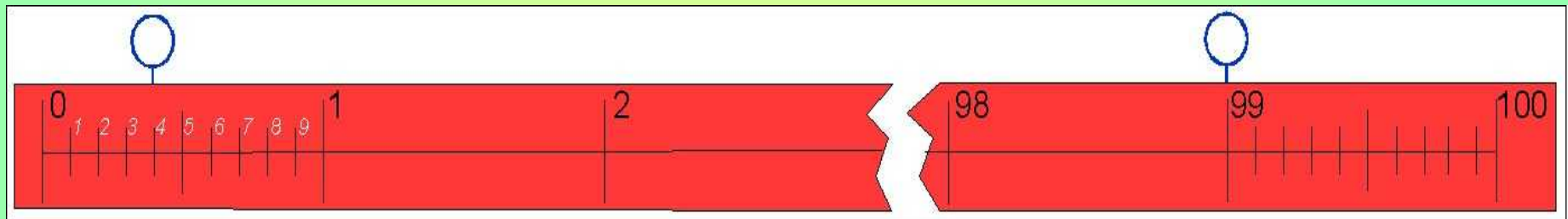
- The first step in reading a surveying chain is to determine the units that are used.



- Knowing that the chain is 100 feet long, having numbers from 0 to 100 indicates that each number is one foot of distance.
- Each foot has nine (9) lines (10 spaces), therefore each line represents  $1/10$  or  $1/10$  of a foot.
- The reading for this example is 98.6 ft.

# Reading A Cut Chain

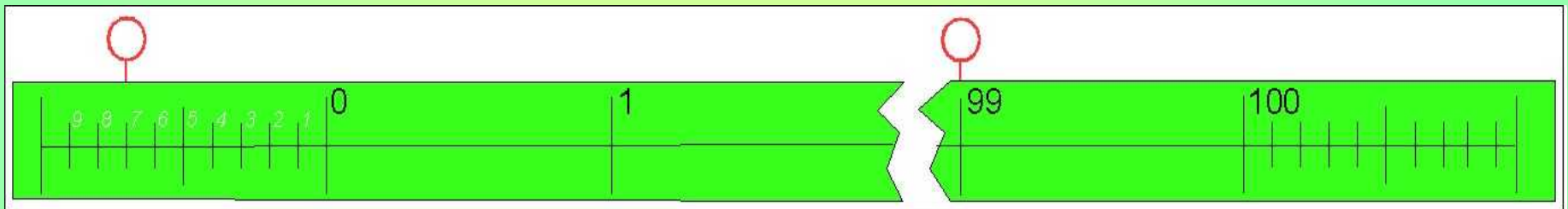
- The first foot or cut chain gets its name from the fact that the whole foot reading at the head of the chain must be reduced “cut” by the partial foot.



- In this example the pin at the head is on 99 feet and the rear pin is on 0.4 feet. The distance is  $99 - 0.4$  or 98.6 feet.

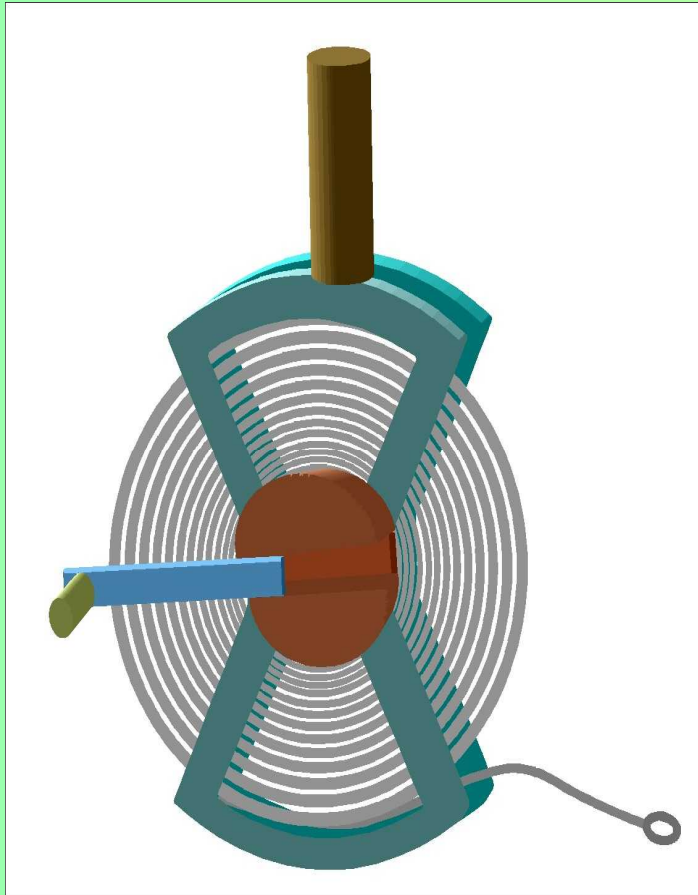
# Reading An Add Chain

- The extended foot (add) chain gets its name because an additional foot is added to each end of the chain.



- The partial foot is added to the foot value at the head of the chain.
- In this example the head pin is on 99 feet and the rear pin is at 0.7 feet. The distance is  $99 + 0.7$  or 99.7 ft.

## Steel chain on holder



To rewind chain on holder:

1. Hold holder vertical in the left hand.
2. Attach 100 foot end of the tape with the numbers up.
3. Wind tape up rotating the handle clockwise.
4. Remember to wipe tape with a dry cloth as it is wound onto the handle.



## Odometer Wheel

Odometer wheels use different units on the odometers.

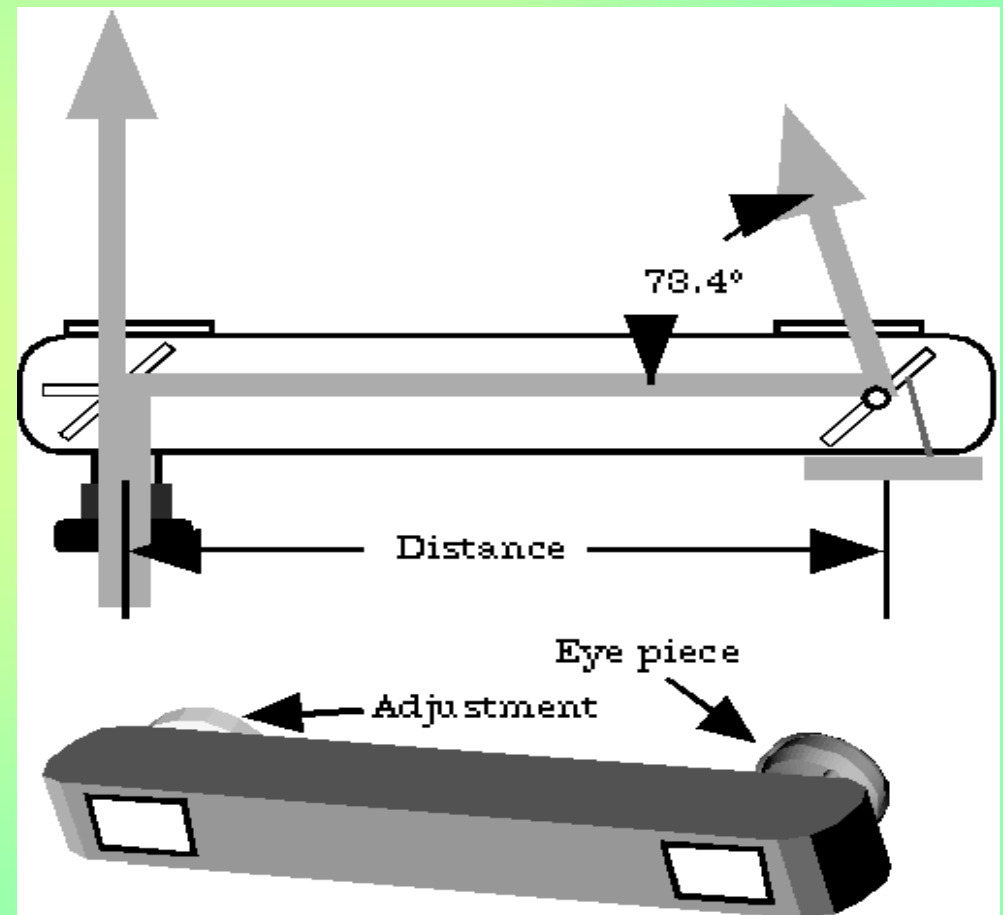
Insure you know the measuring units before you start to use the wheel.



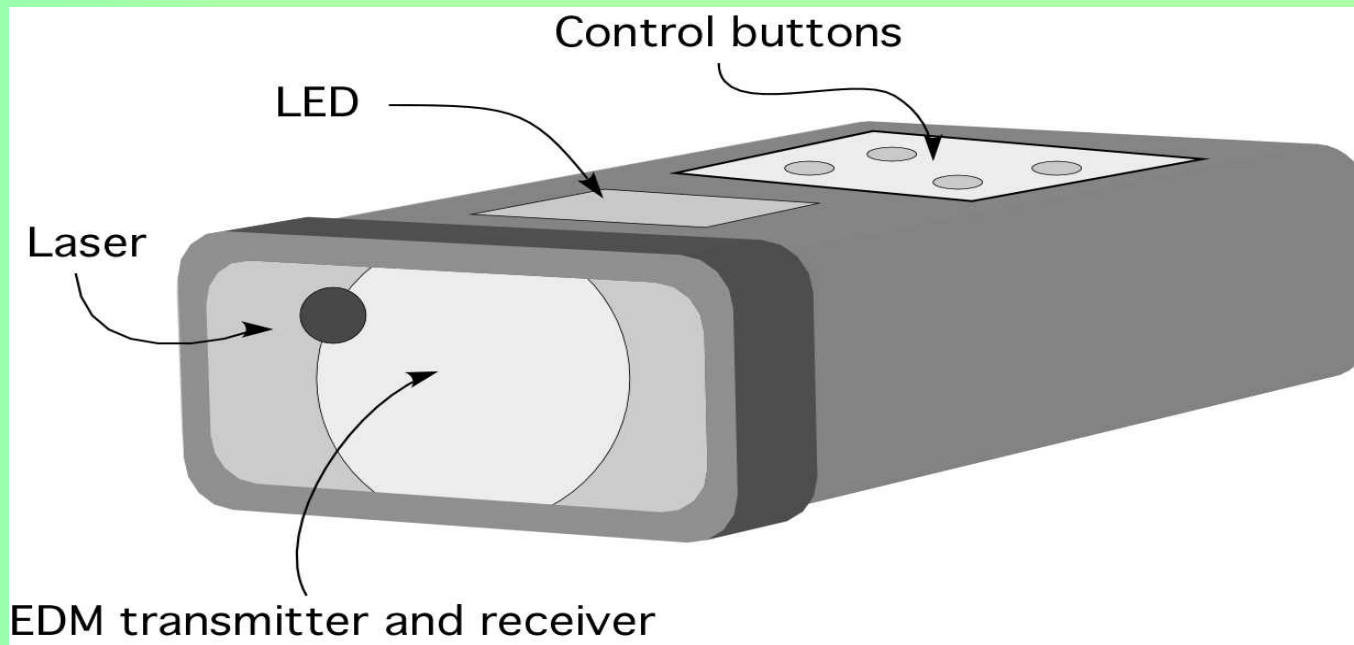
## Optical range finder

One of two main types of range finders.

The second type uses lasers. These are more popular today.



# Laser Tape



The most popular type of range finder.

Many different models.

Many different features.

Many different prices. (Precision)

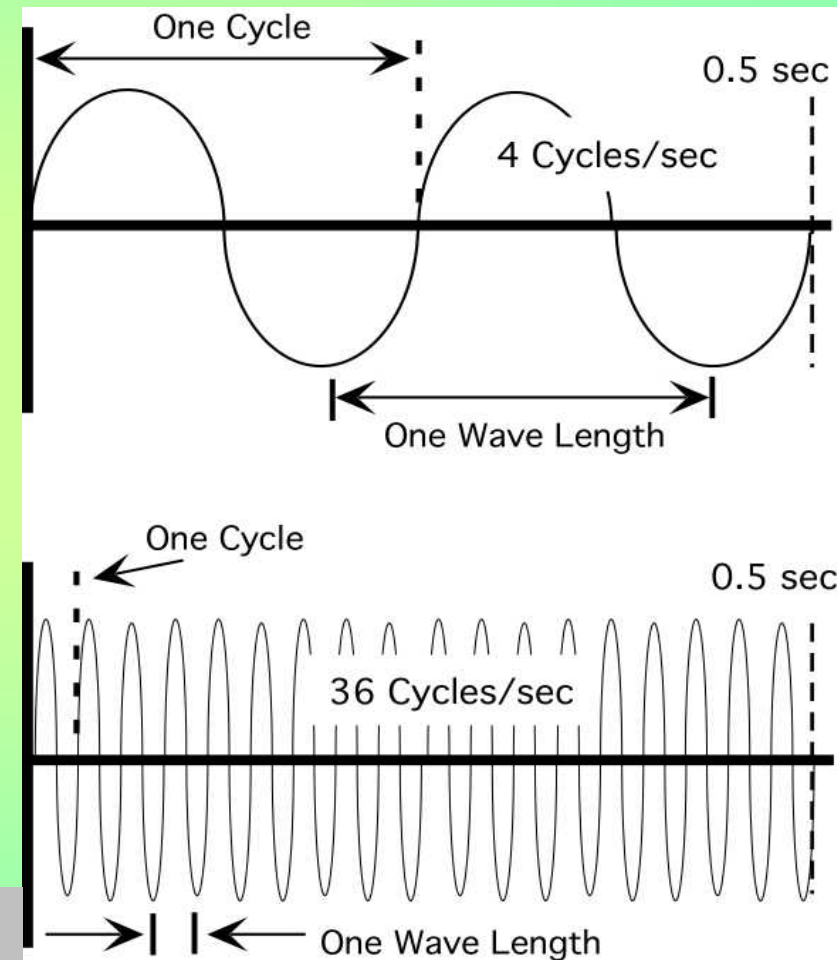
# Principles of Laser Measuring

Laser light and other signals travel at the speed of light.

If you know speed and time, you can calculate distance.

Multiple signals are used to determine partial cycles.

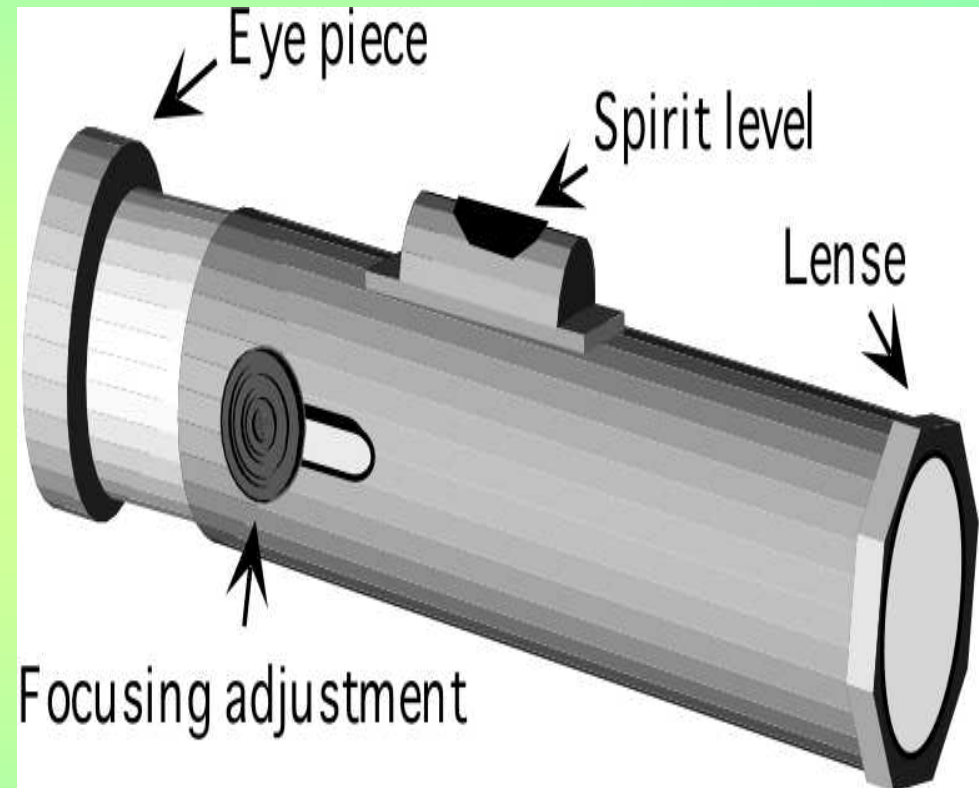
$$\text{Velocity} = \frac{\text{Distance}}{\text{Time}} \quad \text{Distance} = \text{Velocity} \times \text{Time}$$



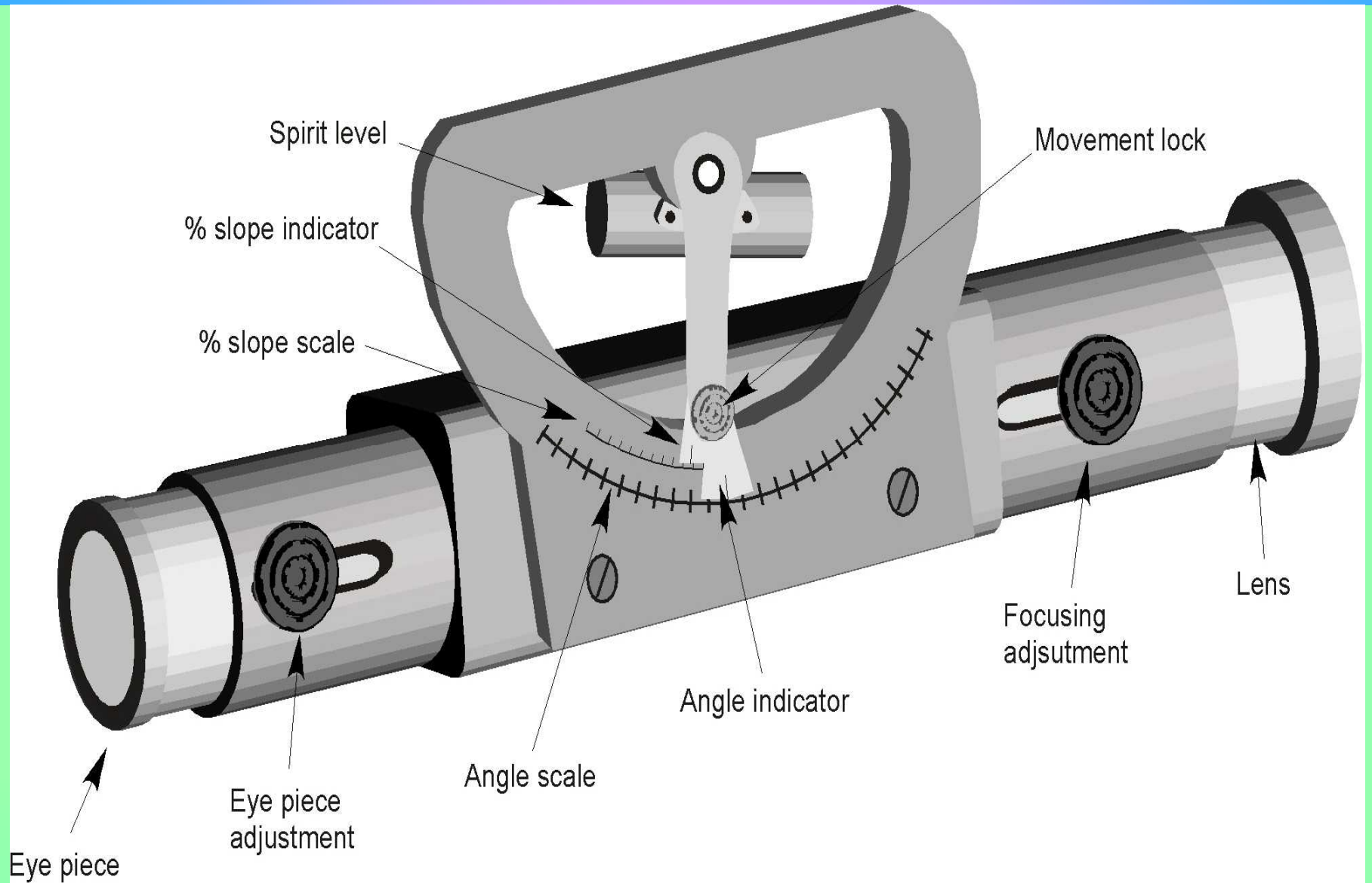
## Hand level

This is the simplest type of hand level. It is useful for estimating slope & elevation changes.

This instrument is called the Abney level. It can be used to measure slope, vertical angles and stadia distances.

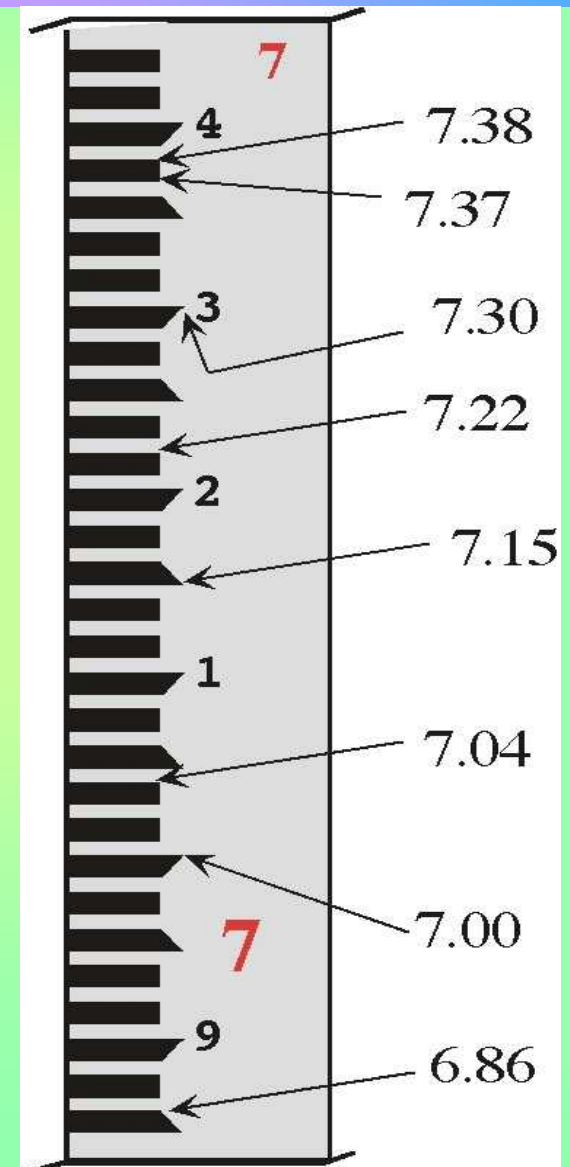


# Hand level



## Stadia Distance

- Measuring distance by stadia requires the ability to read a surveying rod.
- The Philadelphia style rod measures to 1/100 (0.01) feet.
- Red numbers are whole feet.
- Black numbers are 1/10's of a foot.
- Bars are 1/100's of a foot.

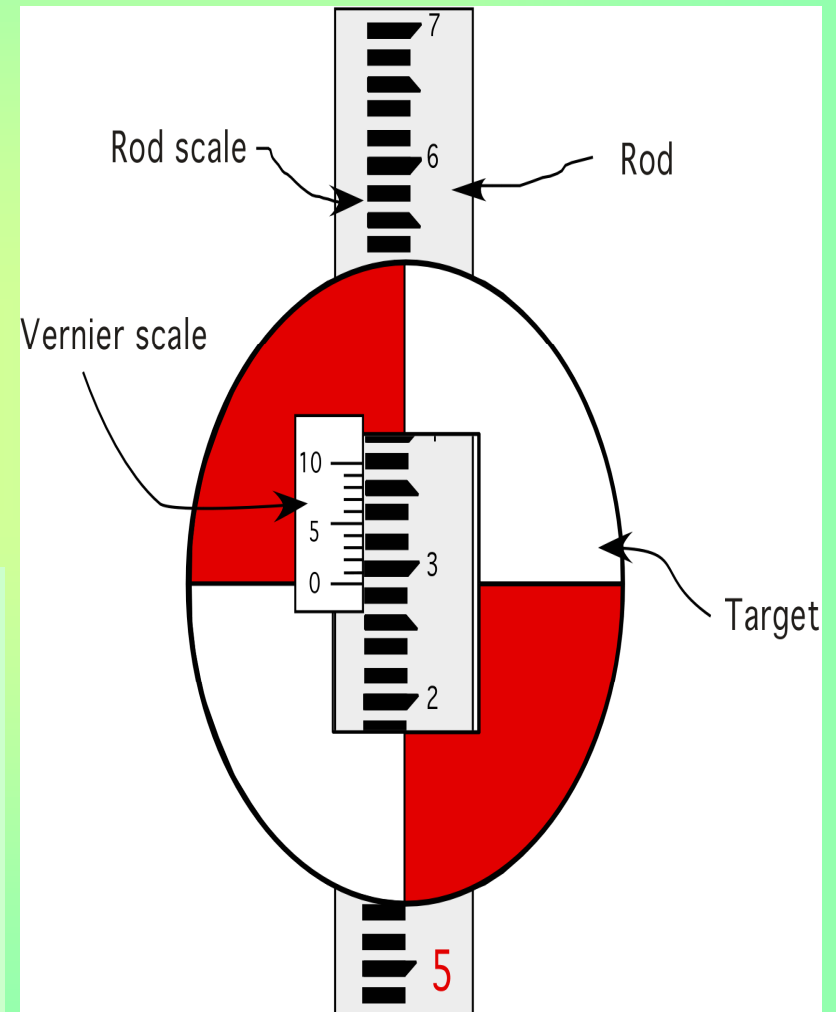


## Rod with Target

The use of a target improves the accuracy of the readings and increases the readable distance between the rod and the instrument.

A rod with target can be used four ways.

1. Direct read
2. Indirect read
3. High rod
4. Extended rod



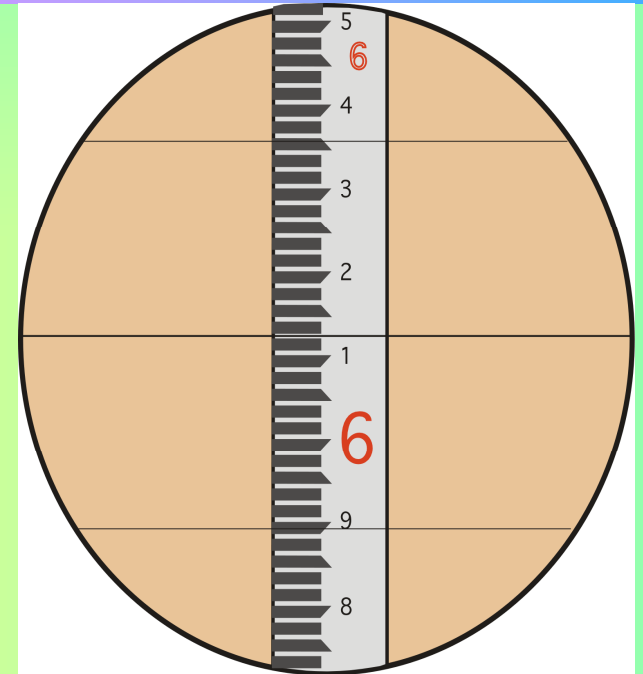


## Distance by stadia

Top Stadia Cross hair

Elevation Cross hair

Bottom Stadia Cross hair

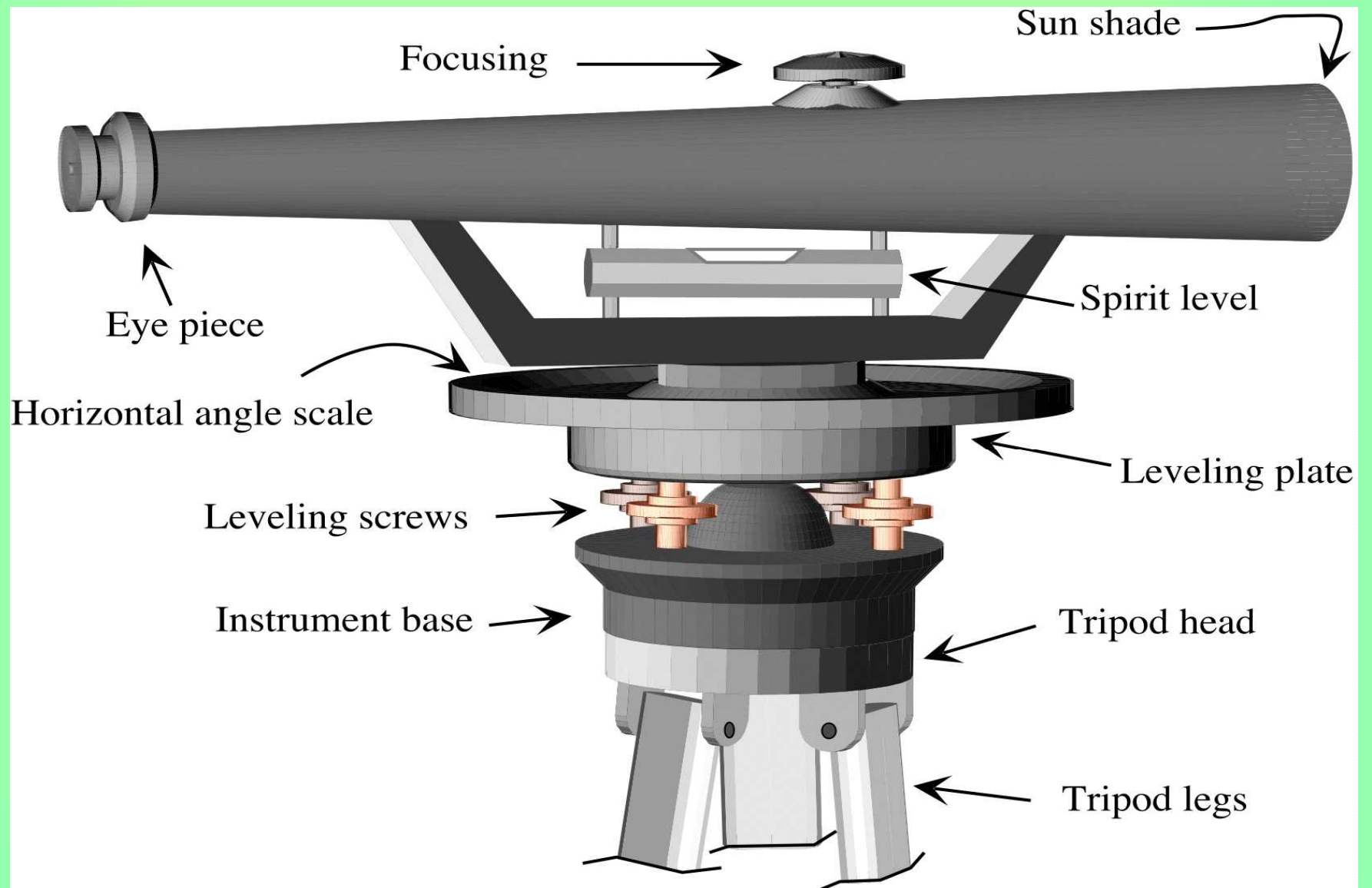


$$\text{Distance} = (\text{TSR} - \text{BSR}) \times \text{SF}$$

What is the stadia distance for the illustration?

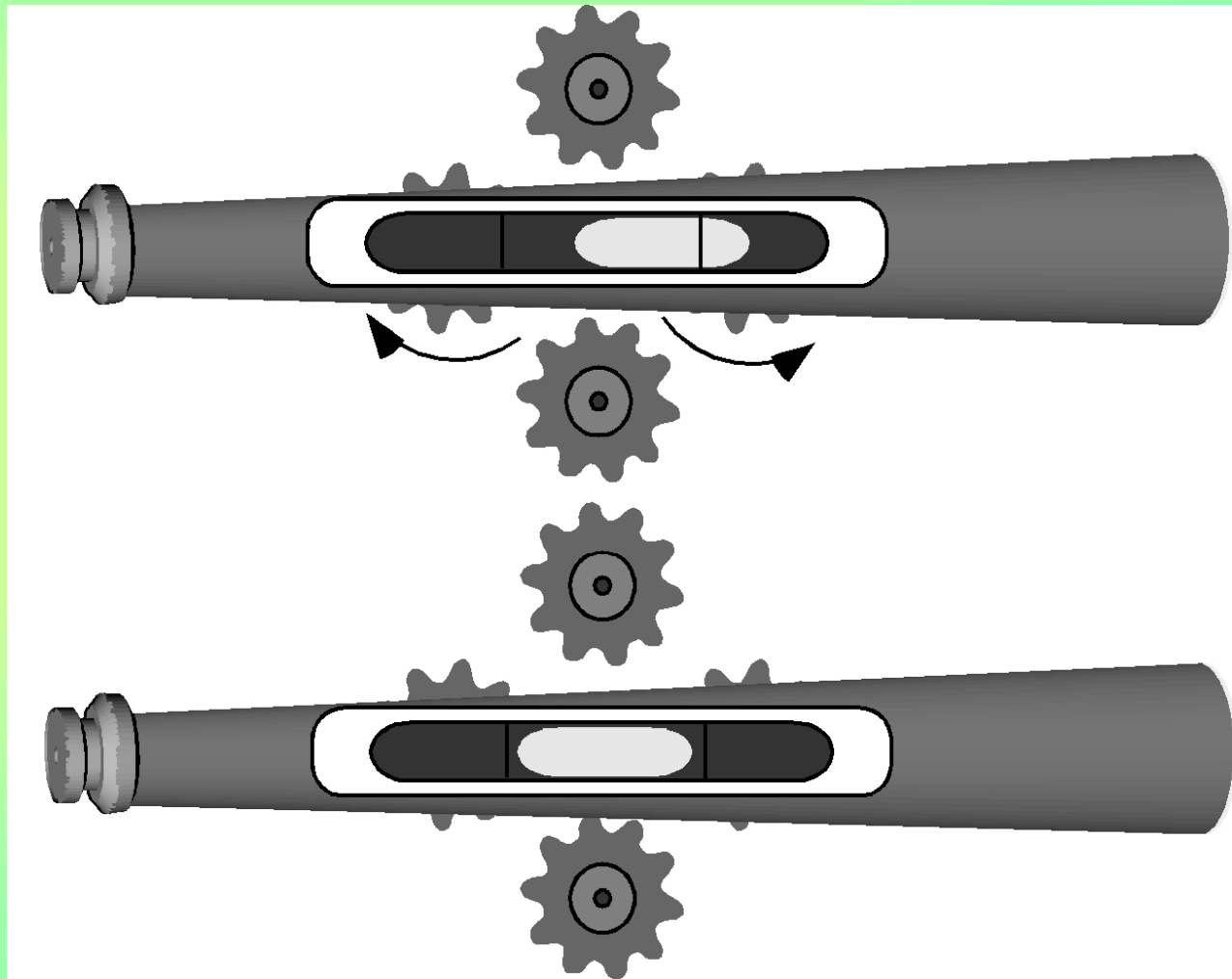
47 ft

# Dumpy (Wye) Level



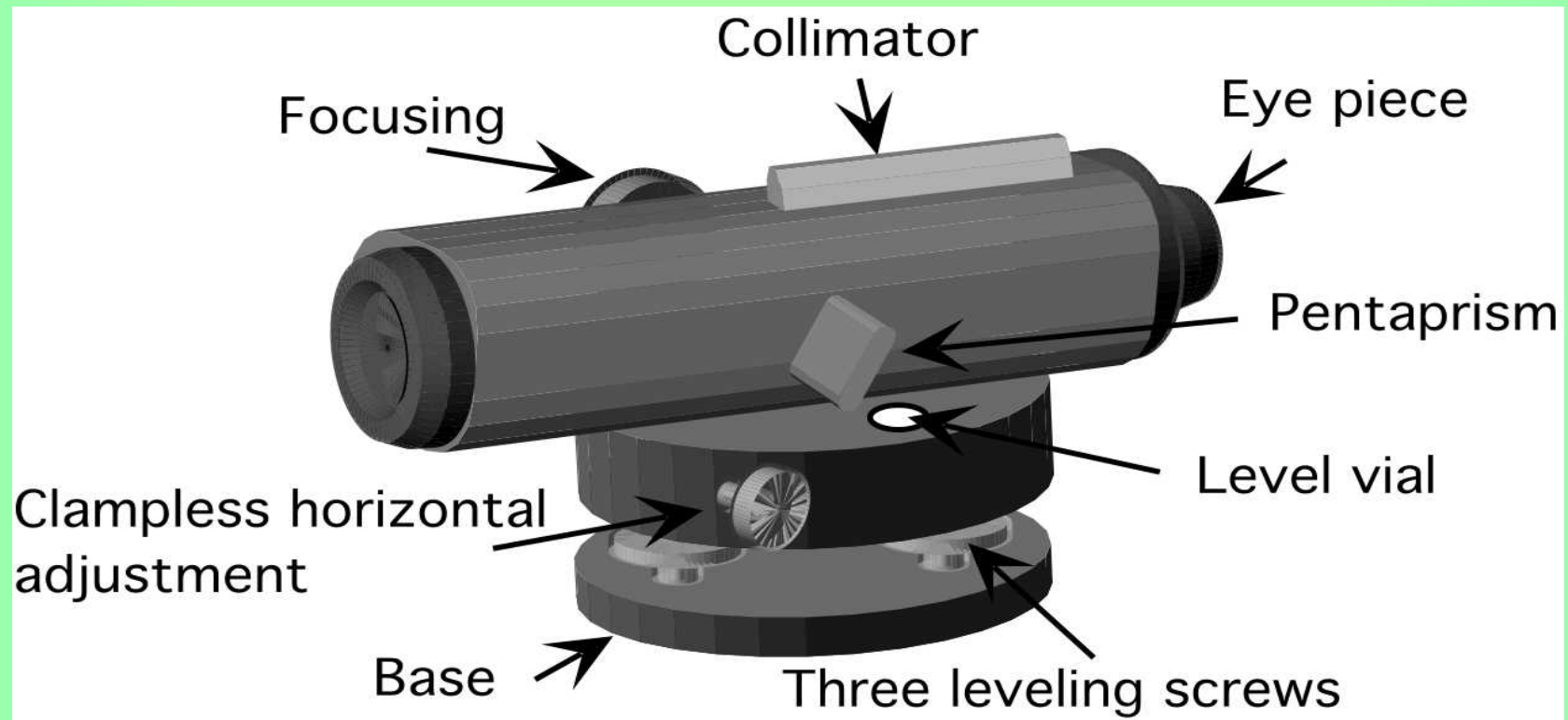
## Leveling a four (4) legged instrument

Left thumb  
rule



Note: The spirit level has been moved on top of the telescope for illustrative purposes.

# Automatic Level



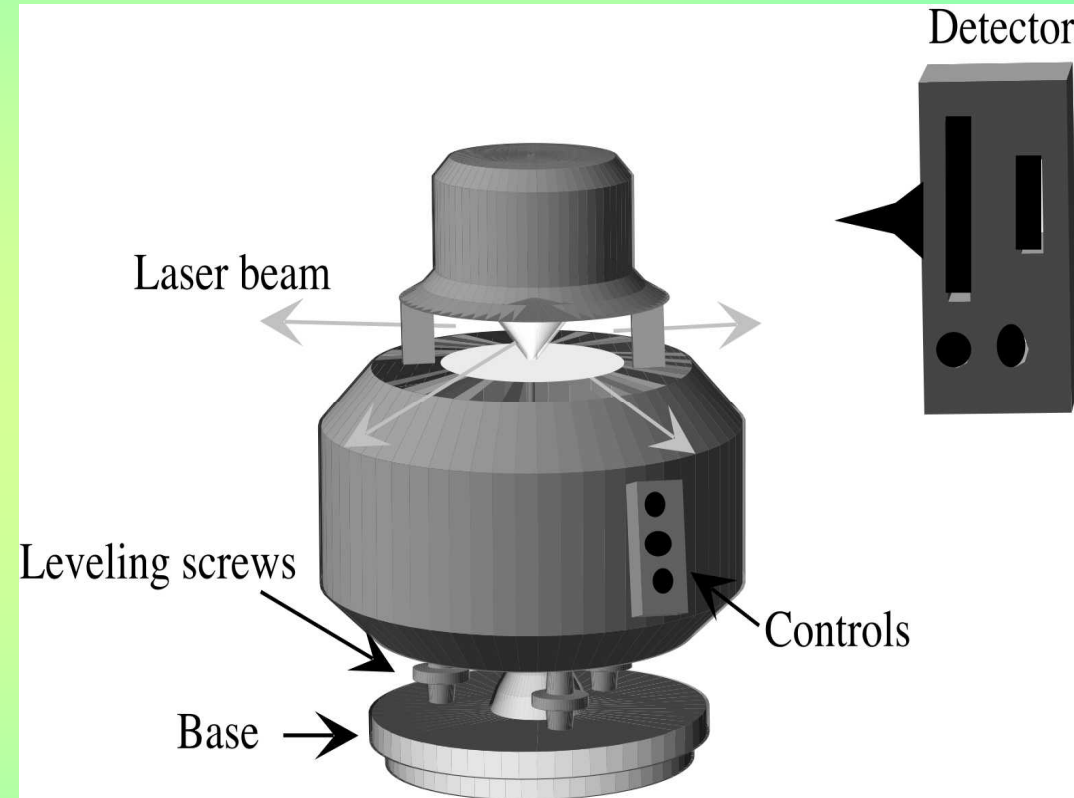
Automatic levels get their name because one of the internal lenses is mounted on a pendulum.

All the operator must do is get it close to level.

## Laser Level

The primary options for survey quality laser levels are:

- ❖ Visible or non-visible
- ❖ Rotating or non-rotating



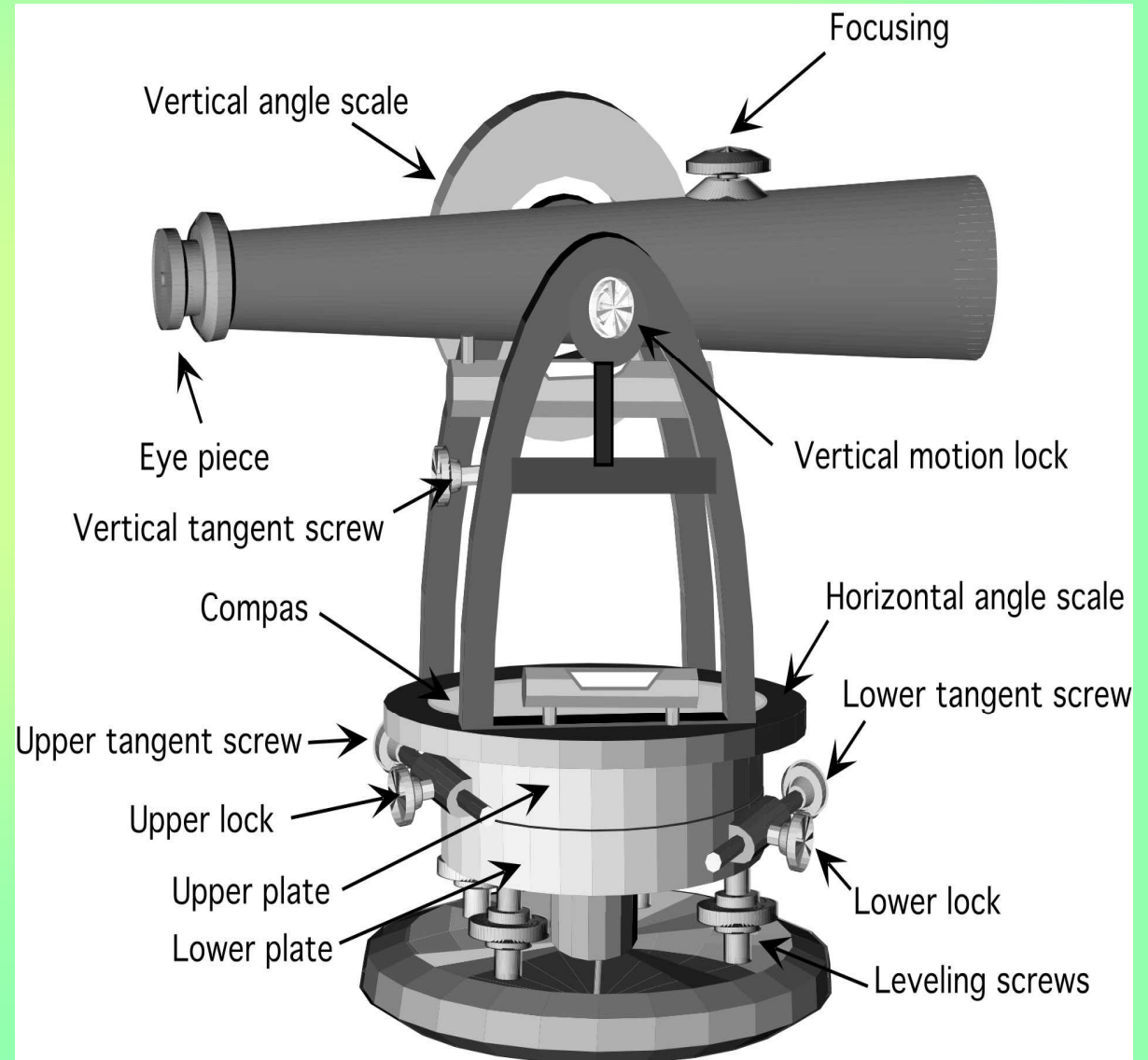
The one we use is non-visible, non-rotating.

# Transit

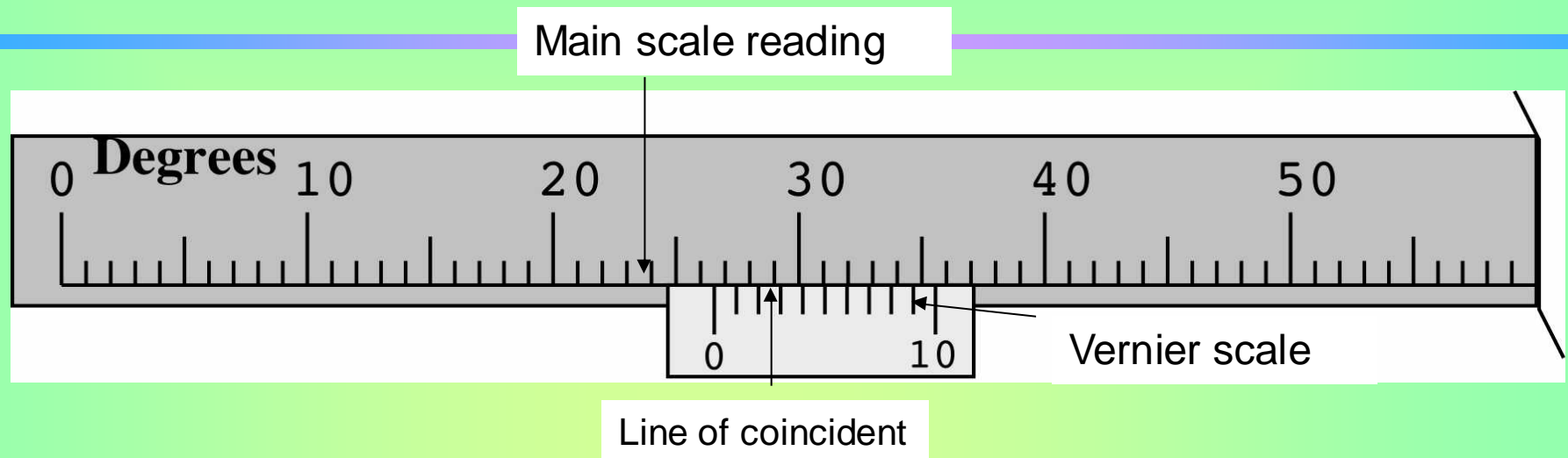
Transits are the most versatile instrument.

They are also the most complicated.

Most have been supplanted by total stations.



## Vernier scale



Mechanical instruments use Vernier scales to improve the precision of the instrument.

The Vernier scale divides the last unit on the main scale into another set of fractional parts.

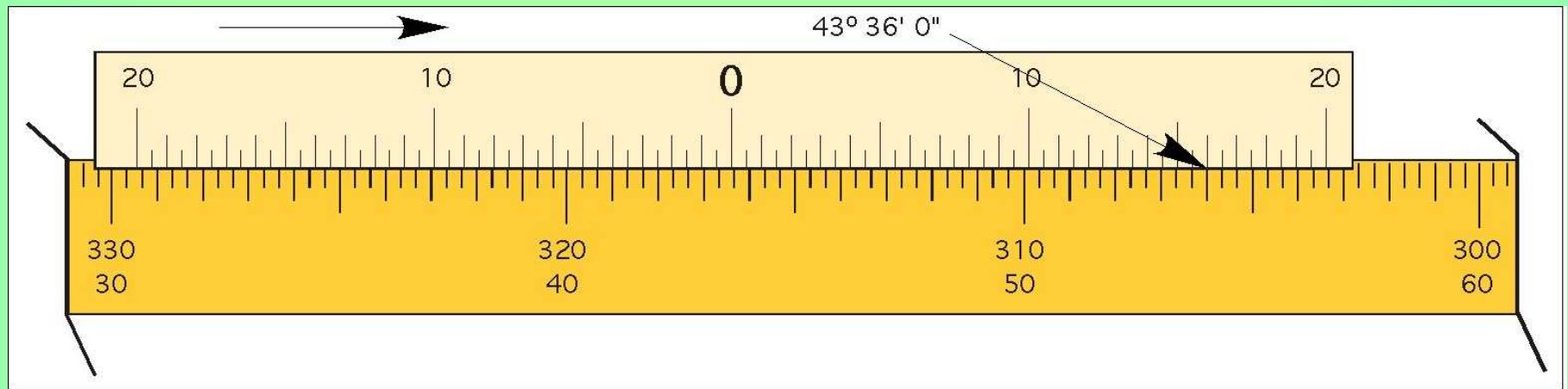
The main scale is read at the zero (0) on the Vernier scale.

The Vernier scale is read at the line of coincident.

What is the reading for this Vernier scale?

26.5°

# Double Vernier Scale



The double Vernier uses the same steps.

When reading a double Vernier you must determine which side of the Vernier should be read.

This is determined by the direction of rotation of the instrument.

**[Note: the Vernier scale rotates]**

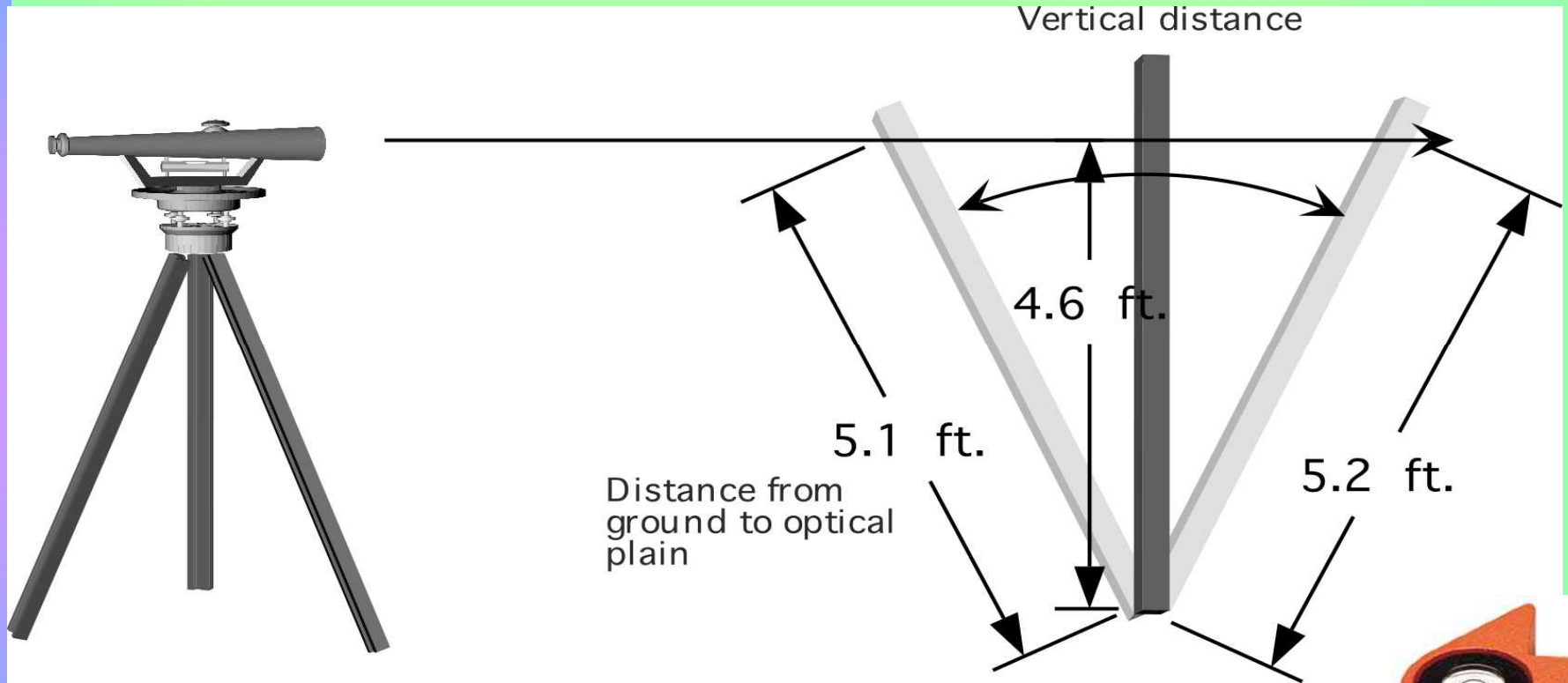
Clockwise rotation (right turned) = Left side

Counter clockwise rotation (Left turned) = Right side



# Rocking the rod

Surveying-I



Rocking the rod should be used when a rod level is not available.



# Additional Equipment

Surveying-I

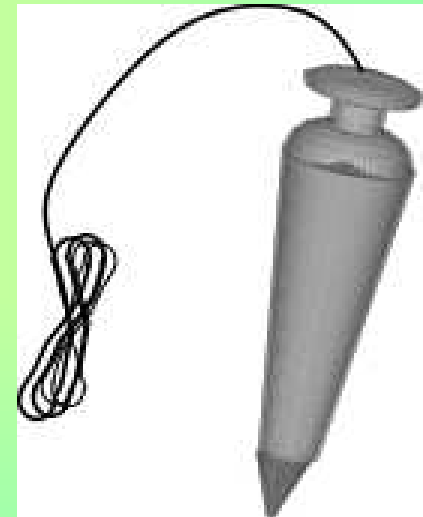


Range pole

Surveyors nail



Plumb Bob



Thanks