

# Modern Surveying Instruments

*Vedprakash marlapalle*

# Modern equipments

- EDM – Electronic distance measurement equipment.
- Electronic theodolite.
- Total station.

- By the 1970's, relatively small, lightweight and easy-to-use electronic distance measuring devices, called **EDM's** were in use.
- The advance of technology and miniaturization of electronic components enabled the building of theodolites that measure angles electronically, called **Electronic Theodolite**
- Combination of an electronic theodolite and electronic distance meter, and software running on an external laptop computer known as a data collector, called **Total Station**
- **The Global Positioning System (GPS)** was designed for military applications. Its primary purpose was to allow soldiers to keep track of their position and to assist in guiding weapons to their targets
- A computerized data base management system for capture, storage, retrieval, analysis, and display of spatial data, called **GIS**

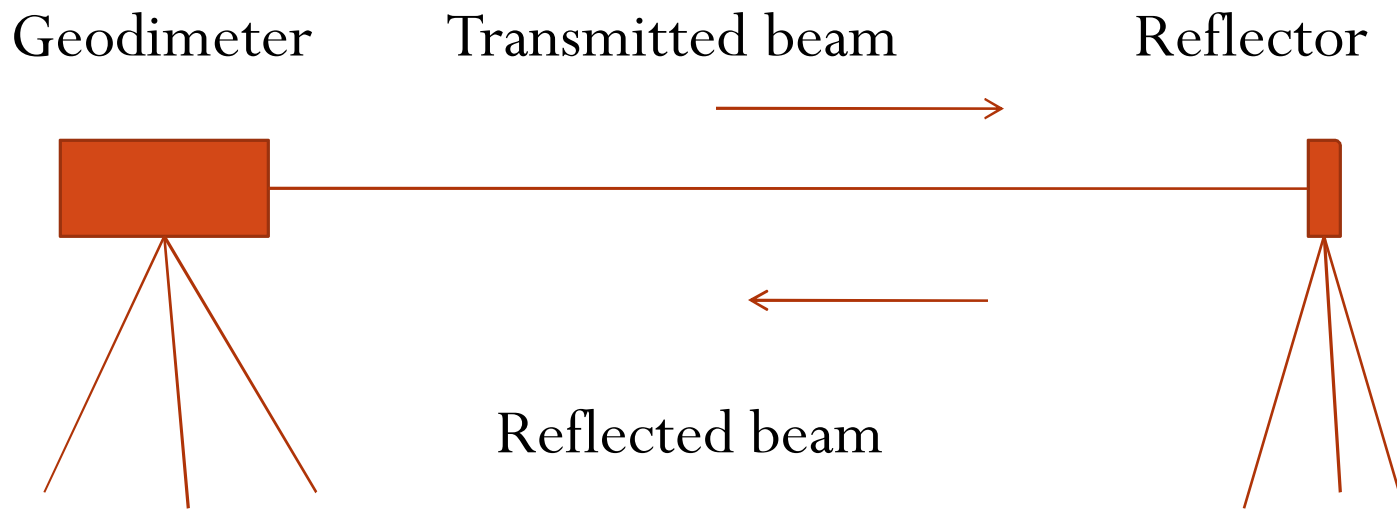
# EDM

- Measurement of distance is accomplished with a modulated microwave or infrared carrier signal, generated by a small solid-state emitter within the instrument's optical path, and bounced off of the object to be measured. The modulation pattern in the returning signal is read and interpreted by the onboard computer in the EDM. The distance is determined by emitting and receiving multiple frequencies, and determining the integer number of wavelengths to the target for each frequency.

# Principle

- In EDM the beam of light is the carrier and which is reflected back from mirror located at the other end. Such instrument are less expensive because one active instrument and battery are only needed at one end and instrument at other end is simply a reflecting mirror centered over ground centre mark

# Principle



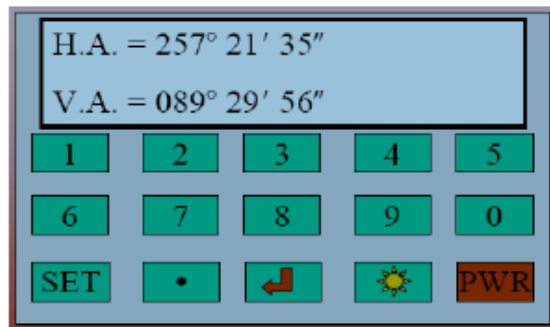
# Hand held EDM

- Very handy
- Cheap
- Can be used with accuracy of 10mm or so
- Rapid measurement
- Long range
- High accuracy
- Measurement of moving target



# Electronic Theodolite

- For precise surveys the vernier theodolites are replaced by modern theodolites such as optical and electronic theodolites.
- The electronic theodolites have optical system to scan both horizontal and vertical circles and display them digitally on a screen





# TOTAL STATION

- **Basic Principle**

A total station integrates the functions of a theodolite for measuring angles, an EDM for measuring distances, digital data and a data recorder. All total stations have similar constructional features regardless of their age or level of technology, and all perform basically the same functions.

# Basic principle of total station

1. These instruments are measuring the distances of prism poles mounted with prisms with the help of Laser beam or Infrared rays.
2. These signals are emitted by the instrument EDM and reflected back to instruments by the prism mounted on the prism poles.
3. The time interval between emission and reception helps to calculate the distance as the speed of these signals are precisely known.  $D = (t/2) \times v$   
D-Distance, t-Total time taken, v-Velocity

# Features:-

- Total solution for surveying work,
- Most accurate and user friendly,
- Gives position of a point (x, y and z) w. r. t. known point (base point),
- Measures distance and angles and displays coordinates,
- EDM is fitted inside the telescope,
- Digital display,



- On board memory to store data,
- Compatibility with computers,
- Measures distance and angles and displays coordinates,
- Auto level compensator is available,
- Can work in lesser visibility also,
- Can measure distances even without prismatic target for lesser distances,
- water proof,
- On board software are available,
- Can be used for curve layout after feeding data.

## **Total Stations can be used for:**

- General purpose angle measurement
- General purpose distance measurement
- Slope measurement
- Provision of control surveys
- Contour and detail mapping
- Setting out and construction work

- Angular accuracy up to 1”
- Distance measured with laser up to 2 KM
- Distance measured with infrared rays up to 4 KM.( with single prism)
- Capable of storing up to 20,000 points.



# Components of a Total Station

- EDM
- Electronic theodolite
- On-Board Micro-processor
- Data Collector
- Data Storage
- Prisms



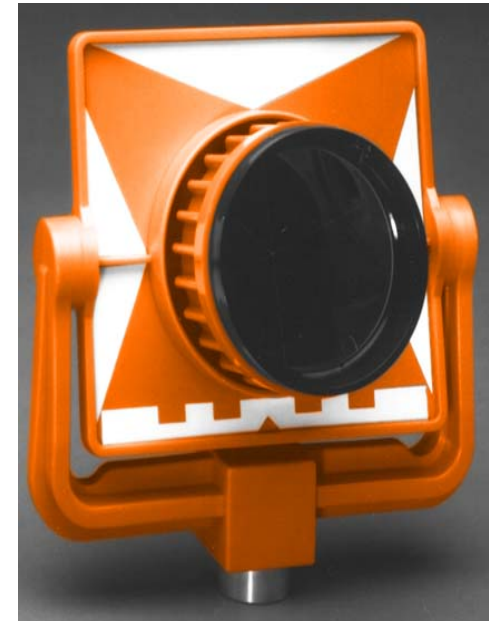


# Micro-processor

- **Averages** multiple **angle** measurements
- **Averages** multiple **distance** measurements
- Computes **horizontal** and **vertical distances**
- **Corrections** for temp, pressure and humidity
- **Computes** all the X, Y and Z **coordinates**

# Specifications

- **Range**  
Reflector less : 3 – 70 meters  
Single Prism : 1 – 3000 m
- **Accuracy**  
Angles : 1'' - 5''  
Distance : 3mm (with prism)  
          :4mm (with out)
- **Data Storage : 5000 points**



## **Advantages of Total Station over Conventional instruments:**

- Traditional survey methods are laborious and time consuming
- Fully automatic electronic measurement
- Digital display of staff reading and distance
- Data storage in instrument possible
- Direct transfer to personal computer of data stored in instruments
- Online operation through integrated interface to computer

## Disadvantages

- Total stations are dependent on batteries and electronics. The LCD screen does not work well when it is cold.
- Battery life is also short, batteries and electronics both do not work well when wet.
- Loss of data is an important consideration.

Recent developments  
include a GPS unit with the  
total station  
Fully integrated data storage  
and data processing, Bluetooth  
data transfer or GPRS



**THANKS FOR YOUR PATIENCE  
HEARING.....**

