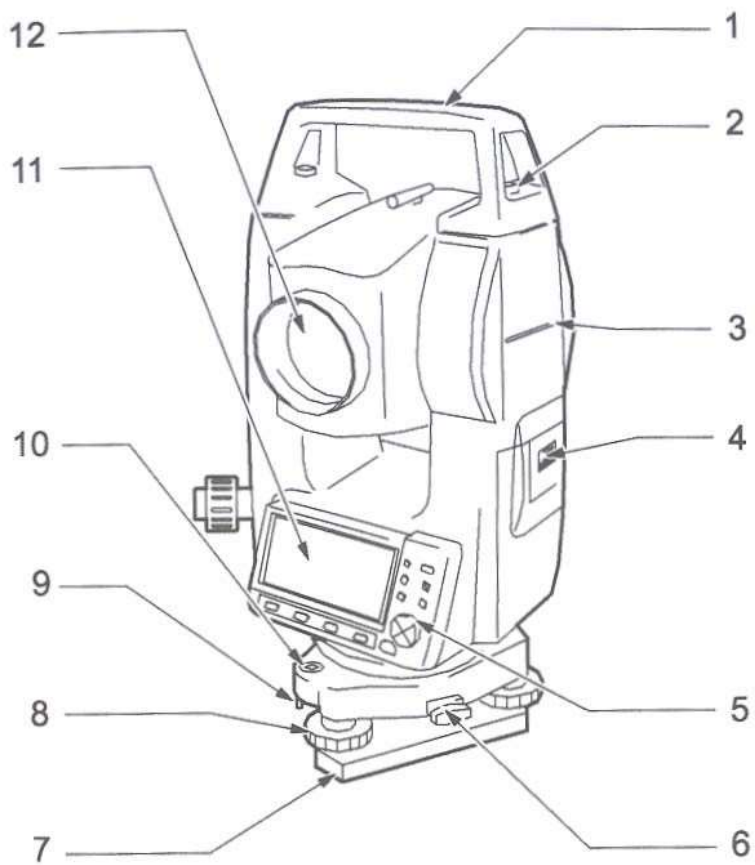
# CE8351 SURVEYING

# TOTAL STATION SURVEYING


**Pentax R300 TS**

**Pentax Reflector prism**

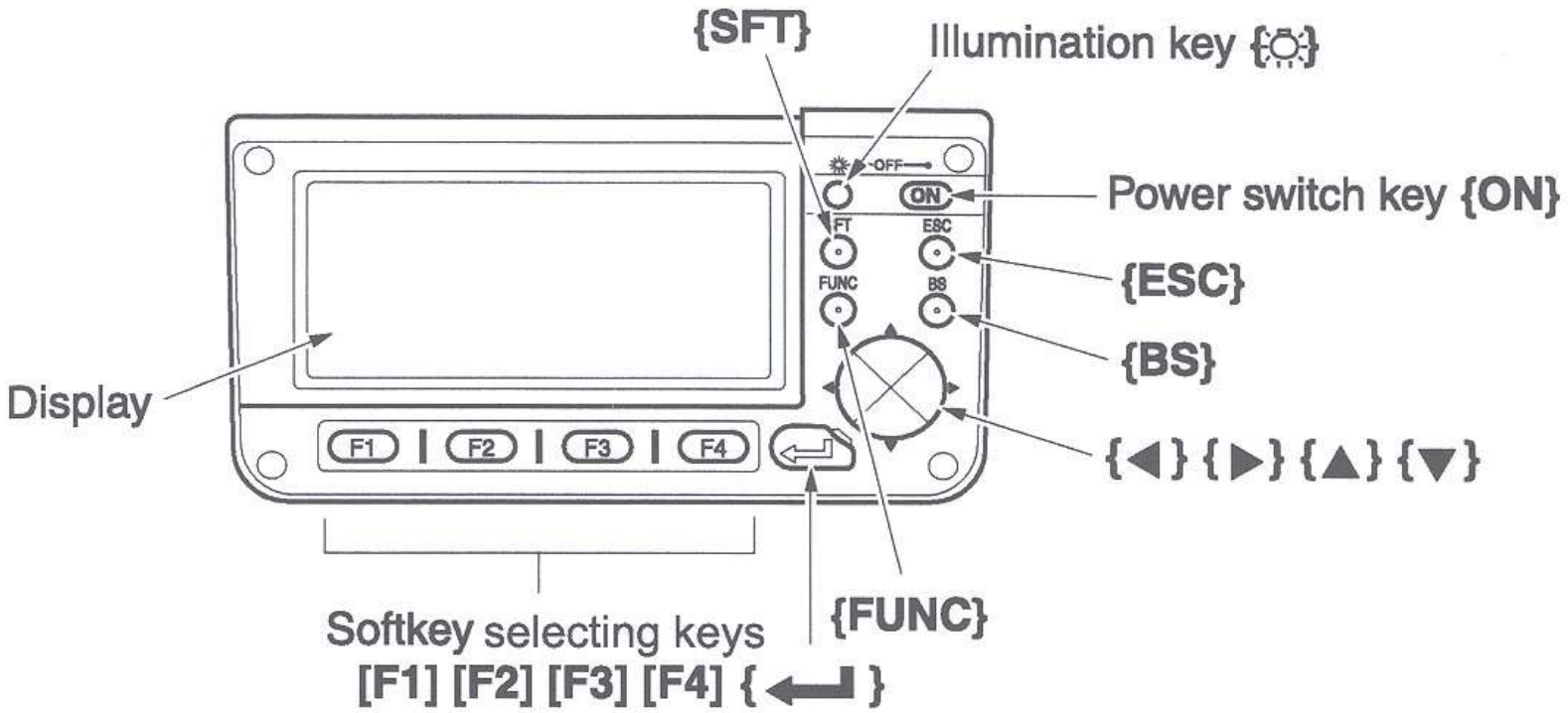
# Parts of the SET Total Station




1 Handle
2 Handle securing screw
3 Instrument height mark
4 Battery cover
5 Operation panel
6 Tribrach clamp (SET310S/510S/610S: Shifting clamp)
7 Base plate
8 Levelling foot screw
9 Circular level adjusting screws
10 Circular level
11 Display
12 Objective lens

# Sokkia SET 550 Total Station Keys/Screen

☞ "5.1 Basic Key Operation"



# PURPOSE

- **IT IS PROCESS OF DETERMINING EARTHEN FEATURES AND RECORDING ITS RELATIVE POSITION ON TO THE PAPER**

# Types of surveying

Traverse survey
Triangulation survey
Plane table survey

Which includes:

1. Linear Measurements
2. Angular Measurements
3. Height Measurements

## Linear measurements we usually do with:

chain

Tape

Substance bar

EDM (Electronic distance measurement instrument)

GPS (Global Positioning System)

## Angular measurements we usually do with:

Compass

Theodolite

## Height we usually do with:

Dumpy level

Auto level

Theodolite & Digital leveler

# Advantages of Digital levels:

- Fatigue-free observation as visual staff reading by the observer is not required.
- User friendly menus with easy to read, digital display of results.
- Measurement of consistent precision and reliability due to automation.
- Automatic data storage eliminates booking and its associated errors.

Automatic reduction of data to produce ground levels, thereby eliminating arithmetical errors.

- Fast, economic surveys resulting in saving in time (up to 50% less effort has been claimed by manufacturers)
- Data on the storage medium of the level can be downloaded to a computer enabling quick data reduction for various purposes.

# Capabilities of Digital levels

- measuring elevation
- measuring height difference
- measuring height difference with multiple instrument positions
- levelling
- slope setting
- setting out with horizontal distance

  levelling of ceilings

# Total station is a combination of :

EDM
Theodolite
Auto Leveler
Microprocessor with specific memory
Battery/spare
(which works about 5 working hours)

About 100 models were released till now by different firms.

# Basic components of Total station

- Prism reflector:

  It is a combination of ranging rod, staff and and optical cuboidal mirror.

  Adjustable height from 1.5m to 3.75m.

  More number of prisms, will give more accuracy.

- GUN: data screen LCD
  eye piece
  telescope 24x to 43x
  environmental box
  microprocessor with memory card of 1 or 2 GB capacity
  1MB can store 800 points.
- Tripod: with different material
  Aluminum tripod weighs 13 to 14lbs
  Wooden tripod will be about 18 lbs.
- Optical and Laser plumb bobs.
- Battery –as an external attachment with indicators
  1.5hours charged battery can work for 3 to 5 hours

## ACCURACY OF TOTAL STATION

**More accuracy can be achieve by :**

1. Careful Centering
2. Accurate pointing target
3. Average of multiple points
4. Better optical lense
5. Strong Tripod
6. Verticality of prism pole

1. Angular accuracy is from 1 to 20 Sec.
2. Linear accuracy is from 2mm to 10mm/per KM
3. Different instruments have different accuracy

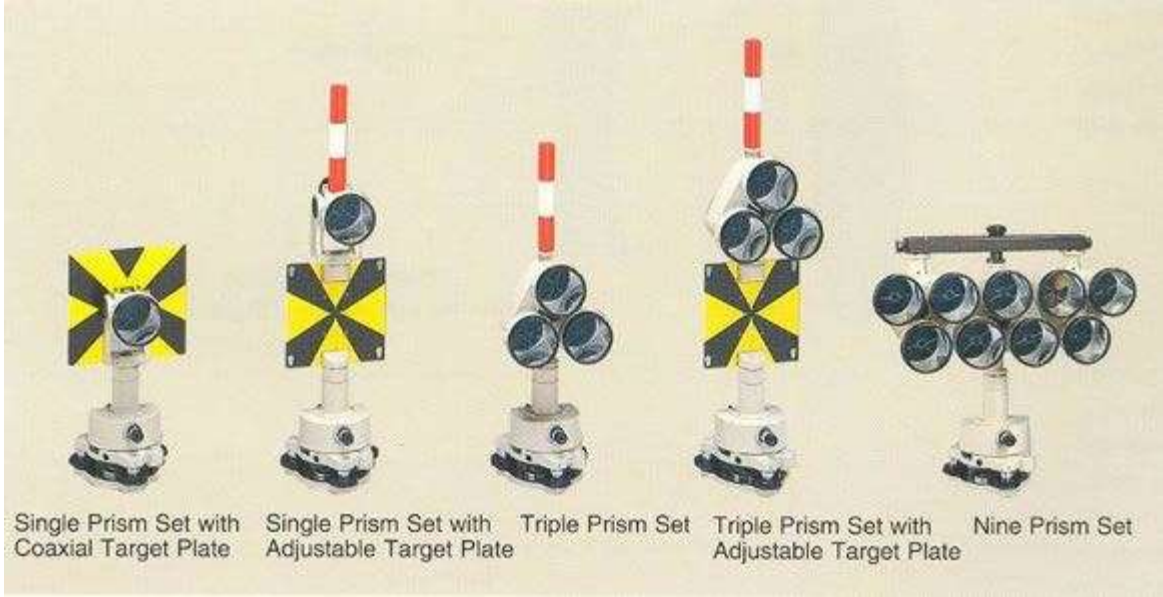
| | Angular | Linear | |
|---|---|---|---|
| | | With 1 Prism | With 3 prisms |
| NIKON | 1 Sec | ± 2 mm | ± 1 mm |
| LIEKA | 1 Sec | ± 2 mm | ± 1 mm |
| SOKKIA | 1 Sec | 2 mm | ± 1 mm |

**Accuracy varies with Price**

**Distance measure with:**

1. Single Prism – up to 2.5 Km
2. Two prisms - 5 to 7 Km
3. Three prisms - 10 to 12 Km

# Target with prism

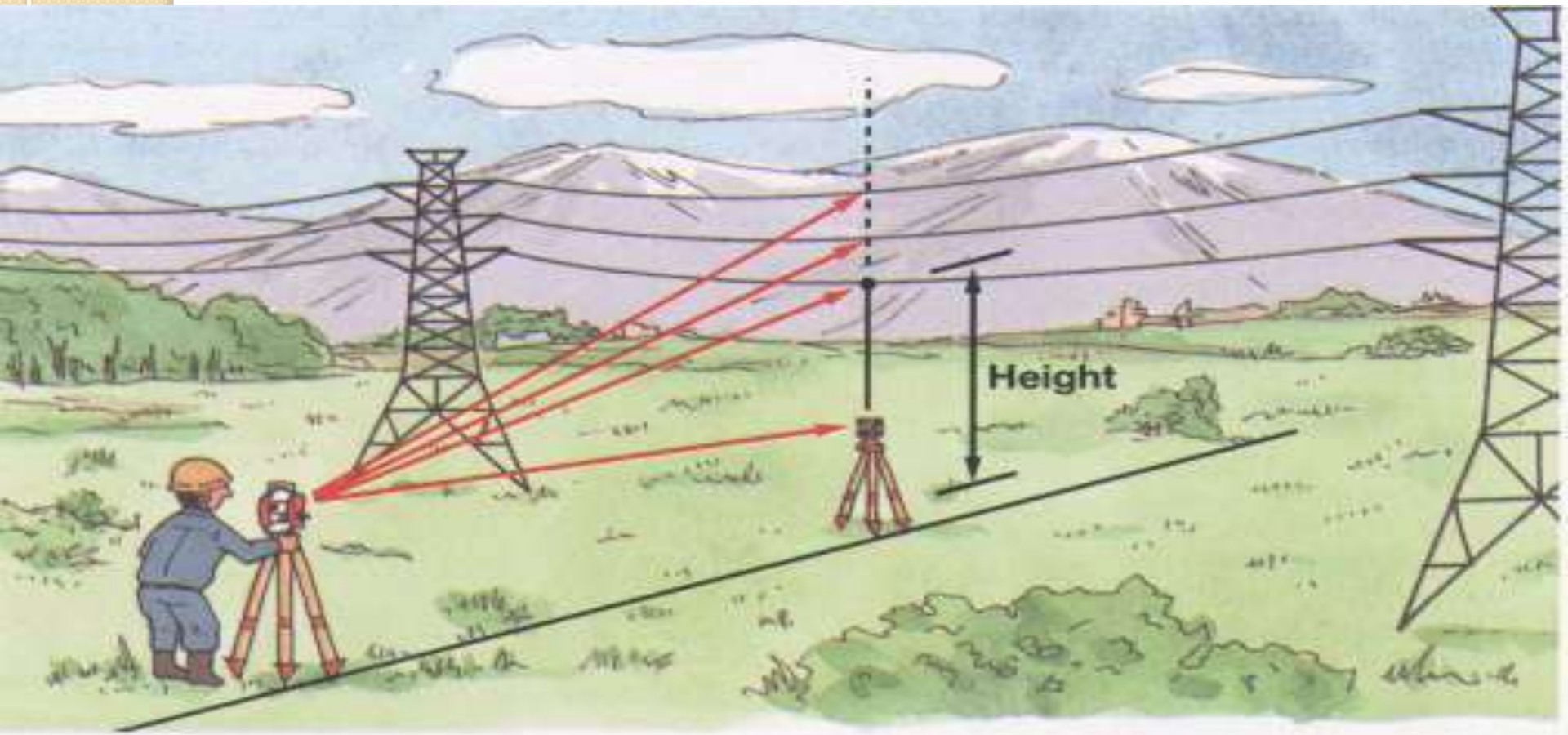


# Functions of T.S:

1. It simultaneously measures angles & distances and Record
2. Correcting the measured distance with:
    1. Prism constant
    2. Temperature
    3. Curvature of earth
    4. Refraction correction
3. Computing the point elevation
4. Computing the coordinates of every point
5. Remote elevation measurement
6. Remote distance measurement
7. Area calculations
8. Data Transferring facility from instrument to S/W and S/W to instrument
9. Format of conversion of units

# REM

Remote Elevation Measurement

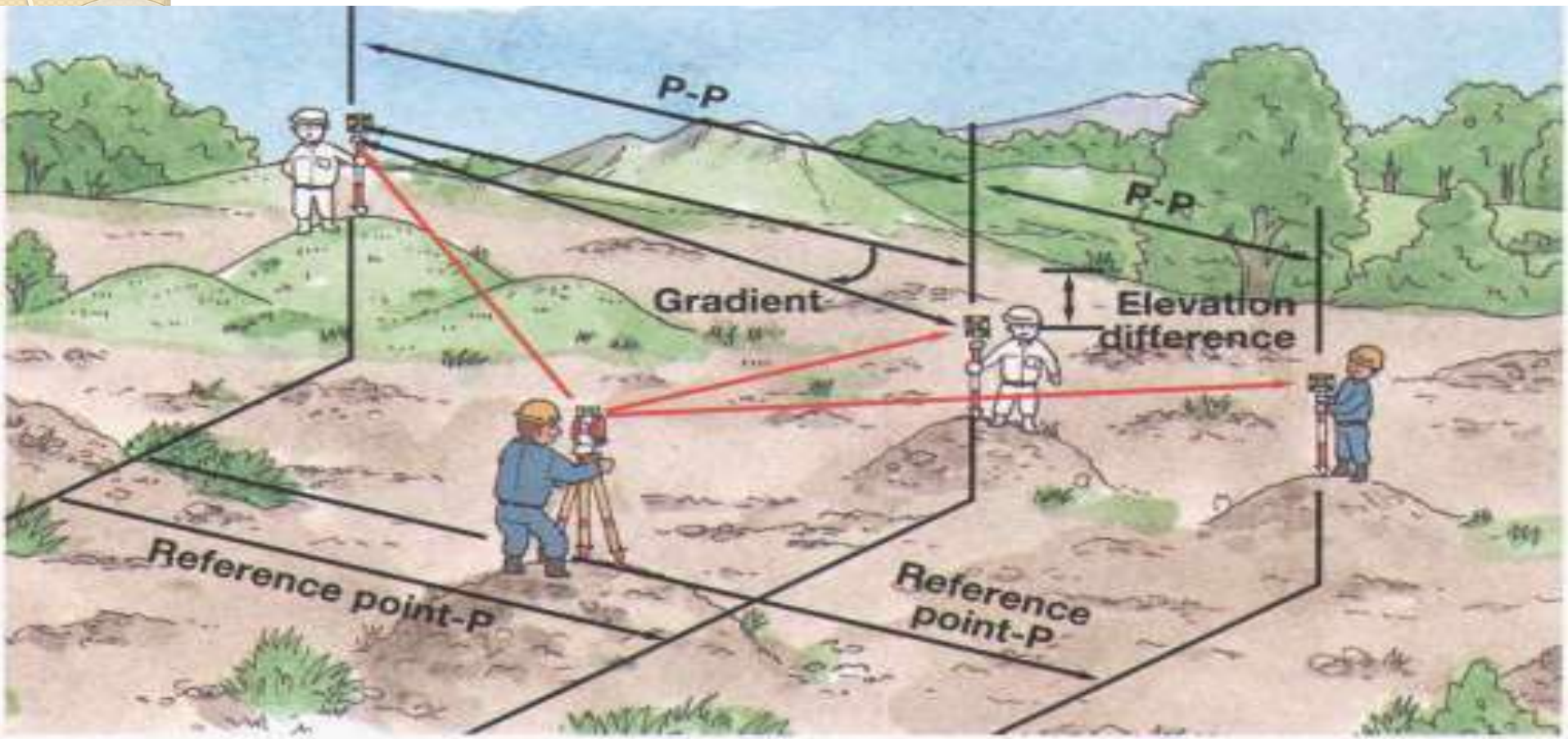



## REM

With REM measurement, a Prism (reference point) is set directly below the place to be measured, and by measuring the Prism, the height to the Target object can be measured. This makes it easy to determine the heights of electric power lines, bridge suspension cables, and other large items used in construction.

# RDM

Remote Distance Measurement




## RDM

With RDM measurement, the horizontal distance, slope distance, difference in height and percentage of slope between the reference point and the observation point are measured. The distance between one observation point and another one is measured as well.

## Application of Total station:

1. Updating mapping
2. Topographic survey
3. Hydrographic survey
4. Cadastral survey
5. Project construction survey
6. Road, Rail Survey
7. Mining survey

# Operations involved while using Total Stations

1. Establishing the site Datum:
   a) Selecting the site Datum
   b) Establishing North

2. Setting up the Total station:
   a) Placing and leveling Tripod on Datum
   b) Placing and leveling the Gun on Tripod
   c) Linking the data connector to Gun

3. Data collector options and setting
   a) Main menu
   b) Basic settings

4. Creating and Operating Job files:

a) Creating a new Job file

b) Opening an existing file

5. Shooting points

a) Identifying the important points to shoot

b) shooting points

c) Shooting additional points

d) Noting the special features

6.Post Processing – Data downloading, conversion

7.Plotting/Map generation.

# Computer software packages

The following post processing computer software packages are in use for various engineering applications.

1. Arc Pad, arc view, arc info
   -conversion from raster to vector form

2. Micro Station - Map generation

3. Erdas – Image processing s/w

4. Surfer, Auto plotter, Civil cad, Pythagarus
   – preparation of contours

5. Survey aid – to draw c/s

The information received is to be analyzed depending on the users requirement.

# Limitations:

1. It is not a Rugged instrument (Sensitive).
2. Prism verticality is questionable.
3. Visibility is must.
4. More Expensive.
5. Requires calibration at every six months.
6. Amount of error is greater at short distances.
7. Height of instrument and prism is to fed.
8. Awareness on battery maintenance.
9. To establish north- compass is required.

# SAFETY PRECAUTIONS

1. Focusing directly at the sun, can result - loss of eyesight on the spot. Use a filter when observing the sun.

2. Never remove the hand grip carelessly. If the grip is loosely or incompletely attached, the instrument could fall and may cause a serious injury.

3. Make sure not to short the battery terminals. If these are shorted, the resulting high current would not only damage to the battery, but also start a fire.

4. If the instrument or battery comes in contact with water, wipe it off as quickly as possible and set it in a dry place for a while. When it is completely dry, put it back in the case.

5. Never disassemble the instrument, if you find a problem. Contact the dealer.

# HOW TO SUPERVISE THE TOTAL STATION WORK

- Have keen observation on the prism boy's attitude. When high precision is required, use the prism tripod, to avoid human error.
- The position of prism shall always be on hard surface instead of soft soil.
- Focusing shall be exactly at the centre of prism, with the help of cross hairs and prism plate.
- While measuring the instrument height and prism height, enough attention shall be diverted. Also, have keen observation while entering the above data.
- Note the location and coordinates of station point and back sight so that specified intermediate points can be checked at later date.
- Obtain a soft copy of field work raw data from the survey agency so that the results can be checked at any time.
- Obtain more number of points to get an average.

# Thank You