



- Theodolite is used to measure the horizontal angles and vertical angles.
- Electronic Distance measurement [EDM] is a surveying instrument that uses infrared or laser beam to measure the distance from the source point to a defined target point.
- Total station:- Total station is the combination of theodolite and EDM
- It can perform all activities like measuring horizontal angle, vertical angle, distance between two points and height of objects.
- It is the most advanced surveying instrument which is widely using because its error is $\pm 5\text{mm}$
- The least count for the total station is 1mm and $1''$.
- It is a componental framed instrument which consists of triangular base, three foot screws, horizontal lock and vertical lock

targeting piece, telescope and various types of bubbles to level the instrument.

Aim:- To study various parts of total station and practicing setting up ,levelling up and elimination of parallax error .

Objective:-

1. TO state the different parts and their working of total station
2. TO set out the total station then carried out centring and levelling.
3. TO observe angles and distances.
4. TO record the coordinates for transverse survey
5. TO link up the field data collected by total station with then to computer .

Instrument preparation:-

1. Place the instrument and put the battery
2. Centring the instrument.

3. Level the instrument.
4. Focussing the instrument.
5. POWER ON, OFF and tilt adjustments.
6. Indexing the vertical and horizontal surfaces.

Operations carried out:-

- To next parameter - downward arrow (↓)
- To previous parameter - upward arrow (↑).
- To change mode of measurement - (SFT) shift
- To provide brightness of laser - star (★)
- To select option & to open the option - Enter (ENT).
- Basic screen mode < Escape >
- To tilt laser < Backspace (B.S) >

Key and description:-

KBy

Description

1. power

ON/OFF power supply

1ST MENU OF INSTRUMENT

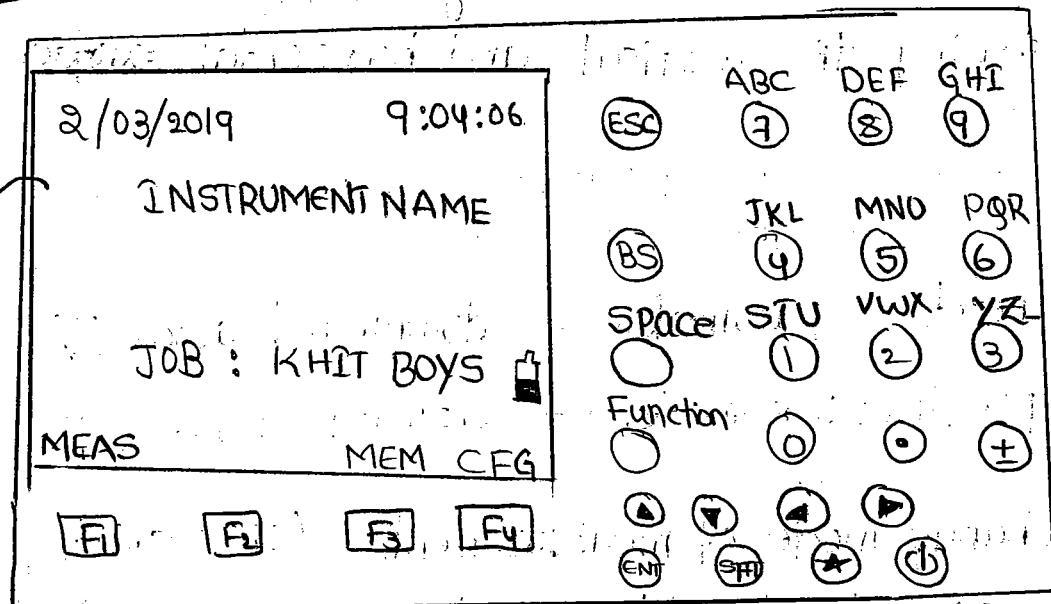


Fig.(1).

MEASUREMENT MODE

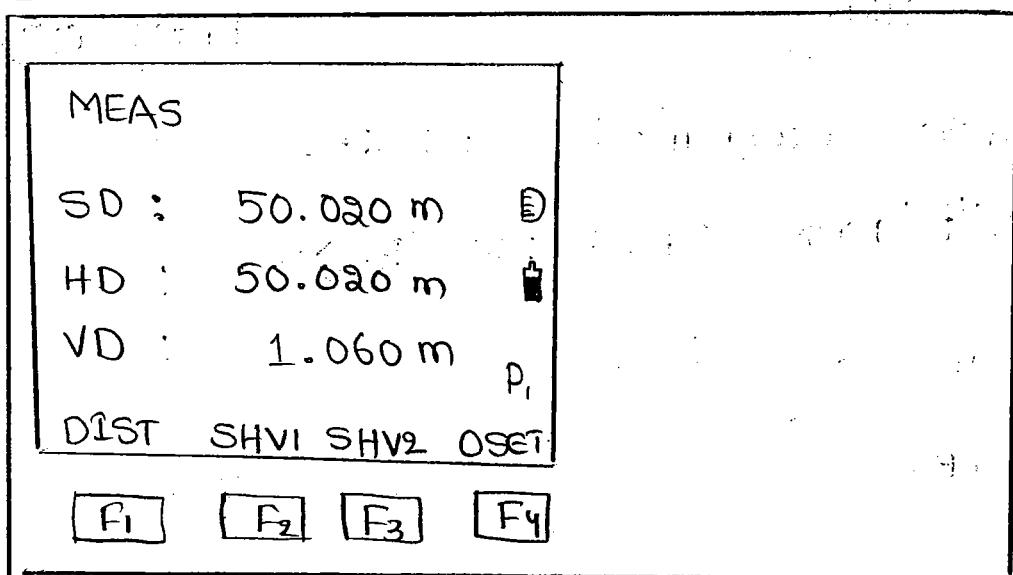


Fig.(2).



2. Escape [ESC]

- Written previous (B1) cancel an operation . . .

3. Enter [ENT]

- Assert the selected option or display the screen value .

4. Laser

- Displays the Laser plummet .

5. Numerics

- The numeric digits are present ^{to} beside the screen

6. Back space [BS]

- To provide screen bubble on screen and laser option .

DISPLAYKEY

→ In first menu. (Fig.1)

1. MEAS

F₁

By pressing F₁, we measure the distances in normal mode and Enter into MEAS mode .

2. MEM

F₃

- Pressing this key we are able to perform tasks on MEMORY Like Job select , Job rename , Job delete and Download etc .

3. CFG

F₄

- Change configuration .

2nd MENU

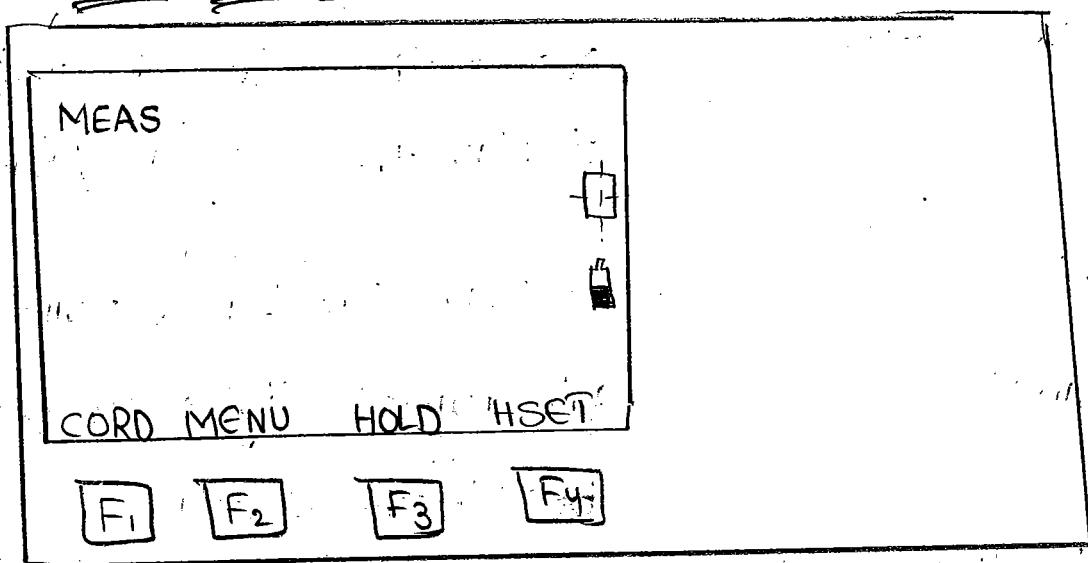


Fig.(3)

→ In MEAS mode, [figure (2)],

4. DIST → F₁ - measures the horizontal, vertical and slope distances

5. SHVI - F₂ } - Gives horizontal and

6. SHV2 - F₃ } - vertical angles.

7. OSET - F₄ - OFF set for given point.

→ AFTER Displaying 1st menu, press Function Key(Fund) [refer figure.(1)], figure (3) represents the 2nd MENU.

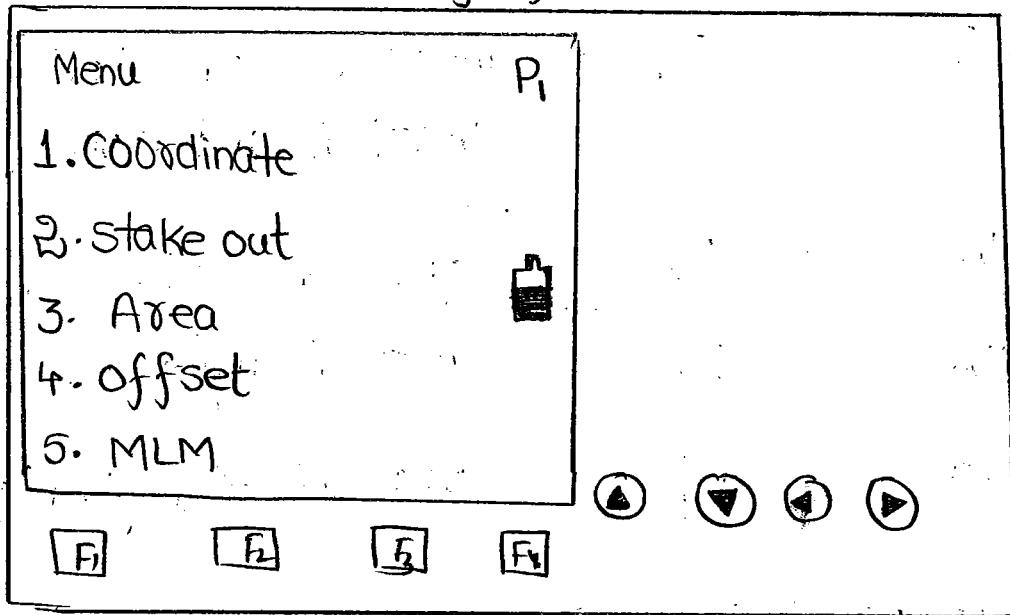
8. CORD - F₁ - Gives CORD

9. MENU - F₂ - Opens into menu which consists of coordinates, area, stakeout, OFFSET, MLM, REM and Resection etc.

10. HOLD - F₃ - Press this key twice retains the horizontal angle shown on the display.

MENU:-

Fig.(4).



press downward arrow (\downarrow), gives following
2nd menu of page 2.

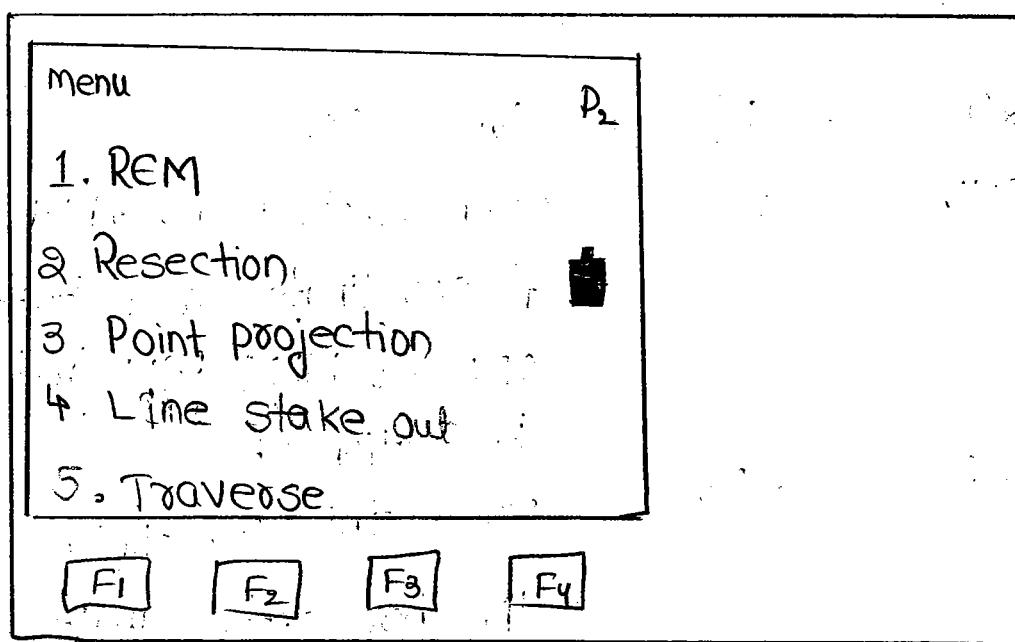


Fig.(5).

11. HSET - F₄ - gives horizontal set of extension angle

→ Go to second menu and press F₂ which ~~gives~~ opens the MENU which consists of various operations as shown in figure (4).

12. Coordinate - 1. - opens into another menu which is useful to read the coordinates

13. Stake out - 2. - open to into another menu which is used to find the position of known coordinates.

14. Area - 3 - used to calculate the area.

15. Offset - 4 - gives offset.

16. MLM - 5 - MISSING LINE MEASUREMENT useful to calculate the distance between inaccessible points.
∴ [figure(5)]

17. REM - 1 - Remote Elevation measurement is useful to calculate the height of objects whose ends are visible

without coordinate

18. Resection - 2 - useful to find the coordinates of unknown point with help of two known coordinates
19. Point projection - 3 -
- 20 Line stake out - 4 -
21. Traverse - 5 - useful to run the traversing

Other function:-

- F₄ - Lase - gives the laser point on ground.
- F₄ - OK - after entering coordinates and giving codes press OK.
- F₁ - READ - To read the coordinates of object position
- F₃ - REC - To record the coordinates of reading values.
- F₂ - TOP - To move up.
- F₃ - LAST - To move ~~down~~ bottom.
- F₃ - Tilt - To project the laser.

← → - To adjust the brightness of laser and screen

SFT - Shift - To change the various modes of measuring like prism mode (P), nonprism mode (NP) and sheet mode (F).

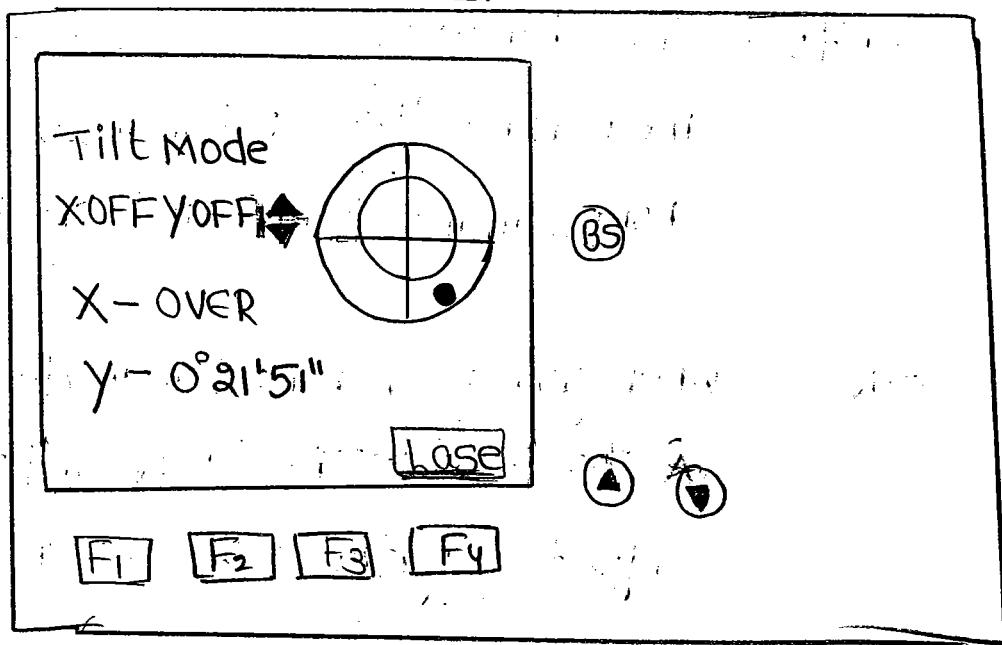
★ - Star - when you are in nonprism mode press ★ to provide the laser and to adjust brightness of screen.

Apparatus:- Tripod, total station, prism and prism pole.

Procedure:-

1. Select the position on ground and fix it by arranging the tripod over it. and the tripod is fixed at a height equal to height of surveyor upto his shoulders to avoid parallax error.
2. Now fix the total station over the tripod and fix a point on which instrument must situate is called centering.

Screen bubble:-



→ indicates screen bubble.

figure.(6).

3. Total station consists of 3 types of bubbles.

Namely a) ~~four~~ level bubble.

b). Ground bubble & screen bubble.

c). Tilt bubble.

4. Level bubble is located at side of instrument and the top of the triangular base

5. It can be levelled by adjusting the legs of the tripod only.

6. Ground bubble or screen bubble appears on screen after switch on press BS (Backspace) in 1st page screen bubble appear on screen, as shown in figure.(6)

7. The screen bubble can levelled by adjusting the 3-foot screws one by using upward and downward arrows (\blacktriangle , \blacktriangledown)

8. The tilt bubble which is located at the top of screen is levelled automatically by levelling the screen bubble.



9. Select the position of object and target it by rotating horizontally and vertically
10. Finally tight the horizontal lock and vertical lock and then measure the required data.

Result:-

→ Levelling, centring and focussing of Object is done successfully by using Total station



Aim:- TO determine the area of given boundaries using total station.

Apparatus:- Tripod, total station, prism, prism pole and tape (30m & 20m & 5m)

Principle:-

- Total station can measure both distances and angles
- It is the combination of theodolite and EDM
- The instrument combines both angle and distance measurement in same unit, it is known as an integrated total station which can measure horizontal and vertical angles as well as slope distances.
- Using vertical angle, the total station can calculate the horizontal and vertical distance components of measured slope distance
- As well as basic functions, total stations are able to perform a number of different survey tasks and





associated ~~tasks~~ calculations and can store large amounts of data.

Description:-

~~~~~

- Total station is simply a combination of transit theodolite and EDM
- It has various parts like triangular base, foot screws, horizontal lock, vertical lock, telescope, screen containing numerics and various types of keys.
- This survey is most accurate survey i.e., its error is  $\pm 5\text{mm}$
- The least count for the total station is 1mm and  $0^{\circ}00'00''$
- It can measure horizontal angles, vertical angles and distances also.
- Using vertical angles total station calculates distance between objects and slope distances.
- The keys in screen performs their role while doing different activities.

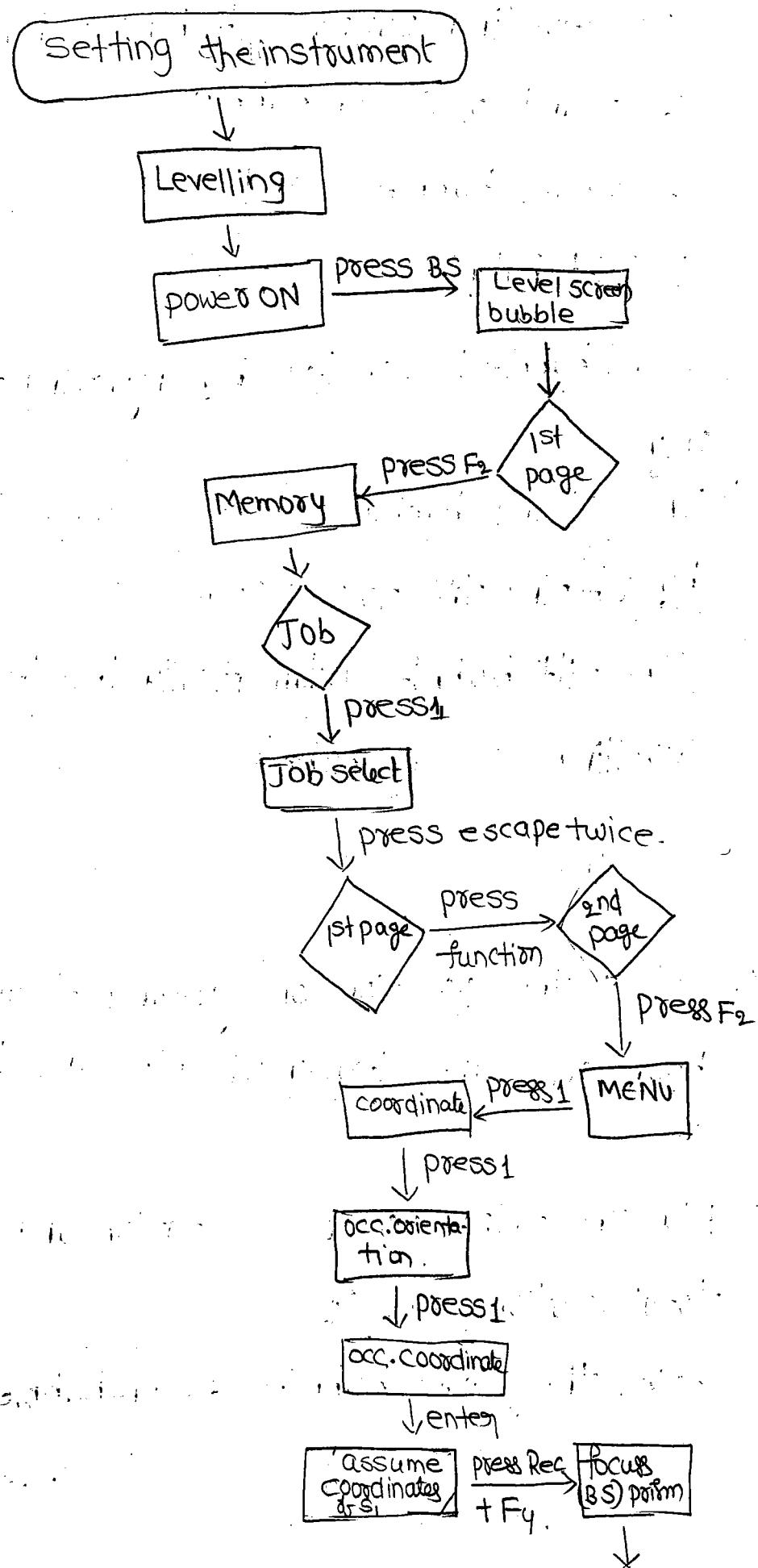


- For levelling purpose it has 3 bubbles. Namely
  1. Ground & screen bubble
  2. Level bubble and
  3. Tilt bubble.
- Level bubble is levelled by adjusting tripod legs only
- The ground bubble & screen bubble is levelled by rotating the foot screws
- The tilt bubble automatically levelled by levelling screen bubble.

Procedure:-  
 ~~~~~~

1. Select the position on ground from which all boundaries are clearly visible and let it be 'O'
2. Fix the tripod over 'O' station and arrange the total station over it.
3. Level the level bubble, ~~screen bubble~~ and ~~tilt bubble~~

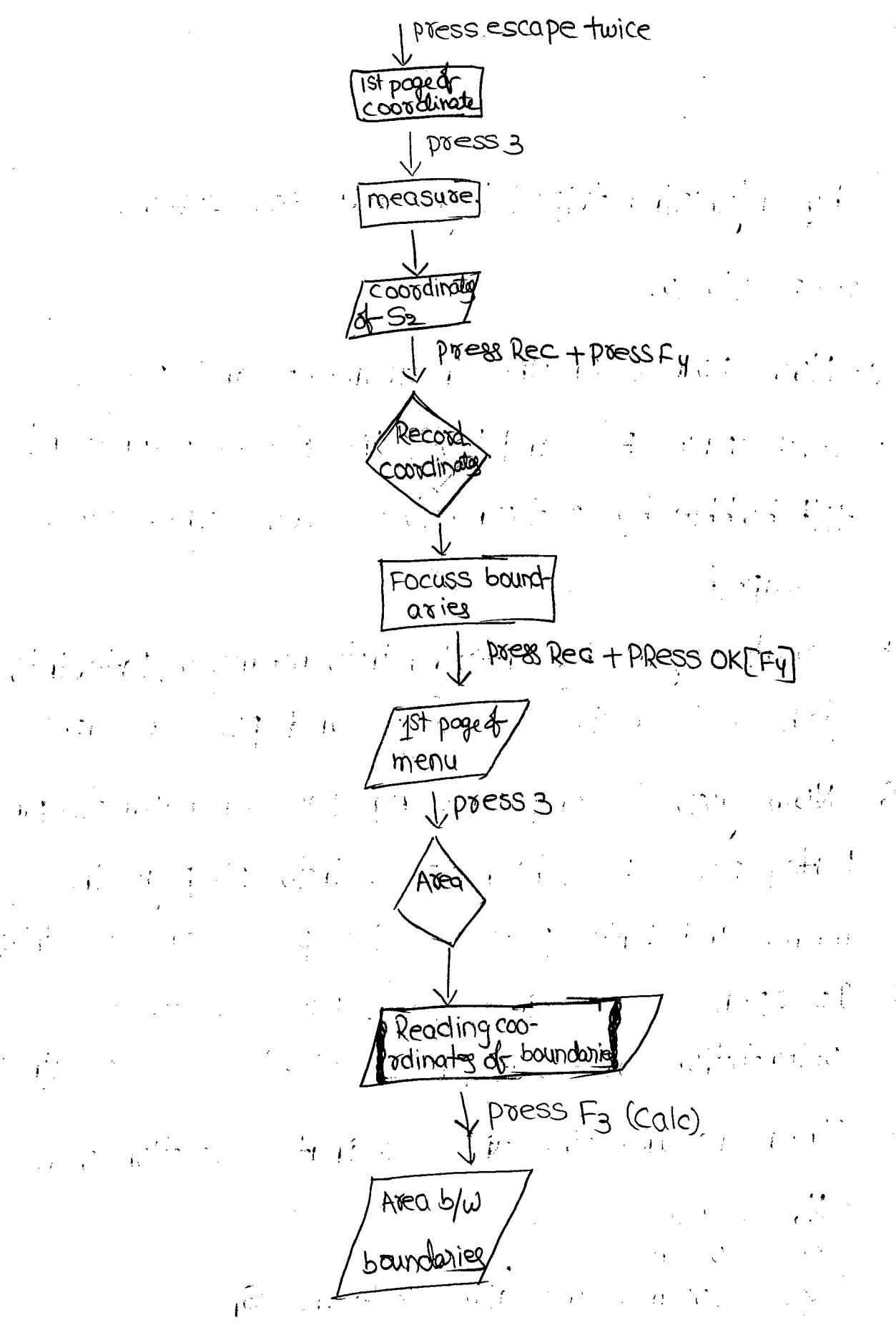
flowchart for procedure:-



by adjusting tripod legs and ~~foot screws~~
respectively.

4. Now power on the instrument and press Back space (B.S) and level the screen bubble and tilt bubble by rotating foot screws. then press escape [ESC]
5. Create a job by entering into memory, later into Job. and finally job select. and press escape.
6. Now goto second page by pressing function [Func] later press F₂ which opens into 1st page in menu and later press '1' i.e., press on coordinate
7. It opens to coordinate and press '1' for occ. orientation and later press '1' for occ. coordinate
8. Then assume the ~~coordinates~~ station 'O' of
 $N_o = 2000m$
 $E_o = 1000m$
 $Z_o = 100m$. and give code as 'S'
9. Next focuss the prism which is at some distance for back sight. and give its code as 'S'

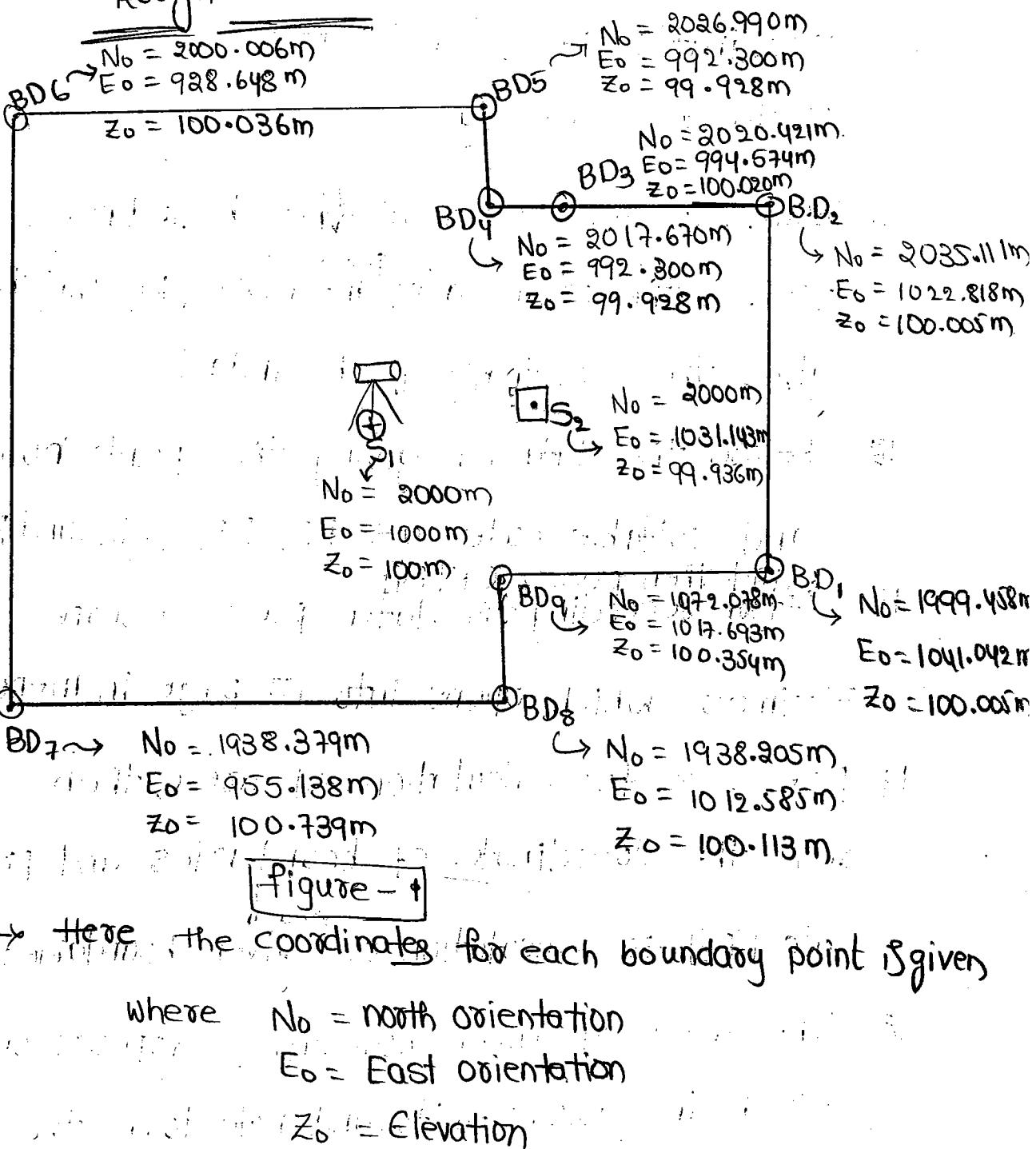






10. Press escape and now press '2' for measuring coordinates of S_2 and later record the coordinates carefully.
11. Now put the prism at the boundaries, focus the prism, later press measure [F_1] which gives the coordinates of boundaries.
12. Record the data by giving the points number and suitable code as BD_1, BD_2, BD_3 , and BD_4 ... and then press OK [F_4]
13. After recording the data press escape 3 times which opens into 1st page in menu.
14. Press 3 for calculation of area, then read the coordinates of boundaries and press calc [F_3] for calculation of area of given boundaries.
15. The area of given boundaries appears on screen in various units and note down the area.

Rough sketch



Where N₀ = north orientation

E₀ = East orientation

z₀ = Elevation

○ indicates boundary point

⊕ indicates instrument position

□ - prism position

$$\begin{aligned} \text{Total area} &= 4802.047 \text{ m}^2 \\ &= 0.4802 \text{ hectare} \\ &= 1.18 \text{ acres} \end{aligned}$$

Precautions:-~~~~~

- Operate the instrument carefully because it is delicate and costly
- Never rotate the instrument when horizontal and vertical locks are kept.
- Give the proper codes while calculating area otherwise the results will not come accurately
- Avoid personal and parallax errors as possible as.

Result:-

- The calculated area of given boundaries with help of total station is = 4802.047 m²
= 0.4802 hectas
= 1.18 acres.



Aim :- To determine area of given boundaries

when all boundaries are not visible by Traversing using total station.

Apparatus :- Tripod, total station, prism, prism pole and tape (30m & 20m & 5m).

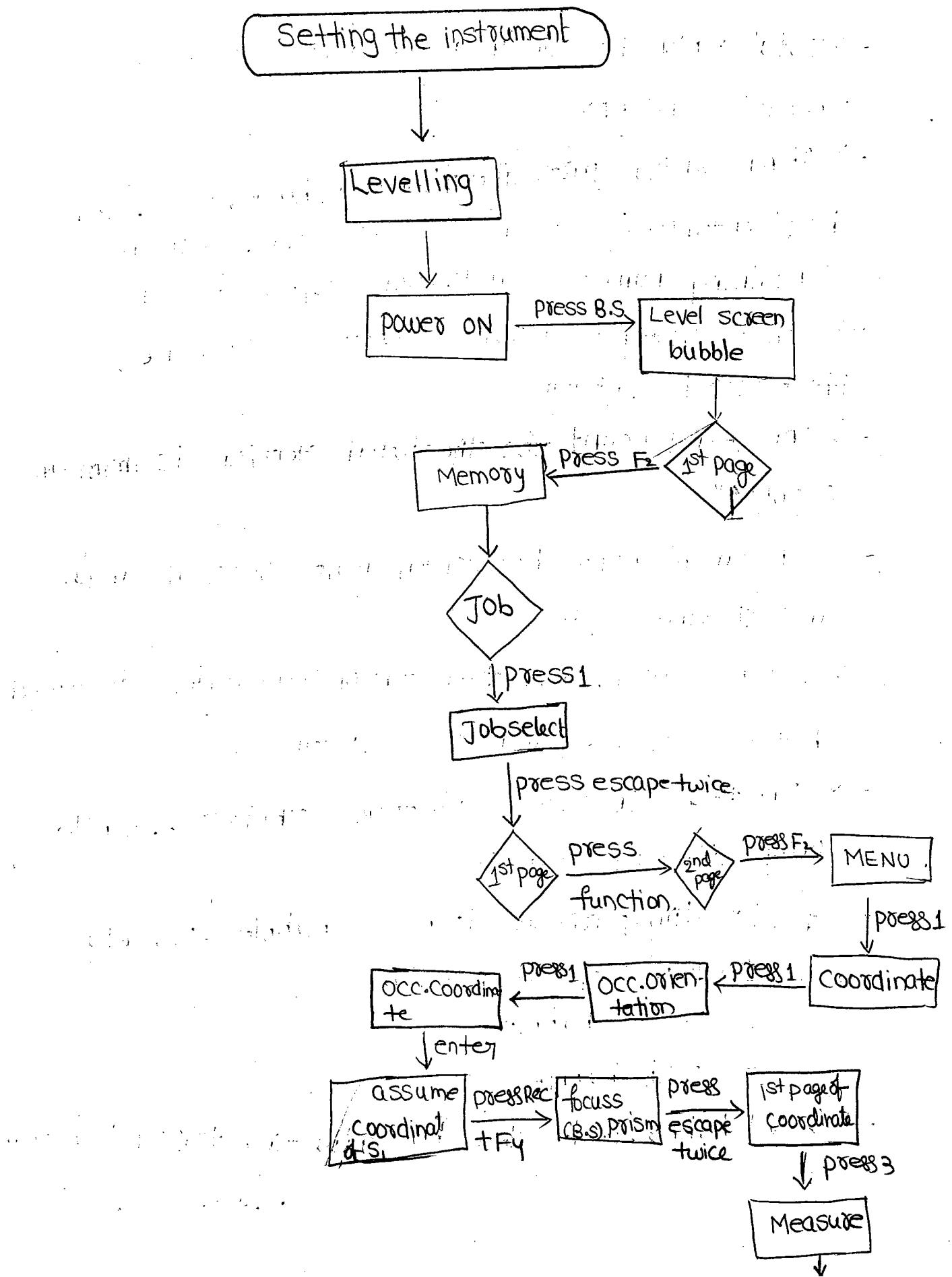
principle:-

- Total station can measure both distances and angles
- It is the combination of theodolite and EDM.
- The instrument combines both angle and distance measurement in same unit, it known as an integrated total station which can measure horizontal and vertical angles as well as slope distances.
- Using vertical angle, the total station can calculate the horizontal and vertical distance components of measured slope distance.
- As well as basic functions, total stations are able to perform a number of different survey tasks and associated calculations and can store large amounts of data.

Description:-

- Total station is simply a combination of transit theodolite and EDM
- It has various parts like triangular base, foot screws, horizontal lock, vertical lock, telescope, screen containing numerics and various types of keys
- This survey is most accurate survey i.e., its error is $\pm 5\text{mm}$
- The least count for the total station is 1mm and $0^{\circ}00'00''$
- It can measure horizontal angles, vertical angles and distances also
- Using vertical angles total station calculates distances between objects and slope distances
- The keys in screen performs their role while doing different activities
- For levelling purpose, it has 3 bubbles. Namely
 1. Ground & screen bubble
 2. Level bubble
 3. Tilt bubble
- Level bubble is levelled by adjusting tripod legs only

flow chart for procedure:-

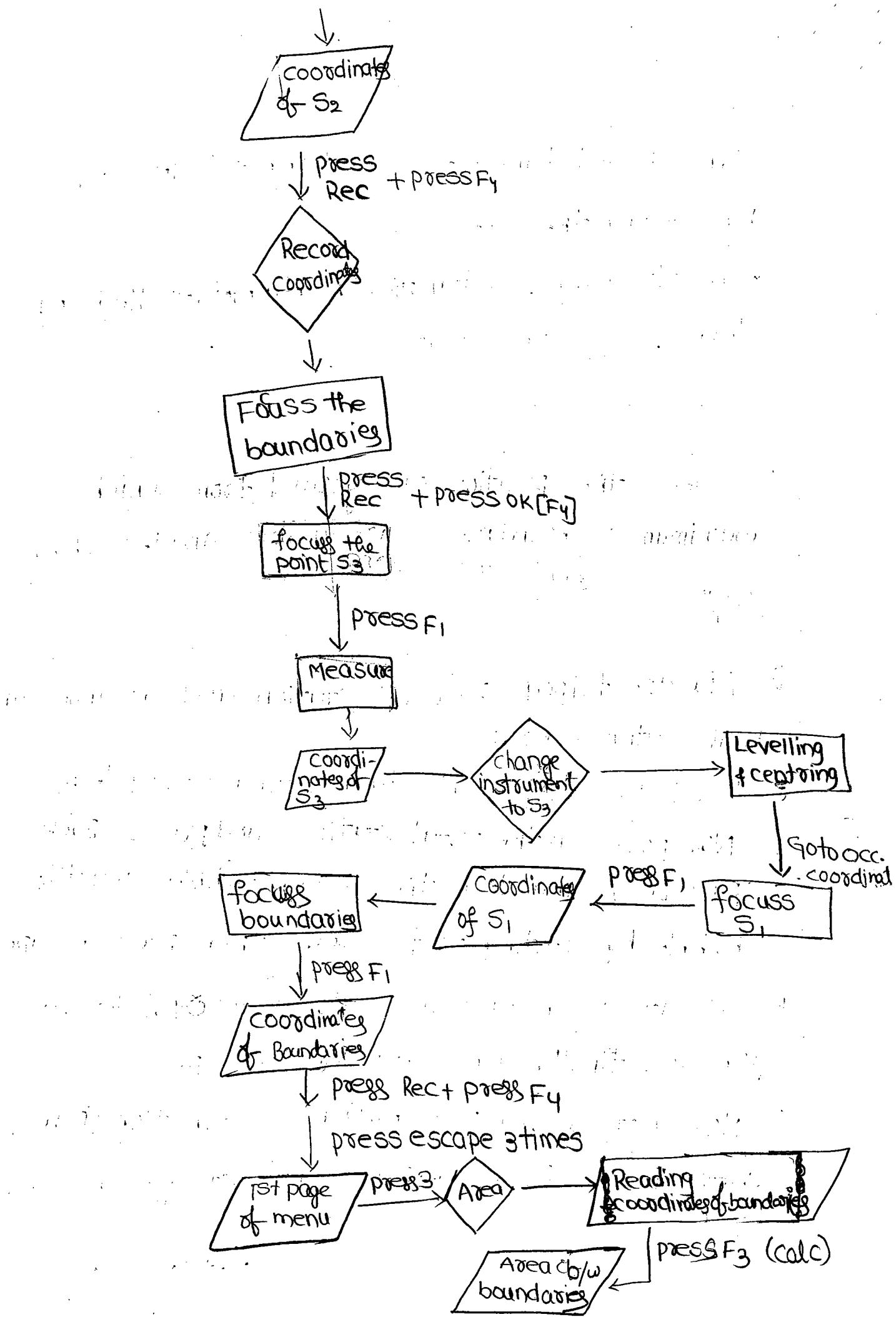




- The ground bubble & screen bubble is levelled by rotating the foot screws.
- The tilt bubble automatically bubble levelled by levelling screen bubble.

procedure:-

1. Select the position on ground from which maximum of boundaries are visible and let it be "S₁"
2. Fix the tripod over 'S₁' station and arrange the total station over it.
3. Level the level bubble by adjusting tripod legs.
4. Now power on the total station and press Back space [B.S] and level the screen bubble and tilt bubble by rotating foot screws then press Escape.
5. Create a job entering into memory, later into job and finally job select Press escape
6. Now go to second page by pressing function [Func] later press F₂ which opens into 1st page in menu





and later press '1' i.e., press on coordinate.

7. It opens to the coordinate and press '1' for occ. orientation and later press '1' for occ. Coordinate.

8. Then assume the coordinates of station 'S_i' as

$$N_0 = 10000m$$

$$E_0 = 5000m$$

$$Z_0 = 100m \text{ and give code as } 'S_i'$$

9 Next focus the prism which is at some distance for back sight and give its code as 'S₂'

10. press escape twice and press '2' [Measure] for measuring coordinates of 'S₂' and later record the coordinates carefully.

11. Now put the prism at the boundaries which are visible, focus the prism, later press measure [F₁] which gives coordinates of boundaries.

12. Record the data by giving the points number and suitable code as BD₁, BD₂, BD₃ and press OK.

13. Next some boundaries are not visible from S, so we have to shift the instrument to other point



from which the remaining boundaries are visible
The process is known as "Traversing"
Let it be as ' S_3 '

14. Now put the press at ' S_3 ' and focuss the prism and measure the coordinates of ' S_3 '
15. Later shift the instrument to ' S_3 ' and levelling and centring are done at the ' S_3 ' station
16. Go to ~~a~~ menu in second page, next enter into coordinate later the occ. orientation and finally occordinate and read the coordinates of ' S_3 ' from the job.
17. Next put the prism at ' S_1 ' and focuss the prism, and measure coordinates of ' S_1 ' for checking purpose
18. Later focuss the other boundaries , calculate their coordinates and record them very carefully by giving suitable codes and points
19. After recording the data press escape '3' times which opens into 1st page of menu.



Name of the Experiment :

Experiment No. :

DATE MONTH YEAR

20. press 3 for calculation of area, then read coordinates of boundaries and press calc[F3] for calculation of area of given boundaries.
21. The area of given boundary appears on screen in various units and note down the area.

Result:-

→ The calculated area of given boundary by traversing is = 1027.158m²
= 0.2538 ~~m~~ acre
= 0.1027 hectare



SKETCH

$\rightarrow N_0 = 10067.513 \text{ m}$
 $E_0 = 5051.753 \text{ m}$
 $Z_0 = 119.655 \text{ m}$

BD₁

BD₄

S & H

BLOCK

$\rightarrow N_0 = 10065.135 \text{ m}$
 $E_0 = 5065.884 \text{ m}$
 $Z_0 = 119.894 \text{ m}$

$\rightarrow N_0 = 9997.485 \text{ m}$
 $E_0 = 5025.961 \text{ m}$
 $Z_0 = 119.876 \text{ m}$

S₂

$N_0 = 9909.873 \text{ m}$
 $E_0 = 5013.012 \text{ m}$
 $Z_0 = 100.038 \text{ m}$

BD₃

$N_0 = 9992.65 \text{ m}$
 $E_0 = 5083.693 \text{ m}$
 $Z_0 = 100.491 \text{ m}$

Figure-(i)

$N_0 = 10000 \text{ m}$

$E_0 = 5000 \text{ m}$

$Z_0 = 100 \text{ m}$

Open traversing

$N_0 = 9965.624 \text{ m}$

$E_0 = 5046.007 \text{ m}$

$Z_0 = 100.081 \text{ m}$

Aim:- To determine the height of object by REM

[Remote Elevation Measurement] with help of total station

Apparatus:- Tripod, total station, prism, prism pole

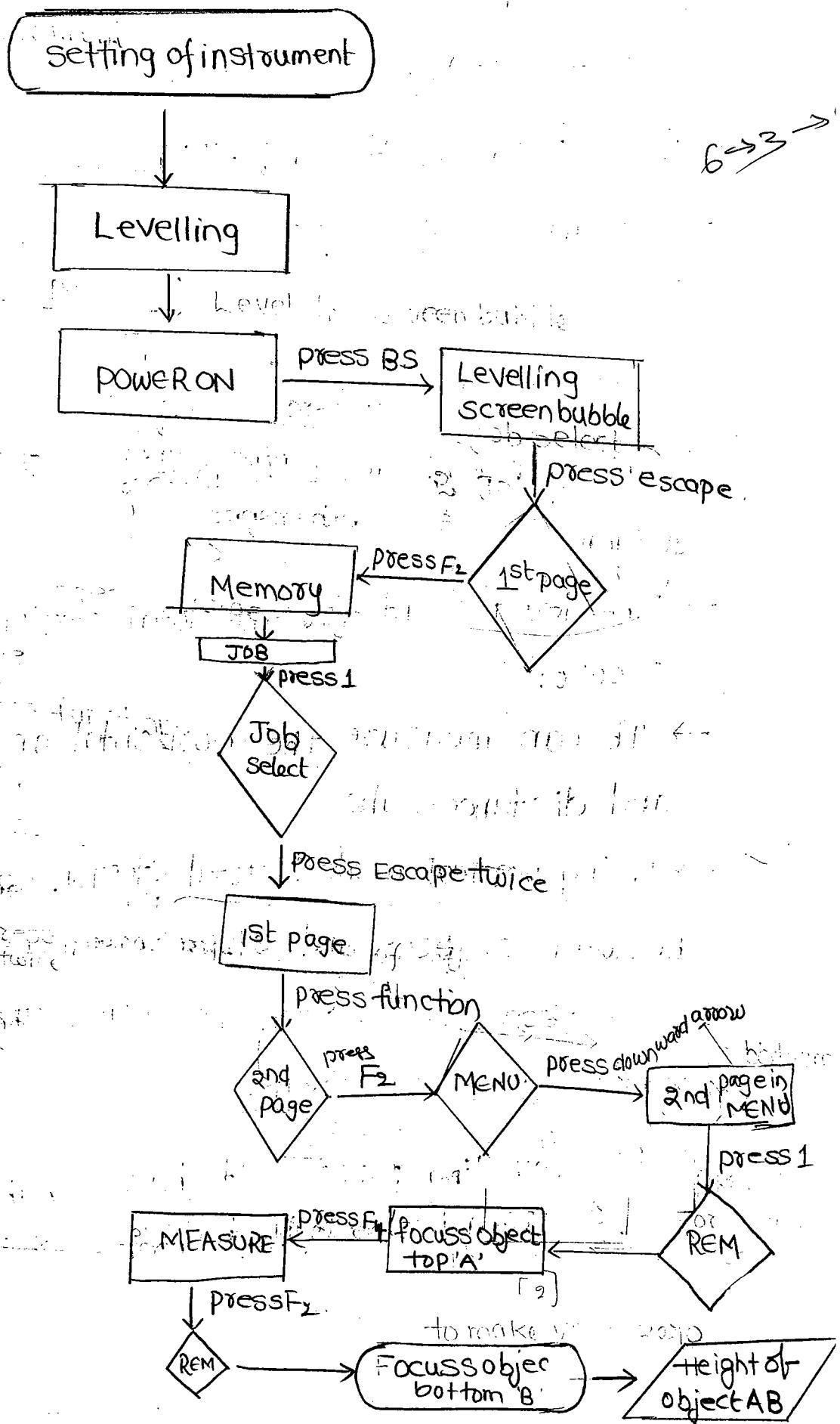
principle:-

- Total station can measure both distances and angles.
- It is the combination of theodolite and EDM.
- The instrument combines both angle and distance measurement in same unit, it is known as an integrated total station which can measure horizontal and vertical angles as well as slope distances.
- Using vertical angle, the total station can calculate the horizontal and vertical distance components of measured slope distance.
- As well as basic functions, total station are able to perform a number of different survey tasks and associated calculations and can store large amounts of data.

Description:-

- Total station is simply a combination of transit theodolite and EDM.
- It has various parts like triangular base, foot screws, horizontal lock, vertical lock, telescope, screen containing numerics and various types of keys.
- This survey is most accurate survey i.e., its error is $\pm 5\text{ mm}$
- The least count for the total station is 1mm and $0^{\circ}00'01''$
- It can measure the horizontal angles, vertical angles and distances also
- Using vertical angles total station calculates distance between objects and slope distances.
- The keys in screen performs their role while doing different activities
- For levelling purpose it has 3 bubbles. Namely
 - 1. Ground or screen bubble.

Flowchart for procedure :-



2. Level bubble and
3. Tilt bubble.

- Level bubble is levelled by adjusting tripod legs. only
- The ground bubble or screen bubble is levelled by rotating the foot screws.
- The tilt bubble automatically levelled by levelling screen bubble.

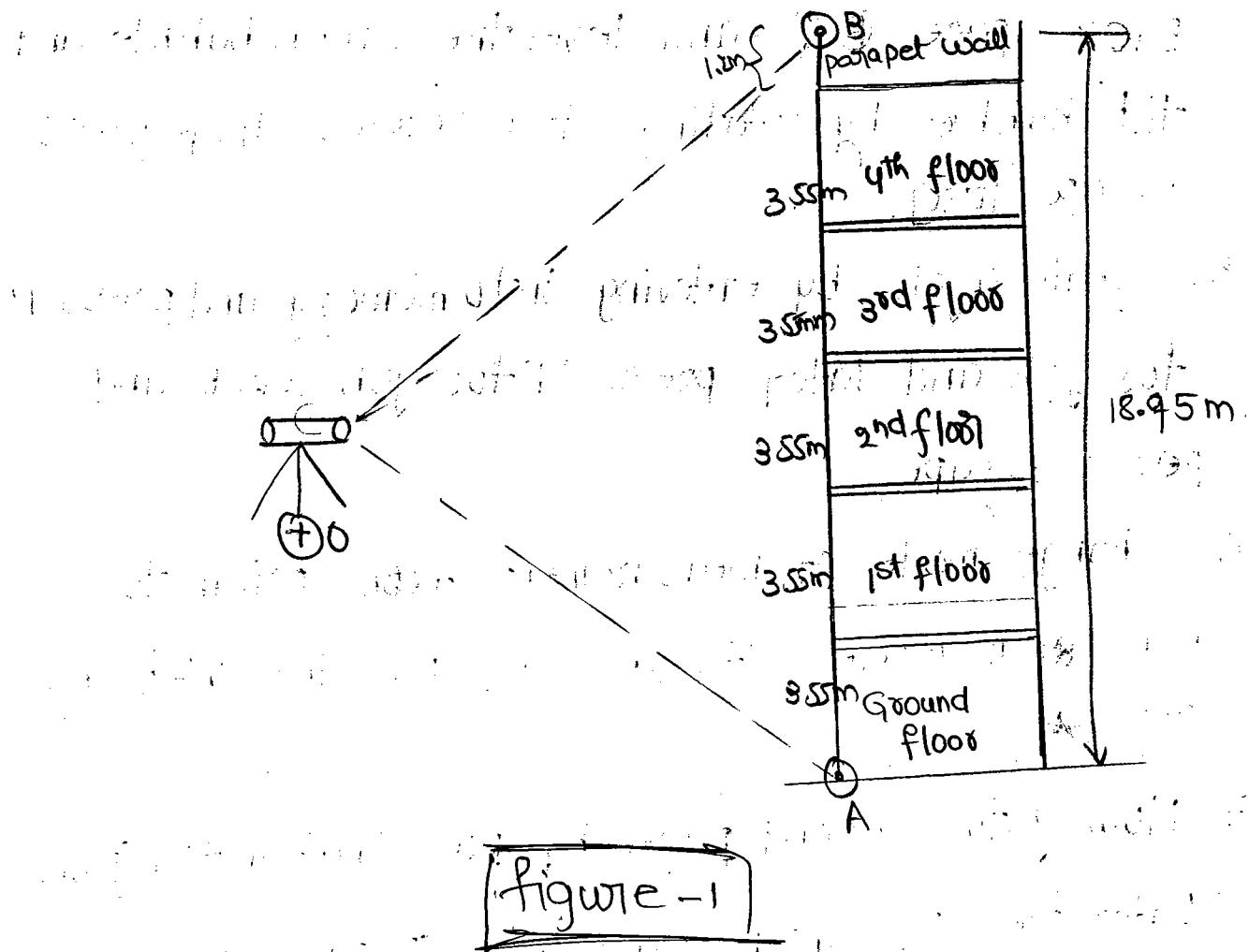
Procedure:-

- REM stands for Remote Elevation Measurement and it will be useful to find the height of an object whose base and top are are visible.
1. Select the position on ground from which the top and bottom are clearly visible and let it be 'O'
 2. Fix the tripod over 'O' station and arrange the total station over it.



3. Level the level bubble, by adjusting tripod legs.
4. Now power on the total station and press back space (B.S) and level the screen bubble and tilt bubble by rotating foot screws ,then press escape [Esc].
5. Create a job by entering into memory and press 'j' for job and later press '1' for job select and press Escape .
6. Change mode of measurement from prism to non prism mode with laser by pressing shift and star (*).
7. Now goto second page by pressing function[Func] Later press F2 which opens into 1st page of menu
8. using downward arrow open page 2 in menu and press '1' for REM
9. Now sight the bottom of the object perfectly and press F4 for measuring the distances.

SKETCH:-



Name of the Experiment :



Regd No.

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DATE MONTH YEAR

<input type="text"/>	<input type="text"/>	<input type="text"/>
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10. Then press F_2 [REM] for making the initial vertical distances as zero
11. Now focuss the top of the object and fix the both horizontal and vertical locks.
12. It automatically shows the height of object on the screen above the slope distance [SD] as Ht.

Result:-

→ The height of the object measured by REM in total station is 18.95m.



KHIT

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Page No.

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Aim:- To determine the distance between two inaccessible points using MLM [Missing Line Measurement] by using total station.

Apparatus:- Tripod, total station, prism, prism pole,

Principle:-

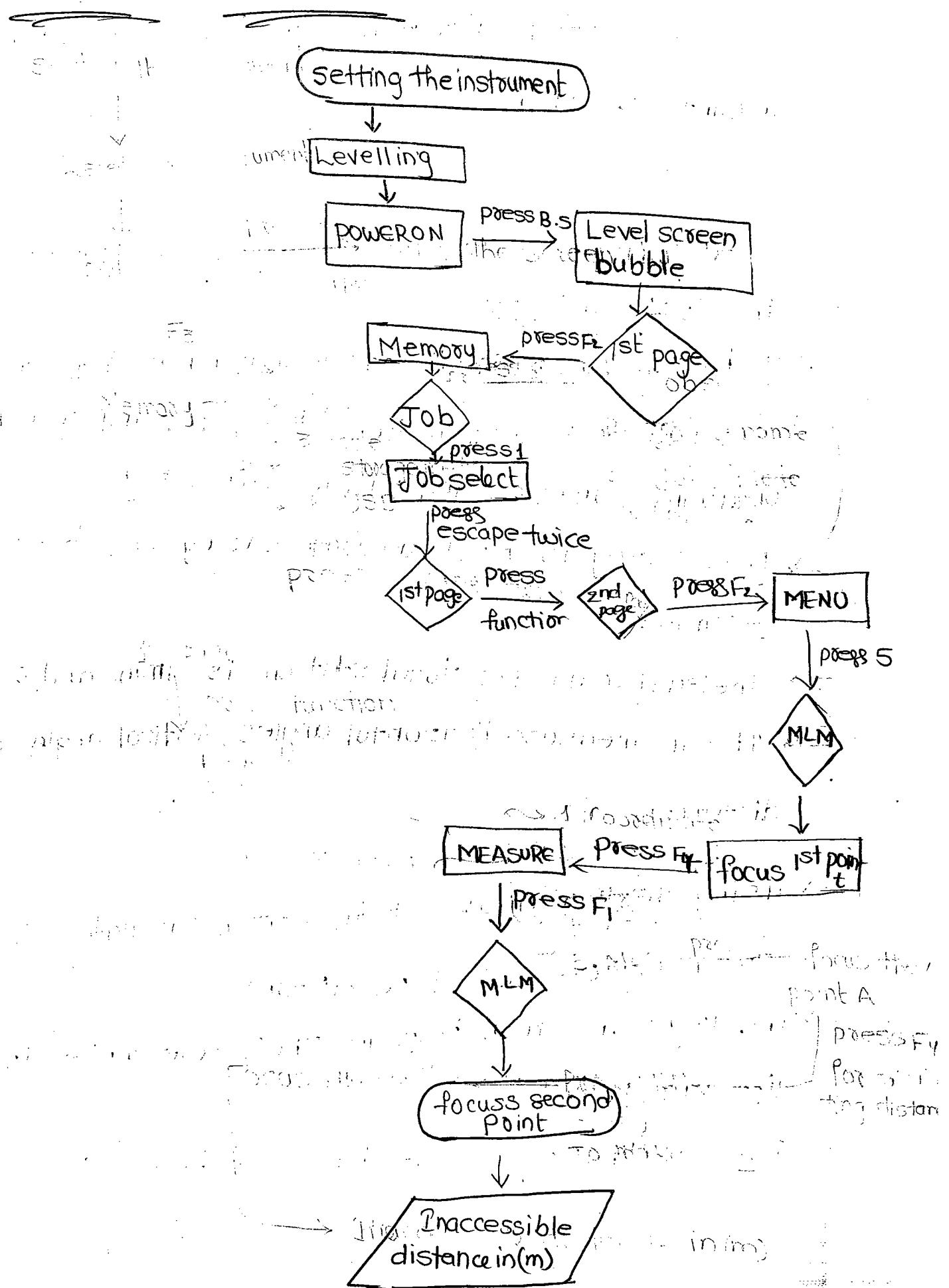
- Total Station can measure both distances and angles.
- It is the combination of the theodolite and EDM.
- The instrument combines both angles and distance measurement in same unit, it is known as an integrated total station which can measure horizontal and vertical angles as well as slope distances.
- Using vertical angle, the total station can calculate the horizontal and vertical components of measured slope distance
- As well as basic functions, total stations are able to perform a number of different survey tasks and

associated calculations and can store large amounts of data.

Description:-

- Total station is simply a combination of Transit theodolite and EDM.
- It has various parts like triangular base, foot screws, horizontal lock, vertical lock, telescope, and screen containing numerics and various types keys.
- This survey is most accurate survey i.e., its error is $\pm 5 \text{ mm}$
- The least count for total station is 1mm and $0^{\circ}00'01''$
- It can measure horizontal angles, vertical angles and distances also.
- Using vertical angles total station calculates distance between objects and slope distances.
- The keys in screen performs their role while doing different activities.
- For levelling purpose it has 3 bubbles. Namely

Flowchart for procedure



1. Ground or screen bubble.

2. Level bubble and

3. Tilt bubble.

→ Level bubble is levelled by adjusting tripod legs only

→ The ground bubble or screen bubble is levelled by rotating foot screws

→ The tilt bubble automatically levelled by levelling screen bubble.

Procedure:-

→ MLM stands for missing line measurement which will be useful for calculating the distance between inaccessible points.

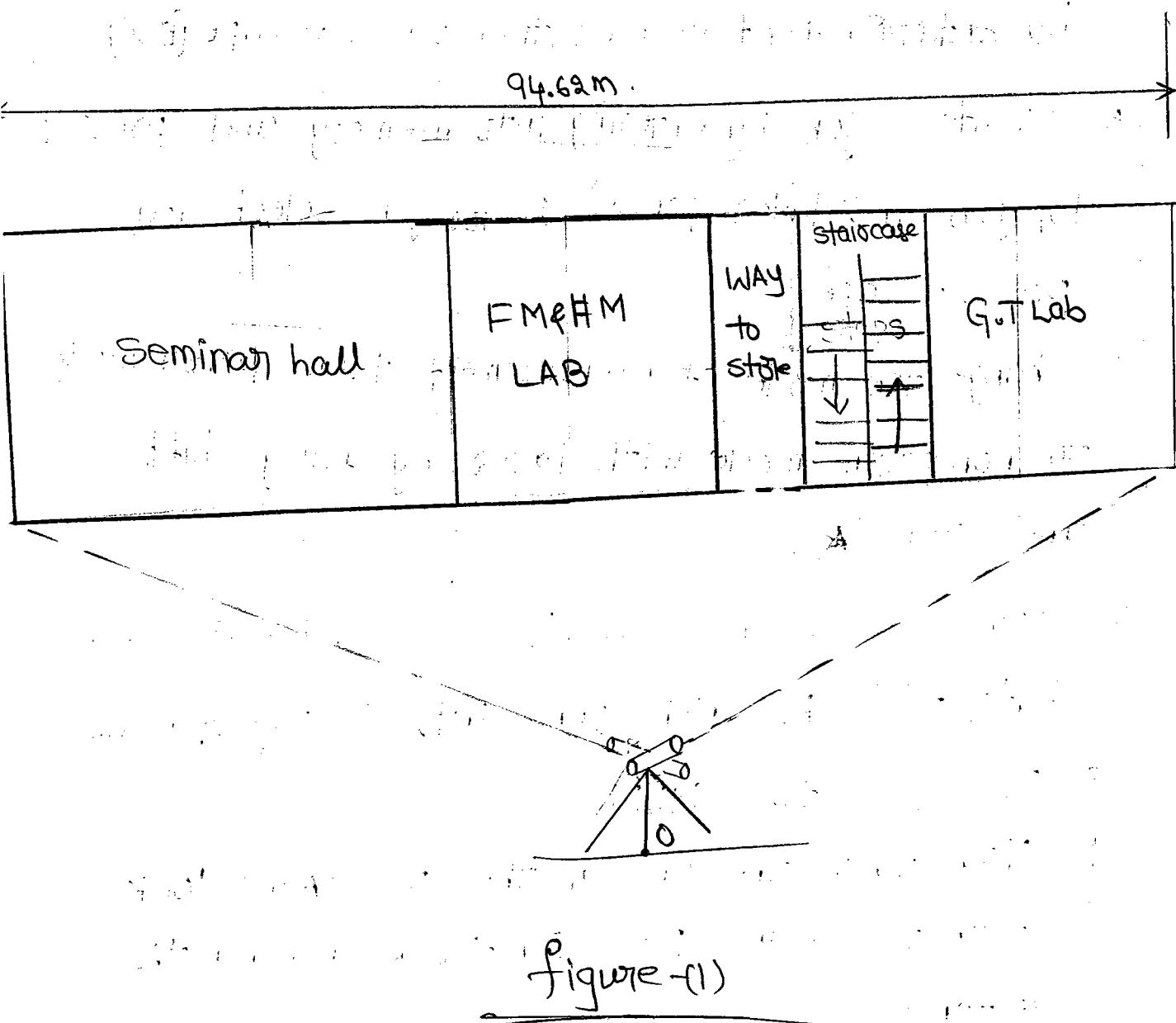
1. Select the position on ground from which both the inaccessible points are visible and treat that position as 'O'

2. Fix the tripod over 'O' station and arrange total

station over it.

3. Level the level bubble, by adjusting the tripod legs only
4. Now power on the total station and press Backspace [B.S] and level the screen bubble and tilt bubble by rotating foot screws, then press escape [Esc]
5. Create a job by entering into memory and press '1' for job and later press '1' for job select and press escape.
6. Change the mode of measurement from prism mode to non prism mode with laser by using shift and star (*) .
7. Now goto second page by pressing function [Func] Later press 'F₂' which opens into 1st page of menu
8. Press '5' for MLM
9. Now focus the one of the points 'A' and lock both locks and press F₄ for measuring the distances.

SKETCH :-



Name of the Experiment :

Regd No.

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DATE MONTH YEAR

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Experiment No. :

10. Then press F1 [MLM] for making the initial & horizontal distance as zero.
11. Now focuss the other end and fix both the locks.
12. It shows the horizontal distance b/w the points in the form of HD:

Result:-

→ The distance between the two inaccessible points = 99.642 m.