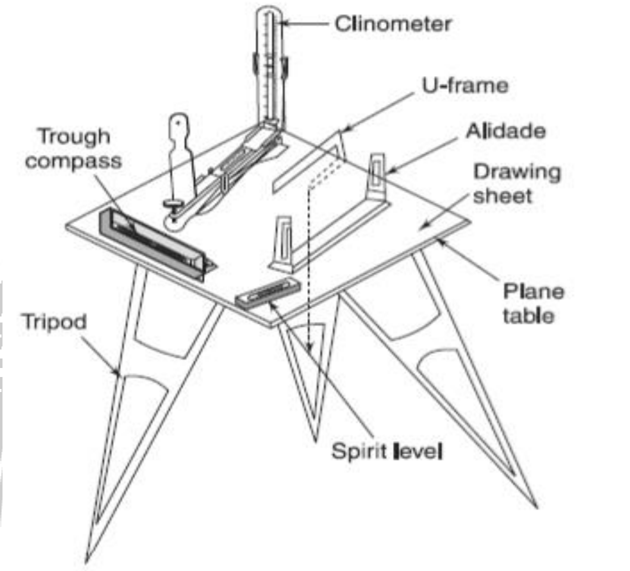
PLANE TABLE AND ITS ACCESSORIES

The plane table is an instrument used for surveying by a graphical method in which the field work and plotting are done simultaneously. It is most suitable for small and medium scale-mapping (1:10,000 to 1: 2,50, 000). plane tabling is now not so universally used.



Plane table with accessories

A plane table is a drawing board mounted on a tripod. An alidade is used to plot the directions and a clinometer to measure the elevations. Accessories such as a plumbing fork or U-frame, trough compass, spirit level, drawing sheet and waterproof cover are also required for the field work. In using the plane table, a drawing sheet is mounted, with adhesives or pins, on the drawing board. Before commencing a plane table survey, the instrument stations are fixed to control the entire area.

The elevations of the points of observation are measured with an Indian clinometer or telescopic alidade. All the measurements made are plotted directly on the drawing sheet
instead of recording in the field book.

The principle used in plane table surveying is that an unknown point of interest can be established by measuring its directions from known points.

Advantages:

1. The observations and plotting are done simultaneously. Hence, there is no risk of omitting necessary details.
2. The errors and mistakes in plotting can be checked by drawing check lines.
3. Irregular objects can be plotted accurately as the lay of land is in view.
4. It is most rapid and useful for filling in details.
5. No great skill is required.
6. It is less costly than theodolite survey.

7. It is advantageous in magnetic areas, where compass survey is not reliable.

Disadvantages:

1. It is not suitable for work in a wet climate and in a densely wooded country.
2. The absence of measurements (field notes) are inconvenient, if the survey is to be replotted to some different scale.
3. It is heavy and awkward to carry and the accessories are likely to be lost.
4. It does not give very accurate results.

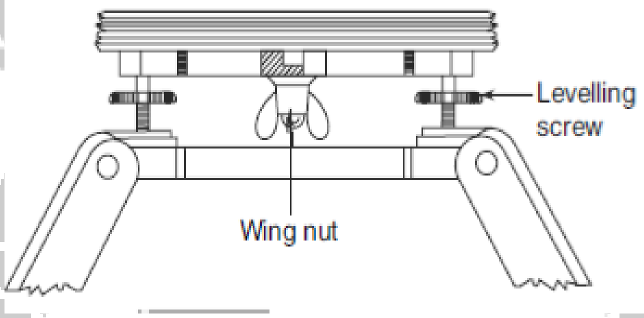
DESCRIPTION OF PLANE TABLE

A plane table instrument, as stated above, consists of a drawing board mounted on a tripod in a way so that the board can be levelled, rotated about a vertical. axis, and clamped in any required position. It also consists of an alidade and some accessories.

Board

The drawing board is carefully made of well-seasoned wood in a way to counteract the effect of warping and damages from weathering. The upper surface is kept smooth. The table at the centre of the underside, is attached to the tripod by means of a screw and wing nut (Fig. 8.3). By means of the wing nut, the table can be clamped in any position. Plane tables are available in the following different sizes.

Designation Size (mm × mm)
B_0 1500 × 1000
B_1 1000 × 700
B_2 700 × 500
B_3 500 × 350

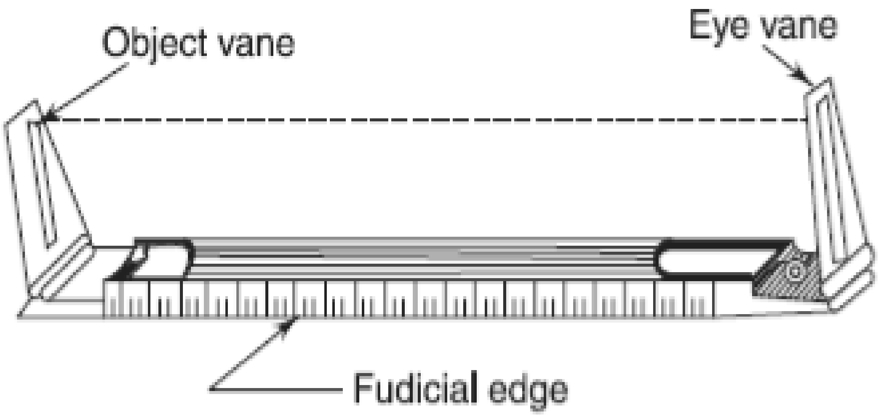


Tripod

An open frame type light tripod is usually provided. In the simplest form of plane tables, levelling of the board is achieved by manipulating the tripod legs and checking the horizontality of the board by means of two spirit levels fixed at right angles to each other in a block of wood. For a beginner it is rather difficult to keep the plane table level throughout the work, since even with a slight pressure on any side of the table, the level of the board is disturbed. In some of the other forms of the tripod heads, levelling screws (Fig.), or ball-and-socket joint (Fig.) is provided to facilitate levelling.

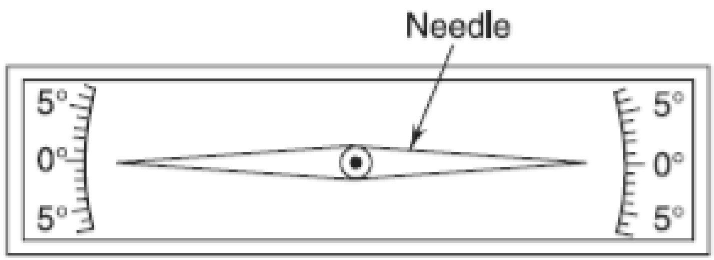
Alidade

It is a wooden or brass ruler of about 50–60 cm in length. It is also known as sight rule. Two vanes, the 'object vane' and the 'sight vane' (Fig.), are hinged at its two ends. It is essential that the plane of the vanes should be perpendicular to the underside of the alidade while the observations are made. These vanes should be folded over the alidade top surface, when not in use. The line of sight thus provided, is parallel to the ruling or fudicial edge of the alidade, but it is unnecessary that the line of sight be parallel to the fudicial edge, provided the horizontal angle between the two remains constant. A scale is attached to the bevelled fudicial edge so as to plot distances to the scale.



Trough compass

Usually it is 15 cm long (Fig.) and is provided to plot the magnetic meridian (N – S direction) to facilitate orientation of the plane table in the magnetic meridian. Although a trough compass is sufficiently accurate for field surveying, it is not precise owing to a parallax arising from the difficulty of ensuring that the eye is in the vertical plane of the needle. To overcome this difficulty the trough compass is modified. An eyepiece and a diaphragm are placed on one side of a tube having a magnetic needle inside. Such a compass is known as tubular compass. The diaphragm of the tubular compass consists of a glass plate with vertical rulings, which is in the same plane as one end of the needle. The observer, on looking through the eyepiece, sees the end of the needle without the parallax.

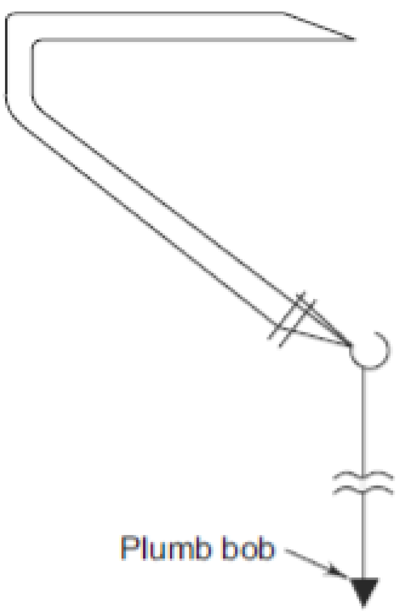


Spirit level

The essential condition in plane table surveying is that the board should be level. This is usually accomplished with a circular spirit level. It is placed on the board in two positions mutually at right angles and the bubble is centred in each position to make the board horizontal.

Plumbing fork

It is a hairpin-shaped brass frame (Fig.) having two arms of equal length. One end of the frame is pointed and is kept over the drawing sheet touching the plotted position of the instrument station. The other end of the frame carries a plumb bob. The position of the plane table is adjusted until the plumb bob hangs over the Plumb bob station occupied by the instrument. The use of a plumbing fork is justified only if the scale of plotting is large, the rays being short. However, for small-scale mapping, which is usually done with a plane table, the use of plumbing fork is a sheer waste.



SETTING UP THE PLANE TABLE

It includes the following operations: (1) Centring, (2) Levelling, (3) Orientation.

Centring

It is the operation of bringing the plotted station point exactly over the ground station. To achieve this the pointed leg of the plumbing fork is placed against the plotted point and the plumb bob is suspended from its other leg. Exact centring is important for large-scale mapping only. For small-scale mapping, an error in centring of about 30 cm is permissible.

Levelling

It is the operation of bringing the plane table in a horizontal plane. Set the plane table at a convenient height, which is elbow level, by spreading the legs. Level the board with the help of a spirit level.

Orientation

It is the operation of keeping the plane table parallel to the position it occupied at the first station. In such a condition all the lines plotted will be parallel to the corresponding lines on the ground. If the board position is different at successive stations, the relative positions of the plotted details will not remain the same as the relative positions of the details on the ground.

Consequently, the plotted work of the previous stations cannot be connected to that of the successive stations. It should be noted that during orientation the table is rotated and the plotted position of the instrument station is also disturbed and shifts relative to the ground stations except when the plotted point happens to lie on the vertical axis of the instrument.

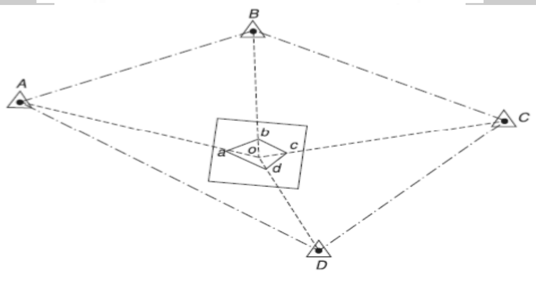
The operations of orientation and centring are therefore interrelated. Since accurate orientation is an essential condition, a compromise can be made with centring, though within permissible limits. Whenever an exact centring is required, for example, in large-scale surveys, repeated orientation and centring by shifting the table are necessary.

METHODS OF PLANE TABLE SURVEYING

The methods of surveying with a plane table are radiation, traversing, intersection and resection. In the figures illustrating these methods, capital letters such as A, B and C have been used to indicate the ground points and small letters such as a, b and c are their corresponding plotted positions on the drawing sheet.

RADIATION

In this method the instrument is setup at a station and rays are drawn to various stations which are to be plotted. The distances are cut to a suitable scale after actual measurements (Fig.).



Radiation with plane table

Procedure:

Select a station O such that all the other stations A, B, C and D are accessible and visible from O. Plot the N – S direction. Setup a plane table at O. Place the alidade at o and successively sight stations A, B, C and D. Draw rays from o to the stations and cut the distances oa, ob, oc and od to the chosen scale. Join a, b, c and

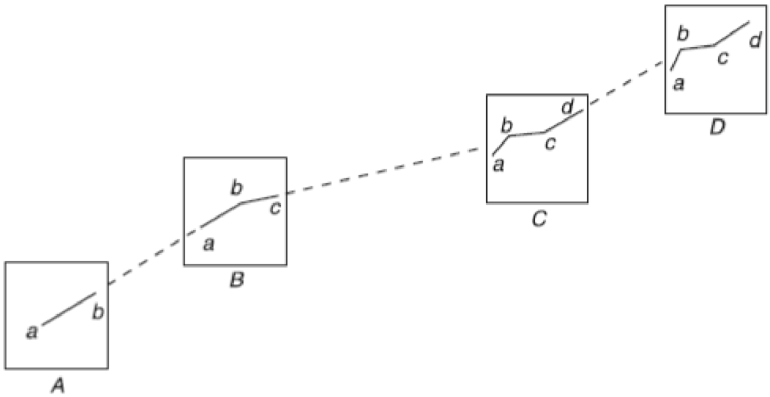
d. This method is suitable only when the area to be surveyed is small and all the stations are visible and accessible from the instrument station.

TRAVERSING

This method is similar to compass or theodolite traversing. The table is set at each of the stations in succession. A foresight is taken to the next station and the distance is cut to a suitably chosen scale.

Procedure:

Set up the plane table at the initial station A (Fig.). Transfer ground station A as a on the drawing sheet. Draw a ray aB along the fudicial edge with the alidade pivoted against a. Cut the distance ab to the selected scale. Shift and set up the table at B. Orient the plane table. Place the alidade at b and sight station C. Draw a ray bC along the alidade and cut the distance bc to the selected scale. The procedure is carried out till all the stations are traversed. It is most suited when a narrow strip of terrain is to be surveyed, e.g., survey of roads, railways, etc. This method can be used for traversing both the open as well as close traverses.



Traversing with plane table

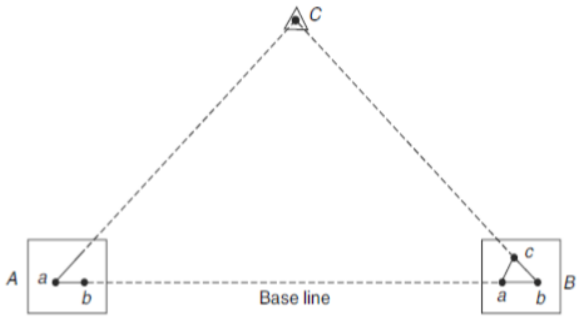
INTERSECTION

In this method two stations are so selected that all the other stations to be plotted are visible from these. The line joining these two stations is called base line. The length of this line is measured very accurately. Rays are drawn from these stations to the stations to be plotted. The intersection of the rays from the two stations gives the position of the station to be plotted on the drawing sheet.

Procedure:

Let A and B be the two accessible stations (Fig.), such that A and B can be suitably plotted. C is the station to be plotted by intersection. Place the plane table at A. Set it up. Plot the N – S direction. Transfer ground station A as a onto the drawing sheet. With the alidade centred at a, sight station B. Draw a ray aB and cut ab to a suitable scale. With the alidade at a, sight C also and draw a ray aC. Shift the table to B and set it up. Place the alidade at b and sight C. Draw a ray bC. The intersection of the two rays gives the position of station C as c on the plane table.

This method is very commonly used for plotting details. It is preferred when the distance between the stations is too large, or the stations are inaccessible, or the ground is undulating. The most suitable example is of broken boundaries which can be very conveniently plotted by this method.



Intersection with plane table

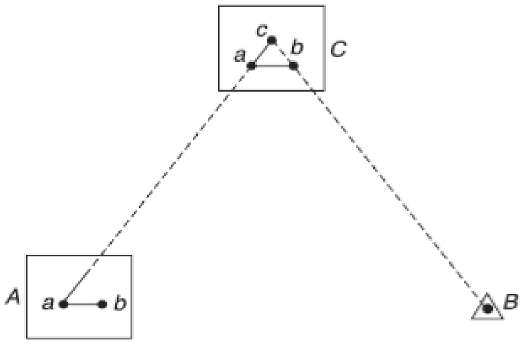
RESECTION

It is a method of orientation employed when the table occupies a position not yet located on the drawing sheet. Therefore, it can be defined as the process of locating the instrument station occupied by the plane table by drawing rays from the stations whose positions have already been plotted on the drawing sheet. The resection of two rays will be the point representing the station to be located, provided the orientation at the station to be plotted is correct, which is seldom achieved. The problem can be solved by any of the methods such as resection after orientation by back ray, by two points, or by three points. These methods are described in the sections to follow.

This method is employed when during surveying the surveyor feels that some important details can be plotted easily by choosing any station other than the triangulation stations. The position of such a station is fixed on the drawing sheet by resection.

Procedure:

Let a and b be the plotted positions of the two ground stations A and B. Station C is to be plotted (Fig.). Set up the table at A, with a above A. Keep the alidade along ab and orient the table so that B is bisected. Pivot the alidade at a, sight C and draw ray aC. Shift the instrument and set it up at C. Place the alidade along ca and rotate the table till it is oriented. With alidade pivoted against b, sight B and draw a back ray. The resection of this ray with the previous ray gives the position of station C as c on the drawing sheet.



Resection by back ray