

## 2.2 Temporary Adjustments of Theodolite

Theodolite has two types of adjustments-temporary and permanent. Temporary adjustments are to be done at every station the instrument is set up. Permanent adjustments deal with the fundamental lines and their relationships and should be done once in a while to ensure that the instrument is properly adjusted. The fundamental lines and their desired relationships are explained later in this chapter and the permanent adjustments are explained in detail in Chapter 4. In this section we will discuss temporary adjustments.

The temporary adjustments are the following:

- (a) setting up and centering,
- (b) levelling,
- (c) focusing the eyepiece, and
- (d) focusing the objective.

### Setting Up and Centering

The following procedure is adopted for this operation.

1. Remove the theodolite from its box carefully and fix it onto a tripod kept over the station where the instrument is to be set up. The tripod legs should be well apart and the telescope should be at a convenient height for sighting.
2. Tie a plumb bob onto the hook provided at the base. If there is no shifting head in the instrument, Centre it by adjusting the tripod legs and shifting the instruments as a whole to bring the plumb bob over the station mark.
3. To centre the plumb bob, shift the tripod legs radially as well as circumferentially. *Moving any leg radially shifts the plumb bob in the direction of the leg. This does not affect the level status of the instrument. Moving any leg circumferentially does not appreciably shift the plumb.* However, this movement tilts the instrument and affects the level of the plate bubbles. By moving the legs, the plumb bob is brought

over the station mark at the same time ensuring that the instrument is approximately level. This saves a lot of time for the next operation of levelling.

4. If the instrument has a shifting head with a clamp, first centre the instrument using legs. Make the final adjustment by loosening the clamp and shifting the head (or the instrument as a whole) to bring the plumb bob over the station mark. In all operations, the starting step should be to first bring the plumb bob very close to the mark and then make the final adjustment using the legs or the shifting head.

## **Levelling**

After setting up and centering the instrument, levelling is done. Levelling has to be done at every station the instrument is set up. By levelling the instrument, it is ensured that as the instrument is swung about the vertical axis, the horizontal plate moves in a horizontal plane. The instrument may have a three-screw or a four-screw levelling head. The levelling operations differ slightly in these two cases as detailed in the following sections. Most instruments have only one bubble tube, but some instruments have two bubble tubes set at right angles over the plates.

### ***Three-screw levelling head***

When the theodolite has a three-screw levelling head, the following procedure is adopted.

1. Swing the theodolite and bring the plate bubble parallel to any two of the foot screws. Centre the bubble by rotating the foot screws. To do this, hold the foot screws by the unbind or reigned on each hand and *rotate both either inwards or outwards* [see Fig. 6.3(a)]. Also note that the bubble moves in the direction of movement of the left thumb during this operation.
2. Once the bubble traverses (or comes to the central position from the graduation of the tube), swing the instrument and bring the bubble over the third foot screw. In this position, the bubble tube is at right angles to the earlier position. Centre the bubble by rotating the third foot screw alone.

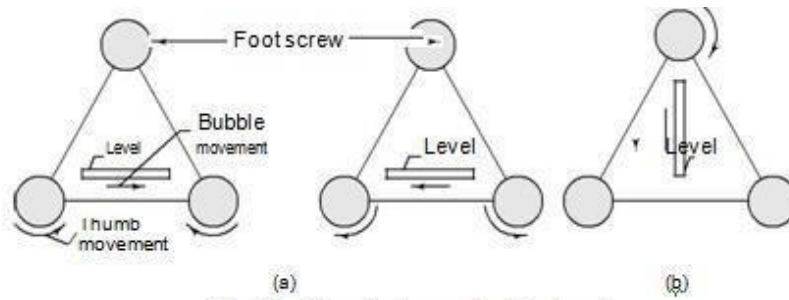


Fig. 6.3 Three-foot-screw levelling head

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3. Bring the plate bubble to its previous position by swinging the instrument back. Check whether the bubble traverses. If it does not traverse, bring the bubble to the centre using the two foot screws as before.
4. Repeat the procedure till the bubble traverses in both these positions.
5. Swing the instrument through  $180^\circ$  and check whether the bubble traverses. The bubble should traverse in all positions if the instrument has been properly adjusted.

If two plate bubbles are provided [see Fig. 6.3(b)], the procedure is the same except that swinging the instrument through  $90^\circ$  is not required. When one plate level is kept parallel to a pair of foot screws, the other plate level is over the third foot screw (in a perpendicular direction). The third foot screw is adjusted alternately by the same process using the foot screws over which they are parallel.

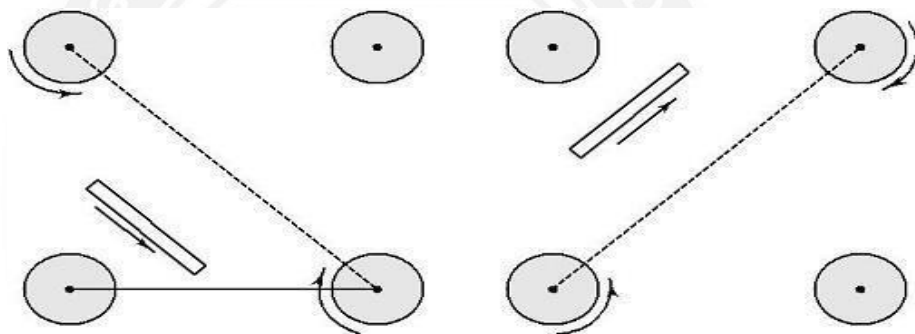
#### ***Four-screw leveling head***

When the theodolite has a four-screw levelling head, the following procedure is adopted.

1. After setting up and centering the theodolite, bring the plate level parallel to any one pair of diagonally opposite foot screws. Operate these foot screws to centre the bubble (Fig. 6.4).
2. Swing the instrument to bring the plate level parallel to the other pair of foot screws. Centre the bubble.

3. Swing it back to the previous position. Check whether the bubble traverses. If it does not, centre it with the foot screws to which the level is parallel.
4. Swing it back, check the position of the bubble, and repeat the procedure.
5. Once the bubble traverses in the two orthogonal positions, swing it through 180°. The bubble should traverse in this position or in any other position.

If two plate levels are provided, the procedure is the same. Bring one plate level parallel to a pair of opposite foot screws. The other pair will be parallel to the remaining pair of foot screws. There is no need to swing the instrument. Bring the bubble to the central position alternately and check in the other positions.



*Fig. 2.2.2 Four-foot-screw leveling head*

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### Focusing the Eyepiece

Focusing the eyepiece is the operation of bringing the cross hairs to focus. The focusing position varies with the eyesight of the observer. If the same observer is taking the readings, this has to be done only once. To focus the eyepiece, use the following procedure.

1. Keep a piece of white paper in front of the telescope or direct the telescope towards a clear portion of the sky.
2. Looking through the telescope, adjust the vision by rotating the eyepiece till the cross hairs come into sharp and clear view.
3. If the eyepiece has graduations, note the graduation at which you get a clear view of the cross hairs. This can help in later adjustment if required.