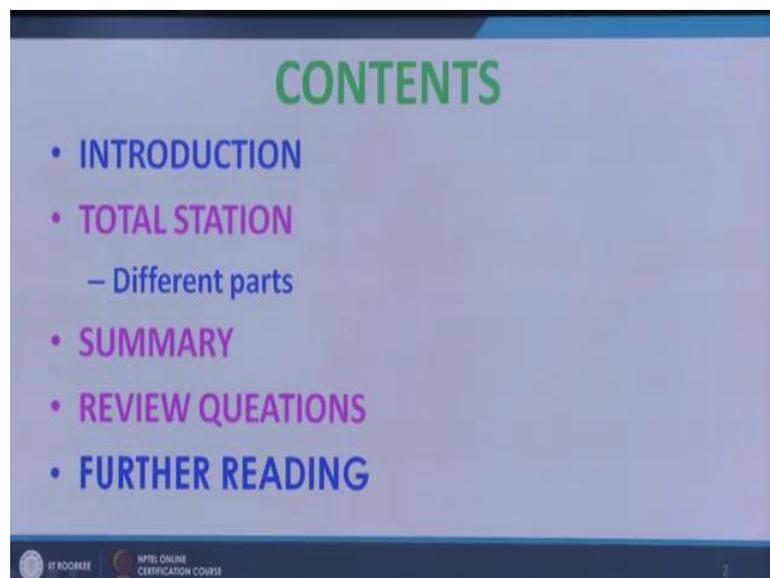


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**Lecture - 18**  
**Total Station**  
**Different Parts**

Welcome students, today is the lesson number 18. In this lesson I will discuss about the different parts of the total station.

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The lesson will be discussed under following heads, first I will introduce the lesson then I will talk about the different parts and their functions followed by summary, review and further reading.

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Now, already in the last class we have seen that a total station is an integrated unit consisting of one electronic theodolite, consisting of this vertical circle as well as the telescope, there is idiom and also there is a microprocessor that is kept inside it.

Now, to carry out defined functions we use this electronic theodolite to measure the horizontal and vertical angle to measure distance using the idiom and to do it automatically using the microprocessor we need to have many other parts. Now we will I will discuss those parts primarily the instrument total station consisting of 2 parts, one is the upper part called elevate and this is the upper part, this is the elevate and this is the lower part called tribrach. Now using this fixing this screw we can open the instrument out of this tribrach or we can also fix this elevate to the lower part.

Now, as I told you that this lower part let me explain about the different parts from the bottom this is the tripod stand and this tripod stand has to be placed over the station point in a levelled way. Then on this tripod stand generally we either we keep this instrument together or sometime we may use the tribrach stand only we can keep it apart from this part and we will make this tribrach here fixed with in this screw and this tribrach is this is the level head or base plate and this is the tribrach on which this instrument or elevate will be fixed. And in this tribrach there are three foot screws which we use to level the instrument and also in this is used to perfectly level and then once it is

used then we make use of we fix it and we have to make use of this fixing screw to fix the upper part with the lower part main important part of this is a telescope.

Because this is the part with which we do direct our instrument to the point of the objects to which we have to bisect it this telescope is having the objective lens, it will be kept to watch the object and there is a eyepiece lens this one through which an observer will see near this eyepiece lens. There is a reticle here and at this reticle there will be crosshairs reticules are like this within this you will be getting the crosshairs like this. So, we have to take the measurement along this line.

Now, this eyepiece there is a screw which we can rotate. So, that we can see clearly this reticle and the crosshairs from here and another circular focusing screw is there this one, this one is the circular foot screws which is used to focus the object and the image of the object is tried to be maintained at the plane of the reticle. So, that we can get the object reflected on this point on this crosshairs

Now, the most important point of this telescope is the line of sight which is the line joining the optical centre of the objective lens and the eyepiece lens and it is beyond and this line of sight when the vertical circle reading is 0 then or 90 degree depending upon whether it is measuring the azimuth angle all the altitude angle this should be perpendicular to the horizontal axis. So, or trunnion axis in the last class I have told you that the instrument is having a horizontal axis passing through this point about which the telescope can rotate. So, in a perfectly level instrument when the vertical circle zenith angle is 0 degree altitude angle is 0 degree then the line of sight should be perpendicular to the horizontal axis.

Now, one more thing whenever we will take observation looking through this telescope the image of the object will be forming at the reticle plane. Now there may be some parallax between the image formed and the reticle, but we should be able to identify by moving our eyes up and below if the object and the reticle knobs together then there is no parallax otherwise there may be relative motion between the object the between the reticle and the image. So, if there is a relative motion between the reticle and the image then there is a parallax and that has to be removed before going taking the reading.

Now, in this with this telescope actually this telescope rotate about the horizontal axis like this and also this telescope may rotate about the vertical axis. Now in case of a manual instrument like this, this rotation about the vertical axis can be; is regulated by using these this screw this is called vertical main screw. Now if I fix it there will not be any movement if the telescope is not moving. So, this is and if I open it the telescope can be rotated about the horizontal axis in a vertical plane.

So, this is called the vertical plate clamping screw. Now when we will bisect any object and we have fixed the main screw main vertical screw, but if we need to vary slightly we can move this one. This is called tangent to vertical screw. So, there are 2 screws one is the main vertical screw and another is the tangent to the vertical screw.

Now, similar to this there are 2 other screws this one if we fix this one then the telescope will not be able to move about the vertical axis; that means, this is the horizontal plate main screw. Now after bisecting the object if we want to have very little fine adjustment along the horizontal circles then we will be using this screw and this is called horizontal plate finest screw or tangent horizontal plate tangent screw.

So, these are the 2 screws which are important this one and this one this one is a vertical plate main screw this is the horizontal plate main screw this is the horizontal vertical plate tangent screw horizontal plate tangent screw. Now, these are the main salient parts where we associated with the telescope and operating these horizontal vertical plate main screw vertical plate screws and horizontal plate screws we can take the telescope at we can bisect any object using this telescope.

Now, in this telescope also there is one part which is inside this probably or it is not it is difficult to see if we look at it very near there will be a hole like this actually this is a point through which laser beam comes out. Now, in this is the mechanical instrument. So, we have to focus the object using the objective lens focusing screw, but in some instrument there is an another arrangement about this telescope which if we press than the focussing of the object is done automatically that is called auto focus. So, in some instrument that arrangement is also available.

Now, as I told you this telescope will be reading to the horizontal circle reading or vertical circle reading this is the horizontal circle reading this is the vertical circle reading and the vertical circles are available here. So, there are 2 parallel plates which

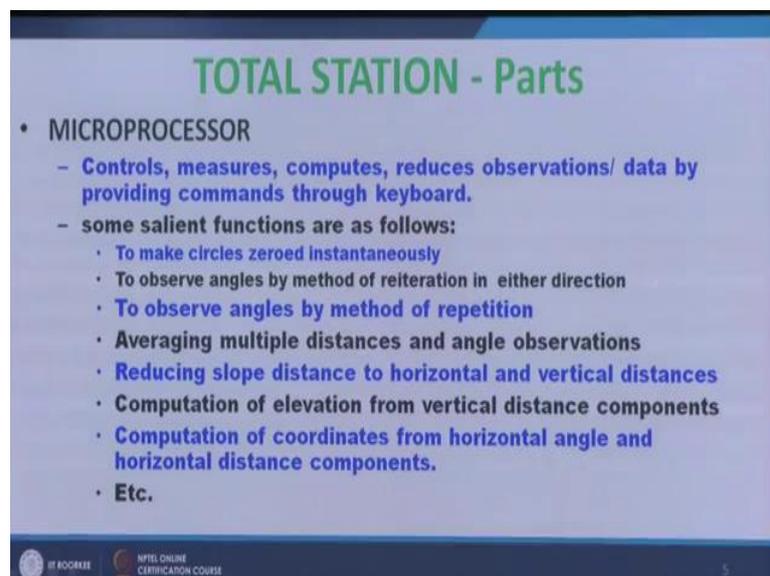
are kept vertically here and when this telescope is one instrument is properly levelled and telescope is looking towards zenith if we point this telescope towards zenith then the vertical angle reading will be 0; that means, zenith angle 0.

Now, and for any vertical horizontal angle measurement this is the horizontal plates there are 2 horizontal plates are there we will learn more detail about these plates and we using those 2 plates actually one is roto, another is stato one is rotate on keeps in static condition the mutual movement of these provides us the horizontal reading.

So, one more thing when the instrument is properly levelled then the horizontal circle will be in a horizontal plane and there is a automatic arrangement in which. So, which the vertical circle will be perfectly in a vertical plane. So, the verticality of the vertical plane will be done automatically or will be achieved automatically by the instrument once we make the horizontal circle in a horizontal plane by using these foot screws and other arrangement.

Now, in a total station all the works like taking measurement once we focus the object using manually using this vertical circle and horizontal circle screws and pointing the telescope towards the object by using these keyboard or keypad. We can make the measurement and all those measurements will be done through software in installing it and through command through these keypads and these we have sub done inside through a microprocessor.

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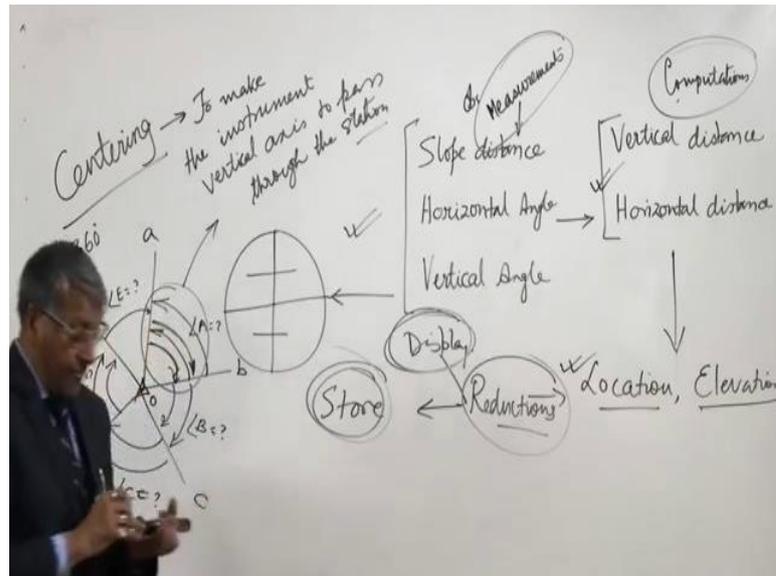
**TOTAL STATION - Parts**

- MICROPROCESSOR
  - Controls, measures, computes, reduces observations/ data by providing commands through keyboard.
  - some salient functions are as follows:
    - To make circles zeroed Instantaneously
    - To observe angles by method of reiteration in either direction
    - To observe angles by method of repetition
    - Averaging multiple distances and angle observations
    - Reducing slope distance to horizontal and vertical distances
    - Computation of elevation from vertical distance components
    - Computation of coordinates from horizontal angle and horizontal distance components.
    - Etc.

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So, microprocessor basically controls measures computes reduce observation data by providing commands through a keyboard. So, there are different types of commands in the keyboard by making use of suitable command we make use of the microprocessor inside it to control the instrument to measure the data to compute the data measure.

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Generally total station as I have already told total station measures slope distance and it measures horizontal angle and it measures vertical angle this called as the measure from this measurement it computes the horizontal distance. In the last class we have told it then vertical distance these are the components it can compute and from come these are the computation this is the observation or measurement this is the computation and using this it reduce the data to location; that means, coordinate and elevation. So, these are the reduction. So, this is the reduction, so all these works observation or measurement and then computation.

So, now these measurements are done by using some particular keys in the keyboard always after the measurement we can make use of some keyboard to compute it and after computation we can use some keyboard to find out to reduce the data towards this and again we can store it, we can display it by using some keys in the keyboard and all these functions measurement computation then reduction then display then store all these works are done through software making use of the microprocessor.

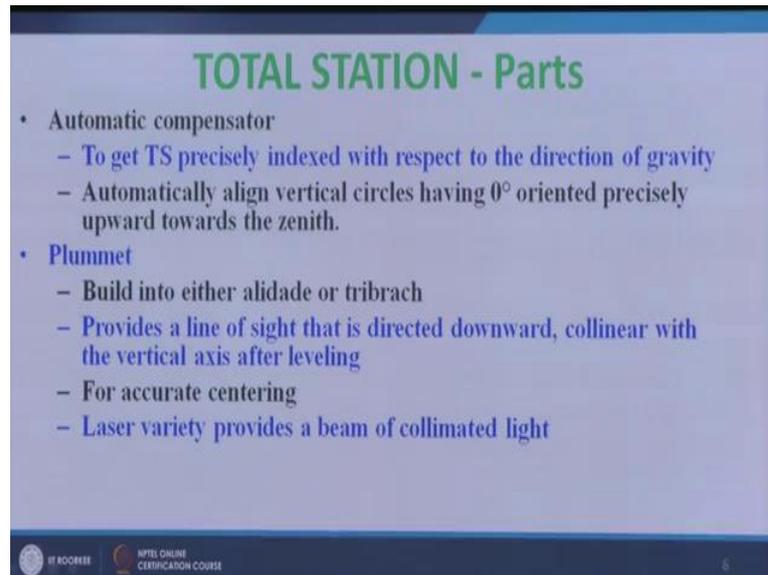
Further some more functions like we can make use of the microprocessor to make the circles 0 because to start with we may start angles from 0. So, we can do that thing using the microprocessor we can observe angle by method of iteration in any direction; that means, suppose we want to know we want to measure the horizontal angle between a number of points CDE. So, we want to find out what are the angles. So, our instrument is kept at this point we want to know; what is the angle? This one, this one, this, this, this is called and automatically because you know if I go back to the; this point that will make the 0 at 360 degree. So, angle a angle b angle c angle d if we say and this is the angle of e summation of this angle will be 360 degree.

So, and this is the by making these measurements subs subsequently this is called method of iteration. So, microprocessor making we can make use of microprocessor to measure this angles by method of repetition; that means, suppose I want to measure this angle very accurately. So, I will take measurement of this angle then again this angle then again this angle then again this angle like this same angle number of times that is called method of repetition.

So, this is also can be done by using microprocessor and then we can take the average using the microprocessor then reducing slope distance to vertical and horizontal distance already I told you that the this is the observed measurement parameters which can be converted to vertical distance of very large distance and that is done by making use of the microprocessor then let coordinates location and all these thing we can do by making use of microprocessor in this instrument.

Further as I already told that if we have a level this instrument properly then our horizontal circle will be in horizontal plane and they once the horizontal plates or horizontal circles are horizontal, then the vertical circle will be perfectly vertical and that is done automatically by the instrument by using arrangement called automatic compensator.

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So, the automatic compensator is the part which makes the vertical circle exactly vertical when the horizontal plates or circles are by horizontal.

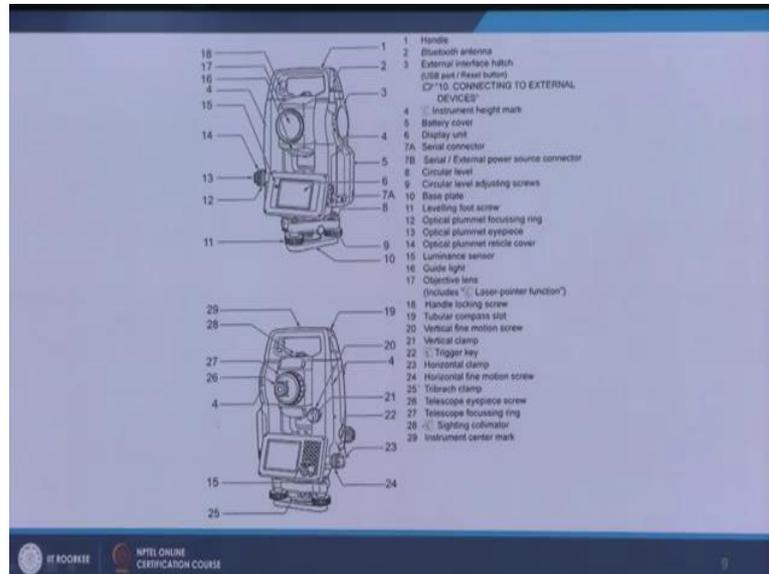
And there is another arrangement this one that is called optical plane plummet depending upon whether it works optically then it will be called as optical plummet in some instrument this part is worked by using some laser ray, there are known as laser plummet. So, what it is done there is IP's here. So, by adjusting the IP's, we can and this is IP's and also there is a reticle here. So, by using these IP's and this adjusting screw we can see the reticle clearly then there is another screw here which we can make use to see whether our instrument is exactly on the top of the instrument station or not.

So, that is called centering operation, centring means to make to make or to keep to make the instrument vertical axis to pass through the station location. So, that is done that is can be achieved by making use of these optical plummet. So, once we level the instrument then using the optical plummet we do make this instrument just vertical axis just passing through the station point. So and that is achieved through this plummet actually through this plummet it provides us a line of sight that is directed downward collinear with the vertical axis after levelling.

Now, in case of laser plummet actually whenever there will be some arrangement to press or to which through which we can send a laser beam and then laser beam will strike

exactly on the top of the instrument station. So, if it is done then we can say that the instrument is properly centred otherwise we have to do centering.

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Another arrangement in some instrument about this idiom in towards your objective lens like you can show you; I can show it here this is an arrangement in some instrument only one in some instrument in the both up and down on this there is an arrangement called optical guidance system. Now these are light emitting diode and if we which enables the details pole to be set directly on the line of sight, so optical; that means, light emitting diode which will emit some light and that light will directed towards the object to which we are bisecting.

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## TOTAL STATION – Parts...

**OPTICAL GUIDANCE SYSTEM**

One or two above or below the telescope tube at the end of the objective lens. These are light-emitting diodes and emit a visible light patterns which enables a detail pole to be set directly on the line of sight and at the correct distance without the need for hand signals from the total station.

In some instrument, OGS is represented as GUIDE LIGHT. It is composed of a light that is divided into green and red sections. A pole man can ascertain the present position by checking the guide light color as follows:

Light Status	Meaning
Increased flashing speed	Move towards TS
Decreased flashing speed	Move away from TS
Fast flashing	Target at the correct distance
Red	Move Target Left
Green	Move Target Right
Red & Green	Target at correct horizontal position

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And if it is bisected properly then it will provide us an indication otherwise if there is some this adjustment between the direction of the object and the direction of the bisection then there will be some other kind of lights which guide us to rotate it on bisect it the telescope exactly on the object.

Now, here is an example that if we will we may get increased flashing light then note towards total station; that means, if we see that it is that optical guidance is giving very strong light flashing. Then we have that object should be taken for near the instrument and if the flashing speed is decreased then we have to take away the target. So, like that there are some indications in this way in which provides us a guidance to keep the target as per our requirement.

Now, in this is instrument there is also communication port like this of this; this is a port in which we can fix USB and also there is another port here or which through which we can communicate this instrument with the some external device like computer and throw this directly. We can make use some computer to upload or download the data or we can transfer the data by using some pen drive here inside. So, these are the communication ports

Now, as I already told this is the tribrach this tribrach is primarily used for levelling as well as centering purpose also will be required and also fixing the instrument with tripod stand and also sometimes we use this tribrach to replace this instrument this part of

instrument by another instrument. So, sometimes we do in the field to avoid the centring and level levelling work to be repeated.

So, with this one you can see some more devices like this is the handle as it is shown here handle then there is an arrangement called it is not there in this instrument here in this part we can fix blue tooth antenna then already I have shown you USB port inside this and then one more thing important is this one this is the this is the point which indicates the height of the instrument. So, we have to measure this point from ground to this we have to measure to find out what is the height of the instrument and that has to fed to the instrument on then there is a circular bubble layer this bubble is something like this and a bubble like this. So, we have to bring this bubble inside this to indicate that the instrument is properly levelled. So, this is the levelled condition.

So, this is done by using the foot screws calls sight polycollimator ORS in collimator and this is used to approximately bisect the object when we will bisect an object we will look through this collimator there is a in inside this collimator there is a triangle like this. So, and whenever we will bisect the object we should it should be like this. So, optical that then and already I had told you this is the fixing screw between your tribrach and the main stations.

So, with this I will like to conclude today's salient parts of the instrument and. So, we can say that the total station can be divided into 2 part one is that upper part which is called elevate and the lower part tribrach and the elevate part can be fixed to the tribrach part by using a fixing screw in the elevate there are three main part like your electronic theodolite then e d m and the micro microprocessor. And to operate these parts we have many other smaller parts we like telescope and all these thing and the lower part tribrach also having some like circular bubble foot screws, tribrach, etcetera and the whole of this instrument is an integrate unit work as an integrated unit and they function automatically by making use of the microprocessor.

So, with these I like to conclude today's class and next class I will be talking on different accessories apart from the basic parts and the basic elements there are some more accessories are associated or connected to this or maintained inside this. So, that we have to discuss and some of them are also external in nature. So, in the next class I will talk on accessories of total station.

Thank you.