



**Ministry of Higher Education and  
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Al-Mustaqbal University College  
Building and Construction Technical  
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# Measuring Vertical and Horizontal Angles using Theodolite

By

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# Theodolite: Introduction





# DEFINITION

- **Centring (plummeting)**

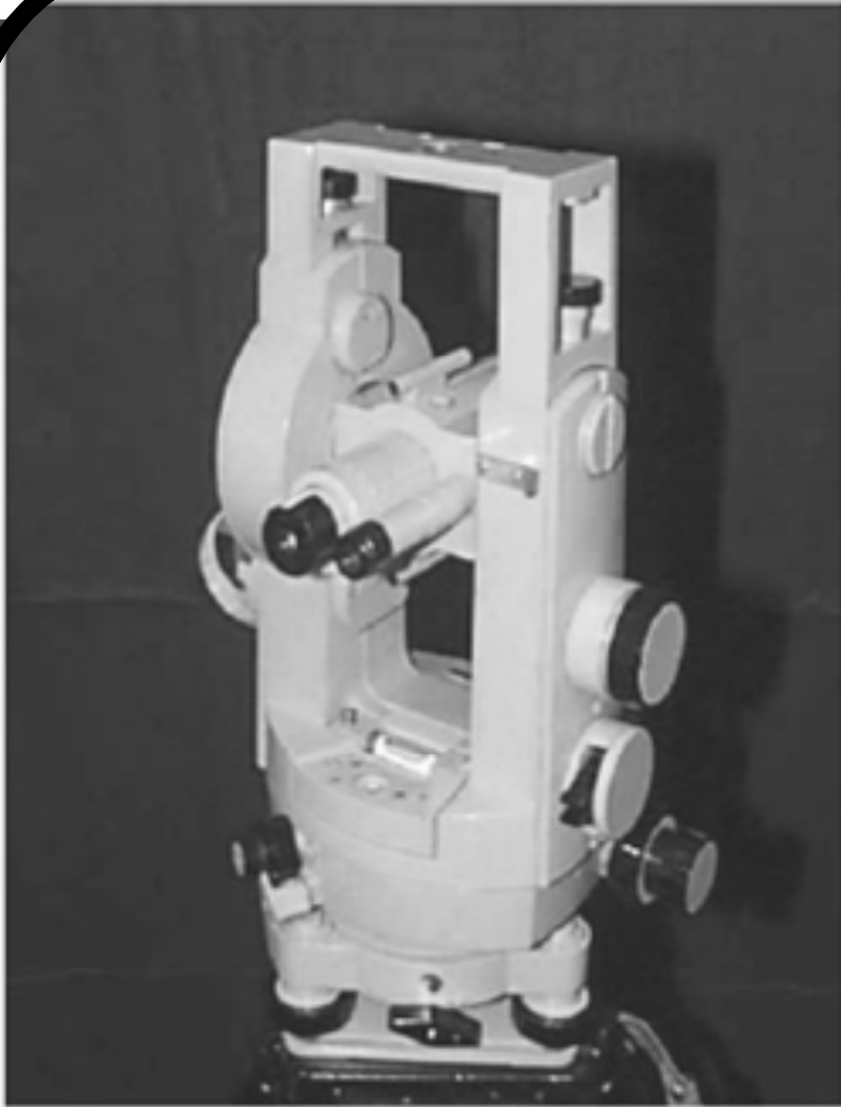
- **The process of setting about the theodolite exactly over the station mark is known as centring.**

- **Face left**

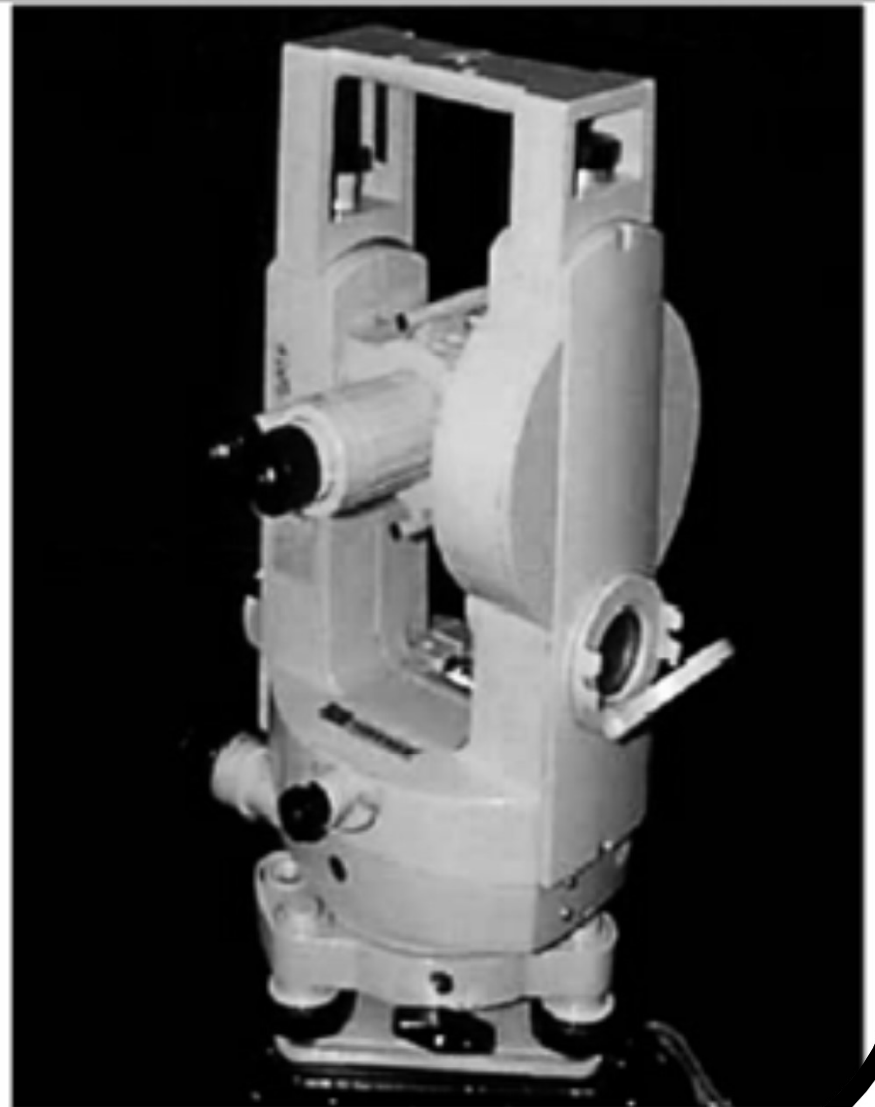
- **If the vertical circle of the instrument is on the left side of the observer while taking a reading ,the position is called the face left.**

- **Face right**

- **If the vertical circle of the instrument is on the right side of the observer while taking a reading ,the position is called the face right**



Face left



Face right



# TEMPORARY ADJUSTMENT OF THEODOLITE

- **Before setting up the theodolite, it should be ensured that**
  - **The levelling screws are at the centre of their run.**
  - **The wing nuts on the tripod legs are tripod enough so that when raised, the tripod legs do not fall under their own weight.**



# **TEMPORARY ADJUSTMENT OF THEODOLITE**

► **Such adjustments involve the following steps**

**1) Tripod setting up**

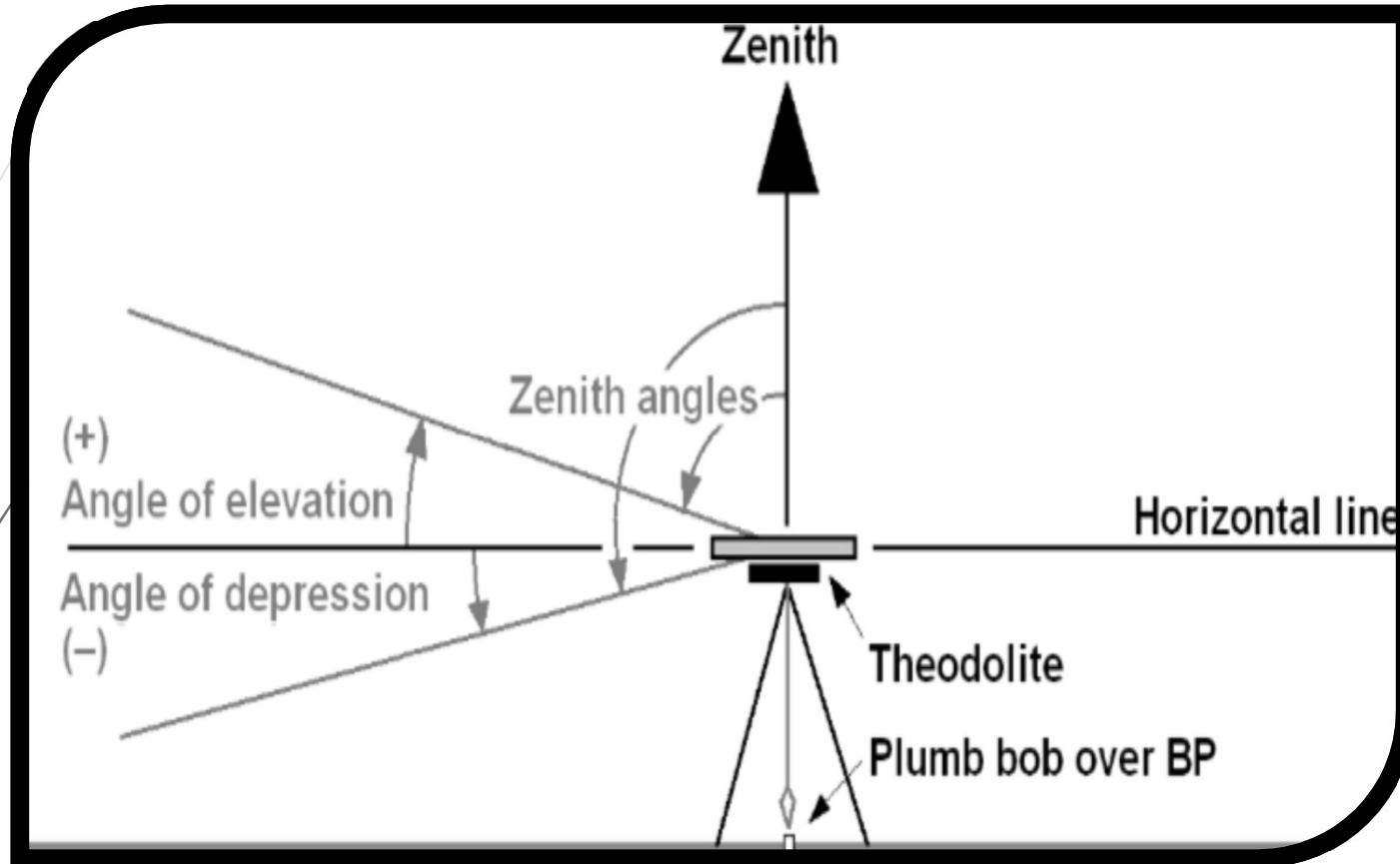
**2) Centring**

**3) Levelling up (two bubbles)**

**4) Focusing the eye-piece**

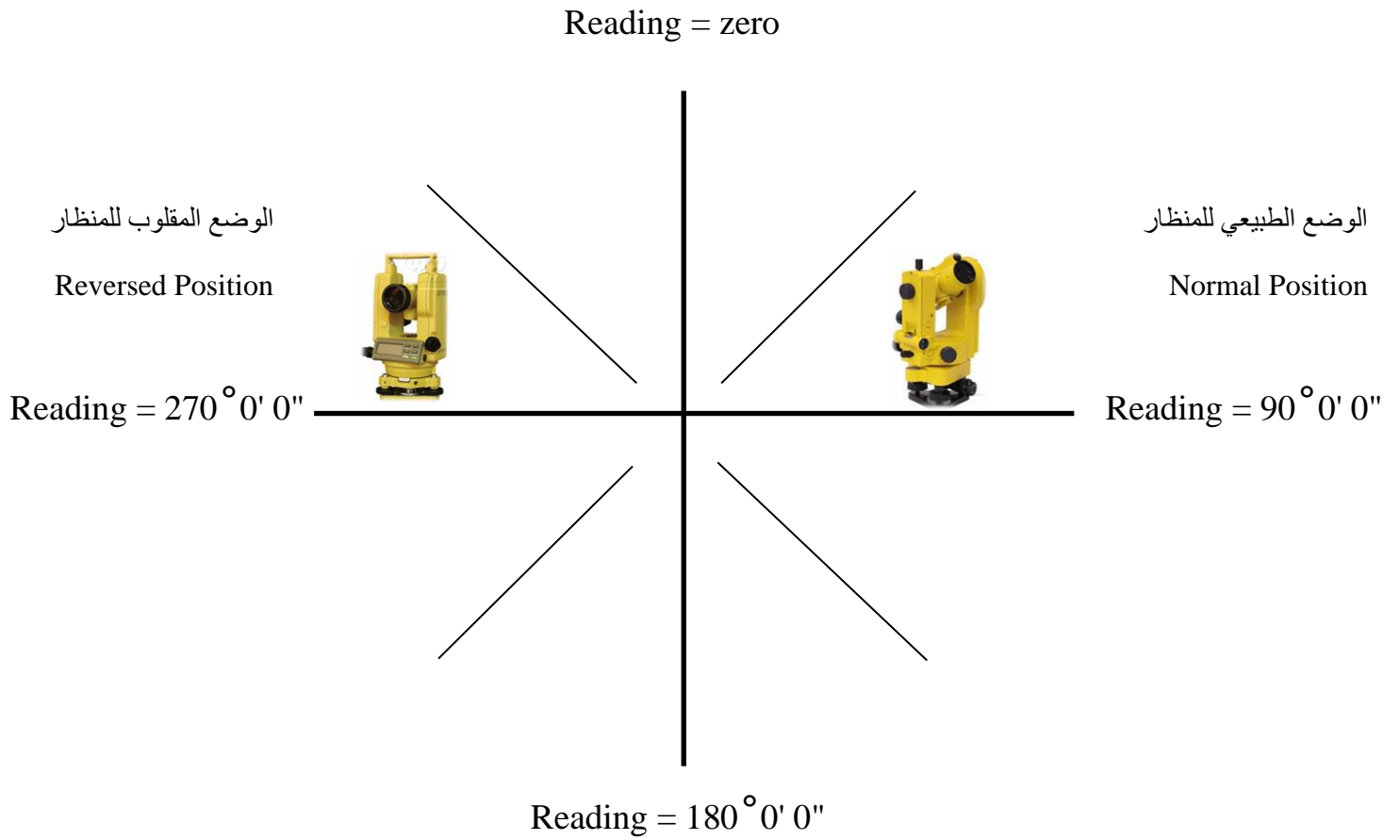
**5) Focussing the object glass**

# MEASURING Horizontal and vertical Angles



$$\text{Zenith angle} = 90 - \text{Elevation angle}$$

## Measuring vertical angles



$$A_n = 90^\circ - \text{Reading} \quad \text{الوضع الطبيعي للمنظار}$$

$$A_r = \text{Reading} - 270^\circ \quad \text{الوضع المقلوب للمنظار}$$

Ex1:- If the reading of the Theodolite was  $82^\circ 17'$  determine the vertical angle.

$$A_n = 90^\circ - 82^\circ 17' = + 7^\circ 43' \quad \text{العلامة الموجبة تعني ان خط النظر مرتفع}$$

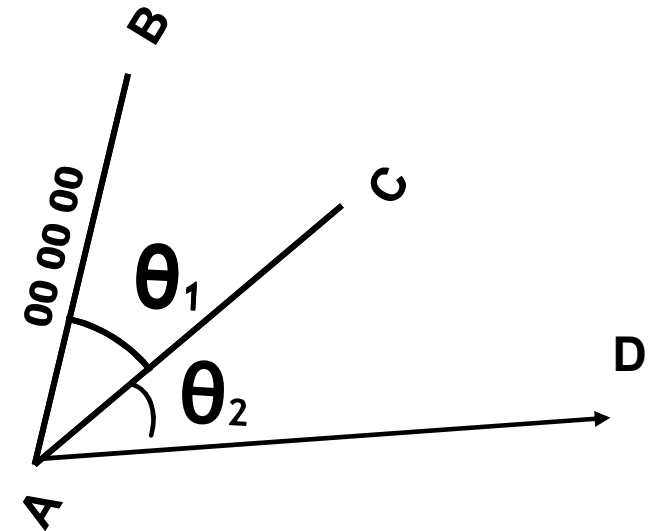
Ex2:- If the reading of the Theodolite was  $264^\circ 26'$  determine the vertical angle.

$$A_r = 264^\circ 26' - 270^\circ = - 5^\circ 34' \quad \text{العلامة السالبة تعني ان خط النظر منخفض}$$



## Measuring Horizontal angle by Direction Method

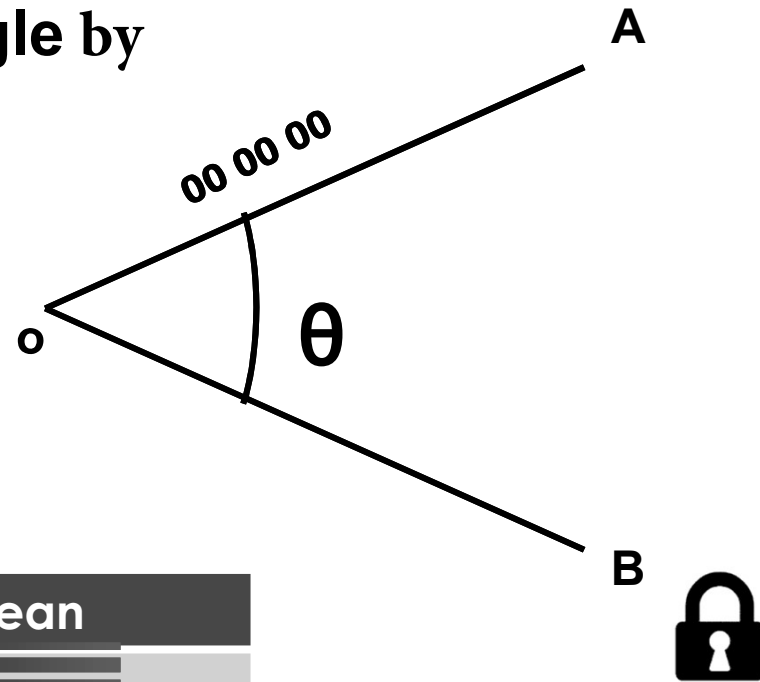
station	P.	face	Direction	mean	angle
A	B	C.L	17 32 58		00 00 00
				54	06 39 10
SET I	C	C.L	24 12 09		
				10	27 39 43
	D	C.L	51 51 51		
				40	
station	P.	face	Direction	mean	angle
A	B	C.L	17 59 01		00 00 00
				13	06 14 30
SET II	C	C.L	24 13 31		
				28	26 52 00
	D	C.L	51 05 31		
				23	



$$B-C = (06\ 39\ 10 + 06\ 14\ 30) / 2 \\ = 06\ 26\ 50$$

$$C-D = (27\ 39\ 43 + 26\ 52) / 2 \\ = 27\ 15\ 51$$

# Measuring Horizontal angle by Repeating method



## Example

station	Face	Reading	Mean
O	A	00 00 00	
3L- Sets	LF1	B 73 17	
	LF2	B 146 34	
	LF3	B 219 50	
3R- Sets	RF1	B 293 08	
	RF2	B 06 25	
	RF3	B 79 43	

$$\text{Second R.} - \text{First R.} = 146^{\circ} 34' - 73^{\circ} 17' = 73^{\circ} 17'$$

$$\text{Final R.} - \text{First R.} / \text{عدد مرات التكرار} = ((360^{\circ} + 79^{\circ} 43') - 73^{\circ} 17') / 5 = 73^{\circ} 17' 12''$$

# End of lecture

