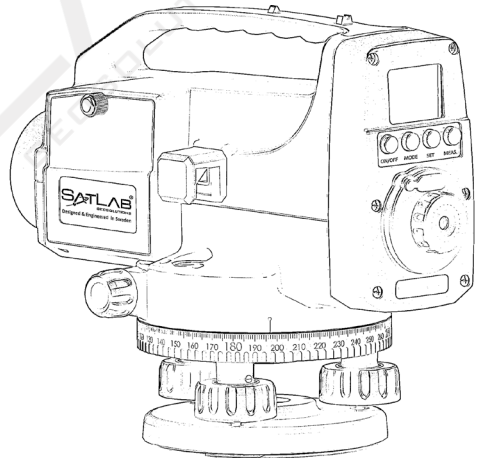


SDL1

Digital Level

USER MANUAL



FOREWORD

Thank you for purchasing the Satlab Digital Level SDL-1. For the best performance of the instrument, please read this user manual carefully and keep them for future reference.

NOTICE

- For optimum usage, this instrument should be checked and adjusted especially after being stored for a long time or after being transported.

For further information, please refer to page 16 under **3. Checking and Adjustment.**

- Before measuring, please check that the instrument is operating properly.
- Do not store the instrument in high temperatures or set it up under strong sunlight to prevent the photosensor from heating up as it may affect the accuracy of the instrument.
- Please use trained staff when operating this digital measuring instrument. Ensure that the staff cleans the surface without scratching or staining the instrument. The instrument must be placed in a proper position.
- When the instrument is being operated, you can use the back side of the bar staff or equivalent.
- For better usage and daily adjustments, it is highly recommended to equip at least two pieces of our standard bar staff.
- When operating in digital mode, avoid direct sunlight from passing through objective lens and the eyepiece which may cause interference if the image of the staff is too dark or the background is too light.
- Please keep the instrument in the case provided during transportation.

- Once your work is completed, please clean the instrument and keep it back into the case.
- Do not touch the lens with your fingers. Please clean the surface, buttons, screen and outer layer of the instrument with a soft cloth. Clean the optical parts only with lens paper.
- Store the instrument in a dry room with consistent temperature.
- If the instrument requires repair, make sure that it is checked and repaired by Satlab technicians or by appointed dealers.

WARNING

- **Never observe the sun through the telescope system.**
- **Please be careful when working around high voltage facilities**
- **Do not handle staff during thunderstorms.**
- **Please place the instrument and battery in a dry and cool place.**
- **Keep the instrument away from flammable and explosive materials.**
- **The survey should be operated in a safe area.**
- **Please observe local safety and traffic rules.**
- **Do not overheat the battery.**

CONTENTS

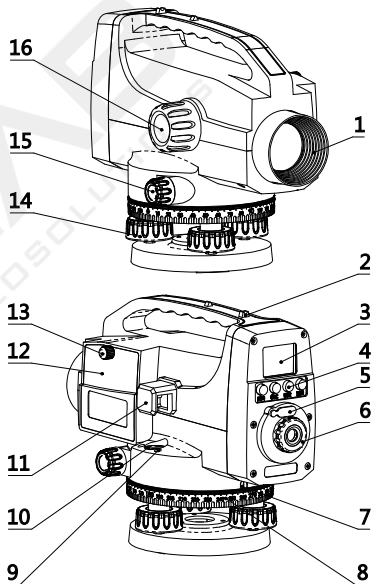
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1. Important Parts and Operational Manual

This figure shows the parts of the instrument

1.1 Important Parts

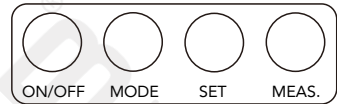
1. Objective Lens
2. Peep Sight
3. Screen
4. Buttons
5. Seal Plug
6. Eye Piece
7. Graduation Pointer
8. Horizontal Graduation Circle
9. Bubble Adjusting Screw
10. Circular Bubble
11. Reflecting Mirror
12. Battery Compartment
13. Battery Set Screws
14. Footscrews
15. Horizontal Tangent Screw
16. Focusing Knob



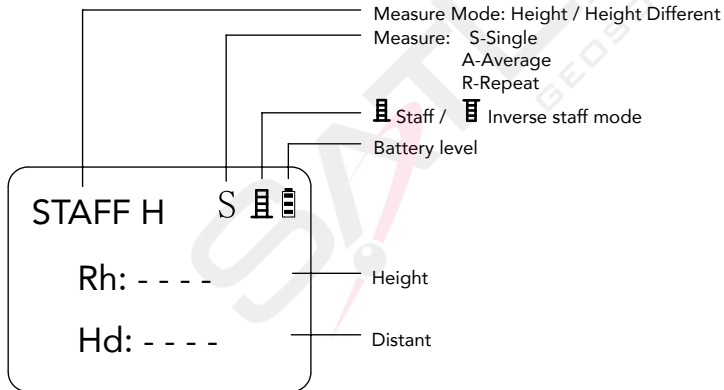
1.2 Buttons

Left to Right

1. Main Function: Power/Mode/Setting/Measure
2. Settings Function: None/Quit/Confirm/Shift
3. Input Function: None/Quit/Shift/Input



1.3 Display Screen



2. Instrument Operation

2.1 Preparation

2.1.1 Installation of Battery

Loosen screw and open the battery cap (fig.1). Install four AA batteries as shown in fig. 2. Lock the cap and tighten the set screw.

Tips: When locking the battery compartment, please tighten the screws.

2.1.2 Instrument Setting

- Extend the tripod legs until the top holder is at eye level.
- Tighten screws and stick tripod legs firmly into the ground.
- Set the instrument and tighten the centering screws accordingly.
- Move the bubble to the center of the circle by adjusting the footscrews (shown in fig. 3). Adjust A and B screws to move bubble left and right then adjust the C screw to move the bubble into the center circle.

Fig. 1

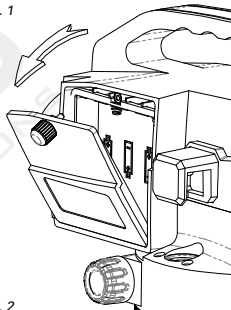
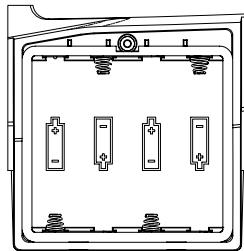


Fig. 2



2.2 Sight and Focusing

- Rotate the eyepiece to ensure that the reticle is clear (fig. 4)
- Target the staff through the peep sight. Rotate the focusing knob to make the staff image clear. Ensure the vertical hair is crossed with the middle of the staff. (fig. 5)
- Move your eyesight left, right, up and down. If the staff image and reticle hair remain still, you can proceed with your measurements.

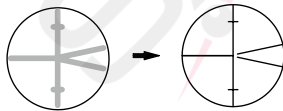


Fig. 4

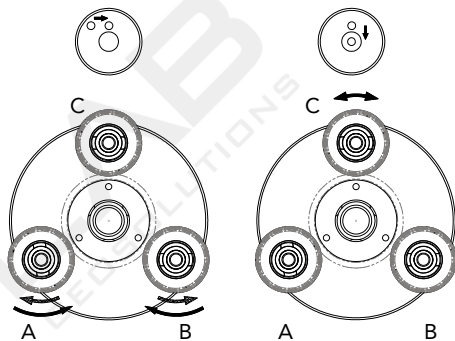


Fig. 3

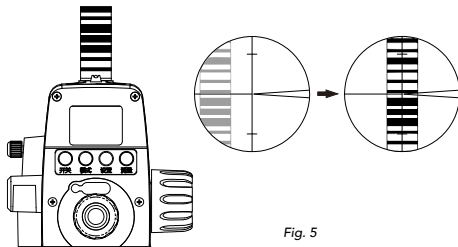


Fig. 5

Attention:

- Bar side is for digital mode measurement while ruler side is for optical mode.
- Digital measurement only fits our standard bar staff.
- Keep the staff in a vertical position with the help of the bubble level
(You can find this accessory in the staff package)

2.3 Digital Mode

2.3.1 Digital Measurement

2.3.1.1 Height

- Press power (ON/OFF) button and wait for the launching to complete
- Press MODE button and select Staff H
- After measurement preparation, press MEAS button, the data will show up in a few seconds.

Height = 1.438m; Distance = 34.39m

- Press and hold the power button to power off

2.3.1.2. Height Difference

- Press power (ON/OFF) button and wait for the launching to complete.
- Press mode button and select DIFF.

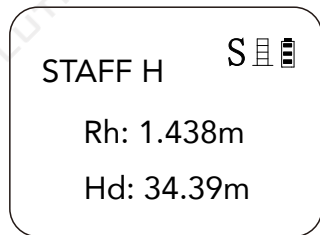


Fig. 6

- MEAS. BS (Staff A) will show up on the screen. Measure the first staff and get the data as Height = 1.568m and Distance = 29.36m (fig. 9).

Press SET button then Meas. FS (Staff B) will show up. Measure the second staff and get the data as shown in fig. 7.

After a few seconds, the height difference will be configured as fig.8.

Height difference = 0.189m, Height of Staff B = 1.379m, Distance to Staff B = 29.98

Tip: Press the button gently to increase the level of accuracy

2.3.1.3 Inverse Staff Mode

This mode is for ceiling leveling. Processes as per below:

- Press SET button until you see the Inverse Staff then press MEAS. to turn it on.
- Inverse the staff vertically and prop it against the ceiling. Then operate the same with 2.3.1.1 and 2.3.1.2



Fig. 7

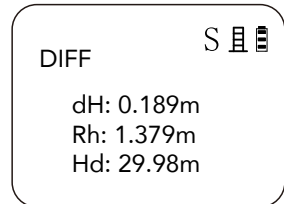


Fig. 8

2.3.2 Instrument Set-up

After start-up, press SET button to enter settings mode. Set button is used for selection while MEAS. button is used for confirmation. MODE button is used to exit.

- Measure Mode

Single: Data is figured out by a single measurement. You can see the "S" on the screen when this mode is activated.

Mean: Several times of measurements averaged out. You can see "A" on screen when this mode is activated.

Rept: Measure target constantly and stops when you press MEAS. button. This mode will show the past data of your last measurement. You can see "R" on screen when this mode is activated.

- Backlight

On: Turn on the backlight

Off: Turn off the backlight

(You can also press and hold the SET button to switch it on or off)

- Beep

On: Turn on the beep device

Off: Turn off the beep device

- Inverse Staff

On: Inverse the staff, you can see $\begin{array}{|c|} \hline \text{ } \\ \hline \end{array}$

Off: Measuring upward staff, you can see $\begin{array}{|c|} \hline \text{ } \\ \hline \end{array}$

- Units
 - m: Metre
 - ft: Foot
- Rounding
 - Minimum reading: 0.01/0.001m
- Auto Off:
 - 15min - The instrument will power off after 15 minutes of idle
 - Off - Instrument will keep running until power is off
- Average Times: Data is figured out by 1 to 9 times for measurement

2.3.3 Operational Settings

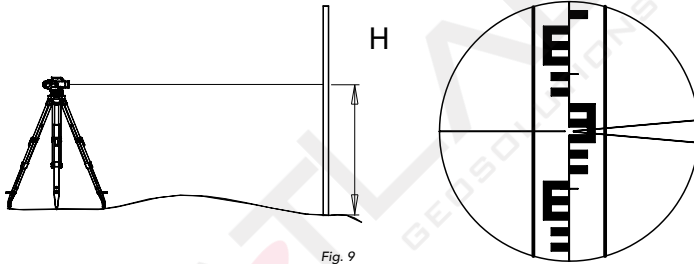
Press and hold the SET button to turn on/turn off the backlight
In 3 seconds after start-up, you can check instrument ID number by pressing SET button

2.4 Optical Measurement

2.4.1 Height measurement

- Use the ruler side of the staff and keep it vertical
- Adjust the eye piece and focusing knob to make the images of the reticle and staff clear

- Read data as fig.9, $H = 1.165\text{m}$



2.4.2 Height Difference

- Set up the instrument at a point approximately halfway between point A and point B
- Position the staff vertically at point A, take a reading as 'a' (Example $a = 1.735\text{m}$)
- Then read the staff at point B and obtain the reading as 'b' (Example $b = 1.224\text{m}$)

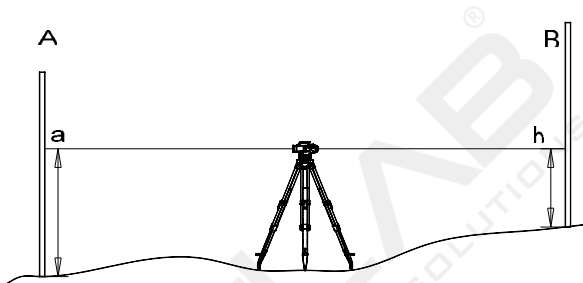


Fig. 10

2.4.3 Stadia Measurement

- Read the staff and count the difference between L and two stadia lines:

Up Stadia Line: 1.238m

Down Stadia Line: 1.091m

Difference $L = 1.238 - 1.091 = 0.147\text{m}$

Distance $D = 100 * L = 14.7\text{m}$

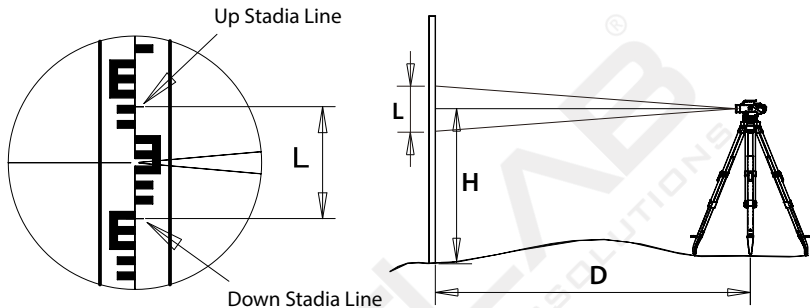


Fig. 11

2.4.4 Angle Measurement

- Direct instrument to staff A and turn Horizontal Circle to "0"
 - Point instrument to staff B
 - Read off H_z - angle from Horizontal Graduation Circle.
- fig. 12: H_z 43°

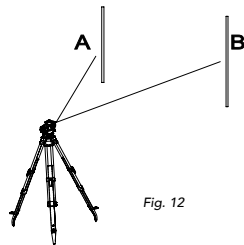


Fig. 12

3. Checking and Adjustment

Please check the instrument before you start work. The instrument must be checked and adjusted by a specialist regularly.

3.1 Circular Bubble

- Center the bubble of the Circular Level precisely by using the Leveling Foot Screws
- Turn the telescope around 180° (or 200 gon)
- The bubble needs adjustment if it is not centered
- Adjusting leveling foot screws should move the bubble to the middle of the offset
- Adjust the rest half of offset by using the Allen Key
- Repeat the above steps until the bubble remains centered when telescope points at any direction

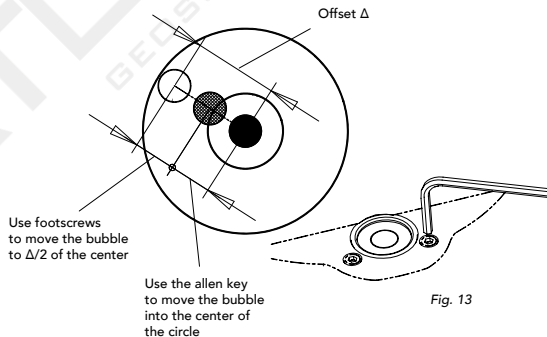


Fig. 13

3.2 Line of Sight

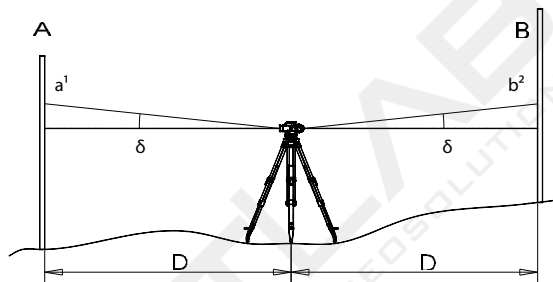
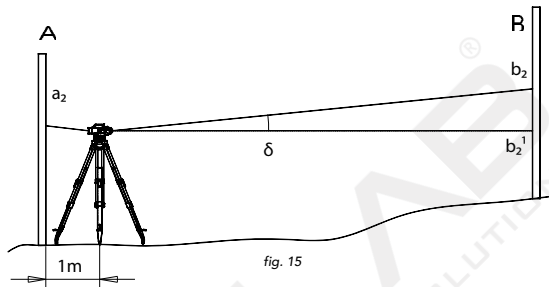


fig.14

3.2.1 Optical

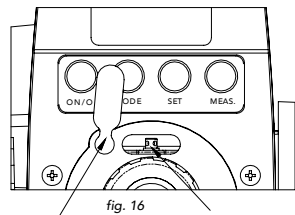
- Set the instrument at a point halfway between point A and B spaced about 30 - 40m apart. Take the readings of staff A and staff B as "a1" and "b1". (fig.14) Calculate the real height difference:
 $\Delta H = a1 - b1$
- Set up the instrument about 1m away from point A and read staff A and staff B as "a2" and "b2". (fig. 15)
- Then you can get the logical value $B2 = a2 - \Delta H$ --- b2' is the height that b2 should be



- When the difference between b_2 and b_2' is more than 3mm, the line of sight must be adjusted
- Pull out the seal plug and adjust the adjusting screw until the horizontal hair moves to reading b_2'

3.2.2 Digital

- Set staff A and staff B with 45 metres distance and set Point 1 at 15 metres and Point 2 at 30 metres at Points where instrument set up (fig. 17)



Seal Plug

Adjusting Screw

Tips: To ensure a correct adjustment, the distance between those points should be kept at a certain range as $15 \pm 0.5\text{m}$

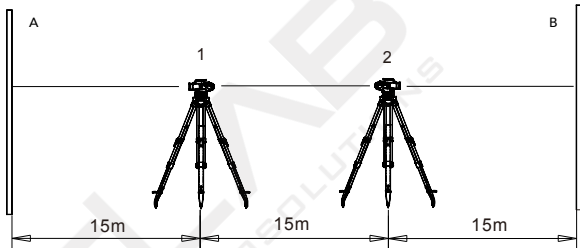


fig. 17

- First set the instrument at point 1. Press and hold Meas. Button and press the Power button to enter adjustment mode (fig. 18). Press MEAS. button then SET button to enter Collimation mode as shown in fig. 19 (MODE = CE SET = OK)

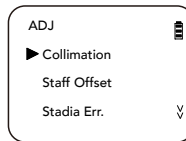


fig. 18

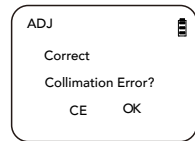


fig. 19

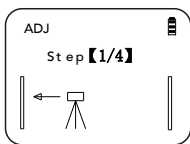


fig. 20

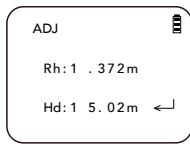


fig. 21

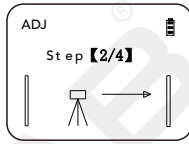


fig. 22

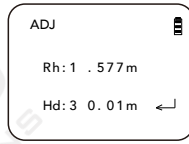


fig. 23

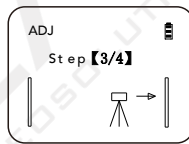


fig. 24

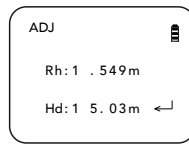


fig. 25

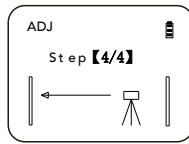


fig. 26



fig. 27

- When you see fig. 20., measure Staff A. After the data showed up as fig. 21, press SET to the next step
- Rotate instrument to point Staff B and measure it. After data showed up as fig. 23, press the SET button to the next step (fig. 24)
- Move the instrument to Point 2 and set it properly, then measure Staff B. After the data showed in fig. 25, press the SET button to the next step (fig. 26)
- Then measure Staff A. After the data is showed as in fig. 27, press the SET button to the next step

- Now measure those 4 points that has been completed. Press the SET button to confirm the results (fig. 28). Then press the SET button to save and restart

3.3 Staff Offset

- When measuring the staff, you may find that the digital and optical mode has a height difference. Thus, you should operate the staff offset.

Attention: Before the staff offset, make sure that you have adjusted 3.2.1 optical line of sight and 3.2.2 digital line of sight.

- Set the staff and instrument properly, read the staff within optical system, like 1.319m
- Turn the staff to the bar side

Attention: Staff should be set in the ground, and when the staff is turning, do not change its height

- Press and hold MEAS. button and power button to enter adjusting mode. Press MEAS. button to select "Staff Offset" (fig. 29), press SET button to enter staff offset (fig. 30) press SET to confirm



fig. 28



fig. 29

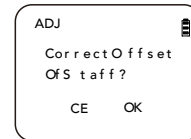


fig. 30

- Input the data you get from “(2)”, press the SET button to select the digital underline place, press MEAS. button to input 0-9 as 1.3190m (fig. 31), Input numbers one by one. When “Enter” shows up in the screen, (fig.32), press the SET button, it will mentioned for you to aim at the staff.
- Measure the staff and get the data as fig. 33. Press the SET button to get the difference (fig.34). Then press SET to confirm and restart.

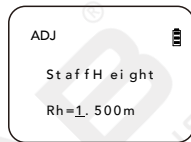


fig. 31

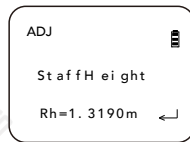


fig. 32



fig. 33

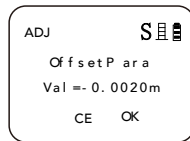


fig. 34

3.4 Stadia Err

- Set the staff and instrument properly, and measure the distance between the staff and the instrument with a high-precision range finder.
- Press and hold MEAS. and the power button to enter into the adjusting mode. Press Meas. to select “Stadia Err” (fig. 35) and press SET to enter Stadia Err (fig. 36), press SET to confirm



fig. 35

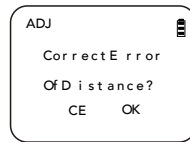


fig. 36

- Input the distance data you get from process (1), press the SET button to select digit underline place, press Meas. to input 0-9 (fig. 37). Input the numbers one by one. When "Enter shows up on screen (fig. 38), press the SET button, and it will mention for you to aim at the staff.
- Measure the staff and get the data as fig. 39. Press the SET button to get the Stadia Err. (fig. 40). Press SET to confirm and restart.

3.5 Reset

Press and hold Meas. and Power button to enter into configuration mode. Press MEAS button to select "Reset" (fig. 41), press SET to enter reset mode (fig. 42), press SET to confirm.

Save and restart.

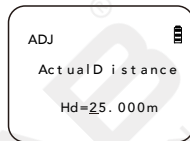


fig. 37

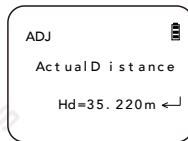


fig. 38

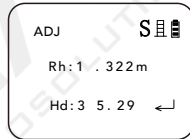


fig. 39



fig. 40

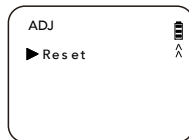


fig. 41

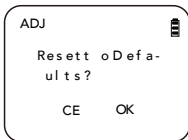


fig. 42

4. Fault Information

Fault Information	Reason	Solution
Poor Condition	Unable to detect staff Barrier Unstable environment Atmosphere disturbance caused by strong wind or light Too close to staff Eyepiece received too much light Background light of staff is too strong Staff set in a dark environment Not focused properly Bad conditions Staff imaging incomplete	Target the staff and focus on it properly Remove barrier Find another spot Wait for good weather Change measuring distance to at least 3m Cover the eyepiece while measuring Change measuring spot or angle or wait for dimmer conditions Ensure that the lighting conditions in the environment is higher than 40 lux Focus the staff to ensure that the image is clear No barriers should exist between the staff and instrument Keep the surface of the staff clear of scratches or stains
Target too far	Measuring distance is more than 110m	Keep the measuring distance between 3m to 110m

5. Technical Data

Accuracy

1km double run leveling

Height:	Digital	0.8mm
	Optical	1.5mm

Distance:	D≤10m	10mm
	D>10m	Dx0.2% ^m

Measuring

Digital working range:	3-110m
Optical min. focusing:	0.6m
Measuring time:	1-3s*
Min. value (height):	0.001/0.0001m
Min. value (distance):	0.01m
Continuous operating time:	>20 hours**
Continuous stand-by time:	>45 hours**
Lowest illumination:	40lux

Telescope

Erect Image	
Magnification:	32x
Aperture:	36m
View angle:	1°20'
Stadia constant:	100
Additive constant:	0

Distance Measurement

Multiplication factor	100
Additive constant	0

Compensator

Damping	Magnetic
Accuracy	0.5"
Working range	15'

Circular Level

Sensitivity	8'/2mm
-------------	--------

Circle

Graduation	1°/1gon
------------	---------

Environmental Specifications

LCD screen resolution	128px x 64px
Operating temperature	-10°C to 50°C
Storage temperature	-40°C to 70°C
Protection	IP65
Battery	AA battery x 4
Dimension	245mm x 130mm x 182mm
Weight	1.8kg

* Actual measuring time depends on the working environment

** Continuous operating time will change according to battery capacity

6. Packing List

Instrument	1 Piece
Manual	1 Piece
Carrying Case	1 Piece
Allen Key	1 Piece
Adjusting Needle	1 Piece
AA Battery	4 Pieces
Plumb	1 Piece
Specialized bar staff	Optional



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