ATO

DMI810/DMI820

V1.9

DIGITAL DISPLAY INCLINOMETER

DMI810/DMI820

TECHNICAL MANUAL

www.ato.com sales@ato.com 800-585-1519 Global Shipping

ATO

DMI810/DMI820 DIGITAL DISPLAY INCLINOMETER

GENERAL DESCRIPTION

DMI810/DMI820 is a digital display inclinometer which took ATO company three years to develop professional for various industry angle controling and measuring.The core of this product is using the micro-mechanical control principle, dual-core measurement unit, can use the Y-axis to compensate X-axis during the measurement process,and then to use ATO patent interleaved and temperature compensation model algorithm to play absolute operation advantages of the micro-mechanical electronic principles,to ensure that the instruments measurement with the long-term stability and repeatability. Single and double axis measurement, measurement range ±30° measurement, resolution 0.001°, highest accuracy <0.005° full value、fast response, stable data, products specially designed for the sides and bottom with magnetic adsorption installation, both sides of the benchmark can be measured and using normally,very convenient to use, DMI810 series has strong scalability, convenient & practical application and industrial reliability, has absolute cost advantage and has an absolute competitive advantage in the international market !

FEATURES

★ Best accuracy: <0.005°
★ Repeatability: 0.003°
★ Angle resolution: 0.001°
★ Maximum measure range: ±30°
★ User can set the alarm value by himself
★ Data store function
★ Absolute/Relative measurement can switch
★ Both sides and bottom can measure
★ Double benchmark strong magnet installation
★ Working Temperature : -10°～ +70℃
★ Auto-angle interleaved compensation function
★ Auto temperature drift compensation
★ User can calibrate ZERO by himself
★ Built-in rechargable industry batteries
★ Night vision fours colors screen
★ IP54 protection class
★ °/mm/m Dual units switch function
★ Filter frequency optional
★ Three kinds of measurement mode selectable (radian, angle, mm)

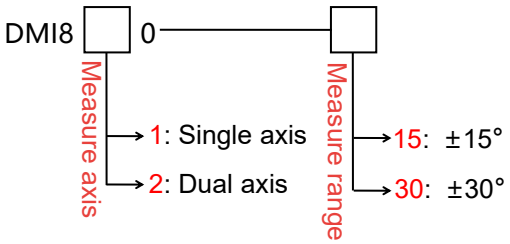
APPLICATION

★ Building construction
★ Automobile four-wheel testing
★ Road slope
★ Machinery installation
★ Piping installation
★ Industrial platform
★ Turntable testing
★ Pan unit angle detection
★ Production jig

▸ SPECIFICATIONS

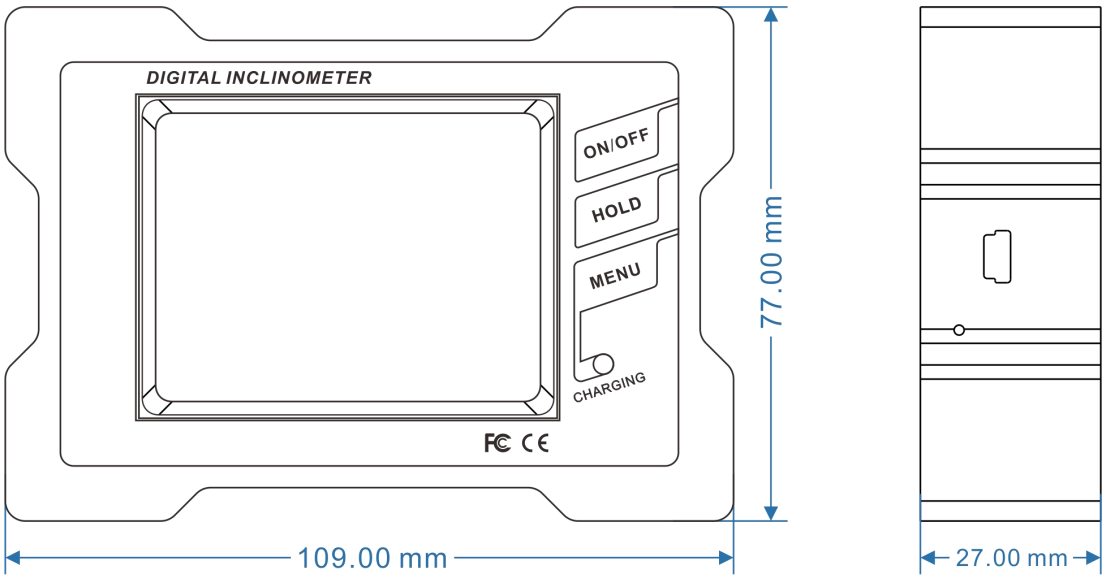
PARAMETER	DMI810		DMI820		UNIT
Measuring Axis	Single Axis		Dual Axis		Axis
Angle Measuring Range	±15 °	±30 °	±15 °	±30 °	°
Angle Measurement Accuracy(Full Range)	<0.005	<0.01	<0.005	<0.01	°
Angle Measure Resolution	0.001	0.001	0.001	0.001	°
Mm/m Measure Range	267	577	267	577	mm/m
Mm/m Measure Accuracy	0.1	0.2	0.1	0.2	mm/m
Mm/m Measure Resolution	0.02	0.02	0.02	0.02	mm/m
Repeatability	0.003	0.003	0.003	0.003	°
Measurement Mode	Angle、Degree/Minute/Second、Mm/m Three modes can be set				
Working Temperature	-10°~ +70℃				
Working Humidity	85%RH				
Power Supply	3.7V Charging Lithium Battery				
Ideal Charging Time	5h				
Battery Continuous Working Time	11h				
Equipped With PC Software	VC Software				
Data Output Signal	USB2.0 (Virtual Serial Device)				
Connect Plug In	Standard USB Connector, Rechargeable				
Shock Resistance	10g@11ms、3 Axial Direction (Half Sinusoid)				
Shock Impact	10grms、10~100Hz				
Waterproof Grade	IP54				
Material	Aluminum Alloy Anodizing				
LCD	64 True Colors Night Vision Display Screen				
LCD Visible Area Size	L57.6*W43.2mm				
Size	L109*W77*H27mm				
Weight	≤350g				

▸ ORDERING INFORMATION



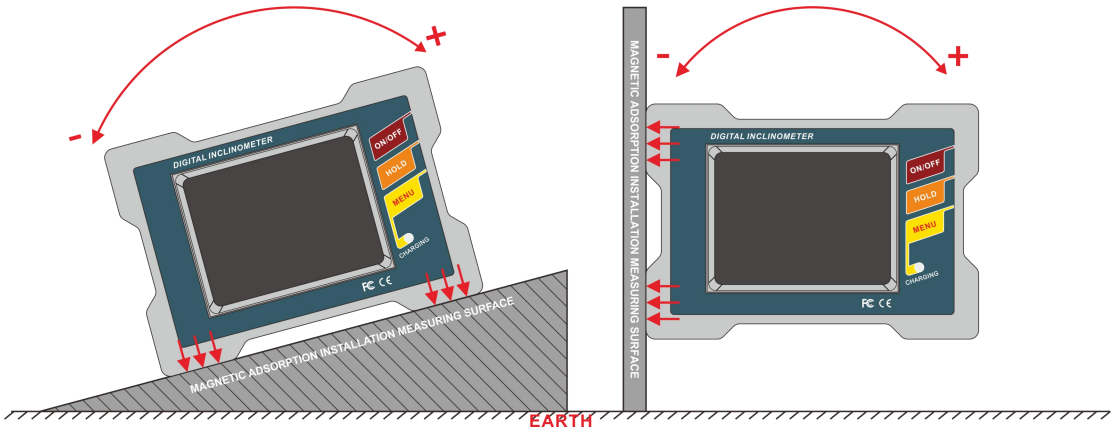
E.g:DMI810-15:means Single axis / Measure range is ±15°.

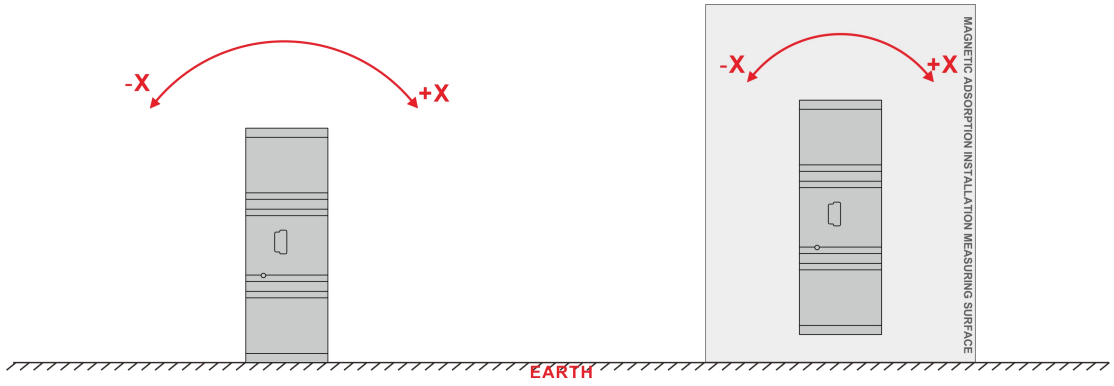
▸ PRODUCT DIMENSION DIAGRAM



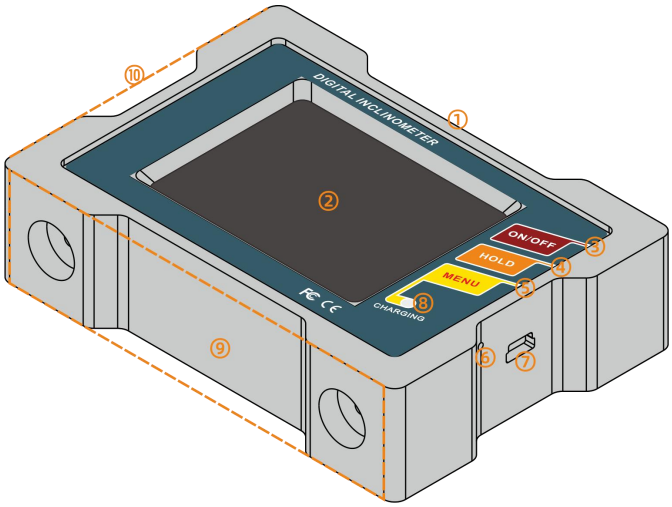
Shell size: L109*H77*W27mm
The left and bottom are the strong magnetic adsorption surface

▸ MEASURE DIRECTION





PRODUCT FUNCTIONS



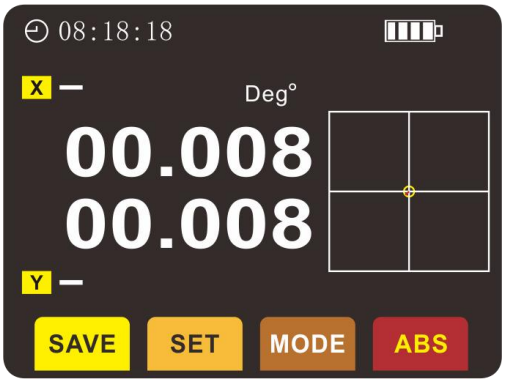
①Metal anti-wear structure
②Display area
③ON/OFF
④HOLD
⑤MENU
⑥Reset hole
⑦USB jack
⑧Charging indicator
⑨Strong magnetic bottom
⑩Side magnetic

①Anti-wear metal: metal shell, hard and durable;
②Display: touch screen display data and operate;
③ON/OFF: press for 3 seconds to turn on or off;
④HOLD: to lock the current data for recording;
⑤MENU: Press to display MENU;
⑥Reset hole: If it crashed, insert a small needle to reset;
⑦USB jack: For charging and USB2.0 virtual serial port output data;
⑧Charging light: light on when charging, light off when charged fully (do not recommend to u se when charging.)
⑨Strong magnetic base: strong magnet at the bottom measure surface;
⑩Side strong magnet: strong magnet at the left side measure surface;
Note: The USB driver can be downloaded from the ATO website: "DMI Series Product USB Driver".

FUNCTIONAL MENU INSTRUCTIONS

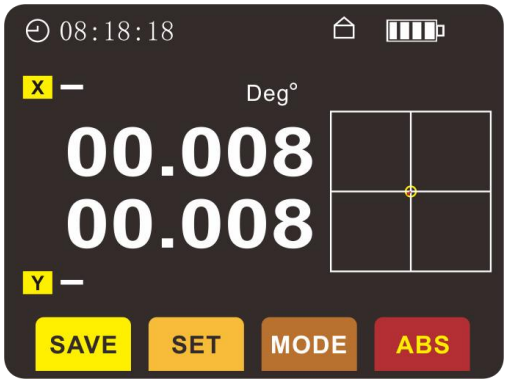
1. Right side button operation of the product:
1.1 ON/OFF power button: Press and hold for 3 seconds, hear "beep..." to turn on, and perform the same operation to turn off.

Power on interface

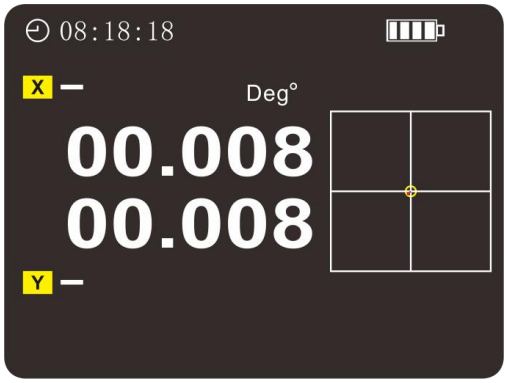


Interface after startup

1.2 HOLD lock button: Lock angle data. Press once to lock data, then press again to unlock. An icon is displayed in the upper right corner of the screen.
1.3 MENU key: Press once to hide the menu bar, then press to display the menu bar.
1.4 Press MENU and HOLD simultaneously to enter touch screen calibration;
1.4.1 Click OK to enter touch screen calibration, click EXIT to exit touch screen calibration.

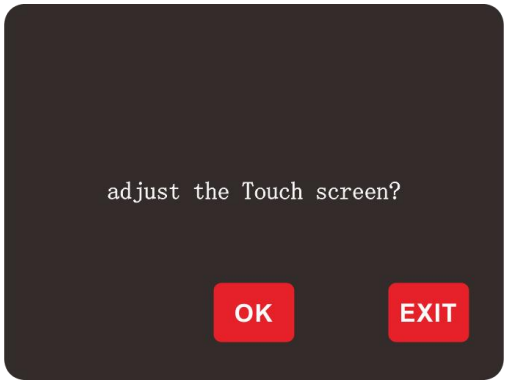


Data lock interface display

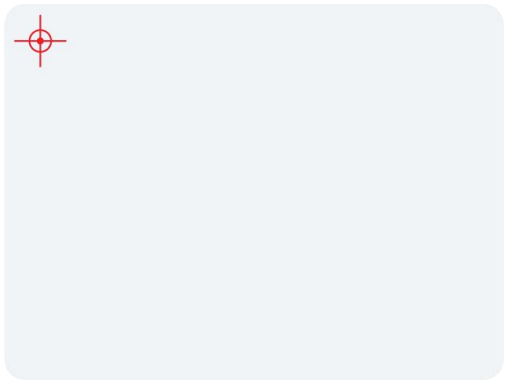


Menu bar hidden interface display

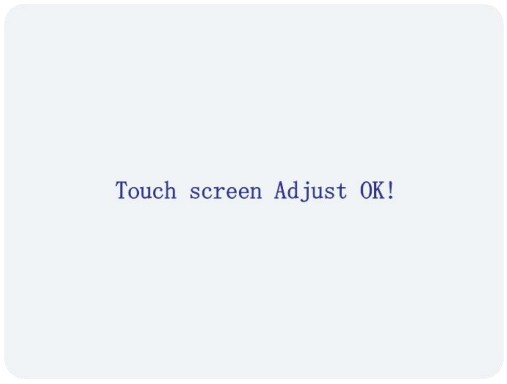
1.4.2 Enter the touch screen calibration, click on the small red dots at the four corners of the screen in sequence, click once to move once, and the small red dots will automatically exit the calibration after moving 4 dots.



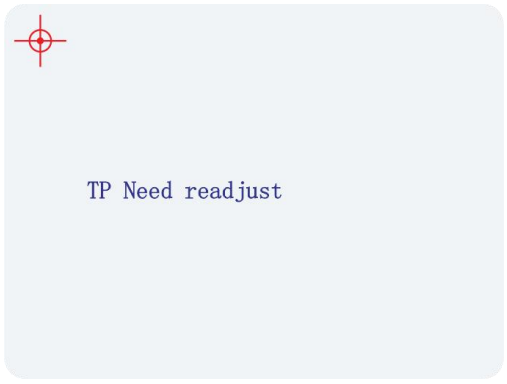
Enter the touch screen calibration interface



Calibrate the interface in the touch screen

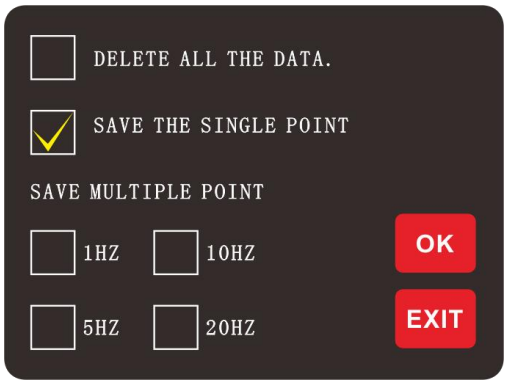


Touch screen calibration successful prompt interface

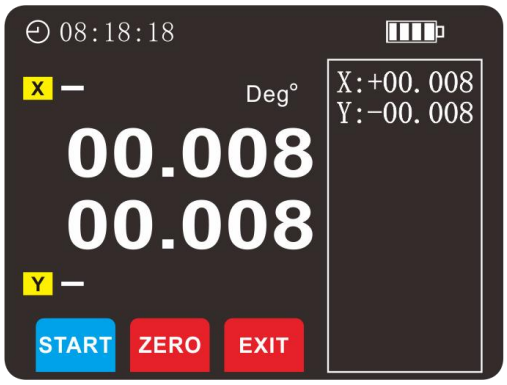


Operation error requires recalibration of prompt interface

2. Menu function at the bottom of the screen:
2.1Click the SAVE button on the touch screen to enter the save option
2.1.1 DELETE ALL DATA;
2.1.2 SAVE THE SINGLE POINT;
Click START to start saving relevant data, which will be saved on the SD card;
Select single save, and the data will be displayed in the right border of the interface. Up to 6 sets of data can be displayed on a single axis, and up to 12 rows of data can be displayed on a dual axis; ABS/ZERO switch key; EIXT: Save Data Exit Interface.

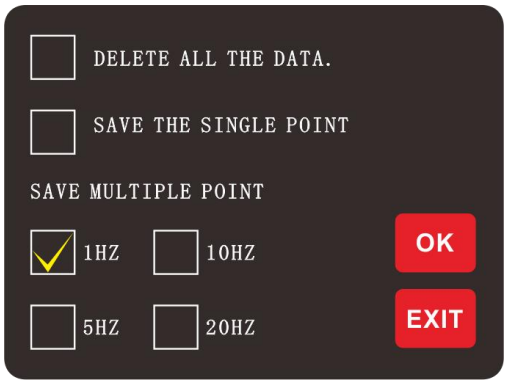


Save the single point interface

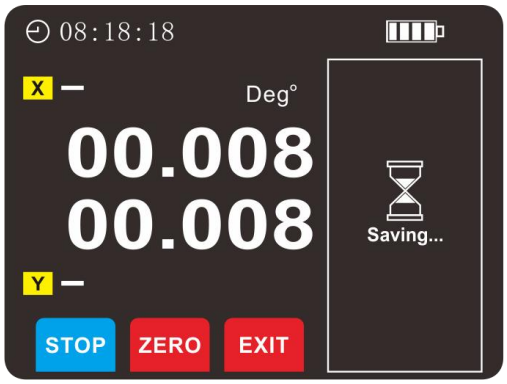


Save the single point display interface

2.1.3 SAVE MULTIPLE POINT(Save frequency 1Hz/5Hz/10Hz/20Hz);
Choose to save continuously multiple times without displaying data on the interface, and save directly to the SD card. After data collection is complete, click STOP to stop saving the data; ABS/ZERO switch key; EIXT: Save Data Exit Interface.

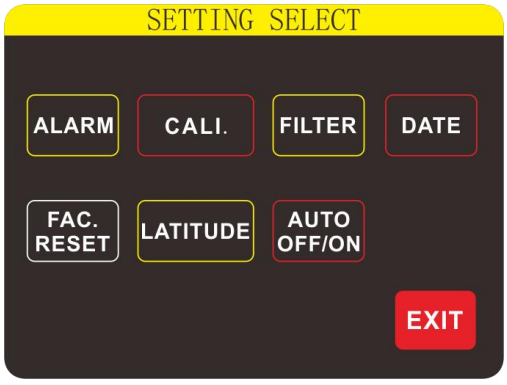


Save multiple point interface



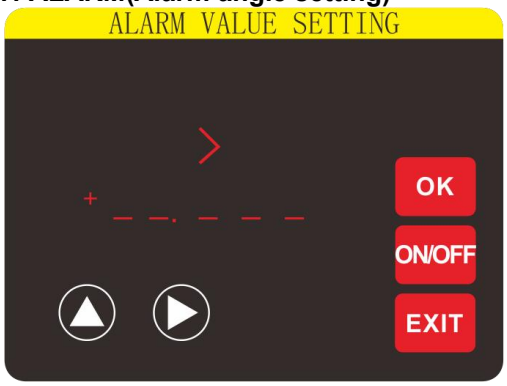
Save multiple point display interface

2.1.4 OK Save Select Exit Interface;
2.1.5 EXIT abandons the option to exit the interface.
2.2 Click the SET button on the touch screen to enter the settings interface. There are six function buttons: (If you do not need to select, simply click EXIT to exit)

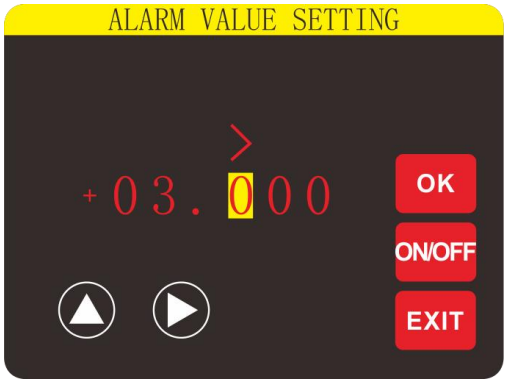


Multiple consecutive single save selection interface

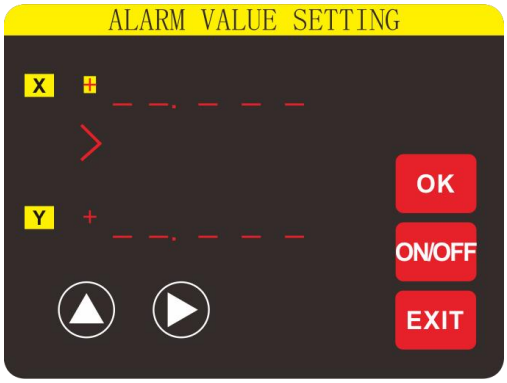
2.2.1 ALARM(Alarm angle setting)



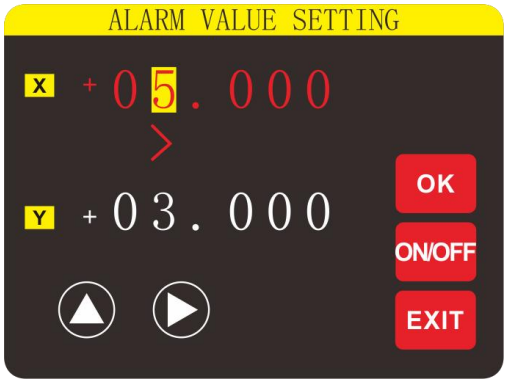
Single axis alarm angle setting interface



Single axis alarm angle setting



Dual axis alarm angle setting interface



Dual axis alarm angle setting

Explain:

1. Click ON/OFF to open the alarm angle setting, which displays a number. When the setting is turned off, it displays as "_ _. _ _".
2. For dual axis products, click on the data angle of the X or Y axis to select the corresponding axis angle setting.
3. Click ▲: Set the data for the corresponding bit.
   ▸ : Select the corresponding data bits that need to be set.

Angle symbol:

+: when it is greater than the corresponding angle, an alarm will be triggered

-: Alarm when the angle is less than the corresponding angle

±: Alarm for exceeding this range

For example, if X is set to+03.00, an alarm will sound when the angle of X is+3.3 degrees, which is greater than 3 degrees

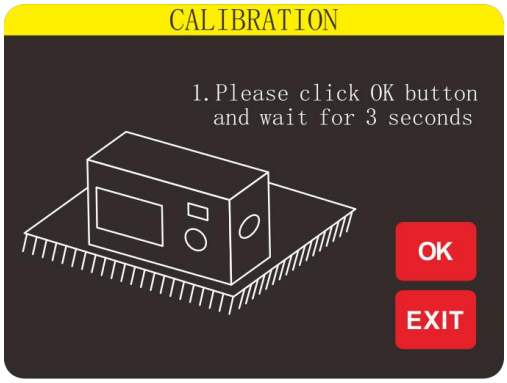
If Y is set to -04.00, an alarm will sound when the Y angle is -4.6 ° or less than -4 °

If Y is set to ± 05.00, an alarm will sound when the Y angle is -6 and exceeds -5~+5 °

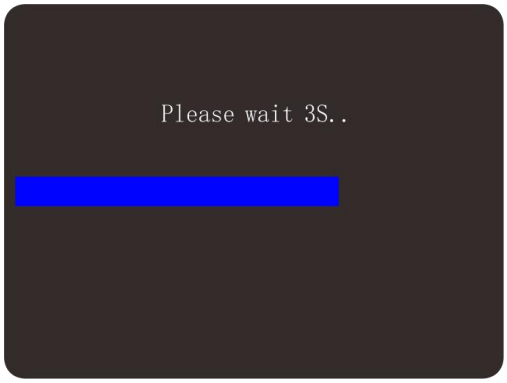
4. Click OK to save the set angle for it to take effect.
5. EXIT: Exit to set angle and save.

2.2.2 CALI (Calibration Settings)

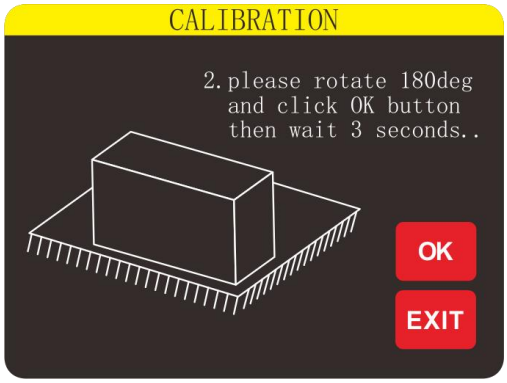
Click OK and follow the prompts to perform the relevant actions (zero calibration requires a high-precision platform, do not operate without this condition)



Product calibration interface



Waiting for calibration interface



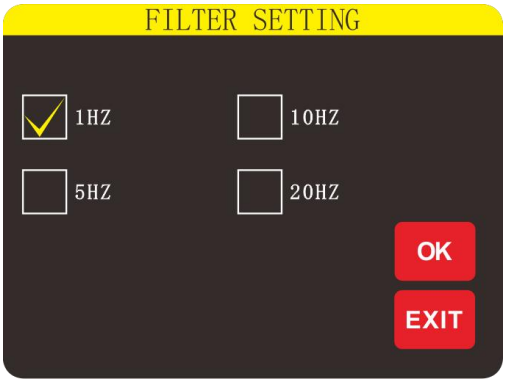
Product calibration interface

Product calibration successful prompt interface

2.2.3 Filter (Filter Frequency Setting)

Factory default is 20Hz.

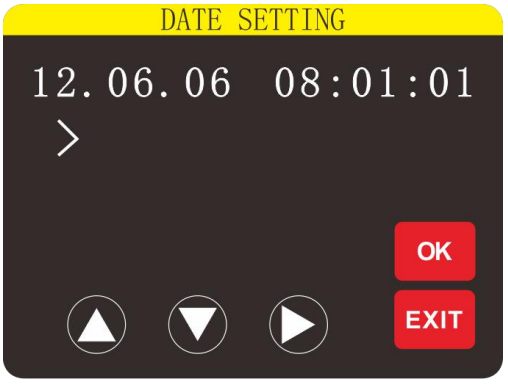
Select the desired filtered output frequency;
OK: Selection successful; EXIT: Exit Selection.



Filter frequency setting interface

2.2.4 DATE (date setting)

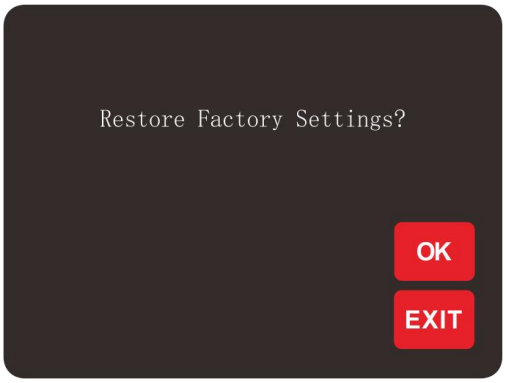
Set the date and time for displaying and saving data;
▸ : Select the year, month, day, hour, minute, and second position of the time, which can be cycled;
▲: Increase the corresponding numerical value;
▼: Reduce the corresponding value;
OK: Save settings;
EXIT: Exit the date setting interface without saving.



Date setting interface

2.2.5 FAC.RESET (Factory Reset Settings)

The restored parameters include alarm angle, filtering frequency, and calibration angle



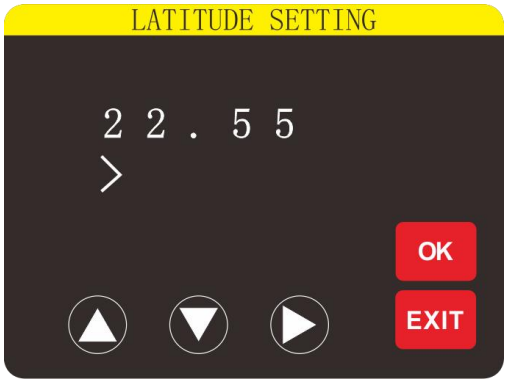
Restore factory settings interface

2.2.6 LATITUDE (local latitude setting)

Set the local latitude value, as the Earth's gravity field varies in different regions, customers only need to set the local latitude, and the product will automatically calculate the local gravity field to correct accuracy errors.

As shown in the figure on the right, click on latitude settings.

1. Click the "▲" button to increase the corresponding bit value from 0 to 9;
2. Click the "▼" button to decrease the corresponding bit value from 0-9;
3. Click the " ▸ " Select the corresponding ten digit, one digit, ten digit, percent digit, and loop to the right of the button;
4. Click OK to save the latitude settings;
5. Click EXIT: Exit Settings



Local latitude setting interface

2.2.7 AUTO ON/OFF (Automatic Shutdown Setting)

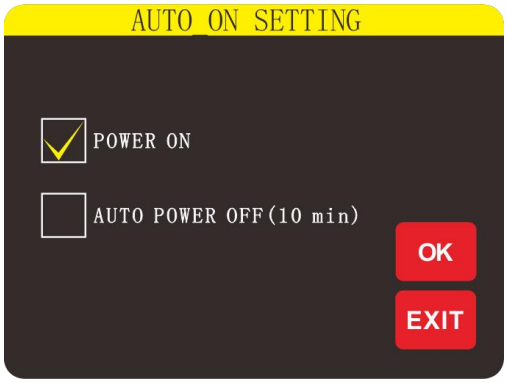
As shown in the figure on the right,

Select 'POWER ON' to keep the product in a powered on state;

Select 'AUTO POWER OFF (10min)' and if there is no operation for 10 minutes, the product will automatically shut down (default setting for the product).

OK: Save Settings.

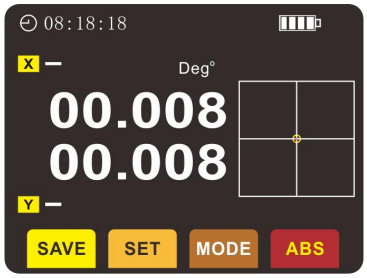
EXIT: Do not save settings and exit.

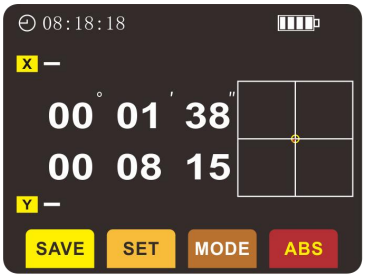


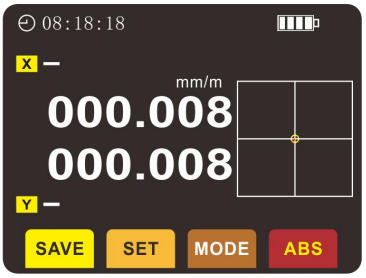
Automatic shutdown settings interface

2.3 Data unit mode selection

MODE can switch between three unit modes with each press: degrees, degrees, minutes, and seconds, and millimeters per meter.

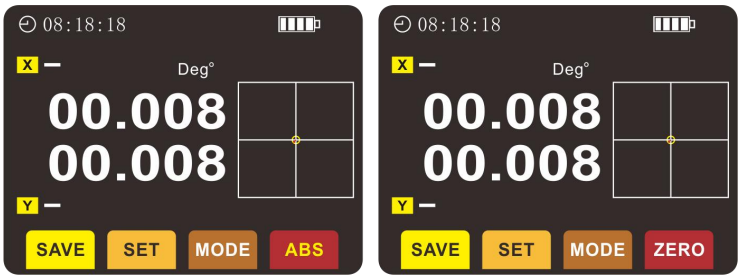






2.4 ZERO/ABS

Zero: Click to set the current angle to zero.
ABS: Click to switch to absolute zero point.



▸ COMMUNICATION PROTOCOL

1. Data frame format: (8 data bits, 1 stop bit, no parity, default rate 115200)

Identifier (1byte)	Data length (1byte)	address code (1byte)	Command word (1byte)	Data field	Checksum (1byte)
68					

Data format: hexadecimal;
Identifier: fixed to 68;
Data length: the length from data length to checksum (including checksum);
Address code: the address of the acquisition module, the default is 00;
Command word: operation command keyword;
Data field: according to the different content and length of the command word changes accordingly;
Checksum: The sum of data length, address code, command word and data field does not consider carry;
For example: 68 04 00 04 08 (length 04 + address code 00 + command word 04 = 08).

2. command word analysis

CMD word	Meaning/Example	illustrate
0X04	**Simultaneous reading of angle commands** E.g: ***68 04 00 04 08***	Data field (0byte) No data field command
0X84	Sensor response reply E.g:***68 10 00 84 00 00 20 08 10 00 25 28 00 37 70 00 C0***	Data field (12byte) **AA AA BB BB CC CD DD DD EE EE FF FF** **AA AA BB BB**: 4 characters represent the X axis; **CC CC DD DD**: 4 characters represent the Y axis; **EE EE FF FF**: 4 characters represent temperature data; The angle format is the same as the X-axis or Y axis analysis method: the angle in the left example is: X axis +00.200°, Y axis -00.252°; Temperature: 37.7°. (Angle analysis decimals are thousandths, ten-thousandths are discarded; temperature data analysis only keep one decimal.) 0A: Checksum, the hexadecimal sum of all data, excluding the prefix 68.
0X05	**Set relative/absolute zero point:** The current angle can be set to zero for relative measurement, or absolute zero can be set so that no power failure occurs. E.g:***68 05 00 05 00 0A***	Data field (1byte) 00: absolute zero 01: relative zero
0X85	Sensor response reply command E.g:***68 05 00 85 00 8A***	Data field (1byte) The number in the data field indicates the result of the sensor response 00: set successfully FF: Setting failed

0X32	**Read the data saved in the SD card:** E.g:***68 04 00 32 36***	Data field (0byte)
0XA2	Sensor response reply command E.g:***68 18 00 A2 AA AA AA AA AA AA AA BB BB BB BB CC CC CC CC DD DD DD DD CS***	Data field (19byte) The number in the data field indicates the result of the sensor response AA AA AA AA AA AA AA: Year, month, day, hour, minute, second BB BB BB BB: For details of the X-axis data, please refer to the X-axis analysis defined by the data format; CC CC CC CC: For details of the Y-axis data, see the analysis of the Y-axis defined in the data format; DD DD DD DD: reserved.

PRODUCT MAINTENANCE

1. The digital angle meter uses a 3.7V rechargeable lithium battery. To improve the battery life, please charge it before the battery is fully depleted.
If there is no digital display when turning on the power switch, please charge it in time.
3. This instrument has strong reliability and can be used in vibration environments, but please do not drop the instrument from a high altitude as it may cause permanent damage.
4. If the instrument is found to be damaged, please do not disassemble it by yourself. Please call our company as soon as possible for professional guidance and maintenance. If you disassemble it by yourself, the manufacturer will refuse to repair it.

WARNING NOTICE

1. This product has high-precision sensors and information processing circuits. It is strictly forbidden to drop, bump, or disassemble by yourself, otherwise you will be responsible for the consequences.
2. Don't press multiple buttons at the same time, it will easily affect the service life of the product.
3. This product should be placed in a safe place that is not easy for children to touch.

DATA FORMAT DEFINITION

Baud rate: (usually is 115200，special one is 9600 , 8 data bits，1 stop bit，no verification)

Example: **X axis: +02.010°　Y axis: -00.513°　Temperature: +50.50°**

68 10 00 84 00 02 01 03 10 00 51 32 00 50 50 00 93

Prefix, fixed 68

Data length, fixed10

Sensor address ,default 00

Command word ,fixed 84

X axis angle :

The first byte is the sign bit, 00 indicate positive angle ,10 indicate negative angle .

The second byte is the integer bit of the angle, is compressed BCD code .

The third byte is the decimal place of the angle,is compressed BCD code.

The fourth byte is the decimal place of the angle, which is the compressed BCD code.

Y axis angle :

Format is same as X axis

Temperature data :

The first byte is the sign bit, 00 indicate positive temperature ,10 indicate negative temperature .

The second byte is an integer bit of temperature, which is a compressed BCD code.

The third byte is the decimal place of the temperature, which is the compressed BCD code.

The fourth byte is reserved byte, fixed 00

The last byte is the sum of all the previous data.

If there is a carry, the lower data is taken.