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## LD-2M Operating Instructions



2 Axis Electronic Inclinometer  
with RS232 and Digital Display

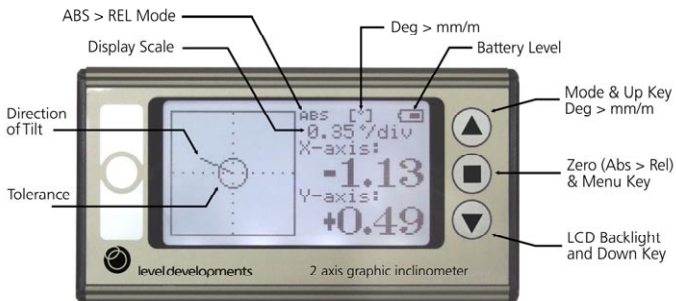
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## Introduction

The LD-2M is a revolutionary measuring tool that provides a digital readout of angle in the X and Y axis simultaneously. It has a measurement range of  $\pm 30^\circ$  and a resolution of  $0.01^\circ$ . It has an overall accuracy of better than  $\pm 0.05^\circ$  and a built in RS232 interface which can be used to connect to a data logger or computer. At the time of writing there is no other product available which can match this performance at the same price.

## Features



On/off switch

RS232/Charge connector

## Measuring Angle

The LD-2M can be used to measure angles in three different modes. It will switch automatically between them depending on how the instrument is positioned.

### **X-Y Axis Measurement Mode:**

In this mode the instrument is placed on its base and the display reads the X and Y axis of tilt simultaneously. The measurement range is  $\pm 30^\circ$  for each axis.



### **X Axis Measurement Mode:**

In this mode the instrument is placed horizontally on the side face and the displays switches to read the X axis of tilt only. The measurement range is  $\pm 30^\circ$ .



### **Y Axis Measurement Mode:**

In this mode the instrument is placed vertically on the side face and the displays switches to read the Y axis of tilt only. The measurement range is  $\pm 30^\circ$ .

## Button Functions

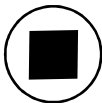
There are three buttons used to control the LD-2M inclinometer. They each have a dual function, one function whilst in normal operating mode and one whilst in the setup menu area. The functions are detailed below:



**'Mode'** and **'Up'** button:

In normal use this button switches the display between reading the angle reading in degrees (°) and reading the gradient in mm/m.

In setup mode (see page 6 for details) this is used as the **'Up'** key to navigate the menu settings.



**'Abs > Rel'** and **'Menu'** button:

In normal use this button switches the display between reading the absolute angle and reading a relative angle from the angle at which the key was pressed. The display will show **'ABS'** when reading in absolute mode.

This button is also used to activate the setup menu, and make selections once in the setup area. To activate the **'Menu'** press and hold this button while the unit is switched on. This will take you directly into the setup menu facility.



**'LCD Back-light'** and **'Down'** button:

In normal use this button switches the LCD back-light on or off.

In setup mode (see page 6 for details) this is used as the **'Down'** key to navigate the menu settings.

## **Battery and Charger**

The LD-2M has a built in Lithium Ion rechargeable battery, and is supplied with an intelligent charger unit. In normal use the battery will last around 100 hours. When the battery indicator reads low, or when the battery is completely flat, plug in the charger unit and allow to charge for 12 hours.

The charger unit is a universal type which can operate from 110-240v a.c. At 50/60 Hz. An adaptor may be required depending on the country of use.

## **Testing the Accuracy**

Please use the following simple procedure to check the accuracy of the LD-2M before using. This should also be carried out if the unit is dropped, or is being used in an environment that varies more than 5°C from the environment in which it was last calibrated.

1) Place the LD-2M down on a clean, flat horizontal surface. The surface does not have to be exactly level. Wait 10 seconds so the display is completely stabilised and note the X and Y angle readings from the display.




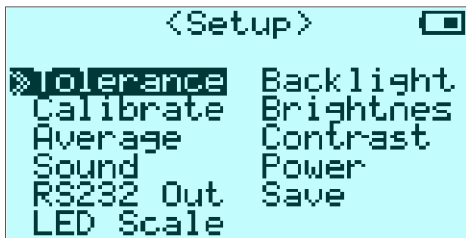
2) Turn the instrument through 180° (see drawing), and place back down in the same spot on the surface. Wait 10 seconds so the display is completely stabilised and note second set of readings of the X and Y angle.






3) Compare the two X-axis readings. One reading should be the negative of the other. For example if  $X_1 = +0.35^\circ$  then  $X_2$  should read  $-0.35^\circ$ . If there is more than  $0.05^\circ$  variation then unit will need to be recalibrated (see page 7). Check the same for the Y-axis readings.

## Setup Menu Mode

There are a number of settings which affect the operation of the LD-2M inclinometer, and these can be accessed from setup menu. To activate the setup menu, switch off the instrument, press and hold the  key and switch the unit back on with the key still pressed. After the start-up screen, the display will show the menu options as follows:



Use the   keys to highlight the required setting and the  key to go to this setting page.

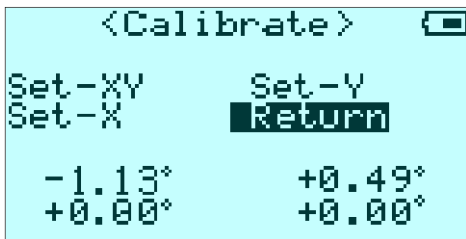
### **Tolerance :**

The tolerance setting controls the scale of the circle which appears in the display. It can be set to '**On**' or '**Off**' and the value can be changed between 0.1 and 10.0°.



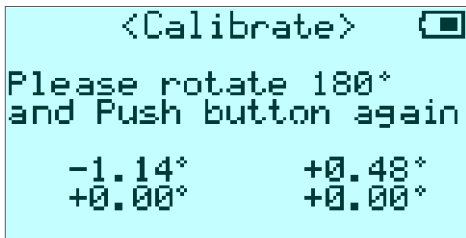
## Calibrate :

The calibrate screen allows you to reset the absolute zero position in the XY mode, the X mode and the Y mode.



### Setting the XY Axis Zero Point -


Place the instrument on a flat stable surface. The surface does not need to be perfectly level. Wait for a few seconds to allow the display to stabilise. Use the  $\blacktriangle$   $\blacktriangledown$  keys to select 'Set-XY' and press the  $\blacksquare$  key. Wait for a few seconds until the display reads :



Turn the level through 180° (as shown in the drawing) placing back down in the same place on the surface as before.




Step 1 - Place instrument down select 'Set XY' and push  button.



Step 2 - Rotate through 180° and push  button again.

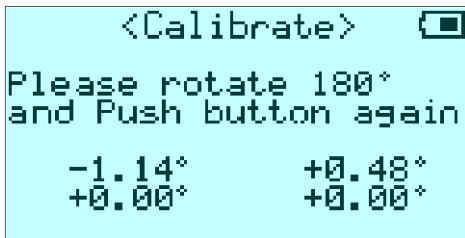


The XY measurement mode zero point is now re-set

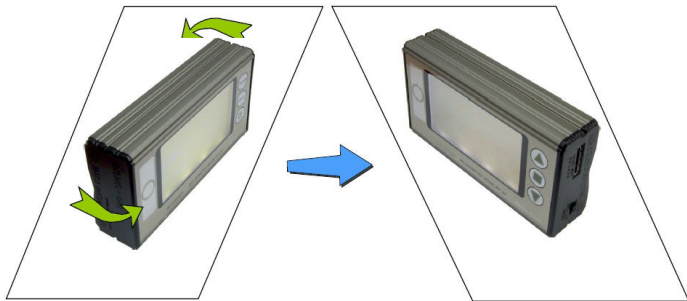
Use the   keys to select '**Return**' and press the  key to return to the main menu. Select save to exit the menu and return to the normal mode of operation.

## Setting the X Axis Zero Point -

Place the instrument on its horizontal side on a flat stable surface as shown in the picture below. The surface does not need to be perfectly level, but should be clean and flat. Wait for a few seconds to allow the display to stabilise. Use the ▲ ▼ keys to select '**Set-X**' and press the ◻ key. Wait for a few seconds until the display reads :



Turn the level through 180° (as shown in the drawing) placing back down in the same place on the surface as before.

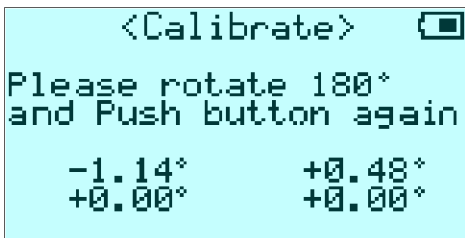


The X measurement mode zero point is now re-set

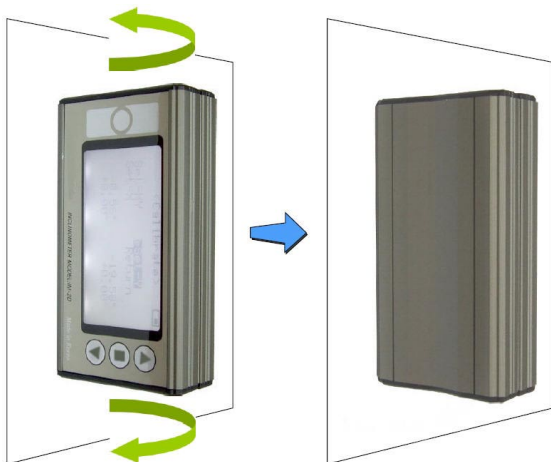
Use the ▲ ▼ keys to select '**Return**' and press the ◻ key to return to the main menu. Select save to exit the menu and return to the normal mode of operation.

## Setting the Y Axis Zero Point -

Place the instrument on its horizontal face against a flat stable surface at approximately 90° to the horizontal, as shown in the picture below. The surface does not need to be perfectly level, but should be clean and flat. Wait for a few seconds to allow the display to stabilise. Use the ▲ ▼ keys to select 'Set-Y' and press the ■ key. Wait for a few seconds until the display reads :



Turn the level through 180° (as shown in the drawing) placing back down in the same place on the surface as before.



The Y measurement mode zero point is now re-set

Use the ▲ ▼ keys to select 'Return' and press the ■ key to return to the main menu. Select save to exit the menu and return to the normal mode of operation.

## Average :

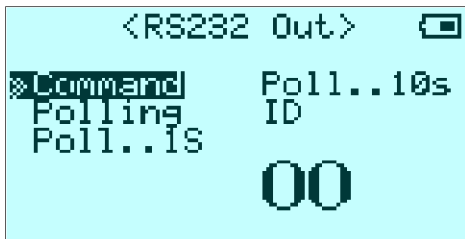
The average setting varies the way the instrument averages the internal readings to give a smooth output. It is factory set to '15' and should be left at this for most applications, although it can be varied in the range of 6-25. A low value will reduce the number of samples used in the moving average calculation, and will give a faster response time, but with more noise. A value of 25 will give a slower response time which could be useful to filter out unwanted noise or vibration. This is an advanced feature that should only be changed if the implications of doing so are understood.

## Sound :

The sound setting screen enables the internal sounder to be switch 'on' or 'off'.

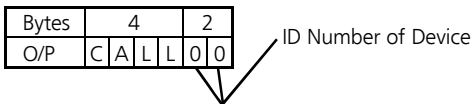
## RS232 Output :

The RS232 setting screen enables you to alter the way in which the RS232 signal is transmitted. Use the ▲ ▼ keys to highlight the desired option and then the ■ key to return to the main menu. Select save to exit the main menu and return to the normal mode of operation.



## Command -

When set to '**Command**', an RS232 output of the X an Y axis readings is sent only in response to a call command from the connected equipment (usually a PC or laptop). The call command needs to be in the format:



## Polling -

When set to '**Polling**', an RS232 output of the X an Y axis readings is sent continuously from the instrument.

## Poll...1s -

When set to '**Poll...1s**', an RS232 output of the X an Y axis readings is sent every 1 second from the instrument.

## Poll...10s -

When set to '**Poll...10s**', an RS232 output of the X an Y axis readings is sent every 10 seconds from the instrument.

## ID -

This number sets the ID of the device when using '**Command**' mode. This enable multiple devices to be connected to a single host.

## RS232 Output Format -

- Baud Rate : 9600 bps
- Parity : None
- Data Bits : 8
- Stop Bits : 1

Bytes	1	1	6	1	1	1	6	1	1									
O/P	x	=	+	3	.	0	2	,	y	=	-	1	7	.	4	5	CR	LF

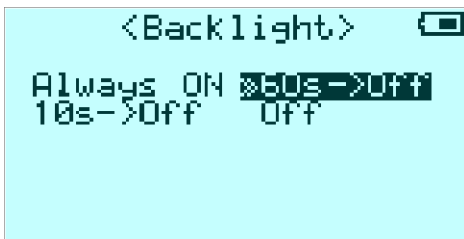
An RS-232 cable for connecting the LD-2M to a PC via a 9 pin D type serial connector is available separately, part number LD-2M-RS232

## LED Scale :

This setting has no effect on the function of the LD-2M. It is a feature which is used on another product which uses the same menu settings. As such no change should be made to this setting

## Backlight :

The backlight setting menu controls the LCD illumination. The backlight is useful for using the product in low light conditions, but if used continuously will cause the battery to run down more quickly. These settings control whether the backlight is on or off as default, or what period of inactivity will cause the light to switch off. The options are:



Use the  $\blacktriangle$   $\blacktriangledown$  keys to highlight the desired option and then the  $\blacksquare$  key to return to the main menu. Select save to exit the main menu and return to the normal mode of operation.

## Brightness :

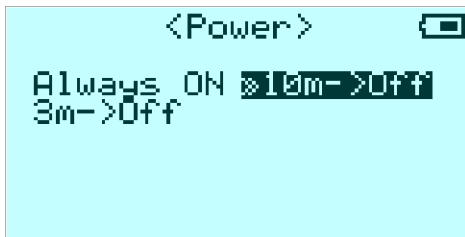
The brightness setting controls the brightness of the LCD backlight. It can be set between 0 and 10. Use the  $\blacktriangle$   $\blacktriangledown$  keys to adjust the brightness value and the  $\blacksquare$  key to return to the main menu. Select save to exit the main menu and return to the normal mode of operation.

## Contrast :

The contrast setting controls the contrast of the LCD, and it can be set between a value of 10 and 40. Use the  $\blacktriangle$   $\blacktriangledown$  keys to adjust the contrast value and the  $\blacksquare$  key to return to the main menu. Select save to exit the main menu and return to the normal mode of operation.

## Power :

The power setting controls the auto shut off period for the instrument. To conserve the battery, it can be set to switch off automatically after 3 minutes or 10 minutes, or it can be set such that it will stay on until switched off at the main switch. The option screen is :



Use the  $\blacktriangle$   $\blacktriangledown$  keys to highlight the desired option and then the  $\blacksquare$  key to return to the main menu. Select save to exit the main menu and return to the normal mode of operation.

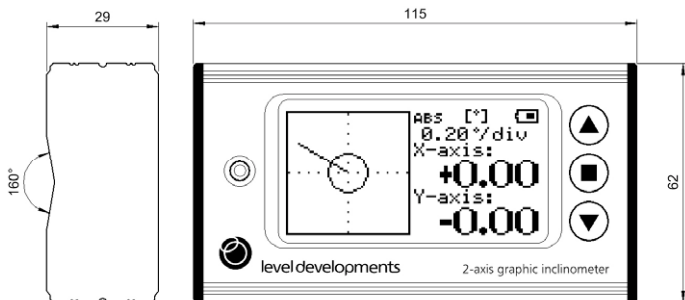
## Save :

To update any changes made in the setup menu, it is necessary to highlight the 'Save' option and press the  $\blacksquare$  key to save and return to the normal operating mode.

## Specifications

- Measuring Range :  $\pm 30^\circ$
- Resolution : 0.01°
- Accuracy :  $\pm 0.05^\circ$  or 1% of measured value
- Response Time : <1.0 second
- Operating Temp. : 0-45°C
- Power : Built in Li-Ion (3.7V)
- Battery Life : 100 hours
- Output Format : RS232 (9600-N-8-1)
- Weight : 250g
- Size : 115 x 62 x 29mm
- LCD : 128x64 pixels with backlight

## Dimensions



## Warranty

If, within one year from the date of original purchase, the LD-2M digital inclinometer fails to function because of defects in materials or workmanship, the manufacturer will, at its option, either repair or replace such components provided the original purchaser:

1. Contacts the dealer from whom the unit was purchased for instructions
2. Follow the dealer's instructions for return of the unit;
3. Submit original date and proof of purchase;
4. Includes a brief explanation describing why the LD-2M is inoperable, or how it was damaged.

This warranty does not cover damage resulting from accident, misuse or abuse, water, tampering, servicing performed or attempted by unauthorised agencies, units that have been modified in any fashion, or units that have not been recalibrated and maintained in accordance with the instructions in this manual.