# User Manual

## Coating Thickness Gauge

V2.4.9

# Contents

## 1. Introductions

This compact gauge can be used for non-destructive coating thickness measurement of non-magnetic coatings, e.g. paint, enamel, chrome on steel, and insulating coatings, e.g. paint and anodizing coatings on non-ferrous metals.

### 1.1 Features

- Large dot matrix LCD screen, the screen can rotate 180 degrees display, standard menu operations.
- Measure mode: single and continuous.
- Two group mode:direct(DIR) and general(GEN), readings will be lost when power off in direct mode, and not be lost in general mode. Readings can be stored for each group.
- Zero point calibration and multi-point calibration(up to 4 points) for each group.
- User can recall, delete specified readings, or delete group readings.
- Statistics display: mean, minimum and maximum.
- Three probe mode: auto, magnetic and eddy current.
- High and low limit alarm value can be set separately for each group, and the screen indicates the alarm when exceeding the limit, accompanied by red backlight prompt.
- Power off automatically.
- USB interface to data transmission.
- Low battery and error indication, low power automatic shutdown.

### 1.2 Application

This gauge is designed for non-destructive, fast and precise coating thickness measurement. The principal

applications lie in the field of corrosion protection. It is ideal for manufacturers and their customers, for offices and specialist advisers, for paint shops and electroplaters, for the chemical, automobile, ship building and aircraft industries and for heavy engineering. It is suitable for laboratory, workshop and outdoor use.

**1.3 Principle of Measurement**

The coating thickness gauge work either on the magnetic induction principle or on the eddy current principle, depending on the type of probe used. This gauge has internal F probe and N probe.

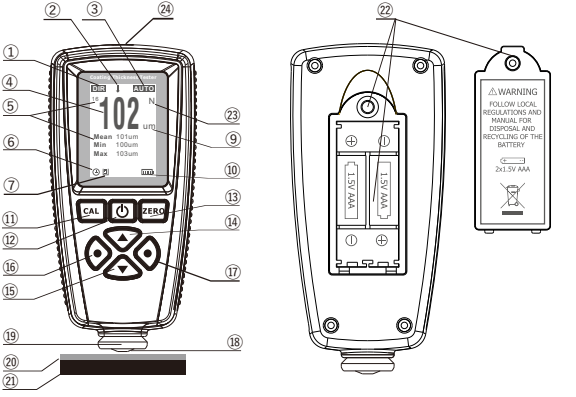
F probe work on magnetic induction principle and should be used for non-magnetic coatings such as aluminium, chrome, copper, zinc, paint and varnish, enamel, rubber etc., on an iron or steel substrate; It is also suitable for alloyed and hardened magnetic steel (however, not suitable for austenic steel).

N Probe work on the eddy current principle and should be used for insulating coatings e.g. paint, anodizing, ceramics, etc., on all non-ferrous metals such as aluminium, copper, zinc die casting, brass etc. and on austenitic stainless steels.

## 1.4 View

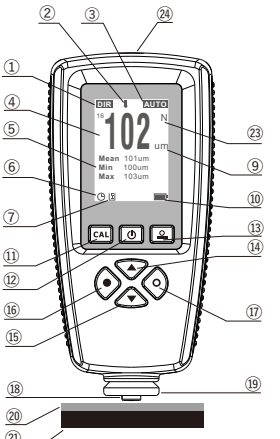
### 1.4.1 **Applied to P1 and P1S**

① Current work group (DIR and GEN n,n=1~4)
② High and low limit alarm (⇑/⇓)
③ Probe mode (AUTO, MAG, EDDY)
④ Measuring readings display
⑤ Statistics display
⑥ Auto-power off indication
⑦ USB connecting indication
⑧ Reserved
⑨ Unit(μm, mm, mil)
⑩ Low battery indication
⑪ **CAL**-Calibration key
⑫ **POWER** on/off key
⑬ **ZERO** calibration key
⑭ **UP** key
⑮ **DOWN** key
⑯ **LEFT** key(menu, select, sure)
⑰ **RIGHT** key(cancel, exit, back, backlight switch)
⑱ Probe
⑲ V groove
⑳ Standard foil
㉑ Substrate
㉒ Battery compartment
㉓ Substrate type(F: ferrous; N: non-ferrous)
㉔ USB interface

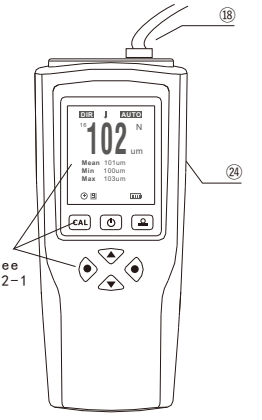


1.4.2 **Applied to P2**

① Current work group(DIR and GEN n,n=1~4)
② High and low limit alarm (⇑/⇓)
③ Probe mode (AUTO, MAG, EDDY)
④ Measuring readings display
⑤ Statistics display
⑥ Auto-power off indication
⑦ USB connecting indication
⑧ Reserved
⑨ Unit(μm, mm, mil)
⑩ Low battery indication
⑪ **CAL**-Calibration key
⑫ **POWER** on/off key
⑬ **ZERO** calibration key
⑭ **UP** key
⑮ **DOWN** key
⑯ **LEFT** key(menu, select, sure)
⑰ **RIGHT** key(cancel, exit, back, backlight switch)
⑱ Probe
⑲ V groove
⑳ Standard foil
㉑ Substrate
㉒ Battery compartment
㉓ Substrate type(F: ferrous; N: non-ferrous)
㉔ USB interface



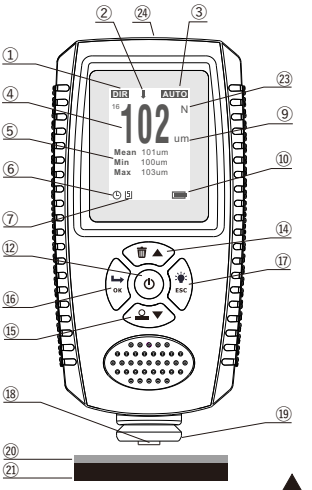

P2-1



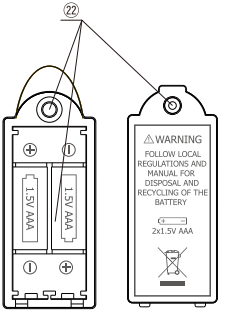

P2-2

1.4.3 **Applied to P3 and P4**

① Current work group(DIR and GEN n,n=1~4)
② High and low limit alarm (⇑/⇓)
③ Probe mode (AUTO, MAG, EDDY)
④ Measuring readings display
⑤ Statistics display
⑥ Auto-power off indication
⑦ USB connecting indication
⑧ Reserved
⑨ Unit(μm, mm, mil)
⑩ Low battery indication
⑪ Reserved
⑫ **POWER** on/off key
⑬ Reserved
⑭ **UP** key(or delete function)
⑮ **DOWN** key(or zero calibration)
⑯ **LEFT** key(menu, select, sure)
⑰ **RIGHT** key(cancel, exit, back, backlight switch)
⑱ Probe
⑲ V groove
⑳ Standard foil
㉑ Substrate
㉒ Battery compartment
㉓ Substrate type(F: ferrous; N: non-ferrous)
㉔ USB interface




P3 P4



## 1.5 Function and Specifications for P1 and P2-1

| Product code | P1 | | P1S | | P2-1 | |
|---|---|---|---|---|---|---|
| Probe | F | N | F | N | F | N |
| Measuring principle | Magnetic Induction | Eddy Currents | Magnetic Induction | Eddy Currents | Magnetic Induction | Eddy Currents |
| Measuring range | 0~2000μm | | 0~2000μm | | 0~5000μm | 0~3000μm |
| Accuracy | ±(2.5% reading+1μm) | | ±(2% reading+1μm) | | ±(2% reading+1μm) (≤2000μm)<br>±(3% reading+2μm) (2001~3000μm)<br>±(5% reading+2μm) (>3000μm) | |
| Resolution | 0.1μm(0~99.9μm)<br>1μm(≥100μm) | | | | 0.1μm(0~99.9μm)<br>1μm(≥100μm) | |
| Calibration | One point to four point calibration, zero point calibration; basic calibration | | | | | |
| Data group | Direct group, four general groups(each group saves 80 (P1) / 500 (P1S) data, independent point calibration and upper and lower limit alarm settings, you can browse and delete data through the menu) | | | | One direct group and four general groups (each group can save 500 data, independent point calibration and upper and lower limit alarm settings, and browse and delete data through the menu) | |
| Statistics | No. of readings, mean, minimum, maximum and standard deviation | | | | No. of readings, mean, minimum, maximum and standard deviation | |
| Units | μm , mm, mil | | | | μm , mm, mil | |
| Alarm | User can set the high/low alarm limit<br>Alarm icon displayed on LCD when over the limit | | | | User can set the high/low alarm limit<br>Alarm icon displayed on LCD when over the limit | |
| Minimum curvature radius convex | 5mm | | | | 5mm | |
| Minimum curvature radius concave | 25mm | | | | 25mm | |
| Minimum measuring area | Diameter 20mm | | | | Diameter 20mm | |
| Minimum thickness of substrate | 0.3mm | 0.05mm | 0.2mm | 0.03mm | 0.2mm | 0.03mm |
| Computer interface | Download data via USB | | | | Download data via USB | |
| Power supply | 2 pcs AAA 1.5V Alkaline battery | | | | 2 pcs AAA 1.5V Alkaline battery | |
| Operation environment | Temperature: -10~50℃(14~122℉); humidity: 20~90%RH; no strong magnetic field | | | | | |
| Storage temperature | -10~60℃(14~140℉) | | | | -10~60℃(14~140℉) | |
| Size | 114*53*25mm(4.49"*2.09"*0.98") | | | | 113*53*25mm(4.45"*2.09"*0.98") | |
| Case material and weight | ABS; About 80g(not including batteries) | | ABS; About 75g(not including batteries) | | ABS; About 75g(not including batteries) | |

**Note: The final specifications may be upgraded without notifying. For more details, please consult with your supplier.**

## 1.6 Function and Specifications for P2-2

| Product code | P2-2 | | | | |
|---|---|---|---|---|---|
| Probe and measuring principle | F: Magnetic Induction; N: Eddy Currents | | | | F10: Magnetic Induction |
| Measuring range | 0~1500μm | 0~2000μm | 0~3000μm | Fe: 0~5000μm<br>NFe: 0~3000μm | 0~10000μm |
| Accuracy | ±(2% reading+1μm) (≤2000μm)<br>±(3% reading+2μm) (2001~3000μm)<br>±(5% reading+2μm) (>3000μm) | | | | ±(1% reading+5μm) (after performing point calibration) |
| Resolution | 0.1μm(0~99.9μm)<br>1μm(≥100μm) | | | | 1μm(0~5mm)<br>10μm(≥5mm) |
| Calibration | One point to four point calibration, zero point calibration; basic calibration | | | | |
| Data group | One direct group and four general groups (each group can save 50 data, independent point calibration and upper and lower limit alarm settings, and browse and delete data through the menu) | | | | One direct group and four general groups (each group can save 500 data, independent point calibration and upper and lower limit alarm settings, and browse and delete data through the menu) |
| Statistics | No. of readings, mean, minimum, maximum and standard deviation | | | | No. of readings, mean, minimum, maximum and standard deviation |
| Units | μm , mm, mil | | | | μm , mm, mil |
| Alarm | User can set the high/low alarm limit<br>Alarm icon displayed on LCD when over the limit | | | | User can set the high/low alarm limit<br>Alarm icon displayed on LCD when over the limit |
| Minimum curvature radius convex | 5mm | | | | 5mm |
| Minimum curvature radius concave | 25mm | | | | 16mm |
| Minimum measuring area | Diameter 20mm | | | | Diameter 40mm |
| Minimum thickness of substrate | 0.2mm | | 0.03mm | | 2mm |
| Computer interface | Download data via USB | | | | Download data via USB |
| Power supply | 3 pcs AAA 1.5V Alkaline battery | | | | 3 pcs AAA 1.5V Alkaline battery |
| Operation environment | Temperature: -10~50℃(14~122℉); humidity: 20~90%RH; no strong magnetic field | | | | |
| Storage temperature | -10~60℃(14~140℉) | | | | -10~60℃(14~140℉) |
| Size | Product:174*73*40mm(6.85"*2.87"*1.57")<br>Probe:Φ17*67mm(Φ0.67"*2.64") | | | | Product:174*73*40mm(6.85"*2.87"*1.57")<br>Probe:Φ28*58mm(Φ1.1"*2.28") |
| Case material and weight | ABS; Device weights about 198g(not including batteries and probe ), Probe weights about 57g | | | | ABS; Device weights about 198g(not including batteries and probe ), Probe weights about 96g |

**Note: The final specifications may be upgraded without notifying. For more details, please consult with your supplier.**

## 1.7 Specifications for P3 and P4

| Product code | P3 | | P4 | |
|---|---|---|---|---|
| Probe | F | N | F | N |
| Measuring principle | Magnetic Induction | Eddy Currents | Magnetic Induction | Eddy Currents |
| Measuring range | 0~1500μm | | 0~500μm | |
| Accuracy | ±(2% reading+1μm) | | ±(1% reading+1μm) | |
| Resolution | 0.1μm(0~99.9μm)<br>1μm(≥100μm) | | 0.1μm(0~99.9μm)<br>1μm(≥100μm) | |
| Calibration | One point to four point calibration, zero point calibration; basic calibration | | | |
| Data group | One direct group and four general groups (each group can save 50 data, independent point calibration and upper and lower limit alarm settings, and browse and delete data through the menu) | | One direct group and four general groups (each group can save 500 data, independent point calibration and upper and lower limit alarm settings, and browse and delete data through the menu) | |
| Statistics | No. of readings, mean, minimum, maximum and standard deviation | | No. of readings, mean, minimum, maximum and standard deviation | |
| Units | μm , mm, mil | | μm , mm, mil | |
| Alarm | User can set the high/low alarm limit<br>Alarm icon displayed on LCD when over the limit | | User can set the high/low alarm limit<br>Alarm icon displayed on LCD when over the limit | |
| Minimum curvature radius convex | 5mm | | 5mm | |
| Minimum curvature radius concave | 25mm | | 25mm | |
| Minimum measuring area | Diameter 20mm | | Diameter 10mm | |
| Minimum thickness of substrate | 0.2mm | 0.03mm | 0.2mm | 0.03mm |
| Computer interface | Download data via USB | | Download data via USB | |
| Power supply | 2 pcs AAA 1.5V Alkaline battery | | 2 pcs AAA 1.5V Alkaline battery | |
| Operation environment | Temperature: -10~50℃(14~122℉); humidity: 20~90%RH; no strong magnetic field | | | |
| Storage temperature | -10~60℃(14~140℉) | | -10~60℃(14~140℉) | |
| Size | 114*54*25mm(4.49"*2.13"*0.98") | | 114*54*25mm(4.49"*2.13"*0.98") | |
| Case material and weight | ABS; About 76g(not including batteries) | | ABS; About 76g(not including batteries) | |

**Note: The final specifications may be upgraded without notifying. For more details, please consult with your supplier.**

## 2. Use the Gauge

If you use the gauge for the first time, please read the chapter 3(factors of affecting measurement accuracy).

### 2.1 Replacing the Battery

Place the gauge upside down on a suitable surface, remove the screws from the battery compartment with a crosstip screwdriver, raise the lid of the compartment, remove battery, insert new battery according to the positive and negative poles and close the lid and fasten with screws.

### 2.2 Basic Measurement Step

Step 1. Prepare the sample to be measured

Step 2. Press ⏻ key to power on.

***Note: If ▭ displayed, the battery is OK. Or if ▭ displayed, the battery capacity is low, and measurement will be not reliable, and you need to replace the battery. The low electric symbol will automatically shut off for 30 seconds.***

***When power on, if in direct group mode(DIR), the readings display area is empty, or if in general group mode (GENn, n=1 to 4), it will display the last readings and statistics value measured before power off last time.***

Step 3. Start measuring. Quickly press the probe vertically on the measured piece, with a sound, the measurement data is completed and update the display area. Then lift the probe to leave the test. after about 1 second, the next measurement can be made.

Step 4. Shut down. Press the switch key alone to shut down. If there is no button and measurement operation, the instrument will automatically shut down after about 3 minutes.

Note: Under normal circumstances, the user can keep the default setting and directly use the instrument after starting the machine. However, according to the specific parts to be tested, it is necessary to find the material of the parts to be tested before the coating process and do the necessary zero operation.

## 2.3 Key and User Interface

The gauge have a standard user interface, user can use it easily.

● Left Key

a. To enter into menu mode from measure mode

b. Left button operations in menu mode
(Including "Sure", "Select", "Delete")

● Right Key

a. Right button operations in menu mode
(Including "Cancel", "Back", "Exit")

b. Press and hold to rotate screen

c. Switch on/off the backlight in measure mode

● Up Key

a. Move up or roll up c. Increasing

b. Delete the last readings or whole group

● Down Key

a. Move down or roll down c. Zero calibration(**For P3, P4**)

b. Decreasing d. Refresh LCD in measure mode(**For P1, P2**)

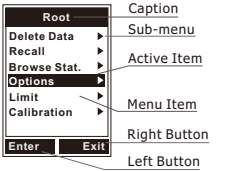
● Zero Calibration Key(**For P1, P2**)

a. Press and hold to do zero calibration

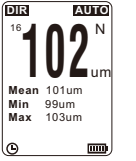
b. Press once to back measure mode in menu mode

c. Press and hold when power on to make system reset. This will restore factory settings

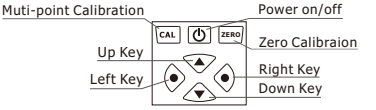
● Calibration Key(**For P1, P2**)
Enter into calibration mode and back measure mode



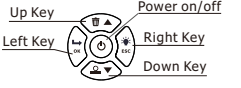

a. Menu Mode




b. Measure Mode




c. Key Define(**For P1, P2**)




d. Key Define(**For P3, P4**)

**2.4 Measure Mode**

- Single measure mode - Place the probe on sample vertically and rapidly, and after one beep, raise it rapidly.
- Continuous measure mode - Place the probe on sample, and don't raise the probe, the measurement will be done continuously in a certain cycle.

**Note: The √ symbol at the tail of the menu item represents that the item is currently selected.**

**2.5 Group Mode**

- Direct Group (DIR)-Be intended for quick occasional readings. In this mode, data are temporarily stored in RAM, it will be lost when power off. The readings and statistics can be shown on the LCD. When the RAM is full, measuring will continue, the oldest readings will be deleted mean while the new readings is stored. Each new readings is stored, the statistics will be upgraded and shown.
- General Group (GEN n, n=1 ~4)-In this mode, data are stored in memory and not lost when power off. When the memory is full, measuring will continue, a "fl" will be shown on the left of readings, the new readings will not be stored, and statistics will not be upgraded.

*NOTE: Whether direct group or general group, they can set independent zero calibration, multipoint calibration and high and low limit alarm value, and once set, the instrument will be permanently saved. Multiple sets of different zero calibration and multi-point calibration can allow you to use in different materials or occasions.*

- Method of switch group mode
  a. Press "Left Key" once to enter into menu mode.
  b. Press "Up Key" or "Down Key" to activate "Options" item, and press "Left Key" once to enter in.
  c. Press "Up Key" or "Down Key" to activate "Group Mode" item, and press "Left Key" once to enter in.
  d. Press "Up Key" or "Down Key" to activate your intended item, and press "Left Key" once to select the item and go back. Press "ZERO Key" to back measure mode.

**2.6 Statistics**

The gauge calculates the statistics for stored readings of each group independently, including mean, minimum, maximum and standard deviation. In direct group mode, when RAM is full, the oldest readings will be deleted meanwhile the new readings will be stored, and the statistics will be upgraded. In general group mode, when memory is full, new readings will not be stored and the statistics will not be upgraded. If user deletes the specified readings or whole group readings, the statistics will also be upgraded.

- Browse the statistics through menu
  a. Press "Left Key" once to enter into menu mode.
  b. Press "Up Key" or "Down Key" to activate "Browse Stat." item, and press "Left Key" once to enter in.
  c. Press "Right Key" once to go back. Press "ZERO Key" to back measure mode.

**2.7 Probe Mode**

In AUTO mode, the probe can automatically determine the type of substrate measured. In MAG mode, the probe can only measure on magnetic substrates. In EDDY mode, the probe can only measure on non-ferrous metal substrates. When a magnetic substrate detected, an "F" will be shown on the right of readings, and when a non-ferrous metal detected, a "N" will be shown.
User can switch probe mode as below.

a. Press "Left Key" once to enter into menu mode.
b. Press "Up Key" or "Down Key" to activate "Options" item, and press "Left Key" once to enter in.
c. Press "Up Key" or "Down Key" to activate "Probe Mode" item, and press "Left Key" once to enter in.
d. Press "Up Key" or "Down Key" to activate your intended item, and press "Left Key" once to select the item and go back. Press "ZERO Key" to back measure mode.

**2.8 Storage**

In general group mode(GEN n), readings and statistics will be stored and not be lost when power off.
In direct group mode(DIR), readings and statistics will be lost when power off.
Each group has individual high/low limit alarm, zero calibration and multi-point calibration, user can change these settings, and they will be stored.
In addition, user can set the system settings (e.g.: Measure Mode,Group Mode,Probe Mode etc.), these settings will also be stored.

*Note: When battery low, user must replace the battery timely. Before replacing the battery, you need to power off the gauge firstly.*

**2.9 Recall and Delete Readings**

- Delete the last readings (Tips: If in measure mode, press the "UP Key" once by one beep).
  a. Press "Left Key" once to enter into menu mode.
  b. Press "Up Key" or "Down Key" to activate "Delete Data" item, and press "Left Key" once to enter in.
  c. Press "Up Key" or "Down Key" to activate "Current Data" item, and press "Left Key" once. A dialog box will be displayed.
  d. Press "Left Key" once to confirm the selection and go back, or "Right Key" to cancel and back. Press "ZERO Key" to back measure mode.

- Delete whole group readings (Tips: If in measure mode, hold the "UP Key" by one beep)
  a. Press "Left Key" once to enter into menu mode ("Root" directory).
  b. Press "Up Key" or "Down Key" to activate "Delete Data" item, and press "Left Key" once to enter in.
  c. Press "Up Key" or "Down Key" to activate "Current Group" item, and press "Left Key" once. A dialog box will be displayed.
  d. Press "Left Key" once to confirm the selection and go back, or "Right Key" to cancel and back. Press "ZERO Key" to back measure mode.
- Recall and delete specified readings
  a. Press "Left Key" once to enter into menu mode ("Root"directory).
  b. Press "Up Key" or "Down Key" to activate "Recall" item, and press "Left Key" once to enter in.
  c. Press "Up Key" or "Down Key" to recall the readings(n/Total number, "n" indicates the index of current shown readings). User can press "Left Key" to delete current shown readings.
  d. Press "Right Key" to go back. Press "ZERO Key" to back measure mode.

***Note: While readings deleted, the statistics will be upgraded automatically.***

**2.10 High and Low Limit Alarm**

Each group has individual high/low limit alarm settings. When switch the work group, the applied alarm settings will also be switched automatically.

- Set high/low limit for the current work group as below.
  a. Press "Left Key" once to enter into menu mode ("Root" directory).
  b. Press "Up Key" or "Down Key" to activate "Limit" item, and press "Left Key" once to enter in.
  c. Press "Up Key" or "Down Key" to activate "Settings" item, and press "Left Key" once to enter in.
  d. Press "Up Key" or "Down Key" to activate your intended item, and press "Left Key" once to enter in.
  e. Press "Up Key" or "Down Key" to increase or decrease the limit value. If hold the key, the limit value will be increased or decreased continuously.

f. Press "Left Key" to confirm new limit value, or "Right Key" to cancel and back. Press "ZERO Key" to back measure mode.

- Clear high/low limit

a. Press "Left Key" once to enter into menu mode("Root" directory).
b. Press "Up Key" or "Down Key" to activate "Limit" item, and press "Left Key" once to enter in.
c. Press "Up Key" or "Down Key" to activate "Clear" item, and press "Left Key" once. A dialog box will be displayed.
d. Press "Left Key" once to confirm the selection and go back, or "Right Key" to cancel and back. Press "ZERO Key" to back measure mode.

***Note: While readings exceed high limit, the alarm symbol ⬆ will be shown on the LCD, and while readings exceed low limit, the alarm symbol ⬇ will be shown. Meanwhile, the red led backlight will be on.***

**2.11 Unit**

User can select the shown unit (Including um, mm and mil) for the readings. Switch the unit as below.
a. Press "Left Key" once to enter into menu mode ("Root"directory);
b. Press "Up Key" or "Down Key" to activate "Options" item, and press "Left Key" once to enter in;
c. Press "Up Key" or "Down Key" to activate "Unit Settings" item, and press "Left Key" once to enter in;
d. Press "Up Key" or "Down Key" to select intended item. Press "Left Key" to confirm it.

**2.12 Speed (Please maintain the default values)**

**2.13 Data Download**

User can use the USB cable to connect the gauge with PC and download stored readings . If USB connected, the symbol will be shown on the bottom of the LCD. When USB connected firstly, the PC need to install driver and software for this application. User can get the driver and software from supplier or download them from specified website. For more details, user can consult with the supplier.

**2.14 Auto Power off**

User can power off via key manually. In addition, for save power, the gauge will turn off automatically in default if not any operations. Before turn off automatically, user will hear several beeps, and then user can press timely any key to let the gauge restart timing and continue working. Enable or Disable this function as below.

a. Press "Left Key" once to enter into menu mode ;
b. Press "Up Key" or "Down Key" to activate "Options" item, and press "Left Key" once to enter in;
c. Press "Up Key" or "Down Key" to activate "Auto Power off" item, and press "Left Key" once to enter in;
d. Press "Up Key" or "Down Key" to select intended item. Press "Left Key" to confirm it.

**2.15 Measurement Accuracy**

The factors affecting the measurement error are multifaceted, as detailed in Chapter 3. Under the normal use of this instrument, the error will remain within a certain index (see 1.6). In order to measure the thickness of the layer more accurately, the user can make measurements many times, delete the suspicious value at the same time, and finally measure the thickness of the layer with the statistical function of the instrument. Overlay thickness = mean (Mean) ± standard variance (Sdev) ± instrument allowable error.

## 3. Factors of Affecting Measurement Accuracy

| Factors \ Principle | Magnetic | Eddy Current | Recommendations |
|---|---|---|---|
| Magnetic properties | √ | | Zero calibration, Multi-point calibration |
| Electrical properties | | √ | |
| Curvature radius | √ | √ | Reference the chapter 1.6, and need to calibrate |
| Substrate thickness | √ | √ | Reference the chapter 1.6, and need to calibrate |
| Size of measuring area | √ | √ | Reference the chapter 1.6, and need to calibrate |
| Surface roughness | √ | √ | Multiple measurements according to method 2.15 |
| Position and shape | √ | √ | Avoid measurement at the edge of the substrate and the steep surface shape |
| Sample deformed | √ | √ | |
| Adhesive substances | √ | √ | Clean probe and sample |
| Strong magnetic field | √ | | Be away from strong magnetic field |
| Temperature and humidity | √ | √ | Instrument calibration at ambient temperature and humidity close to the operating site |
| Measuring operations | √ | √ | Read the chapter 2.2 |
| Low battery | √ | √ | Replace the battery |
| Probe wear | √ | √ | Consult with suppler |

For a more accurate measurement, it is recommended to carefully understand the factors that affect the measurement error before performing the measurement. The main influencing factors listed in the table are briefly described below:

● Magnetic Properties of Substrate

The thickness of the layer is related to the magnetic properties of substrate metal. Different types of metals have different magnetic properties. Heat treatment and cold working will also affect the magnetic properties of the metal. In order to avoid such effects, it is recommended that before starting the measurement, apply standards of the same nature as the piece to be tested to the corresponding calibration as described in Chapter 4.

● Electrical Properties of Substrate

Using the eddy current principle to measure the thickness of the coating will be affected by the metal conductivity of the substrate, which is related to its material and heat treatment. Therefore, before starting the measurement, apply standards of the same nature as the piece to be tested to the corresponding calibration as described in Chapter 4.

● Curvature of Substrate

The influence of the radius of curvature of the substrate on the measurement is not negligible. The smaller the radius of curvature of the substrate, the more obvious the influence on the measurement. Testing on such substrates would be unreliable. Please refer to 1.6, allowing the calibration described in Chapter 4.

● Surface Roughness

The influence of the surface roughness of the substrate on the measurement is also not negligible. The greater the surface roughness of the substrate, the greater the influence on the measurement results. For the coating, multiple locations can be selected for multiple measurements during the measurement, and finally the thickness of the coating can be measured by statistical methods. For the roughness of the substrate to be tested is relatively large, it can also be calibrated by multiple measurements during calibration.

● Specimen Deformation

The probe may cause deformation of the base material or coating during the measurement, so the measured

data will be unreliable.

● Ambient Temperature and Humidity Change too Much

If the operating environment temperature and humidity of the instrument change too much, the instrument should be calibrated under environmental conditions similar to the environment of the piece to be tested.

● Operating Method, Probe Pressure and Orientation

Please read 2.2 carefully to understand the operation method of the probe, especially remember that the probe should be vertically and quickly and stably depressed, and must not be skewed, shaken, or dragged. When operating the instrument, it is recommended to delete the suspicious value before continuing the measurement.

**3.1 Regulation for Usage**

(1) Specimen to Test

The magnetic properties, electrical properties and surface roughness of the test piece should be as similar as possible to the calibration test piece.

The area and thickness of the substrate to be tested shall meet the minimum area and minimum thickness specified in 1.6.

Calibration specimens with a radius of curvature close to the test piece should be used for calibration.

(2) Reading

Random errors and local differences in coating thickness exist objectively. The reading of each measurement of the instrument is not exactly the same, so multiple measurements should be made in the adjacent measurement area. This is especially true for specimens with rough surfaces. In addition, when suspicious values are encountered, it is recommended to delete and then perform the next measurement.

(3) Surface Cleaning

Before measuring, ensure that the surface of the object to be measured and the surface of the instrument probe are clean.

## 4. Zero Calibration

In the measurement, the instrument can easily conduct zero calibration or multipoint calibration, in order to get more accurate measurement results for different measurement conditions. In particular, the metal substrate matching this product is only used to verify the work of the instrument, and can not be used as the calibration substrate for actual measurement.

**4.1 Zero Calibration** **Tip: For products P3 and P4, users should use the "Down Key" instead of the "Zero Key" mentioned in this section**

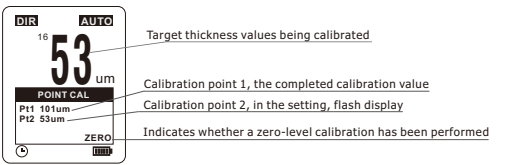
For the specific measurement, it is recommended to do zero calibration before the measurement. First, prepare a substrate not coated with the piece to be tested.

a. Press and hold "ZERO Key" until hearing "beep...beep beep...". The LCD will flash "ZERO" symbol.

b. Measure one or more times on the calibration substrate (better) and the screen value is 0. At this point, the lower statistical value can be ignored.

c. After the above is completed, press "Zero Key" to exit zero calibration, and ZERO disappears at the bottom of the screen.

**Note: For P3 and P4, the user needs to "Left Key" to enter the menu, and then select "Calibration" - "Point calibration" - "Show" or "No display" to turn the point calibration on and off**



**4.2 Multi-point Calibration**

（Up to 4 points, for professional user reference only)

Multi-point calibration, after the user calibrates the specified thickness. In general, the more points, the better the compensation effect. The user shall select the appropriate calibration thickness based on the approximate thickness of the piece to be tested. The approximate thickness of the layer to be measured can be measured roughly in the uncalibrated state, and the user finally estimates it based on experience. The recommended calibration thickness selection rule is that the thickness interval of the covered layer to be measured should be adjacent to the calibration thickness, and try to be located between the calibration thickness (above two points). Calibration method:

a. Zero calibration according to chapter 4.1.
b. In measure mode, press "CAL Key" once to enter into calibration mode（see the figure above).
c. One measurement was made on the selected standard sheet and a reading was displayed on the screen.
d. Press "Up Key" or "Down Key" to increase or decrease the readings until the sheet thickness is displayed. If you hold down the "Up Key" or "Down Key" does not put, the value will continuously increase or decrease at a certain speed, hold down the longer the increase and decrease speed will gradually accelerate, pay attention to observe the change speed, timely release the button and then press single fine tuning.
e. Repeat step c several times, press "CAL Key", the instrument will take the average as the final calibration value.
f. Press "Left Key" to confirm calibration or "Right Key" to cancel calibration.
g. Finished. Press "CAL Key" to exit calibration mode.

**Note:**

a. Zero calibration and multi-point calibration exist independently among the working groups and do not affect each other.
b. In the current working group, after the multi-point calibration reaches 4 points, the user will no longer be able to perform the multi-point calibration. If the calibration is still needed, all the previous point calibration needs to be deleted.
c. Completed readings in each group will not be affected by the latest calibration.
d. In the calibration mode, the measurement is not affected, and the calibration point value will be regarded as the measurement data for storage and statistics, which the user can delete if unnecessary.

**4.3 Calibration value removed**

(Zero calibration can be directly recalibrated, and the deletion operation is not necessary)

When starting a new measurement task, if necessary, please delete the zero and multi-point calibration and recalibration. Delete the method is as follows:

a. Press "Left Key" once to enter into menu mode.
b. Press "Up Key" or "Down Key" until "Calibration" is selected, and press "Left Key" once to enter in.
c. Press "Up Key" or "Down Key" until "Clear" is selected, and press "Left Key" to enter the ok dialog box.
d. Press "Left Key" to determine delete the current working group zero calibration and multipoint calibration, and press "Zero Calibration button" to return to measurement mode.

**Note:**

a. Delete operations are limited in current work group, and the other groups will not be affected.
b. Users can also delete the magnetic induction method to zero calibration, multipoint calibration, or eddy current method to zero calibration, multipoint calibration.

## 5. Maintenance

Users should avoid using the instrument under excessively harsh conditions such as easy collision, heavy dust, high temperature, humidity, strong magnetic field, oil pollution, etc., otherwise, the instrument will be damaged under the above circumstances, our company will not provide warranty service, please understand. During the use of the instrument, if there are serious abnormalities such as repeated measurement values, no response on the screen, no response to the buttons, and no shutdown, please try to restart the machine. If the instrument is no response and can't be turned on, you can remove the battery, and a few minutes later, reinstall the battery, and try again.

Start at the same time always hold down the "zero calibration key" (for product P3, P4 boot does not release the boot button, can enter the reset interface), welcome after the interface, the user will see the system reset prompt dialog box, can press the "left button" to confirm the system reset, reset after all set reset factory default value, the instrument will automatically restart.**←Restore the factory setting method**

If the above method still can't eliminate the fault, please don't disassemble and repair it by yourself. At this time, you should fill in the "Warranty Card" and contact our after-sales personnel toimplement the warranty regulations in time.

**6 .Warranty**

(1) For more methods of using the instrument, please forgive us not to include them in this manual, if you have other needs or any questions, please consult your dealer.

(2) When the instrument fails to work and needs to be repaired, please fill in the "Warranty Card" properly and explain the failure correctly. Please send the "Warranty Card", a copy of the purchase invoice, together with the instrument to our after-sales service department. If the above related items are complete, our company promises to complete the repairment and return it to you as soon as possible after receiving the mail.

(3) If the warranty period is exceeded, we will check and repair fee may be collected in accordance with company regulations.
(4) The company will not provide warranty service for product damage caused by self-disassembly and maintenance, or improper transportation, storage and use, or without proof of purchase.
(5) The normal wear and tear caused by the use of LCD lenses, batteries, key prints, probes, cabinets, etc. will not be covered by the warranty.