# Coating Thickness Gauge

# User Manual

# *CONTENTS*

# 1 Overview

This compact, handy pocket 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 manufactures and their customers, for offices and specialist advisers, for paint shops and electroplaters, for the chemical, automobile, shipbuilding and aircraft industries and for light and heavy engineering.

**Features:**

- With different external probes, the gauge can be applied to measuring thickness of non-magnetic coating on magnetic metal substrate, as well as non-conductive coating on non-magnetic metal substrate.
- Two measuring modes: single or continuous, changeable.
- Two work modes: direct or group, changeable.
- High precision mode: multiple measurements and automatically data filtering method to reduce disturbance of measure results
- Temperature compensation: compensate the measurement distortion caused by

the drifting of temperature.

- Give five statistical values: average, maximum, minimum, measure number, and standard deviation.
- Two calibration methods can be applied to the gauge; And the system error of the probe can be corrected with the basic probe calibration method.
- Data storage: up to 500 measurements storage.
- Set boundary: alarm while measurements out of boundary.
- Battery information indicates the rest capacity of the battery.
- Beep prompting.
- Five statistical data：MEAN，MAX，MIN，NO.，S.DEV
- Auto power off function to conserve battery life.

## 1.1 Measuring Principles

The gauge adopts two thickness-measuring methods: magnetic induction method and eddy current method.

Magnetic Induction method: The probe and the magnetic metal substrate will form a closed magnetic circuit when probe contacting with the coating; the magnetic resistance of closed magnetic circuit varies due to the existing of non-magnetic coating. The thickness of the coating can be measured through the variation of magnetic resistance.

Eddy current method: The high frequency alternating current generates an electromagnetic field in the probe coil; eddy current will be formed on metal substrate when the probe contacting with the coating , and the eddy current has an effect of feedback on the coil in probe. The thickness of the coating can be calculated through measuring the effect of feedback.

The range of applications is indicated by the probes available.

-F probes work on the magnetic induction principle and should be used for non-magnetic coatings such as aluminum, chrome, copper, zinc, paint and varnish, enamel, rubber etc., on an iron or steel substrate; they are also suitable for alloyed

and hardened magnetic steel.

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

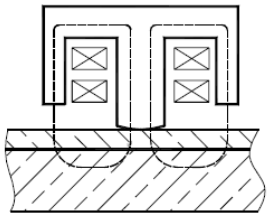

Figure1.1 Principle of magnetic induction method

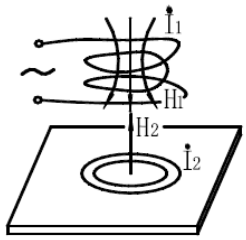


Figure1.2 Principle of eddy current method

# 1.2 Introduction


Power/Backlight

File/Statistics

Delete

MENU Menu

ZERO Calibrate

Confirm

Up

Down

PRB Probe

Figure1.3 Appearance of the meter



1 Battery mark
2 File name
3 Probe type
4 Measure mode
5 Time
6 Result

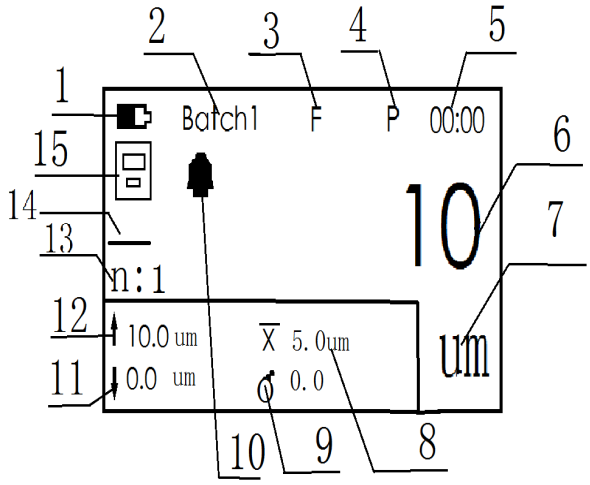
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Batch1
F
P
00:00
10
n:1
10.0 um
0.0 um
X 5.0um
0.0
um

Figure1.4 LCD Display

## 1.3 Technical Parameters

### 1.3.1 Measuring range and Accuracy (see Appendix table 1)

### 1.3.2 Working environment

- Temperature：0℃～40℃
- Humidity：20%RH～90%RH
- Without strong magnetic field

### 1.3.3 Power

- AAA 1.5V x3

### 1.3.4 Size and weight

- Size：155mm×68mm×27mm
- Weight：about 200g

# 2 Operation

## 2.1 Measuring steps

a) Preparing the measuring material (see Part 4).

b) Power on: Put the probe into an open space, and press the key  .

c) Check the battery information, and change the battery if necessary.

d) Calibrate the gauge if necessary according to the calibration method shown in Part 3.

e) Measuring: Put the probe close to the measuring material perpendicularly and rapidly, and press the protecting jacket lightly to keep the contact closely. Then the thickness will be shown on the LCD screen accompany with a beep indication, and the measurement can be repeat after bringing up the probe.

f) Power off: Press the key  to shutdown immediately or the gauge will be power off automatically in about 2 minutes, and the standby time can be set according to section 2.3.2 “Function setup steps”.

**Note:**

1) If the probe is not stable during the measurement, an error result may be shown which can be deleted.
2) After more than two measurements being saved, five statistical data can be achieved: Measurement numbers (NO.), Average value (MEAN), Maximum Measurement (MAX), Minimum Measurement (MIN), and standard deviation.

## 2.2 Functions and operation method

This section introduces the main functions of the gauge and the detailed operation method.

### 2.2.1 Probe type (Automatic ⇔Magnetic ⇔ Non-magnetic)

The probe type can be set by the following steps:

a) In most cases,the meter can identify the probe type automatically, and display "F" or "N" tag in the main interface.
b) When the electromagnetic interference is strong enough to affect the automatic probe identification of the meter, press the key [PRB] to switch the probe type mamually.

### 2.2.2 Measure mode (Single ⇔ Continue)

One of the following two measure modes can be used:

- Single：Once the probe contact with the material, one measure result will occur accompany with one beep indication.
- Continue: Put the probe contact with the material without bringing up, the measurement will be processed continually, and each measure result will be refreshed accompany with one beep indication.

See section 2.3.1 "System setup steps" and choose "Measure" option for configuring the measure mode.

### 2.2.3 Work mode (Memory Mode⇔ Non-Memory Mode)

One of the following two work modes can be used:

- Memory Mode Off: The measure result will not be saved, and it will be ignored when the meter calculates the statistical data.
- Memory Mode On: Measure result is saved to the active file automatically. All of the measure results can be used for statistical data, but the new result will

be ignored if the active file is full with 100 measure results.

See section 2.3.1 “System setup steps” and choose “Measure” option for configuring the measure mode.

### 2.2.4 Set active file

Active file can be set by the following steps:

When the main user interface is displayed, press the  key shortly to switch the file from Batch1 to Batch5 circularly.

**Note: The LCD display will enter the statistical page if long-pressing the  key.**

## 2.2.5 Data view

### 2.2.5.1 View historical data

The saved results could be read or deleted by the following steps:

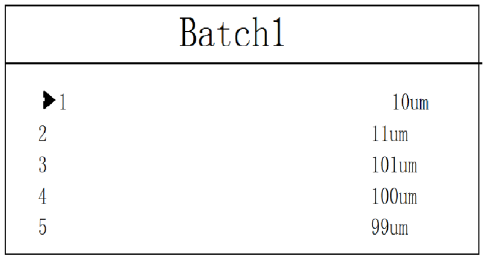


Figure 2.1 Data viewer interface

a) Press the key  in the main interface to enter the data viewer interface.

b) Press the key  or the key  to look over the measure results, and each

result could be deleted by pressing the key  .

c) Long press the key  to delete all the data in the active file.

#### 2.2.5.2 Erase storage file

Follow the steps of 2.3.2, and press the key  or the key  to choose the tab "Erase file" or "Erase all data", and then press the key  to confirm the deletion or press the key  cancel the deletion. For the tab "Erase file", only active file is cleared. For the tab "Erase all data", all of five files are cleared.

### 2.2.6 About measure and error

- All the measurements will be kept in a decided error range (see Appendix table 1) if a proper calibration is done.
- In the view of statistics, one data is unreliable. So each measure result shown in the screen is an average value of multiple measurements.
- To achieve a more accurate measure result, multiple measurements on the same point is needed, and the error data should be ignored.

  So the final coating thickness is: CH = M+S+δ,

Where CH is the coating thickness, M is the average value of multiple measurements, S is the standard deviation, δ is the allowable deviation

For the high precision mode, multiple measurements and data filtering are automatically proceed by the gauge, so the user could achieve an accurate measure result much easier through this mode.

## 2.3 System and function setup

Most of the parameters are configured by system setup of function setup. For system setup, language, unit, measure mode, alarm, temperature compensation, two-point calibration and beep can be set. For function setup, load default, statistical data, erase file, erase all data, precision, threshold, margin, contrast, and standby time can be set.

### 2.3.1 System setup steps

a) Press the key 

in the main interface to choose the tab "MENU", and press the key  to enter the setup menu.

b) Press the key  or the key  to choose the tab "System setup", and

press the key ↵ to enter the system setup menu.

c) Press the key ▲ or the key ▼ to choose the item, and press the key OK to switch the item.

d) Press the key MENU to return.

### 2.3.2 Function setup steps

a) Press the key MENU in the main interface to choose the tab "MENU", and press the key ↵ to enter the setup menu.

b) Press the key ▲ or the key ▼ to choose the tab "Function setup", and press the key ↵ to enter the function setup menu.

c) Press the key ▲ or the key ▼ to choose the item, and press the key OK to enter the item.

d) Press the key ▲ or the key ▼ to configure the item, and press the key ↵ to confirm.

e) Press the key MENU to return.

# 3 Calibration of the gauge

Calibration should be performed in the measuring environment for higher accuracy.

## 3.1 Calibration block

Known thickness foil and known thickness coating slice can be considered as calibration block.

a) Foil

For magnetic induction method, foil indicates non-magnetic metal or non-metal foil. And for eddy current method, foil usually indicates plastic foil. Foil is easier for calibration on curved surface.

b) Coating slice

Coating slice is a known thickness and even coating which is solid combined with the plate. For magnetic induction method, the coating is non-magnetic. And for eddy current method, the coating is non-electric.

## 3.2 Calibration Plate

a) For magnetic induction method, the magnetic and roughness of the plate

should be the same as the measuring material. For eddy current method, the electric of the plate should be the same as the measuring material.

b) For the measuring material that the plate is over the critical thickness list in "Appendix table 1", two kinds of calibration could be used:
   i. Calibrate on a metal foil which has the same thickness as the measuring material plate.
   ii. Calibrate with a metal mat which has the similar electric and enough thickness. The metal mat and the metal plate should close to each other. And this method is not suit for the material which has coating on both sides.

c) For the measuring material which cannot be calibrated on the plane, the curve of the calibration plate should be the same as the measuring material.

## 3.3 Calibration method

The gauge has two calibration methods: zero calibration and two-point calibration. And the gauge also has a calibration method for the probe: basic calibration.

### 3.3.1 Zero calibration

For the measurement on different plate, zero calibration must be performed. Deviation will appear if the feature of calibration plate and measuring material is different.

One of the following two methods could be used for zero calibration:

- **Calibrate on the plate**
  a) Measure on the plate, and the screen display <×××μm>.
  b) Press the key ZERO before bringing up the probe, and the screen display <0μm>.

  Repeat step a~b will achieve higher accuracy.
- **Calibrate on the foil**
  a) Press the key ZERO in main interface to enter "Zero calibration" mode.
  b) Measure on a foil, and the screen display <××××μm>.
  c) Press the key ↑ and the key ↓ to correct the thickness value.
  d) Press the key ↵ to confirm; or press the key MENU to cancel; or press the key ZERO to clear the older zero calibration information.

Repeat step a~d will achieve higher accuracy.

### 3.3.2 Basic calibration for the probe

Basic calibration should be performed for the following situation:

a) Change the probe.
b) The header of the probe is wear.
c) The probe has been repaired.
d) Special usage.

Operation steps:

a) Press the key  during power on to enter the basic calibration mode.
b) Press the key 

to change probe type. If the screen display the indicator "F" on the right side of the top line, the calibration will be performed for magnetic probe; And if the screen display the indicator "N" on the right side of the top line, the calibration will be performed for non-magnetic probe;
c) Calibrate infinity point: Put the probe away from the plate, and then press

the key ↵ while the value is stable.

d) Calibrate zero point: Put the probe close to the plate, and then press the key ↵ while the value is stable.

e) Calibrate 5 to 10 known thickness points:

   i. Press the key ▲ or the key ▼ to correct the thickness on the top line.

   ii. Measure the foil, and then press the key ↵ while the value is stable, or press the key MENU to skip this point.

f) All the calibration information will be shown again after all the points completed. And the indicator "PASS" or "FAIL" can be seen from the bottom line. Press the key ↵ to turn to the main interface;

***Note: Skipped point should be less than 5.***

***Calibration point should be gradually changed from small to large***

### 3.3.3 Temperature Calibration:

# 4 The factors affecting the measuring accuracy

| Method / Factors | Magnetic Induction | Eddy Current |
|---|---|---|
| Magnetic property of the plate | ▲ | |
| Electric property of the plate | | ▲ |
| Thickness of the plate | ▲ | ▲ |
| Edge effect | ▲ | ▲ |
| Curvature | ▲ | ▲ |
| The deformation of material | ▲ | ▲ |
| Roughness or the surface | ▲ | ▲ |
| Magnetic field | ▲ | |
| Attachments | ▲ | ▲ |
| Pressure of the probe | ▲ | ▲ |
| Direction of the probe | ▲ | ▲ |

▲ ------ have influence

# 5 Maintenance and repair

## 5.1 Work environment

Strict avoidance of collision, heavy dust, moisture, strong magnetic field, oil etc.

## 5.2 Battery replacement

Battery should be replaced by the following steps while the battery is low:

a) Power off.

b) Open the battery compartment cover.

c) Remove the battery, and put in the new one.

d) Close the battery compartment cover.

e) The battery should be removed if the gauge is not using for long time.

# Appendix

## Appendix table 1 Technical parameters

| Probe type | | F | N |
|---|---|---|---|
| Measuring principle | | Magnetic induction | Eddy current |
| Measuring range | | 0～1500 um | 0～1500 um |
| Low range resolution | | 0.1 um | 0.1 um |
| Accuracy | Zero calibration | ±(3%H+1) um | ±(3%H+1) um |
| | Two point calibration | ±[(1～3)%H+1] um | ±[(1～3)%H+1] um |
| Measuring Condition | Min. radius of curvature | Cx. 1.5 mm | Cx. 3 mm |
| | Min. radius of area | Φ7 mm | Φ5 mm |
| | Critical thickness of plate | 0.5 mm | 0.3 mm |

Note: H – nominal value of thickness

**Appendix table 2 Probe selection reference**

| Coating / Plate | Non-magnetic Coating of Organic material (Such as: paint, enamel, plastic, anodizing, etc.) | Non-magnetic Coating of Nonferrous metal (Such as: Chromium, zinc, aluminum, copper, tin, silver, etc.) |
|---|---|---|
| Magnetic metal such as iron and steel | F type probe Measure range: 0μm ~ 1500μm | F type probe Measure range: 0μm ~ 1500μm |
| Nonferrous metal such as Copper, aluminum, brass, zinc, tin, etc. | N type probe Measure range: 0μm ~ 1500μm | N type probe Measure range: 0μm ~ 40μm (only for Chromium on Copper) |

# User Notice

1. Please fill out the warranty registration card seriously and seal your Company Chop after you get the instrument. Then mail the copies of the warranty registration card and the invoice to our user service center or you can relegate that to the seller when buying the instrument.
2. If it go wrong for quality matter within a year after you buy our instruments, please take your warranty registration car and invoice to our repair station nearby for repairing, changing or returning. If you can’ t show the warranty registration card and the invoice we would calculate the warranty period since the instruments are produced, and the warranty period is one year.
3. If it is out of the warranty period, the repair stations are response for after service and repairing and charge according to the rules of our company.
4. You need to pay for additional configuration, such as special probe and the software.
5. If transportation, installation, faulty operation problem, lead to the equipment's part damage. The damages caused by transportation, installation, faulty operation, non-professional maintenance are out of warranty service. If you alter the warranty registration car or there is no invoice, we wouldn’ t provide free repair.