MN-5402-TC21-E

5402-TC21

COATING THICKNESS GAUGE (ADVANCED TYPE)

OPERATION MANUAL

PLEASE SCAN QR CODE TO WATCH THE OPERATION VIDEO OF PRODUCTS.

VIDEO

INSIZE

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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.

Different software versions can be chosen, customers can choose appropriate version according to their needs. Customers can update their gauge to upper version after licensing without having to return the gauge back to the factory.

Suffix	Version	Description
None	Standard Ver.	Included all standard features, references for other versions
-B	Bluetooth Ver.	Support Bluetooth communication and real-time measurement
-O	Command Ver.	Support command control function and real-time measurement
-T	Cu-Sn Ver.	Support Cu-Sn mode. The thickness of tin coating on copper surface can be measured
-Z	Weight Ver.	Support Weight mode. Both thickness and weight of zinc coating on galvanized steel plate can be measured simultaneously

Note: Multiple functional versions can be superimposed, -BTZ indicates Bluetooth, Cu-Sn and Weight Version.

* 5402-TC21 is bluetooth version and support bluetooth communication.

1.1 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.
- High precision sample chip and dedicated temperature compensation model used for high precision measurement
- Efficient filtering algorithm used for Anti-electromagnetic interference
- Support weight measuring mode (only for Weight Ver.). Both thickness and weight of zinc coating on galvanized steel plate can be measured simultaneously by pre-setting the density of

the coating material

- Support Cu-Sn mode (only for Cu-Sn Ver.). The thickness of tin coating on copper surface can be measured.
- Probe can be re-matched with the gauge after wear
- Support High Precision Single Point Measurement, Scan Mode, Differential Mode and Alarm Mode
- Zero Calibration, One-Point Calibration, Two-Point Calibration and Basic Calibration can be used for system error auto correction
- Mini-USB interface used for communication and portable cable printer
- Support Bluetooth communication (only for Bluetooth Ver.) and

command control (only for Command Ver.), which can be used to communicate with PC or smart phone for online measurement.

- Host software upgradable
- Contrast adjustable and backlight selectable
- Stability indicator for measuring status monitoring
- Battery indicator for battery quantity monitoring
- Thickness and relevant information can be stored completely
- Up to 500 measurements storage.
- Give five statistical values: average, maximum, minimum, measure number, and standard deviation.
- Beep prompting.
- Auto power off function to conserve battery life.

1.2 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.

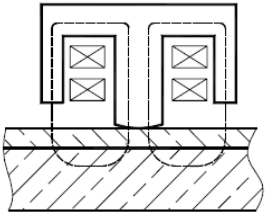

Figure 2 Principle of magnetic induction method

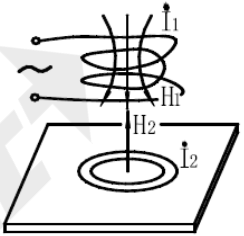

Figure 2 Principle of eddy current method

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1.3 Introduction

Figure 3 Schematic view

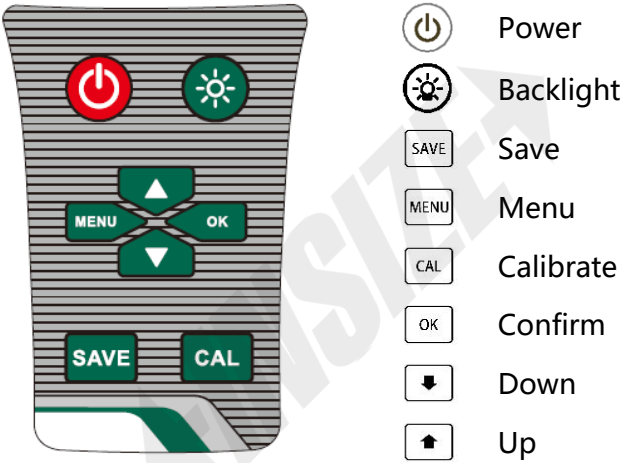
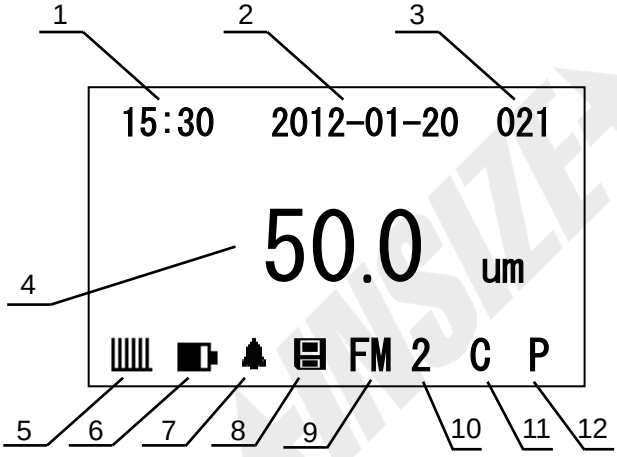


Figure 4 Keypad view



1. System Time
2. System Date
3. Storage
4. Measurements
5. Coupling Status
6. Battery Sign
7. Alarm Sign
8. Auto-Save Sign
9. Probe Type
10. 2-Point Cal Sign
11. Temperature Compensation Sign
12. Measure Mode

Figure 5 LCD display

1.4 Technical Parameters

1.4.1 Measuring Range and Accuracy (see Table 1)

1.4.2 Working Environment

- Temperature: -10℃ ~ 50℃
- Humidity: 20%RH ~ 90%RH
- Without strong magnetic field

1.4.3 Power

- 3 * AAA alkaline batteries

1.4.4 Size and Weight

- Size: 150mm×70mm×30mm
- Weight: about 160g

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2 Operation

Please read Chapter 3 (Calibration of the gauge) and Chapter 4 (Factors affecting the measuring accuracy) carefully before using the gauge.

2.1 Measuring steps

a) Preparing the measuring material.

b) Power on: Put the probe into an **open space**, and press the key ⏻. Do not put the probe close to any metal material before the probe type indicator is shown.

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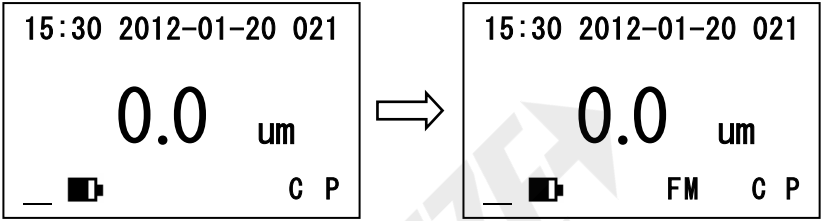


Main Interface (MI) – No probe MI – Probe type "FM"

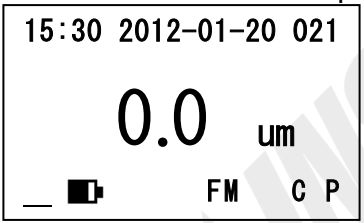
c) Check the battery information, and change the battery if necessary.

d) Check the probe type, and re-connect the probe if the type indicator is incorrect.

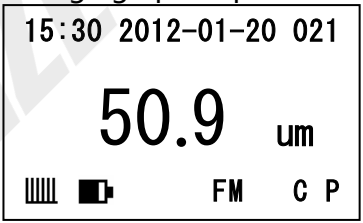
e) Calibrate the gauge if necessary according to the calibration method shown in Chapter 3.

f) Measuring: Put the probe close to the measuring material

perpendicularly and rapidly after the temperature calibration indicator "C" shown, 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.



MI – before measuring



MI – after measuring

g) 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 2.2.2 Advanced setup steps。

Note:

1) Zero Calibration should be done before measuring the coating thickness on different property of the base material, which includes material type, base thickness, base curvature and surface rough of the base.
2) An error result may be shown if the probe is not stable during the measurement.
3) During the measuring process, the feature of the probe will be changed while the temperature is drifting, and the measurement distortion will be found. The technic of temperature compensation has been used in the gauge to process the real-time calibration of the temperature drifting.

To ensure that the technic of temperature compensation works effectively, measuring operation should be processed after the real-time temperature compensation indicator "C" appears.

4) Select the probe type manualy can help recogonize the probe faster.

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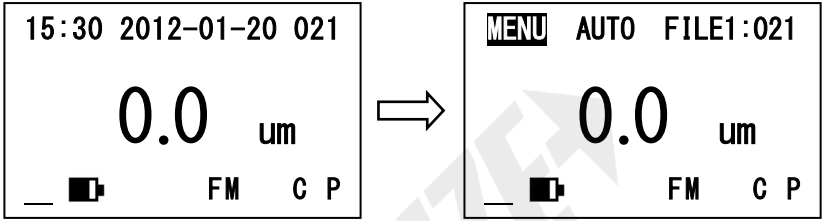
2.2 Basic and advanced setup

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

2.2.1 Basic setup steps

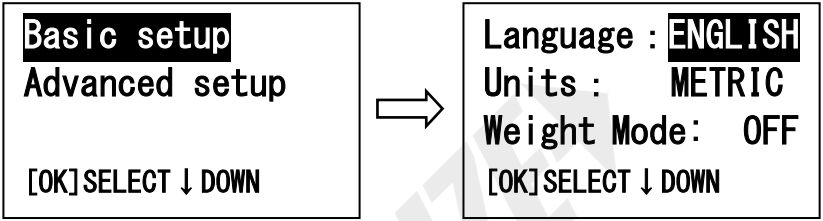
a) Press the key MENU in the main interface to choose the tab "MENU" , and press the key OK to enter the setup menu.



Main Interface (MI) Menu Interface

b) Press the key [↑] or the key [↓] to choose the tab "Basic setup", and press the key [OK] to enter the basic setup menu.

c) Press the key [↑] or the key [↓] to choose the item, and press the key [OK] to switch the item.



Setup Select Interface　　Basic setup Interface

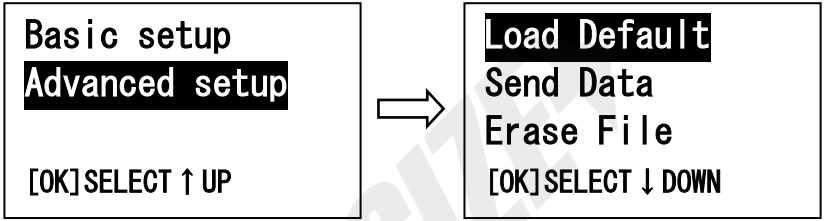
d) Press the key [MENU] to return.

2.2.2 Advanced setup steps

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

b) Press the key [↑] or the key [↓] to choose the tab "Advanced setup" , and press the key [OK] to enter the

advanced setup menu.



Setup Select Interface Advanced setup Interface

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 [OK] to confirm or press the key [MENU] to return.

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2.3 Functions and operation method

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

2.3.1 Restore factory settings

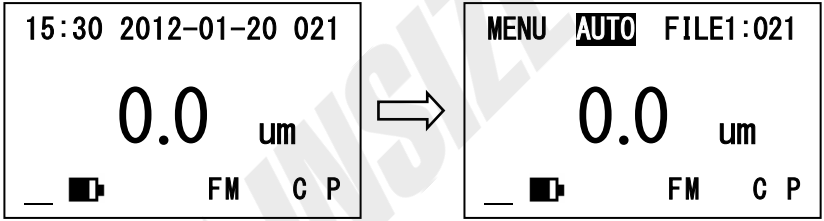
One of the following two measure modes can be used:

- Fast way: Press the key ⏻ and SAVE simultaneously to power on the gauge under power off status. Release the key ⏻ first, and then release the key SAVE after "Load default" is shown on the screen.
- Normal way: Power on the gauge, and then enter the "advanced setup interface" (see 2.2.2).

2.3.2 Probe mode

The probe type can be set by the following steps:

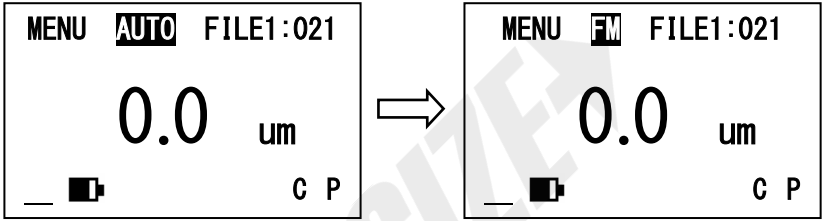
a) Press the key MENU in the main interface to choose the tab "AUTO" .



Main Interface Probe Mode Interface (PMI)

b) Press the key OK to switch the tap: "AUTO" indicates the auto recongnise mode. "FM"、"NM"、"FL"、"NL"、

“FX” 、 “FT” 、 “FS” indicates corresponding probe type.



PMI- AUTO PMI – FM

Power on after inserting probe or insert probe after power on, “CHECK PROBE, DON’T USE” will be displayed in the center of the screen. At this time, do not put the probe near any metal objects, especially do not measure on the workpiece, to avoid probe parameters identification errors. Wait until the "PROBE

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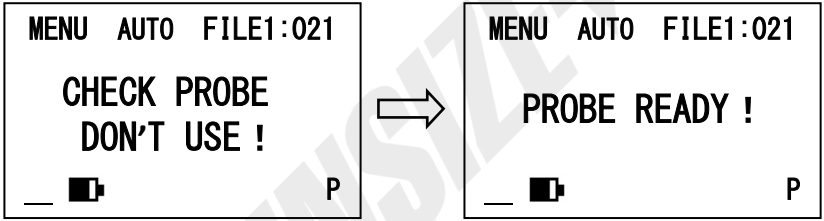
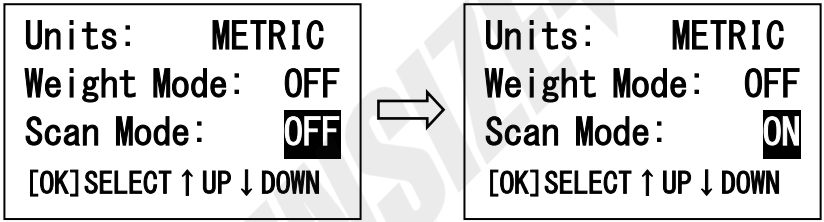
READY!" is displayed, the probe type indicator will be shown at the bottom of the screen. And it is necessary to check that the identified probe type is correct before starting measurement.



In some serious magnetic field interference environment, the instrument may not correctly identify the probe type, then the measuring margin can be appropriately increased in "Set Margin" menu (see 2.2.2). Or specify the probe type.

2.3.3 Measure mode

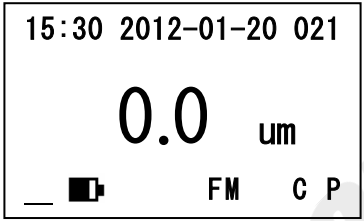
The gauge supports two measure modes: high precision mode and scan mode.



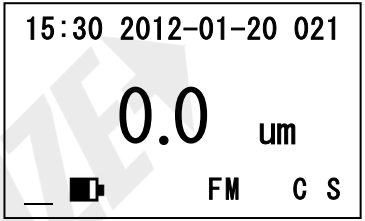
High Precision Mode　　Scan Mode

The gauge works on high precision mode by default, the measure mode indicator shows "P". To use scan mode, turn on the "Scan Mode" option in "Basic setup" menu (see

2.2.1), and the measure mode indicator shows “S”.



High Precision Mode



Scan Mode

In scan mode, about three readings will be shown on the LCD display every second, and online monitoring can be realized. In high precision mode, the gauge can ignore error result automatically during multiple measurements and give the average value in final. The measuring time will increase about 2

seconds.

The high precision mode can be configured by the following parameters:

- Measuring precision: Measurement times for average. By setting this parameter higher, the measurement times will be more, the accuracy will be higher, and the measure time will be longer.
- Measuring Margin: The maximum error limit for data filtering. All the measure results over the error limit will be ignored while computing the average value. By setting this parameter lower, the error limit will be lower, and the accuracy will be higher. For some special environments,

measure result will be strongly influenced by outside magnetic disturbance, and the measuring margin should be set little higher to insure that the high precision mode is working.

```
Set Precision
Set Threshold
Set Margin
[OK]SELECT ↑UP ↓DOWN
```

⇨

```
Margin : 02
[OK] to exit
↑  to add
↓  to reduce
```

Advanced setup interface Set margin interface

See section 2.2.2, enter advanced setup interface, and press the key [↑] or [↓] to choose "Set precision" or "Set

margin" option. Press the key [OK] to enter the configuration interface, and use the key [⬆] or [⬇] to modify the parameter. Then press the key [OK] or [MENU] to return.

2.3.4 Alarm mode

The gauge supports alarm mode. Open the alarm function, the gauge will beep alarm when the measured value exceeds the limit. To use alarm mode, setting the "Alarm Mode" option in "Basic setup" menu.

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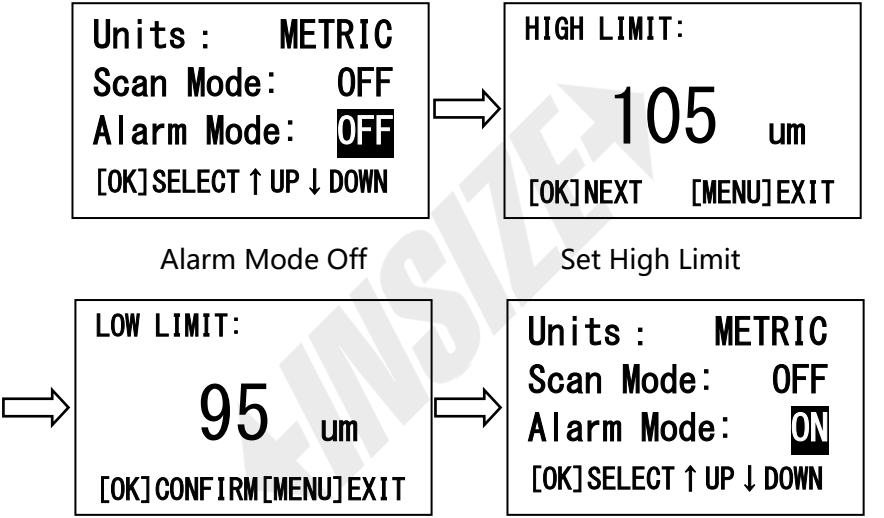
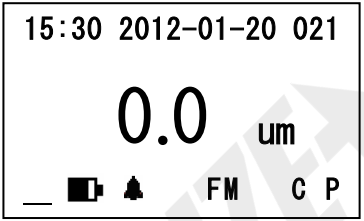


Alarm Mode Off

Set High Limit

Set Low Limit

Alarm Mode On

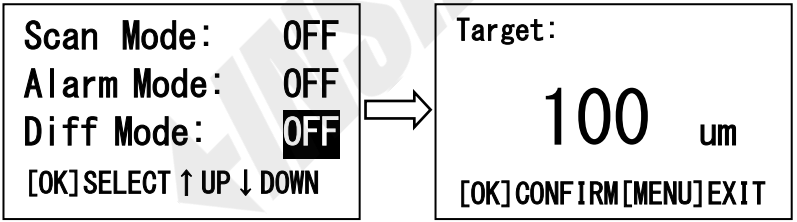


MI - Alarm Mode On

After the alarm mode is enabled, the alarm indicator will be shown in main interface. When the measured value exceeds the limit, the alarm indicator will be flashing and accompanied by a beep alarm.

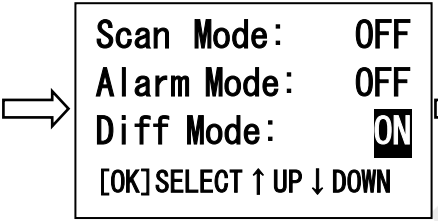
2.3.5 Differential mode

The gauge supports differential mode. Open the differential mode, the value displayed on the screen is the difference between the actual measured value and the target value. To use differential mode, setting the "Diff Mode" option in "Basic setup" menu.

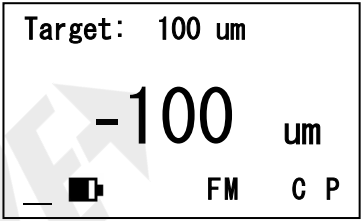


Differential Mode Off

Set Target Value



Differential Mode On

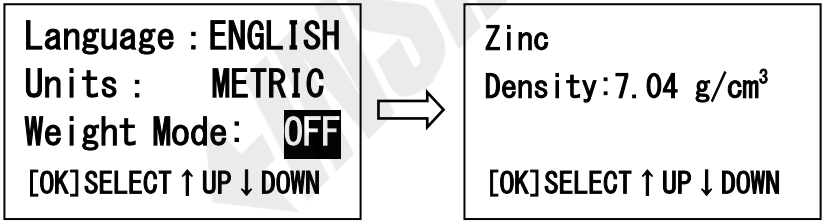


MI - Differential Mode On

After the differential mode is enabled, the target value will be shown in the top bar, and the difference between the actual measured value and the target value will be shown in center.

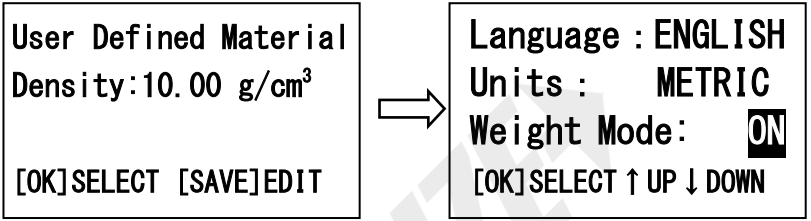
2.3.6 Weight mode *

The gauge supports weight measuring mode (only for Weight Ver.), both thickness and weight can be measured at the same time by pre-setting the density of the coating material. To use weight measuring mode, setting the "Weight Mode" option in "Basic setup" menu.



Weight Mode Off

Density setting

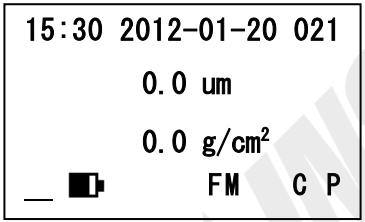


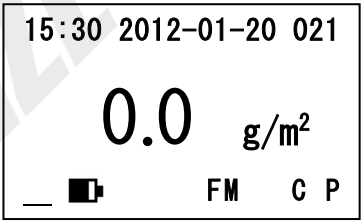
User Defined Material　　Weight Mode On

See section 2.2.1, enter basic setup interface, and press the key [↑] or [↓] to choose "Weight Mode" option. Press the key [OK] to enter the density setting interface, and use the key [↑] or [↓] to choose the material type. Then press the key [OK] or [MENU] to return. If the user defined material has been chosen, then press the key [SAVE] to modify the density

value.

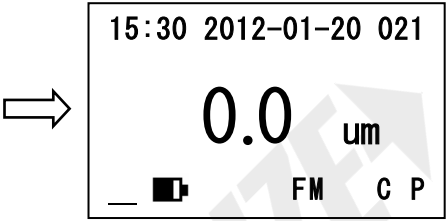
In weight measuring mode, the measurements can be switched between the following three display modes by press the key ⬆ or ⬇.





Both thickness and weight

Only weight



Only thickness

2.3.7 Cu-Sn mode *

The gauge supports Cu-Sn measuring mode (only for Cu-Sn Ver.), the thickness of tin coating on copper surface can be measured. To use Cu-Sn mode, setting the "Cu-Sn" option in "Basic setup" menu.

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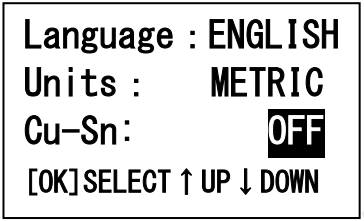
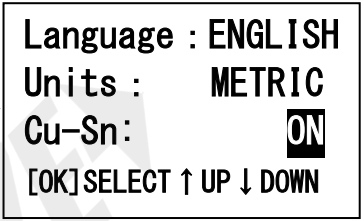
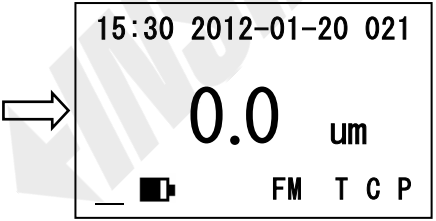


Cu-Sn Mode Off



Cu-Sn Mode On



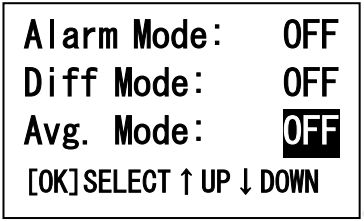
MI - Cu-Sn Mode On

After the Cu-Sn mode is enabled, the Cu-Sn indicator "T" will be shown in main interface, and the measurements are corrected by a dedicated algorithm.

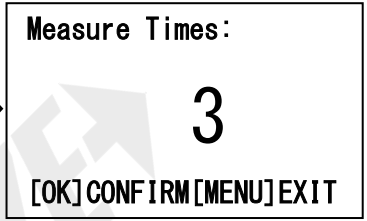
Notice: The Cu-Sn mode is only designed for measuring the tin coating on copper surface. Please disable the Cu-Sn mode when measuring other workpieces.

2.3.8 Average mode

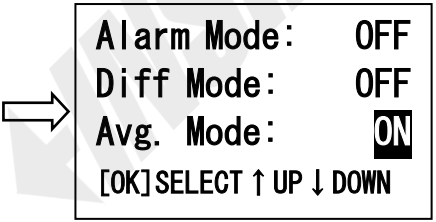
The gauge supports average mode. Open the average mode, the average value will be displayed after the total number of measurements is reached measure times. To use average mode, setting the "Avg. Mode" option in "Basic setup" menu.



Average Mode Off

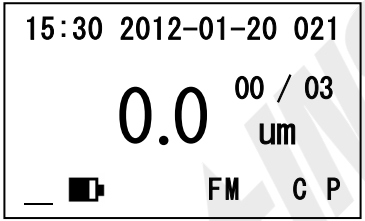


Set Measure Times

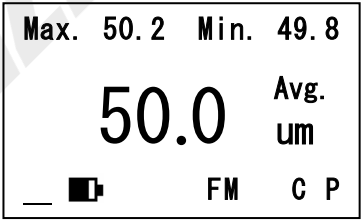


Average Mode On

After the average mode is enabled, the current and preset measure times will be shown in main interface. the average value will be displayed after the current times is reached preset times, and the maximum and minimum values of these measurements are displayed at the top bar.



MI - Average Mode On



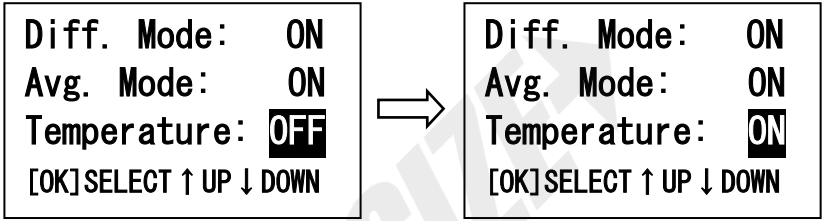
MI – Display Average Value

2.3.9 Temperature compensation

During the measuring process, the feature of the probe will be changed while the temperature is drifting, and the measurement distortion will be found. The function of temperature compensation uses the advanced temperature compensation arithmetic to process the real-time calibration of the temperature drifting. So the influence of temperature is virtually eliminated, and the measurement is more accurate. The function of temperature compensation can be used by the following steps:

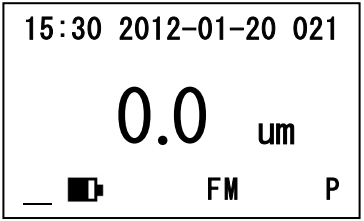
a) See section 2.2.2, enter basic setup interface, and press the key [↑] or [↓] to choose "Temperature". Press the

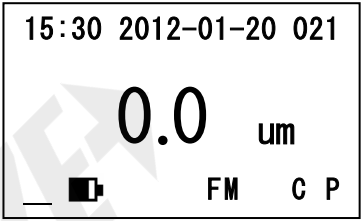
key [OK] to turn on the temperature compensation.



Temperature compensation off　　Temperature compensation on

b) Back to the main interface, and wait for few seconds. The real-time temperature calibration will be success after the indicator "C" appears.





Temperature compensating Compensation completed

c) Put the probe close to the measuring material and measure.

d) Bring up the probe, and waiting for the appearance of the indicator "C" for the next measurement.

2.3.10 Data storage

A group of measuring information includes measurement, probe type, measure time and measure date can be stored.

There are five storage files, and 100 measurements for each file.

2.3.10.1 Set or erase active file

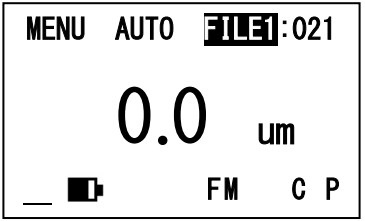
Active file can be set or erased by the following steps:

a) Press the key [MENU] in the main interface, and choose the tab "FILE" .

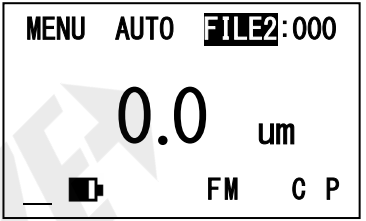
b) Press the key [↑] or the key [↓] to switch the active file from file1 to file 5.

c) Press the key [SAVE] to clear the active file.

d) Press the key [OK] to view the data logger.



Set active file – FILE1



Set active file – FILE2

Note: Data storage, data removing and data statistic are both proceed for the active file.

2.3.10.2 Save data

Up to 100 results could be stored for each file, and the gauge provide five files in total.

The data can be stored by one of the following method:

- Manually: Measure result can be saved by pressing the key SAVE in the main interface.
- Automatically: Measure result is saved to the active file automatically. The auto-save indicator "" shows in status bar.

  Hold the key SAVE in main interface for about two seconds to switch the storage mode between "Manually" and "Automatically"

2.3.10.3 Using the data logger

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

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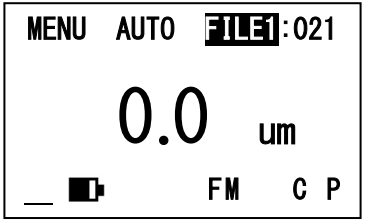
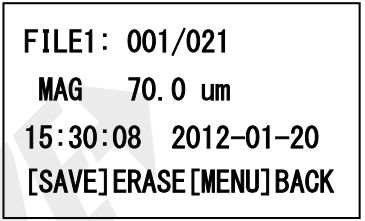




Set active file – FILE1 Manage FILE1

a) Press the key [MENU] in the main interface to choose the tab "FILE" , and press the key [OK] to enter the data viewer interface.

b) Press the key [▲] or the key [▼] to look over the data

c) Press the key [SAVE] to delete selected data.

d) Press the key [CAL] to calculate the statistics for all data in

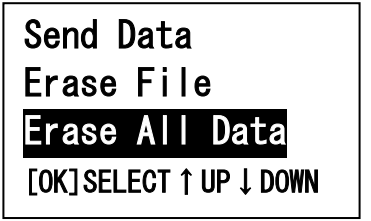
active file, which includes maximum, minimum, average and standard deviation.

e) Press the key [OK] to send all data in active file to PC or portable printers.

f) Press the key [MENU] to return.

2.3.10.4 Erase storage file

See section 2.2.2, enter advanced setup interface. Press the key [↑] or the key [↓] to choose the tab "Erase file" or "Erase all data". And then press the key [OK] to confirm the deletion or press the key [MENU] cancel the deletion. For the tab "Erase file", only active file is cleared. And for the tab "Erase all data", all of five files are cleared.



Advanced setup interface　　Erase confirm interface

2.3.11 Set measure threshold

See section 2.2.2, enter advanced setup interface, and press the key [↑] or [↓] to choose "Set threshold" option. Press the key [OK] to enter the configuration interface, and use the key [↑] or [↓] to modify the parameter. Then press the key [OK] or [MENU] to return.

```
Erase All Data
Set Precision
Set Threshold
[OK]SELECT ↑UP ↓DOWN
```

⇨

```
Threshold: 00
[OK] to exit
↑ to add
↓ to reduce
```

Advanced setup interface Set threshold interface

Measure threshold is the minimum variation of the thickness for the measure. All the measure results that the variation is less than the threshold is ignored.

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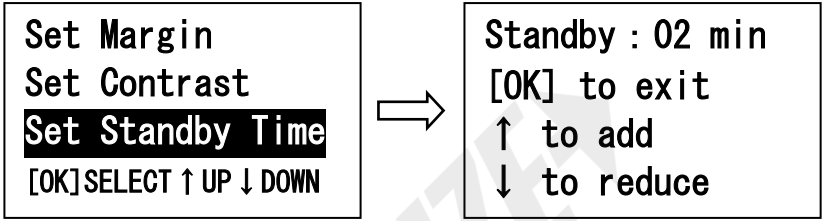
2.3.12 Set standby time

To save power, the gauge will enter standby mode during a nominal time in main interface, set by user. In the standby mode, the gauge stop measurement to save power consumption. Press any key to exit standby mode.

See section 2.2.2, enter advanced setup interface, and press the key [↑] or [↓] to choose "Set Standby Time" option. Press the key [OK] to enter the configuration interface, and use the key [↑] or [↓] to modify the parameter. Then press the key [OK] or [MENU] to return.



Advanced setup interface　　Set standby time interface

Notice: The function of standby mode will be disabled if the standby time is set to zero.

2.3.13 Set power off time

To save power, the gauge will be powered off automatically during a nominal time, set by user.

See section 2.2.2, enter advanced setup interface, and press

the key [↑] or [↓] to choose "Set Power Off" option. Press the key [OK] to enter the configuration interface, and use the key [↑] or [↓] to modify the parameter. Then press the key [OK] or [MENU] to return.

```
Set Contrast
Set Standby Time
Set Power Off
[OK]SELECT ↑UP ↓DOWN
```

⇨

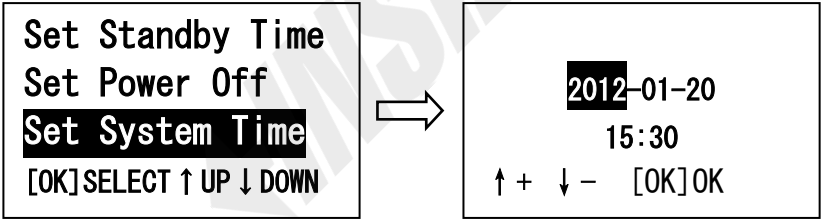
```
Power off : 02 min
[OK] to exit
↑ to add
↓ to reduce
```

Advanced setup interface Set power off time

Notice: The function of auto power off will be disabled if the power off is set to zero.

2.3.14 Set system time

See section 2.2.2, enter advanced setup interface, and press the key [↑] or [↓] to choose "Set System Time" option. Press the key [OK] to enter the configuration interface, and use the key [↑] or [↓] to modify the parameter. Then press the key [OK] or [MENU] to return.



Advanced setup interface　　Set system time

2.3.15 Cable Communication

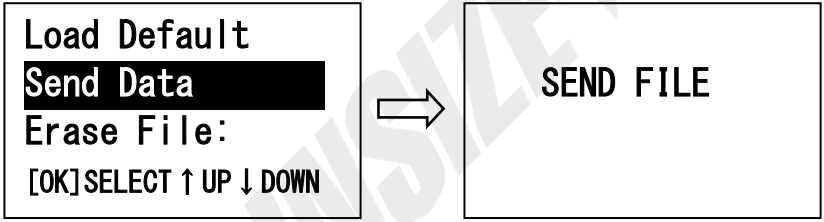
The gauge supports virtual serial communication with Mini-USB interface. It can be used to communicate with PC. Configure the gauge and PC as below:

1) Connect the gauge to the PC using the mini-USB cable.
2) Open serial port communication tools on PC, choose the serial port (COMx) of the gauge (with the keyword of "CP210X" in the description of the port), and configure the communication tool as blow:

   Data Bits - 8, Parity - None, Stop Bits - 1, Baud Rate - 9600
3) Transfer data from the gauge:

a. Enter "Advenced Setup" menu, select "Send Data" option

b. Press the confirm key ↵ to send data



Send Data Option

Sending data

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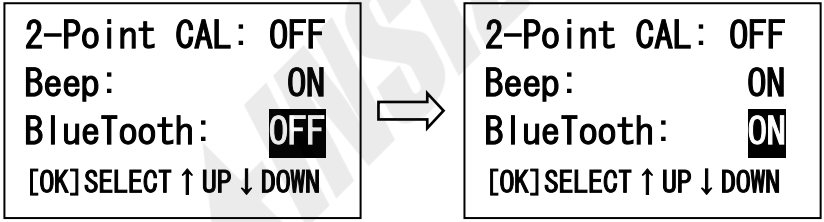
2.3.16 Bluetooth Communication

The gauge supports Bluetooth communication (only for Bluetooth Ver.). The ability of Bluetooth can be used to communicate with PC or smart phone. Configure the gauge and PC (or smart phone) as below:



Bluetooth off　　Bluetooth on

1) To use Bluetooth communication, setting the "Bluetooth" option in "Basic setup" menu.
2) Turn on the Bluetooth of PC (or smart phone), search for the Bluetooth device which contains the gauge SN in device name, and complete Bluetooth pairing by using the code of "0000"
3) Open serial port communication tools on PC (or smart phone), choose the serial port (COMx) of the gauge (with the keyword of "Bluetooth" in the description of the port), and configure the communication tool as blow:

   Data Bits - 8, Parity - None, Stop Bits - 1, Baud Rate - 9600
4) Transfer data from the gauge (see 2.3.15)

2.4 About measure and error

- All the measurements will be kept in a decided error range (see 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.
- 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.

  So the final coating thickness is: $CH = M+S+\delta$,

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

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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

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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 according to the critical thickness list in "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 three calibration methods: zero calibration, one-point calibration and two-point calibration. And the gauge also

has two calibration methods for the probe: basic calibration and temperature coefficient calibration.

3.3.1 Zero calibration

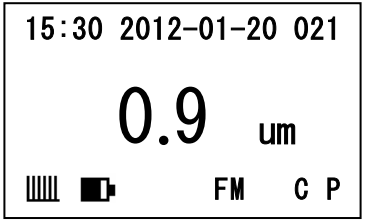
For the measurement on different plate, zero calibration must be performed. Deviation will appear if the feature of calibration plate and measuring material is different.

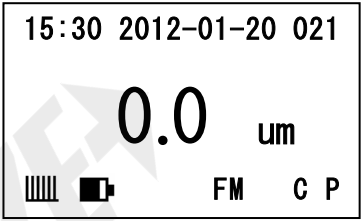
Zero calibration can be performed by the following steps:

a) Set measure mode to high precision mode (the measure mode indicator shows "P" , see 2.3.3)

b) Measure on the plate, and the screen display <××μm>.

c) Press the key CAL, and the screen display <0.0 μm>.





Zero calibration – before

Zero calibration – after

Repeat step a~c will achieve higher accuracy.

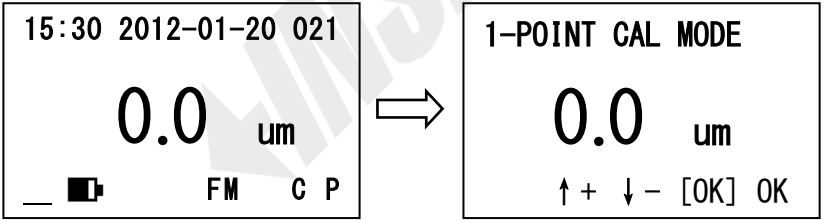
NOTE: Zero calibration should be preform on the base material which has the same property with the measure material. And the appendix plate is just used for checking the gauge.

3.3.2 One-point calibration

Zero calibration should be substituted by one-point calibration if the base material cannot be found.

a) Set measure mode to high precision mode (the measure mode indicator shows "P" , see 2.3.3)

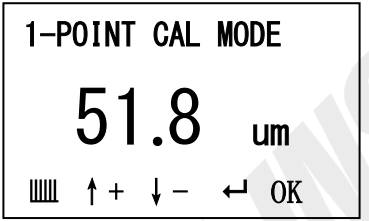
b) Hold the key CAL for about two seconds in main interface to enter "one-point calibration" mode.

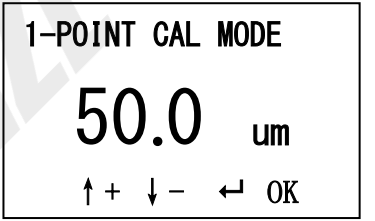


Main interface One-point calibration

c) Measure on a foil, and the screen display <×××μm>.

d) **Bring up the probe**, and press the key [↑] and the key [↓] to correct the thickness value.





One-point calibration – Measure Modify thickness value

e) Press the key [OK] to confirm; or press the key [MENU] to cancel; or press the key [CAL] to clear the older zero

calibration information.

Repeat step a~e will achieve higher accuracy.

Calibration thickness should less than 200um for one-point calibration. Otherwise, the accuracy for thin coating will be lower.

NOTE: One-point calibration is a complementary of zero calibration. Previous zero calibration is invalid if one-point calibration have been perform, vice versa.

3.3.3 Two-point calibration

Two-point calibration is used for increasing measurement accuracy for a small range. One of the following two methods could be used for two-point calibration:

- **One foil**

  This method is used for measuring thin coating.

  a) See section 2.2.2, enter basic setup interface, and press the key [↑] or [↓] to choose "2-Point CAL". Press the key [OK] to turn on the Two-point calibration.

```
Avg. mode:    OFF
Temperature:  ON
2-Point CAL   OFF
[OK]SELECT ↑UP ↓DOWN
```

⇨

```
Avg. mode:    OFF
Temperature:  ON
2-Point CAL   ON
[OK]SELECT ↑UP ↓DOWN
```

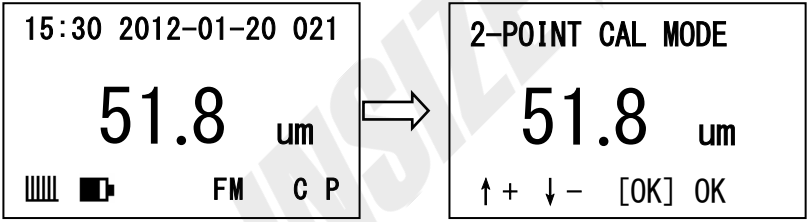
Two-point calibration - On　　Two-point calibration - Off

  b) Perform zero calibration on the plate. See 3.3.1 "Zero

calibration" for more details.

c) Measure on a foil, and the screen display <×××μm>.

d) Press the key [⬆] or the key [⬇] before bringing up the probe to enter "two-point calibration" mode.



MI – measure Two-point calibration interface

e) Press the key [⬆] and the key [⬇] to correct the thickness value.

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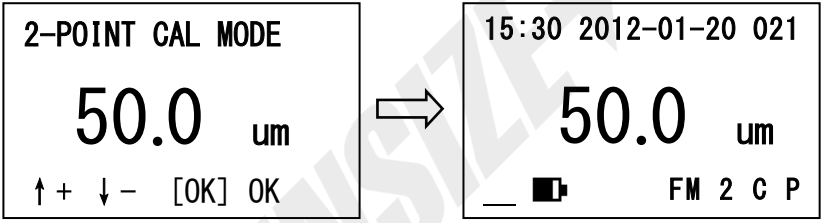
f) Press the key [OK] to confirm; or press the key [MENU] to cancel; or press the key [CAL] to clear the older two-point calibration information.



Correct thickness value Two-point calibration affect

Repeat step c~f will achieve higher accuracy.

- **Two foils**

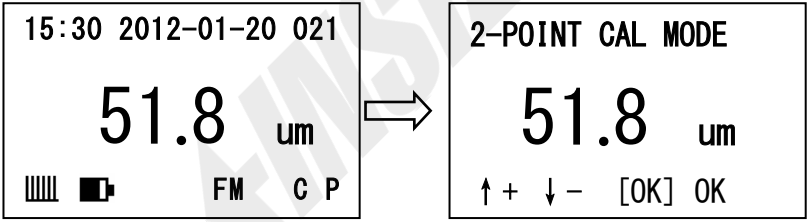
a) Turn on two-point calibration from basic setup menu, see

One foil.

b) Perform one-point calibration on the thin foil. See 3.3.2 “One-point calibration” for more details.

c) Measure the thick foil, and the screen display <×××μm>.

d) Press the key [↑] or the key [↓] before bringing up the probe to enter “two-point calibration” mode.

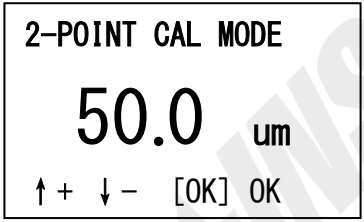


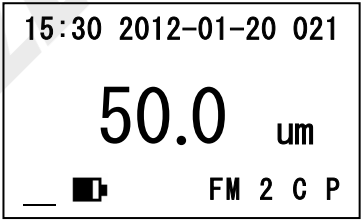
MI – measure

Two-point calibration interface

e) Press the key [↑] and the key [↓] to correct the thickness value.

f) Press the key [OK] to confirm; or press the key [MENU] to cancel; or press the key [CAL] to clear the older two-point calibration information.





Correct thickness value Two-point calibration affect

Repeat step c~f will achieve higher accuracy.

The indicator "2" indicates that the two-point calibration is

effective.

Note: Two-point calibration information will be cleared automatically after zero calibration.

3.3.4 Basic calibration for the probe

Basic calibration should be performed for the following situations:

a) Change the probe.

b) The header of the probe is wear.

c) The probe has been repaired.

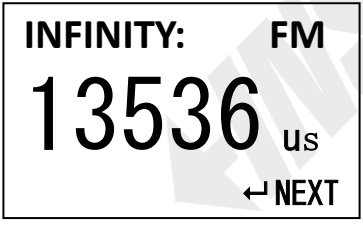
d) Special usage.

Operation steps:

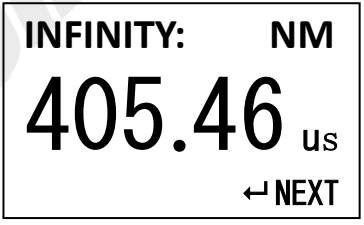
a) Press the key [⬆] during power on to enter the basic

calibration mode.

b) Press the key MENU to change probe type. If the screen display the indicator "FM" on the right side of the top line, the calibration will be performed for FM probe; And if the screen display the indicator "NM" on the right side of the top line, the calibration will be performed for NM probe.



Basic calibration – FM probe



Basic calibration – NM probe

c) Calibrate infinity point: Put the probe away from the plate, and then press the key [OK] while the value is stable. For probe FM, FL, FX, FS, the value should between 13500 and 13600. For probe FT, the value should between 15900 and 16100. Press the key [CAL] to re-match the probe if the value is out of range.

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

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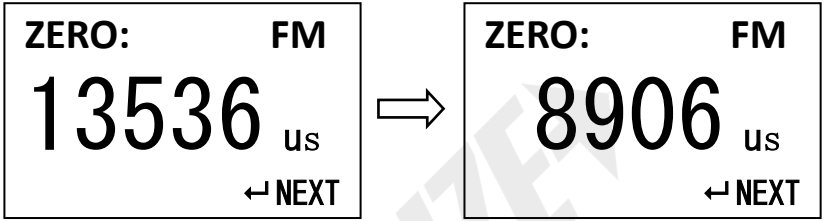
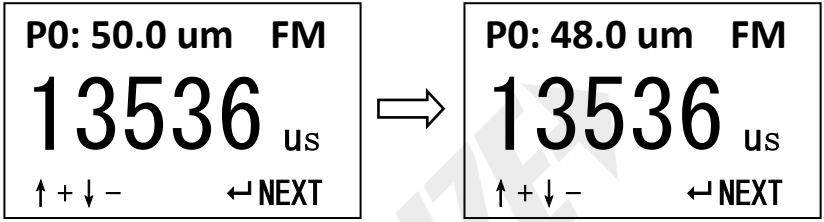


Calibrate zero point – before　　Calibrate zero point – after

e) Calibrate 5 to 10 known thickness points:

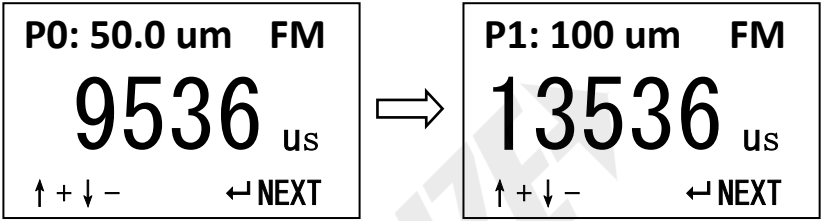
   i. Press the key ⬆ or the key ⬇ to correct the thickness on the top line.



Calibrate know thickness　　Modify thickness value

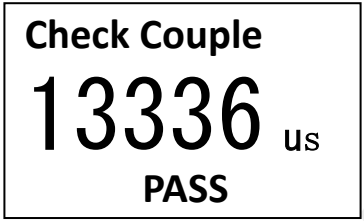
ii. Measure the foil, and then press the key [OK] while the value is stable, or press the key [MENU] to skip this point.

INSIZE

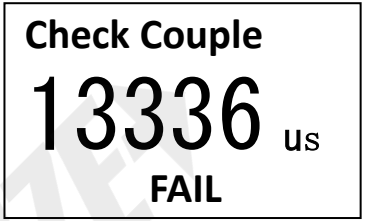


Calibrate know thickness – after Calibrate another thickness

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 [OK] to turn to the main interface; or **press the key [SAVE] to save the calibration information to default**.



Basic calibration completed



Basic calibration failed

Note: The last calibration point can not be skipped. Skipped point should be less than 5.

The default calibration points can be measured by stacking the folis provided with the main unit. Calibration point should be gradually changed from small to large.

3.3.5 Temperature coefficient calibration for the probe

- **Calibrate the temperature coefficient**

  Temperature coefficient should be modified for the following situations:

  a) Change probe, and the temperature coefficient of the probe is unknown.

  b) Measure result is obviously changed throw the temperature drifting, and the measurement distortion is light.

  c) Special usage.

  Operation steps:

  a) Press the key [↓] during power on to enter the temperature coefficient calibration mode.

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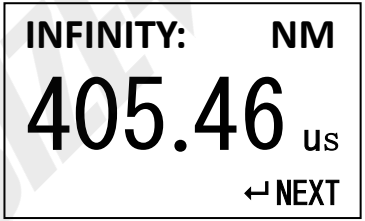
b) Press the key MENU to change probe type, the symbol "FM" on the top right indicates probe FM, and the symbol "NM" indicates probe NM.

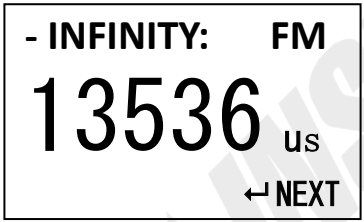
INFINITY – FM probe



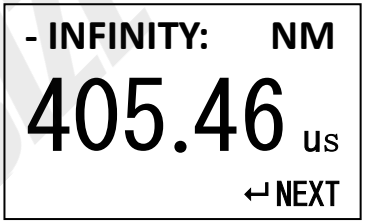
INFINITY – NM probe

c) "INFINITY" interface: Calibrate infinity point. Put the probe away from the plate, and then press the key while the value is stable. For probe FM, FL, FX, FS, the value should

between 13500 and 13600. For probe FT, the value should between 15900 and 16100. Press the key to re-match the probe if the value is out of range. Then press the key OK while the value is stable.



Temperature interface – FM

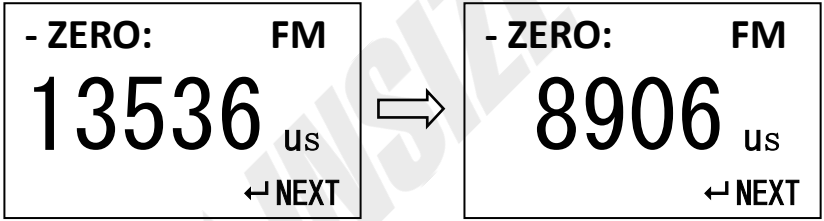


Temperature interface – NM

d) "-INFINITY" interface: Calibrate infinity under the first temperature condition. Put the probe away from the plate,

and then press the key OK while the value is stable.

e) "-ZERO" interface: Calibrate zero under the first temperature condition: Put the probe close to the plate, and then press the key OK while the value is stable.

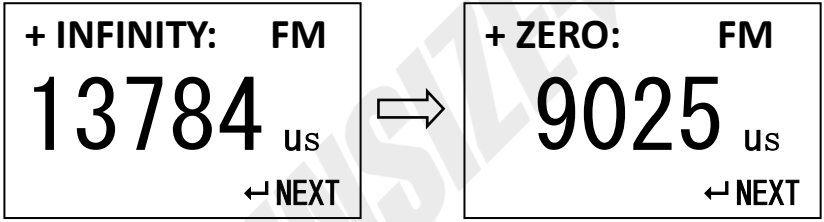


Calibrate first zero – before Calibrate first zero – after

f) "+INFINITY" interface: Calibrate infinity under the second temperature condition: Change the temperature, and

re-measure the infinity point.

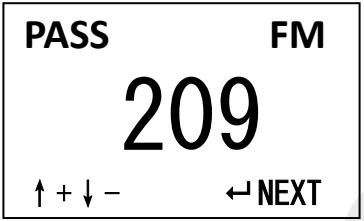
g) "+ZERO" interface: Calibrate zero under the second temperature condition: re-measure the zero point.

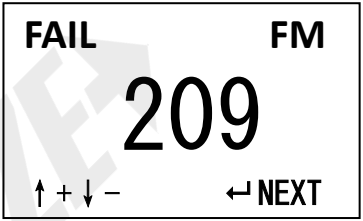


Calibrate second infinity Calibrate second zero

h) The temperature coefficient will be shown after the calibration. And the indicator "PASS" or "FAIL" can be seen from the bottom line. Press the key OK to turn to

the main interface.





Temperature calculate completed　　Temperature calculate failed

Note: For F type, the difference between two measurements of infinity point should be more than 50; for N type, should be more than 0.5.

- **Modify the temperature coefficient**

  Temperature coefficient should be modified for the following

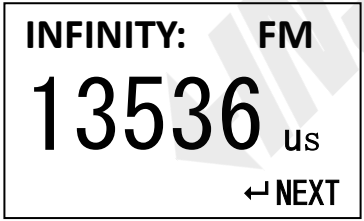
situations:

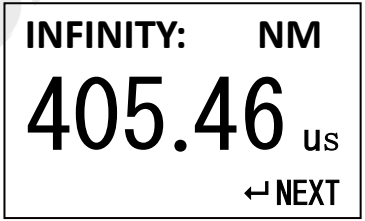
a) Change probe, and the temperature coefficient of the probe is known.

b) Measure result is obviously changed throw the temperature drifting, and the measurement distortion is light.

c) Special usage.

Operation steps:



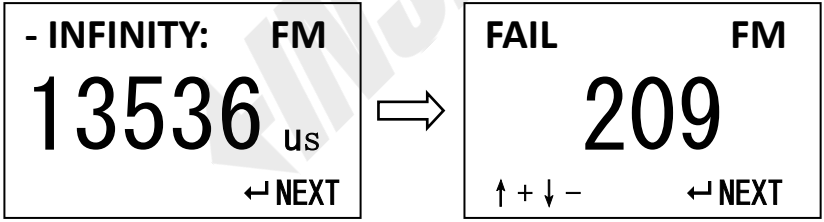


Temperature interface – F Temperature interface – N

a) Press the key [↓] during power on to enter the temperature coefficient calibration mode.

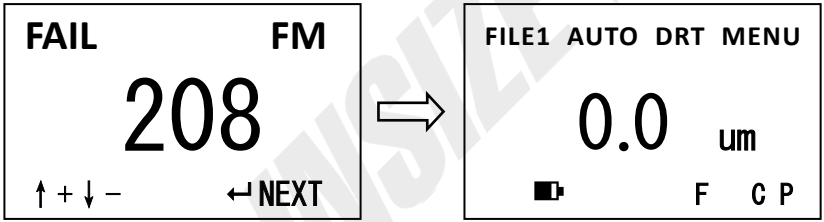
b) Press the key [MENU] to change probe type, and use the key [OK] to confirm.

c) Press the key [MENU] to skip the calibration steps, and enter the temperature coefficient display.



Calibrate first zero Coefficient adjust

d) Press the key [↑] or the key [↓] to modify the temperature coefficint, and press the key [OK] to confirm and enter the main interface.



Coefficient adjust Main Interface

4 Factors affecting the measuring accuracy

Factors \ Method	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	▲	▲

5 Maintenance and repair

5.1 Work environment

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

5.2 Battery replacement

The battery should be replaced by the following steps while the battery indicator changes to " ▭ " :

1) Press the key to power down the gauge.
2) Take off the battery compartment cover and take out the

battery pack.

3) Insert the connection plug of the new battery pack into the battery socket.

4) Reset the battery cover.

5) Turn on the gauge to check.

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Appendix

Table 1 **Technical parameters** (H - thickness value)

Probe form	F (magnetic)						N (eddy)	
Probe type	FM	FL	FX	FT	FS	FH	NM	NL
Measuring range (μm)	0~1500	0~3000	0~10000	0~1500	0~500	0~3000	0~1500	0~3000
Accuracy (μm) (Basic Cal.)	±(0.5+ 1%H)	±(1+ 2%H)	±(1+ 3%H)	±(1+ 1%H)	±(0.5+ 1%H)	±(1+ 2%H)	±(0.5+ 1%H)	±(1+ 2%H)
Accuracy (μm) (Zero Cal.)	±(1+ 2%H)	±(1+ 3%H)	±(2+ 5%H)	±(1+ 2%H)	±(1+ 2%H)	±(1+ 3%H)	±(1+ 2%H)	±(1+ 3%H)
Min. radius of convexity (mm)	1.5	1.5	10	1.5	1	1.5	3	6
Min. radius of area (mm)	Φ7	Φ7	Φ40	Φ7	Φ3	Φ7	Φ5	Φ7
Critical thickness of plate (mm)	0.5	0.5	2	0.5	0.2	0.5	0.3	1
Contact temperature (°C)	0~50	0~50	0~50	0~50	0~50	0~300	0~50	0~50
Measure dir.	↓	↓	↓	↓	↓	↓	↓	↓

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	F type Probe
Nonferrous metal such as Copper, aluminum, brass, zinc, tin, etc.	N type Probe	N type Probe (only for Chromium on Copper, range:0~40μm)

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