BENETECH®

Model：GM220

Film/Coating Thickness Gauge
User's Manual

CONTENTS

Warranty:

1). For the terms of warranty please read provided
    warranty card.
2). We disclaim any liability due to: transportation damages;
    incorrect use or operation; manipulation, alterations or
    repair attempts; without warranty card, invoice.

⚠ Specific Declarations:
    We reserves the right to modify product design and
specification without notice.

Maintenance and warranty

Maintenance:

1). Replacement and maintenance of battery:

a. After power on, if a symbol ⊡ appears on the LCD,
   you need to replace the battery immediately, for details
   please refer figures and contents on page 9 of this
   manual.
b. Remove the battery from the unit if it is not required for
   extended periods of time in order to avoid damage
   resulting from a leaking battery.

2. Do not store or use the unit in following environment:

a. Splashes of water or high levels of dust.
b. Air with high salt or sulphur content.
c. Air with other gases or chemical materials.
d. High temperature or humidity (above50℃, 90%,) or
   direct sunlight.
3. Do not disassemble the unit or attempt internal
   alterations.
4. Never use alcohol or diluents to clean the unit casing
   that will especially erode the LCD surface; just clean the
   unit with little damp spong and mild soap.

1. Before use

Check-up

   Carefully unpack your kit and ensure that you have the
following items. In case that any item is missing or if you
find any mismatch or damage, promptly contact your dealer.

○ Digital film coating thickness gauge   1PCS
○ 9V battery   1PCS
○ Instruction Manual   1PCS
○ Standard sheet gauge   6PCS
○ Iron base material for calibration   1PCS
○ PP Packing Box   1PCS

Introduction

This portable product adopts magnetic induction techn-ique for measurement. The compact design perform fast, precise and non-destructive digital coating measurement and plating on steel magnetic conductor. It is widely used on manufacturing, workshop, chemistry or quality control fields.

Features

- ◯ LCD display measurement value and status.
- ◯ Using Hi- sensibility sensor for precise measurement.
- ◯ 0 point, 2 point and basic, three different calibration methods to make it easy to process the system quick calibration.
- ◯ Measure mode: Single, continually and difference .
- ◯ Data record, recall and delete function.
- ◯ Data analysis: Average, Maximum, Minimum, standard deviation, and measure times.
- ◯ Beep sounds indication.
- ◯ Metric / Imperic unit selection.
- ◯ Low Battery indication.
- ◯ Auto power off .
- ◯ LCD backlight .
- ◯ Simple, compact structure and portable design.

b. To ensure more precision reading, you can measure several times, and then delete the max error one, at last use analysis function to get five statistical data: average value (AVG), MAX, MIN, standard warp (dFR), data number (NO).

c. According to the international standard, the final measure result can expressed as the following formula:

$$CH=A+/-2D$$

CH---the thickness of the coating

A----the average value of the measure data (AVG)

D-----standard warp (dFR)

2. Attentions in operation:
  a. The property of substrate metal
     The metal magnetism and surface roughness of the standard pieced should similar with the target piece.
  b. the thickness of the substrate:
     Check whether the substrate's thickness is less than the critical thickness 0.5mm.
  c. verge effect:
     Do not measure at the locations where there are steep shape change of the measured, i.e. Verge, hole or inner corner and so on.
  d. Curvature:
     Do not measure at the distorted surface.
  e. The readings
     Because the readings may not be identical all the time, so you should several measurements at the same area. The local difference of the coating also requests to measure several times at the specified area especially rough surface.
  f. Cleanness of surface:
     You should clear all the adhesive layer on the surface like dust, grease, rust etc. Before taking measurement, but do not remove any coating.

3. About the measurement reading:
  a. As per statistics, single value in not reliable enough,so all the output readings are average value of multiple measurements that is carried out by the unit within hundreds fo milliseconds.

Specifications

1. Measurement range :

| Range	Resolution	Accuracy
0~1800μm	0.1um/1μm	±(3%H+1)

Remark: H=Nominal transformation ratio

2. Condition of Objective material:

○ Suitable for measure non-magnetic coating on magnetic conductor base material.
○ The minimum curvature radius.
  Convex: 2mm Convex: 2 Concave=11 Concave: 11mm
○ Minimum Sample diameter: 12mm
○ Minimum Substrate thickness : 0.5mm

3. Other Specification:

Technical parameter	Technical specification
LCD display	3 1/2 display
Power supply	9V Alkaline battery
Operation current	About 14mA
Battery life	Continuously 20 hour .
Auto power off	1 minute
LCD backlight function	7 second.
Operation temperature	0~40℃
Operation humidity.	10~95% RH
Low battery indication	7.0V ± 0.2V
Product size	67x 30x 175mm
Weight	133G (without battery)

Overview
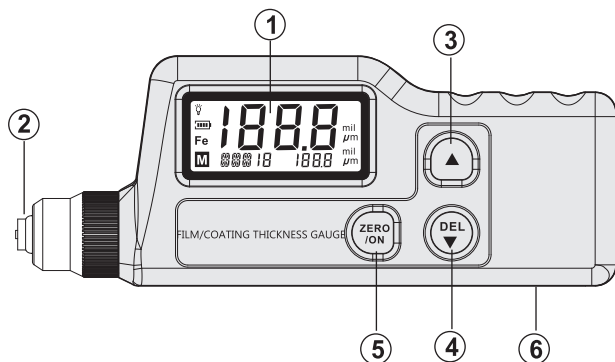
1. LCD display

2. Sensor

3. ▲   a: Scroll through Menu;   b: Scroll store data
      c: Set calibration

4. DEL▼   a: Scroll through Menu;   b: Scroll store data
      c: Data delete function   d: Set calibration

5. ZERO/ON   Power on/ set zero

6. Battery door (At the back of the body)

can affect the measurement. The bigger the roughness degree is, the bigger the effect is. Rough surface will cause system error and incidental error. You should increase the measurement number at different place to reduce incidental error. If the substrate metal is rough, you must adjust ZERO point on the substrate metal which is not coated and has similar roughness with the target one; or you can use impregnant which can not erode the substrate metal to dissolve the coating, and then to adjust the ZERO point.

f. Magnetic field:
   The strong magnetic generated form the surrounding electronics will severly affect the measurement precision.

g. Adhesive layer
   The unit is sensitive to the attachment between the test-head and the coating, so you must clear the layer to make sure the test head contact the coating diretly.

h. the detect head's pressure:
   The pressure on the target piece can affect the measur-ement value, so the unit use spring to generate a steady pressure.

I. Detect head's angle:
   The angle of the test head affects the measurement. You must be sure the detect head to be contact the target piece at a upright angle.

j. the target piece's distortion
   The detect head can make the target piece of soft coating distort, if the distortion is too big, the measurement value will not correct.

3. Other items

1. Factors which affect the measurement precision and
   some instruction:
   a. Magnetism of substrate metal:
      The magnetism rule varies with the magnetism of a
      specific substrate metal(in application there is only
      a slight the magnetism change of low carbon steel),
      to avoid the interference resulting from the heat
      treatment and cold process of the metal, a standard
      piece to be coated can also be used to calibrate.
   b. Thickness of substrate metal:
      Every instrument is subject to a critical thickness of
      a certain substrate metal which allows the measurme-
      nt could be taken when the thickness is lager than the
      critical. .
      This unit's critical thickness(minimum substrate thic-
      kness) is 0.5mm.
   c. Verge effect:
      The unit is sensitive to the steep change on the surface
      of the target piece. So the output obtained near the
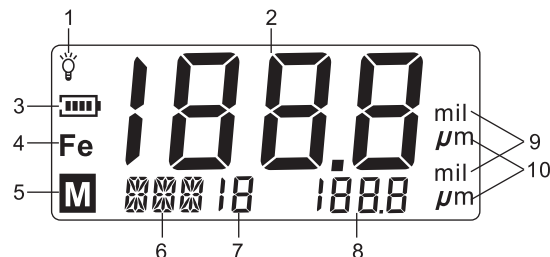   verge or inner angle of the piece is not reliable.
   d. Curvature:
      The curvature of the target piece can affect the
      measurement result. This effect will increased as the
      curvature's radius reduced.
   e. Roughness degree of the surface:
      The roughness degree of substrate metal and coating

LCD Display

1. ☼ : Backlight icon, the backlight will be actived for
        7 seconds upon operations when measure.
2. Measurement value.
3. ▥ Battery power symbol, shows current battery
      voltage as following 5 grades:
      ▥ :battery is sufficient
      ▥ :battery is comparative sufficient
      ▥ :battery is nearly deficient
      ▭ :battery is nearly exhausted, need to have a
         replacement
      ▭ :battery is exhausted completely.
4. **Fe** : Ferrous measuring.
5. **M** : indicates the unit have the data in memory.
6. Measurement mode, Data analysis indication.
7. Number of recorded data
8. Recorded data value.
9. mil : Imperial system unit (1mil= 0.0254mm = 25.4μm)
10. μm : Metric system unit (1mm = 1000μm)

2. Operation

Substrate and standard piece

○ Standard piece:
  a. All the sample with a known thickness could be used as a standard calibration piece and in short referred to as standard piece.
  b. The coated standard piece
     An even firmly-coated standard piece with a known thickness could be used as a Standard Piece too, and in terms of the application of this product, the coating must be non-magnetic.

○ Substrate:
  a. The standard substrate's roughness and magnetism, must be close to those of the material to be measure To identify the suitability of the substrate, compare the outputs from the standard piece with the material to be measured.
  b. If the thickness of the material is in the range of the regulated, two methods could be selected to calibrate.
  1). To calibrate a metal Standard Piece that with same thickness as the material to be measured.
  2). use a similar magnetic and electricity standard metal gasket piece which have enough thickness for calibration, be sure that there is not spacing between substrates.
  c. If the curvature of the material is too big to be calibrated on the flat surface, please ensure that the coated standard pieces curvature has the same thickness as the material to be measured.

Display dFR value:

Display number value:

📄 Caution:
  a. when the measurement number is flashing, please press ZERO/ON key to stop it, and then press UP / DOWN key to change mode.
  b. The values shown in the operation instruction are merely a example to illustrate, please refer to the value obtained in your practice.
  c. If there is nothing operation for 1 min, the tester will power off automatically.

The unit also provide data analyse function after have measured several group data, press DOWN/ UP key to change mode, LCD will display average value (AVG), MAX, MIN, standard warp (dFR), data number (NO), LCD displays as following picture:

Display Average value:

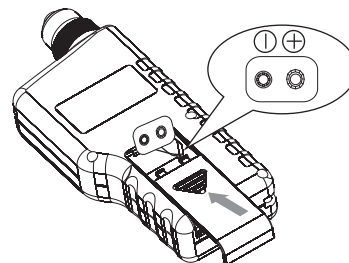Display MAX value:

Display MIN value:

1). Grip tightly the unit body with your left hand; hold down the battery door with your right hand thumb to open it according to the arrow direction, as shown in the following figure:
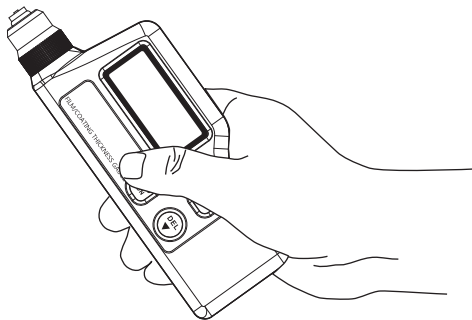

2). Insert the 9V battery into battery compartment, note the battery polarity, and then close the battery door, as shown in the following figure:
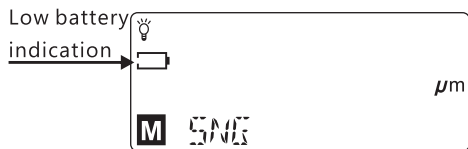
3). Turn on the unit and check-up battery

a. Press the [ZERO/ON] key to turn on the unit, as shown in following figure:

b. After the entire screen displays for 1 second, the default state is acceleration mode, if the low battery symbol ▭ or ▭ appears, please promptly replace the battery, as shown in following figure:

Low battery indication →

μm

M SNG

Data record/recall and delete

1. Record:
   The measurement result will be saved automatically after every measuring and the measurement quantity will inc-rease one by one after every measurement until the max number 15. The unit only shows the reading without rec-ord in memory if there 15 records have been saved in memory.

2. Review stored data
   Press UP and DOWN key to review the measurement values when the measurement number is flashing.

3. Delete
   a. delete the current data: when you want to delete one of the recorded reading, you can press the 'down' key to go back to the above one when the measurement number is flashing, and then take another measurement for replace the recorded data.
   b. delete all the data: you can delete all the data by press the ZERO/ON key for 2 second when the measurem-ent number is flashing.

Standard deviation measurement

○ Press ZERO/ON key and then press UP /DOWN key to change the test mode, when LCD display DIF that means got into Coating standard deviation measurement mode.
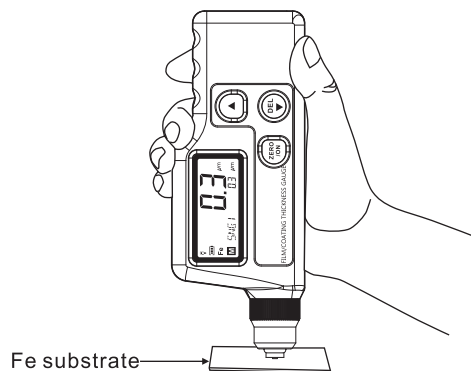LCD displays as following picture:
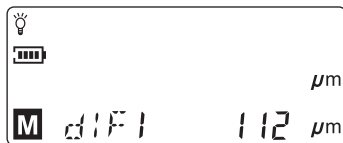
○ Place the sensor to the target piece you want to measure, and then press the sensor lightly to measure, the buzzer will sound, LCD will display the value of the difference between the last reading and the current reading, LCD displays as following picture:
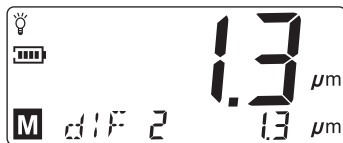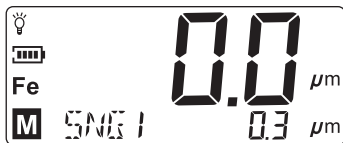

Instrument calibration

To ensure the precise test result, please calibrate the instrument at the test scene. The instrument has three methods to calibrate: zero point calibration, two point calibration, basic calibration.

○ Zero point calibration:
  a. Take a measurement on a standard substrate or on a uncoated substrate. LCD display a data, for example ,0.3μm as shown in the figure below:
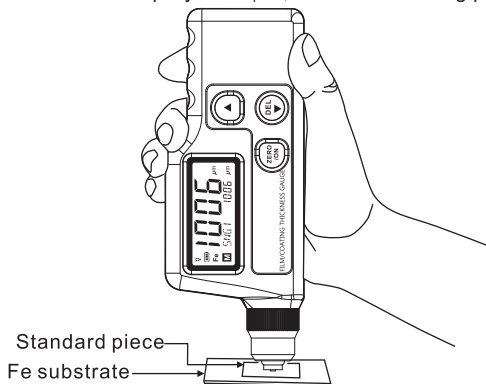

Fe substrate

  b. Do not lift the sensor tip and press the ZERO/ON key, the buzzer sounds indicates Zero point calibration is completed . LCD displayed like the following picture at this time:

Fe **M** SNG1 0.0 µm / 0.3 µm

c. Repeat step a and b to make basic measure value less than 1µm, this can improve measurement precision.

○ Two point calibration:
   a. calibrate zero point first.
   b. take a measurement on the standard piece which thickness close to the target piece.(like 1000µm), if the LCD display 1006µm, like the following picture:

Standard piece
Fe substrate

c. Do not lift the sensor tip and press the UP and DOWN key to correct the reading, after these the calibration is completed, the instrument is ready to process. LCD displayed like the following picture at this time:

Continuous measurement

○ Press ZERO/ON key and then press UP / DOWN key to select the test mode, when LCD displays CTN, that means into Continuous measurement mode. LCD displays as following picture:


Fe **M** CTN µm

○ Place the sensor to the target piece you want to measure, and then press the sensor lightly to measure, the buzzer will not sound during the measurement, LCD will display the measurement result continuously until the sensor is lifted, the last measure value will be saved in the test automatically, and the data is numbered as 1 .(when the second measurement is finished, the reading will be numbered in sequence as 2, until the max memory is 15), LCD willdisplays as following figure:

Fe **M** CTN1 199 µm / 199 µm

O Prepared target piece you want to test.

O Press ZERO/ON key to turn on the unit, the default test mode is single test mode, LCD displays as following picture:

Fe µm
M 5NG µm
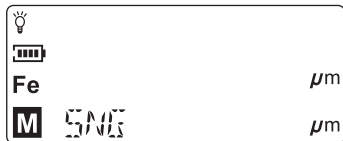
O Contact sensor with the test surface vertically and press the sensor lightly, an output appears on the LCD, for example, 138 µm, and buzzer beeps, LCD displays as below:

Fe 138 µm
M 5NG1 138 µm

O Every time sensor contact the test surface vertically, an output will be generated with a beep of buzzer.
For another measurement, lift the sensor, and repeat the operation above.

📄 Caution:
If the sensor contact the iron basic too closed in process of self-check after power on, LCD will display ERR.

Fe 1000 µm
M 5NG1 1006 µm

To ensure a precise two point calibration, repeat step b and c to improve measurement precision and reduce incidental error.

O Basic calibration:
It is necessary to change the basic calibration under the following conditions:
----------the top of the sensor is wear and tear
----------after the sensor is maintained
----------Special use
----------the product has not been used or calibrated for a long time
If the reading go beyond the regulate range of the accuracy during the measurement, it is necessary to calibrate the sensor again, this process is termed basic calibration. Input seven adjust value (zero and 6 thickness value)to re-calibrate the detect head. The operation method of basic calibration is as following:

a. Prepare six standard pieces, which the thickness at 45~55, 95~105, 220~280, 450~550, 900~1050, 1900~1999, unit: µm.
b. Press the UP key and ZERO/ON key to turn the products, LCD displays as following:

0.0 µm
M CAL

After that, you can take zero calibration to iron basic.

c. Choose a standard piece at thickness between 45-50, when obtain a reading, for example 49.0, LCD displays as following:

Press UP and DOWN key to adjust the display value until the reading equals with the standard piece's thickness, and then place the next standard piece on the iron basic to calibrate.

d. When calibrate the standard piece at 95~105, for example, 100, LCD displays as following picture:

Press 'up' and 'down' key to adjust the display value until the reading equals to the standard piece's thickness, and then place the next standard piece on the iron basic to calibrate.

e. Repeat the above steps until the last standard piece is calibrated, after the product auto power off and the new calibrated value has been saved in the products memory. Power on the unit again, the unit will process according to the saved.

Unit selection

○ Press ZERO/ON key to turn on the unit, and then press UP / DOWN key to select the test mode, when LCD display UINT.

The default unit is μm, LCD displays as following picture:

○ Press ZERO/ON key, you can select your desired unit on μm or mil, LCD displays as following picture: