

**Diesella**

Coating Thickness Gauge X500

# User Manual

Item no. 15079550 **V2.6.0**



A



B



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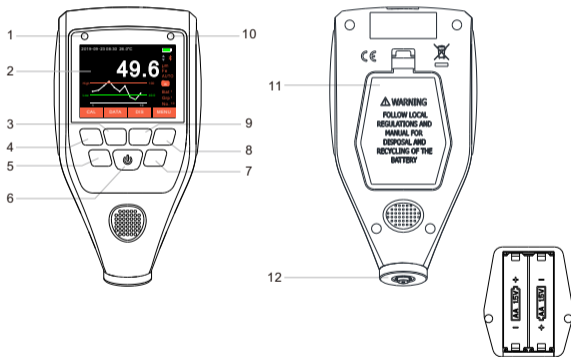
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# 1. Introduction

The thickness gauge can non-destructively measure the thickness of non-conductive coatings on metal surface and the thickness of non-ferromagnetic coatings on ferromagnetic metal (such as iron, nickel and cobalt). Specific uses of the instrument include measuring the thickness of paint or galvanized layer on iron and stainless steel's surface, also, measuring the thickness of paint or plastic film on aluminum and copper's surfaces.

## 2. View

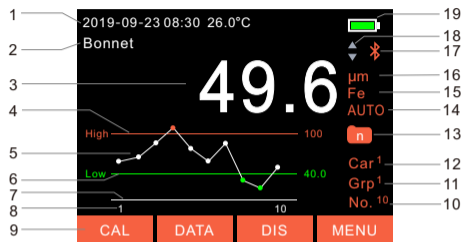
1. Indication Light 1
2. Display Zone
3. Multi-Functional Button F2
4. Multi-Functional Button F1
5. Button for Batch (Car) No. Switch
6. ON/OFF Button
7. Button for Group Switch
8. Multi-Functional Button F4
9. Multi-Functional Button F3
10. Indication Light 2
11. Battery Case
12. Probe



Note: Battery must be installed according to the direction of polarity as shown.

### 3. LCD Display

1. Status
2. Group Information (Car Mode Only)
3. Data Display
4. Indicator Line for High Limit
5. Graph
6. Indicator Line for Low Limit
7. Dotted Line on Graph
8. No. for Data
9. Dynamic Key Indicator
10. No. of Readings
11. No. of Data Group
12. Car (Batch) Series No.
13. Data Group Mode
14. Probe Mode
15. Substrate Type
16. Unit
17. Bluetooth
18. Alarm Indicator for High & Low Limits
19. Battery Power Indicator



## 4. Function and Specification

Type	A	B
Measuring Principle	Fe: Magnetic Induction; NFe: Eddy Current	
Measuring Range	FN2.0 probe: 0~2000μm FN3.0 probe: 0~3000μm F5.0N3.0 probe: Fe: 0~5000μm, NFe: 0~3000μm	
Accuracy	± (2% reading+1μm) (≤2000μm) ± (3% reading+2μm) (2001~3000μm) ±(5% reading+2μm) (>3000μm)	
Resolution	0.1μm (0μm~99.9μm); 1μm (≥100μm)	
Calibration	Zero Calibration; Multi-Point Calibration	
Storage	10*13*10 measurement data	
Statistics	Number of Readings, Max, Min, Mean, Sample Standard Deviation, Coefficient of Variation, Number Below Limit, Number Above Limit	
Unit	μm, mm, mil, inch	
Minimum Curvature Radius	Convex 5mm; Concave 25mm	
Minimum Measuring Area	Diameter 15mm	
Minimum Thickness of Substrate	Fe: 0.20mm; NFe: 0.03mm	
Power Supply	2 pcs 1.5V AA alkaline batteries; 2 pcs 1.2V AA Ni-MH batteries	
Operation Environment	Temperature: -10~+50°C; Humidity: 20~90%RH (Non-Condensing)	
Storage Environment	Temperature: -20~+60°C; Humidity: 20~90%RH (Non-Condensing)	
Weight	137g (No battery)	Housing: 135g (No battery) Probe: 63g

## 5. Usage

If you are the first time to use this instrument, please read section 6 carefully first. (The factors of affecting measurement accuracy)

### 5.1 Battery Installation

- (1) Install the battery according to the indications of the positive and negative poles inside the battery compartment.
- (2) Fasten the battery lid to prevent it from being popping out.
- (3) Take out the battery when the instrument will not be used for a long time.

### 5.2 Turn on/off

- (1) Turn on: Long press the ON/OFF button to turn it on.
- (2) Turn off: Long press the ON/OFF button to turn it off, or set automatic shutdown.

Note: The data is the last reading of the first batch (Car), first group when the instrument is turned on.

### 5.3 Basic Measuring Step


Step 1. Prepare the sample to be measured.

Step 2. Turn on the instrument.

Step 3. The probe end is quickly attached to the surface of the object to be measured. During the shrinking of the probe into the instrument, the instrument can automatically distinguish the properties of the substrate and measure the thickness of the coating (plating) layer. After the displayed reading is refreshed with the sound of “Beep”, remove the probe from the surface of the object being measured. Then user can start the next measurement.

Note:  indicates low battery, and it will effect the accuracy of measurement. Please replace new battery.

## 5.4 Settings

How to set a function: press “MENU” button to enter into menu page, after selecting the target item, press “Enter” button to enter into the settings page of the item and set up accordingly. ● indicates item selected,  indicates item enabled.

### 5.4.1 Probe Mode

- (1) Eddy Current Mode: In eddy mode, the probe can only measure on non-ferrous metal substrates, and when a non-ferrous metal detected, the “NFe” will be shown.
- (2) Magnetic Mode: In magnetic mode, the probe can only measure on magnetic substrates. When a magnetic substrate detected, the “Fe” will be shown.
- (3) Auto Mode: The instrument will automatically determine the type of mode measured and show the substrate type.

### 5.4.2 Unit

μm, mm, mil and inch.

### 5.4.3 Language

Multiple languages are available.

### 5.4.4 Calendar

- (1) Display on/off: To set whether to enable the time display.
- (2) Display Type: To set the time and date displays separately or at the same time.
- (3) Date Format: To set the display format of the date.
- (4) Set Date: To set a specific date. An item with a blue background indicates that the item is editable and can be edited with pressing the multi-function button. Press ◀ button when setting the year or press ▶ button when setting the day, you can save the settings and return to the previous page.
- (5) Set Time: To set the specific time. An item with a blue background indicates that the item is editable

and can be edited with pressing the multi-function button. Press ◀ button when setting the hour or press ▶ button when setting the minute, you can save the settings and return to the previous page.

#### **5.4.5 Backlight**

Brightness of the screen backlight can be adjusted automatically or manually.

#### **5.4.6 Volume**

The volume can be adjusted.

#### **5.4.7 Bluetooth**

The instrument supports Bluetooth function. After Bluetooth is enabled, the measurement page displays a Bluetooth icon, 🔌 indicating that it is connected, 🔌 indicating that it is disconnected.

Note: Only after the Bluetooth is enabled can the APP provided by our company be used for operation.

Please consult your instrument dealer to obtain the APP.

#### **5.4.8 Temperature**

(1) On/Off: To set whether to enable the temperature display.

(2) Temperature Unit: Celsius (°C) and Fahrenheit (°F).

#### **5.4.9 Auto Rotate**

The instrument supports automatic screen rotation function (only measurement page).

#### **5.4.10 Auto Shutdown**

The instrument supports automatic shut-down, with options for disabled, 1 minute, 2 minute, 5 minute and 10 minute modes. When the shutdown time is set, the timer will be started immediately. If there is any operation (press the button or measure) during this period, the timer will be restarted. If the disabled mode is selected, the automatic shutdown function is turned off. There will be a prompt sound 5 seconds before the automatic shutdown. When the timing reaches the set time, the instrument will save the settings and measurement data and then automatically shut down.

#### 5.4.11 Car or General

Switching car mode or general mode is available.


#### 5.4.12 Reset

Restore factory defaults is high risk operation, once confirmed to execute, the instrument will immediately return to factory state, all measurement data in the instrument will be cleared. Before this operation, please confirm again whether it is necessary to perform this operation. Instrument need to restart after factory defaults restored.

#### 5.4.13 Device

Available to view the device information of the instrument.

### 5.5 Display

How to enter a certain item: Press the “Dis” button to enter the display setting page, select the corresponding data display mode and statistics options. ● indicates that the item is selected,  indicates item enabled.

#### 5.5.1 Settings for How Data Display

There are a various ways of data display, such as statistical values, trend graphs, curve graphs and histogram for users to choose.

#### 5.5.2 Settings and Viewing of Statistical Options

(1) Select Statistics

In the selecting statistics, you can select the data to be displayed.

Note: When the item “All PSPC Values” is selected, all items related to PSPC are automatically selected, and the selected state of items unrelated to PSPC will be automatically canceled.


(2) View Statistics

The measurement interface can not fully display all statistics. All statistics could be completely viewed in

browsing statistics.

Note: When the NDFT value (see point 5.6.2, point 3) is off, the four items which are “NDFT Value”, “%>=NDFT”, “90%-100% NDFT ” and “IMO 90:10 pass/fail” in PSPC will display “\*\*\*”.

## 5.6 Data

To enter an item: Press the “DATA” button to enter the data selection page. After selecting the target option, press the “Enter” button to enter the item’s settings/viewing page and perform the corresponding operation. ● indicates item selected,  indicates item enabled.

### 5.6.1 Review

The instrument display page can record up to 10 data. If there are more than 10, the instrument will automatically update the latest data and discard the oldest data. The recorded data can be deleted by pressing the “Delete” button.

Note: Of this item, the deletion can only be saved when the instrument is turned off normally. If the instrument is accidentally power off, the deleted data will still be saved in the instrument.

### 5.6.2 Setting Limit

#### (1) High Limit

The high limit can be selected to be turned on or off, and also can be set.

Note: When the high limit is off, in the browsing statistics, the items related to high limit will display “\*\*\*”.

#### (2) Low Limit




The low limit can be selected to be turned on or off, and also can be set.


Note: When the low limit is off, in the browsing statistics, the items related to low limit will display “\*\*\*”.

#### (3) NDFT

The NDFT value can be selected to be turned on or off, and the specific NDFT value can be set.

### 5.6.3 Group Type

The instrument provides a variety of data sets types for users to select. On the measurement page,  indicates normal mode,  indicates average mode,  indicates PSPC mode.

Note: During using the average mode for measurement, the measured data can be saved in the measurement statistics after calculating the average value only when measurement points is equal to the set average times. “1” in the icon  indicates the measurement times of the current buffered average mode, and “5” indicates the set average number of times. When “IMO PSPC” is selected, it will automatically enter the NDFT setting page.

### 5.6.4 Clear Current Group

Clear all data in the current data set.

Note: This operation can only be saved when the instrument is turned off normally. If the instrument is accidentally powered off, the deleted data will still be saved in the instrument.

### 5.6.5 Clear Current Batch(Car)

Clear all data of the current batch (Car).

### 5.6.6 Clear All Batches(Cars)

Clear data of the all batches (Cars).

## 5.7 Calibration

How to enter an item: Press the “CAL” button to enter the calibration selection page and select the corresponding calibration operation.

Note: When calibrating, all the operation can only be saved when the instrument is turned off normally. If the instrument is accidentally powered off, the deleted data will still be saved in the instrument.

### 5.7.1 Zero Calibration

Zero calibration is recommended before use. First of all, please prepare an uncoated substrate consistent

with the part to be tested.

#### (1) Enter Calibration

Zero calibration operational steps: Enter the zero calibration page and follow the instructions to measure one or more times on the calibration substrate (multiple calibrations are better). At this time, the screen displays a value of 0. After completing the calibration, press the “Finish” button to return to the previous page.

Note: Users are advised to set probe mode to auto mode before performing zero calibration.

#### (2) Clear Magnetic

Clear zero calibration data of magnetic mode.

#### (3) Clear Eddy

Clear zero calibration data of eddy current mode.

### 5.7.2 Point Calibration

#### (1) Select Calibration (up to 4 points, for professional users' reference only)

Multi-point calibration operational steps: After entering the corresponding type of point calibration operation page, press the “Add” button to add a new calibration point. As instructed, measure once or more times on a calibration substrate covered with a standard calibration diaphragm (multiple calibrations are better). The “Source” displayed on the screen is the current measurement value, and the “Target” is the expected standard diaphragm value. The user can modify the “Target” to the standard diaphragm value. After completing the calibration operation, press “Save” button to save the calibration data and return to the previous page.

If the user has done zero calibration of this type before, the first value in point calibration is 0. The zero calibration value can not be edited or deleted on the point calibration page. For the calibrated point, the user can choose to “Edit” or “Delete”. User selects “Edit” to recalibrate the calibration point.

Note: Users are advised to set probe mode to automatic mode before performing point calibration. Zero

calibration is not recommended after performing point calibration.

(2) **Clear Magnetic**

Clear zero calibration data of magnetic mode.

(3) **Clear Eddy**

Clear zero calibration data of eddy current mode.

**5.7.3 Clear All**

Clear all calibration (including zero calibration and point calibration) data.

**5.8 Batch (Car) Switch**

On the measurement page, short press the batch (car) switch button once and the batch (Car) number increases one to switch to the next batch (Car). Long press the batch (Car) switch button and batch (Car) number decreases one to switch to the previous batch (Car).

**5.9 Group Switch**

On the measurement page, short press the group switch button once and the group number increases one to switch to the next group. Long press the group switch button and the group number decreases one to switch to the previous group.

**5.10 Delete Measurements Directly**

On the measurement page, short press the power button to delete the last measurement data of the current group immediately.

Note: This operation can only be saved when the instrument is turned off normally. If the instrument accidentally powered off, the deleted measurements are still saved in the instrument.

**5.11 Measurement Error**

There are many factors that affect the measurement error. Please refer to section 6 for details.

Using instrument normally, the error will be kept within certain indicators (refer to section 4). The user can make multiple measurements and delete the suspicious value at the same time, and finally use the statistical function of the instrument in order to measure the coating thickness more accurately.

## 6. Factors of Affecting Measurement Accuracy

<b>Principle</b>	<b>Affecting</b>	<b>Magnetic Induction</b>	<b>Eddy Current Effect</b>	<b>Improvement Suggestions</b>
Substrate Magnetic Properties		√		Zero calibration, Multi-point calibration
Substrate Electrical Properties			√	
Radius of Curvature of Substrate		√	√	Please read section 4 carefully to decide if you need to calibrate
Substrate thickness		√	√	
Substrate Area		√	√	
Roughness of Substrate Surface		√	√	Multiple measurements according to the method in section 5.11
Substrate Edge Effect, Shape Change		√	√	Avoid measuring at the edge of the fabric, where the surface shape changes abruptly
Deformation of Substrate or Coating		√	√	
Attached Substances		√	√	Clean probe and test piece surfaces
Strong Magnetic Field		√		Far away from strong magnetic field
Environment Temperature and Humidity		√	√	Perform instrument calibration in the same environment as the operating site
Method of Operation		√	√	Please read section 5.3 carefully
Low Battery		√	√	Replacement battery
Probe Wear		√	√	

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

#### (1) Magnetic Properties of Substrate

The thickness of the coating is measured by the principle of magnetic induction, which will be affected by the magnetic properties of the base metal. Different types of metals have different magnetic properties. Heat treatment and cold working will also affect the magnetic properties of the metal. In order to avoid such effects, it is recommended that before starting the measurement, the corresponding calibration operation described in Section 5.7 should be performed using the substrate with the same properties as the test piece.

#### (2) Electrical Properties of Substrate

Using the eddy current principle to measure the thickness of the coating will be affected by the metal conductivity of the substrate, which is related to its material and heat treatment. Therefore, before starting the measurement, the corresponding calibration operation described in section 5.7 should be performed using the substrate with the same properties as the test piece.

#### (3) Radius of Curvature of Substrate

The influence of the radius of curvature of the substrate on the measurement is not negligible. The smaller the radius of curvature of the substrate, the more obvious the influence on the measurement. Please refer to the allowable range of radius of curvature in the technical parameter table of section 4 and then perform the corresponding calibration operation described in section 5.7.

#### (4) Surface Roughness of Substrate

The influence of the surface roughness of the substrate on the measurement is also not negligible. The greater the surface roughness of the substrate, the greater the influence on the measurement results. For the coating, multiple locations can be selected for multiple measurements during the measurement, and

finally the thickness of the coating can be measured by statistical methods. For the roughness of the substrate to be tested is relatively large, it can also be calibrated by multiple measurements during calibration.

#### (5) Deformation of Substrate or Coating

If the material of the base material or coating is soft, the probe may cause deformation of the base material or coating during the measurement, so the measured data will be unreliable.

#### (6) Ambient Temperature and Humidity

The temperature and humidity of the working environment of the instrument have an impact on the measurement results, and the instrument should be calibrated in the same environment as the operating site.

#### (7) Operating Method, Probe Pressure and Orientation

The probe should be vertically and quickly and stably depressed, and must not be skewed, shaken, or dragged. When operating the instrument, it is recommended to delete the suspicious value before continuing the measurement.

## 7. Regulation for Usage

#### (1) Specimen to Test

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

The area and thickness of the substrate to be tested shall meet the measurement area and thickness range specified in the technical parameter table in section 4.

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

#### (2) Reading

Random errors and local differences in coating thickness exist objectively. The reading of each

measurement of the instrument is not exactly the same, so multiple measurements should be made in the adjacent measurement area. This is especially true for specimens with rough surfaces. In addition, when suspicious values are encountered, it is recommended to delete and then perform the next measurement.

### **(3) Surface Cleaning**

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

## **8. Maintenance**

Users should avoid using the instrument under excessively harsh conditions such as easy collision, heavy dust, high temperature, humidity, strong magnetic field, oil pollution, etc., otherwise, the instrument will be damaged under the above circumstances, our company will not provide warranty service, please understand. During the use of the instrument, if there are serious abnormalities such as repeated measurement values, no response on the screen, no response to the buttons, and no shutdown, please try to restart the machine. If the fault still does not disappear, please remove the battery, wait for a few minutes before inserting the battery to turn on, press and hold the power button and the F4 key at the same time when the power is turned on, and after the boot interface is completed, a beep sounds, indicating that the forced reset was successful. After a successful reset, all settings are restored to the factory defaults, and the instrument will automatically restart.

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

## 9. Warranty

- (1) For more methods of using the instrument, please forgive us not to include them in this manual, if you have other needs or any questions, please consult your dealer.
- (2) When the instrument fails to work and needs to be repaired, please explain the failure correctly. Please send a copy of the purchase invoice, together with the instrument to our after-sales service department. If the above related items are complete, our company promises to complete the repairment and return it to you as soon as possible after receiving the mail.
- (3) If the warranty period is exceeded, we will check and repair fee may be collected in accordance with company regulations.
- (4) The company will not provide warranty service for product damage caused by self-disassembly and maintenance, or improper transportation, storage and use, or without proof of purchase.
- (5) The normal wear and tear caused by the use of LCD lenses, batteries, key prints, probes, cabinets, etc. will not be covered by the warranty.





