

# Digital Electronic Coating Thickness Gauge

# DPM-816 PRO



## USER MANUAL

EN-01.11.19

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## Device controls

### "MODE" button

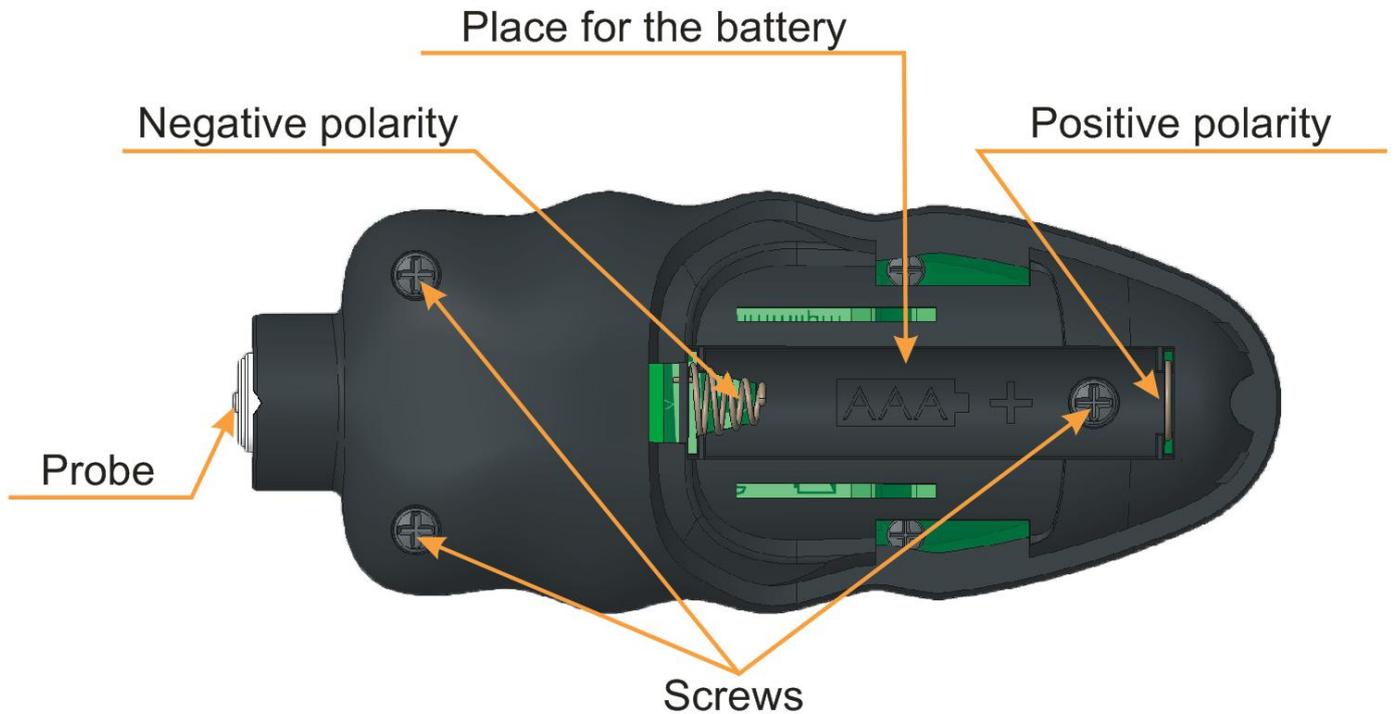
- Switches the operating mode
- Increases the thickness during calibration
- Switches on two-point calibration
- Switches on six-point calibration of ferrous metals

### "POWER" button

- Turns on (off) the device
- Turns on (off) the display backlight
- Switches to the next point of calibration, and saves calibration

### "UNIT" button

- Switches the unit of measurement
- Decreases the thickness during calibration
- Resets zero deviation and two-point calibrations
- Switches on six-point calibration of non-ferrous metals



# Introduction

Dear owner of the digital coating thickness gauge (referred to as "the device" from this point), we congratulate you with the purchase of the device of Russian origin.

We are confident that the device will be useful to you, and last a long time.

For correct and optimal use of the device, read this manual carefully.

## **This model has the following features:**

- Accurate coating thickness measurement on ferrous, non-ferrous and galvanized metals
- Measurement on convex and concave surfaces
- Measurement on galvanized surfaces
- Measurement of deviation from a sample
- Wide range of measurement up to 3000µm (118 Mils)
- Measurement in millimeters, mils, and micrometers
- Wide operating temperature range, -25 to 40°C (-14 to 40 F) with automatic calibration adjustment
- Informative LCD display with backlight
- Sensor pressure stabilization
- Automatic metal type recognition (Fe/nFe)
- Automatic and manual selection of measurement methods
- Measurement using magnetic induction and eddy current
- Power supplied through one AAA battery at 1.5 volts
- Low battery indicator

- Small and convenient size
- Automatically turns off power and backlight
- 5 modes for various measurement conditions
- Independent calibration using one, two or six points of reference, saved to non-volatile memory of the device
- Simple, intuitive controls with 3 buttons
- Distinct sound signal for each measurement method and button press
- Complies with industry standards
- 3 year factory warranty

## Purpose

The device is designed to measure coating thickness:

**Magnetic induction method** - thickness of various dielectric (paint, plastic, primer, etc.) and electrically conductive, non-magnetic surfaces (aluminum, zinc, chrome, copper) on a ferrous metal substrate (steel, iron).

**Eddy current method** - thickness of various dielectric coatings (paint, plastic, primer, etc.) on a non-ferrous metal substrate (aluminum, zinc, copper, etc.)

## Application

Process control of application of paint or other protective coatings in service centers and in manufacturing.

Diagnostics of the car body to assess its condition.

For example: when buying a car, before repairing dents without paint (PDR), or scratch removal.

## Device care

Please keep in mind that the device is a high precision measuring instrument. Avoid dropping the device and subjecting it to mechanical impact.

The device is protected against moisture, but is not waterproof. It must not be used underwater or in heavy rain. If the surface of the device accidentally gets wet, wipe off the moisture with a soft, dry piece of cloth.

Do not use the device near sources of strong magnetic fields or in the presence of strong radio waves. They can impact the performance and measurement accuracy of the device.

Do not leave the device exposed to high temperatures, such as in a car, exposed to direct sunlight. Disassembling the device is forbidden.

If the device is brought from a cold to a warm environment, condensation may form on its surface and its internals. To avoid condensation, first place the device in a plastic bag. Before removing the device from the bag, wait for it to warm up.

Should condensation form, do not use the device. Wait until all the condensate evaporates.

# Cleaning the device

To remove dust from the device case or the sensor, use a soft, dry cloth. Do not use cleaning agents containing organic solvents.

# Storage conditions

Store the device in a warm and dry place away from direct sunlight. Do not leave the battery inside the device during long term storage.

Do not leave the device near strong sources of magnetic fields, for example, near magnets, power supplies or electric motors.

Do not store the device in hot, humid or dusty environments, or in environments containing corrosive chemical substances.

# Display

The device has an informative LCD display with a backlight that automatically turns off. It shows the coating thickness, mode, method, measurement units and other parameters.

Although the LCD display is manufactured using FSTN technology with a wide operating temperature range, it may refresh slower in low and high temperatures.

# Sound signal

The device has a distinct sound signal for each measurement method. This allows the user to quickly identify the type of metal

substrate under the coating when measuring in automatic mode, without having to look at the display.

## Sensor

To increase the accuracy of measurements and to enable measurements on convex and concave surfaces, the device uses a sensor constructed to stabilize the pressure on its sensitive tip against the surface, as well as a spherical form for its sensitive tip.

The sensitive part of the sensor is made of high-strength heat-treated steel, and the area of contact with the measured surface is less than 1 mm<sup>2</sup>.

**Do not apply mechanical stress to the sensor. Do not attempt to extract the sensor from the device, and do not rotate it. This may interfere with the correct operation of the device.**

## Included in the set

First of all, make sure that the following items are present:

- Coating thickness gauge
- Aluminum and steel base plates for calibration
- Two sample plastic plates for calibration
- User manual

## Getting started

To get started, you need to install one alkaline battery type AAA, 1.5 volts.

Before first use, or in case the device has not been used for an extended period, as well as to increase the measurement accuracy, you need to calibrate the device using one, two or six points of reference.

## Installing the battery

Open the battery cover, shifting the cover with your thumb in the direction of the arrow. Insert the battery, taking note of the polarity. Close the battery cover until it clicks.

## Low battery indicator

The device consumes very low power, and can last an extremely long time from a single battery without a backlight.

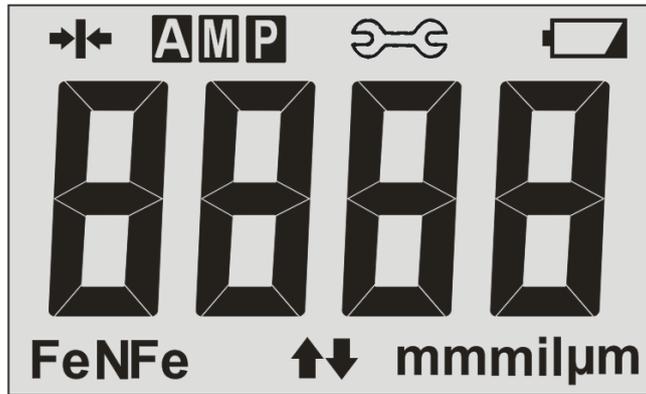
When the battery eventually loses its capacity and does not supply enough power, the top right corner of the display will show a low battery indicator.

- Do not use the device with a low battery!

## Turning on the device

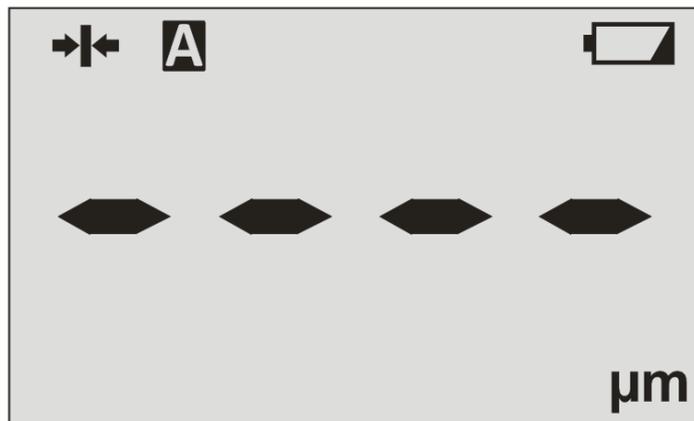
To turn on the device, press and hold the  button for 2 seconds until the device emits a sound signal.

After turning it on, the display will show "8888".



The device will begin to automatically test and calibrate the sensor.

After 2-3 seconds, the display will show dashes, indicating that the device is ready to take measurements.



**IMPORTANT! When turning on the device, keep it away from metal objects and strong sources of magnetic fields!**

## Turning off the device

To turn off the device from any state, press and hold the



button for 2 seconds.

## Display backlight

The device has an integrated backlight for the display. To turn the

backlight on or off, shortly press the



button.

# Operating modes

The device has 5 operating modes: **A**, **M**, **P**, **Fe**, **nFe**. To switch between these modes, shortly press the  button, which will switch modes in a loop. The current mode will be shown on the display.

**A - Auto:** Quick measurement with automatic selection of measurement method. Dynamic resolution. Great for checking the car body.

**M - Manufacturing:** Detailed and precise measurements with high resolution across the entire range. Automatic selection of measurement method. It is recommended to complete the two-point calibration before measuring in this mode.

**P - Program:** Measurement using six points of reference for custom calibration. Automatic selection of measurement method. To use this mode, completing the six-point calibration is required. This mode is designed for cases where the standard factory calibration of the sensor is not suitable. For example, when measuring coating thickness on a substrate with properties vastly differing from steel and aluminum.

**Fe - Magnetic induction method:** Quick, continuous measurement (4 measurements per second) of coating thickness on a ferrous metal substrate, using magnetic induction. For accurate measurements, it is recommended to complete the two-point calibration before measuring.

**nFe - Eddy current method:** Quick, continuous measurement (4 measurements per second) of coating thickness on an aluminum alloy substrate, using eddy current. For accurate measurements, it is recommended to complete the two-point calibration before measuring.

## Units of measurement

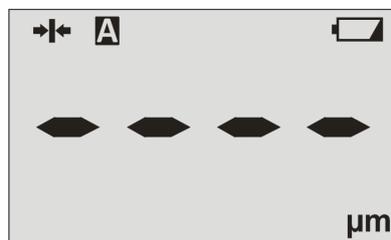
For user convenience, the device can display the results of measurement in several units of measurement: millimeters, mils, and micrometers.

The choice of units of measurement is made with short

consecutive presses of the  button, which will switch units in a loop. The current unit will be shown on the bottom right corner of the display.

## Taking the measurement

Turn on the device (*see the "Turning on the device" section above*) and wait for automatic calibration to complete. After automatic calibration (takes 2-3 seconds) the display will show dashes.



If necessary, select the desired mode and unit of measurement in which you want to get the result.

## **Taking measurements in A, M, P modes (automatic modes):**

Firmly place the device sensor flat against the surface to be measured. Do not move the device during measurement (until a sound signal is emitted), otherwise the measurement may be inaccurate.

Once the device detects that the sensor is on the surface in a fixed position, you will hear a sound signal indicating the completion of measurement. Move the device away from the measured surface. The display will show the result for 30 seconds - the measured coating thickness and method of measurement: Fe (magnetic induction, ferrous metals) or nFe (eddy current, non-ferrous metals).

The accuracy of measurement depends on how flatly and firmly the device sensor is pressed against the measured surface.

If you are using the sample plates included in the set to measure or calibrate, the measurement must be taken from the center of the plates.

## **Taking measurements in Fe, nFe modes (continuous measurement):**

In these modes, the device takes measurements quickly and continuously. To take measurements, place the device sensor against the surface to be measured. The device will immediately and continuously (4 times per second) display the result of the measurement.

These modes are useful when it is difficult to hold the device in a fixed position. For example, when measuring on pipes, convex and concave surfaces.

## Calibration

For accurate thickness measurements, the device needs to be calibrated. The device retains the calibration information and in most cases you don't need to calibrate it again before every use.

**Be sure to check and complete the calibration the first time you use the device, or if you have not used it for a long time.**

For the highest accuracy, it is advisable to calibrate the device using a substrate that closely resembles the surface to be measured (material, form, size).

For example, when measuring the coating thickness on carbon steel and chrome steel substrates, the calibration will vary insignificantly, but aluminum and zinc substrates will vary greatly. Therefore it is important to calibrate.

### **The device has separate, independent calibrations:**

Zero deviation calibration (one point of reference) and two-point calibration are performed independently (separately) for A, M, Fe, nFe modes, and for P mode with each measurement method (magnetic induction and eddy current). This allows you to set up a one-time calibration for modes A, M, Fe, nFe, for example on carbon steel and aluminum substrates, and for P mode, chrome steel and zinc substrates. To switch between calibrations, simply switch between modes.

Keep a clean environment during calibration, as the slightest bit of dust stuck between plastic and metal base plates may distort the result by 5-10  $\mu\text{m}$ .

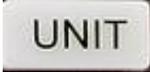
## Zero deviation calibration (one-point calibration)

### When to calibrate:

1. When measuring on a metal substrate without a coating, the device will show a result greater or less than zero (depending on the properties of the metal substrate). After calibration, the device will display zero.
2. In cases where you need to measure deviation from a sample. In these cases, the zero deviation calibration is done on a sample coating and the device will use that coating as a point of reference - "0". The device will display the difference from the sample coating in subsequent measurements.

### Zero deviation calibration procedure:

For zero deviation calibration, take a measurement of the metal substrate without a coating, or a measurement of sample coating.

When the result is displayed, press and hold the  button for 2 seconds. The display will show "CAL", which indicates a successful calibration.



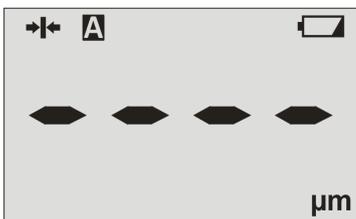
Verify the result by repeating the measurement.

## Removing calibrations

This function will completely remove zero deviation and two-point calibrations for all modes.

This function will restore the device's functionality in case of incorrect calibration, but for accurate measurements it needs to be calibrated again.

To remove calibrations, when the display shows dashes



, press and hold the **UNIT** button for 3

seconds.

The display will show "-CL-" and a sound signal will be emitted.



The calibrations have been erased.

# Two-point calibration

## When to calibrate:

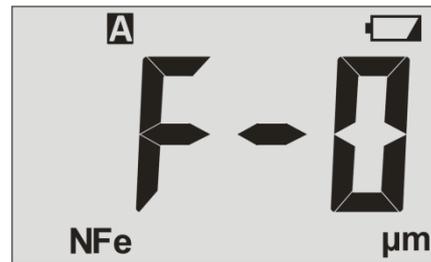
- Before first use;
- If the device has not been used for an extended period;
- Before each measurement for maximum accuracy.

## Two-point calibration procedure:

To enter calibration mode, press and hold the

 button for 2 seconds until the display shows "F-0". This

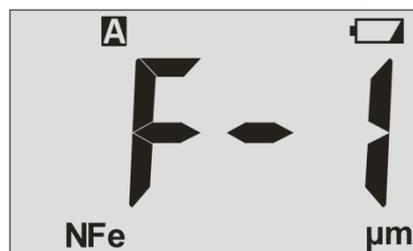
indicates the zero point calibration.



Take a measurement on a metal substrate without a coating, for which the device will be calibrated. If necessary, repeat the measurement. To proceed to the next point for calibration, shortly

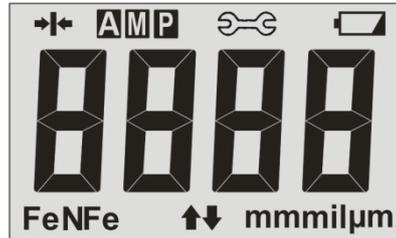
press the  button while the measurement result is being displayed.

The display will show "F-1", the second point of calibration.



Take a measurement on the same metal substrate together with a sample coating of known thickness, for example 700 or 1000 µm. If necessary, repeat the measurement. While the measurement

result is being displayed, shortly press the **MODE** or **UNIT** buttons to adjust the displayed thickness of the measured coating, and shortly press the  button to save the calibration. The display will show "8888", indicating that the calibration has been



successfully saved.

Verify that the calibration is correct by repeating the measurement of the metal substrate with and without the sample coating. If unsuccessful, repeat the calibration.

## Six-point calibration

This calibration is available in "P" measurement mode and will be required when measuring coatings on substrates whose properties differ from standard substrates, or for more accurate measurements in a given range.

The new device's calibration is identical to the factory calibration.

For calibration, a metal base and 5 plates of known thicknesses are required (not included in the set). All calibration points must be evenly distributed throughout the measuring range.

F-0 (point 0) - Base without a coating (zero).

F-1 (point 1) - Plate with a thickness of 80-300 $\mu$ m (3-12 mils).

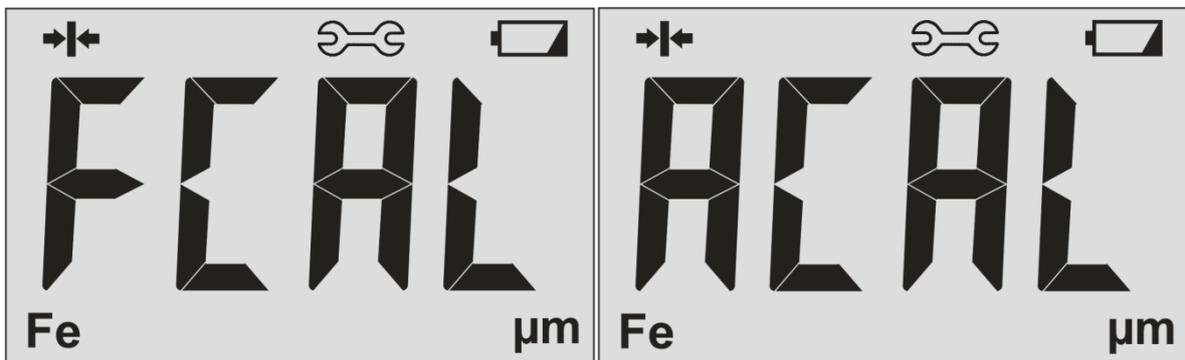
F-2 (point 2) - Plate with a thickness of 400-800 $\mu$ m (16-31 mils).

F-3 (point 3) - Plate with a thickness of 900-1800 $\mu$ m (36-70 mils).

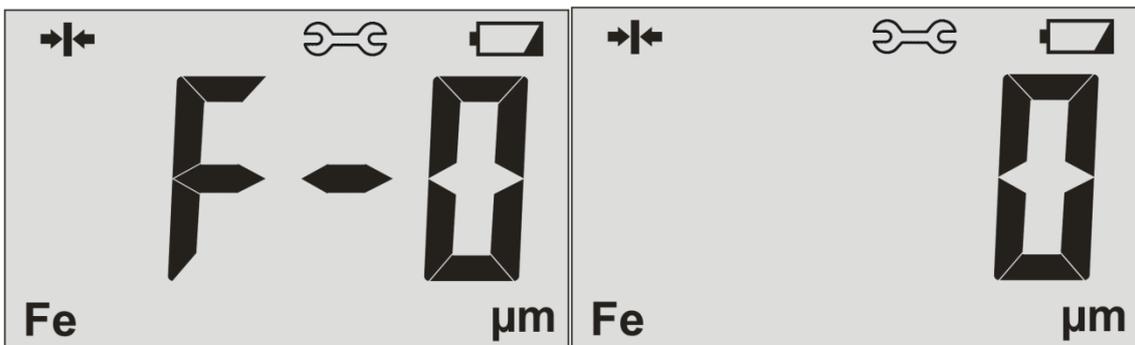
- F-4 (point 4) - Plate with a thickness of 1900-2500µm (75-98 mils).
- F-5 (point 5) - Plate with a thickness of 2600-3500µm (102-137 mils).

### Entering the calibration mode:

Turn off the device, then press and hold the **MODE** button to enter calibration mode for a ferrous metal substrate (magnetic induction method) or the **UNIT** button to enter calibration mode for a non-ferrous metal substrate (eddy current method), until the display shows "FCAL" or "ACAL" respectively.



Wait until the display shows "0", indicating zero point calibration. From this moment, calibration can begin.

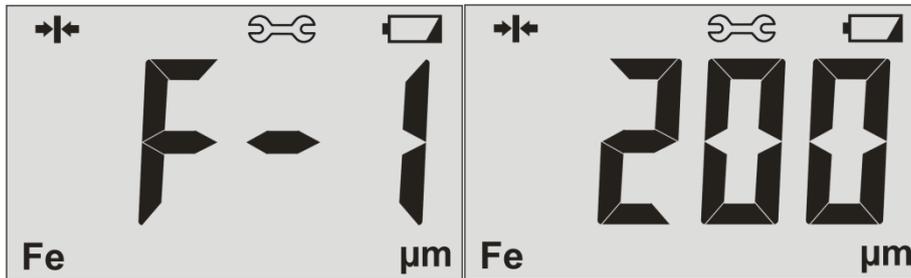


### Calibration process:

The first point of calibration is "0". Take a measurement of the metal base without a coating, for which the device will be calibrated. If necessary, repeat the measurement.

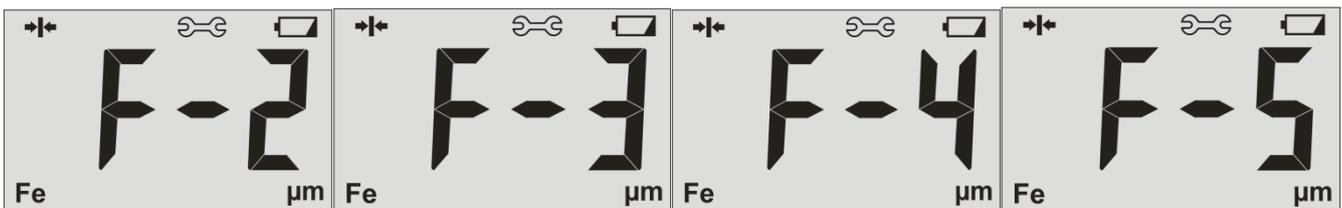
Shortly press the **POWER** button to save the result and proceed to the next point of calibration.

The display will show "F-1" - the next point of calibration, and the device will show the recommended thickness of calibration plate for the current point of calibration.



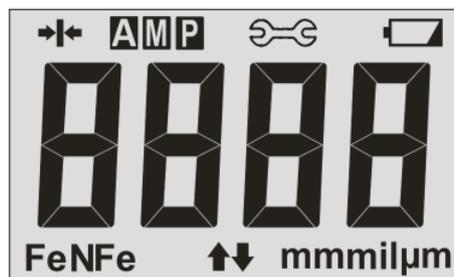
Take a measurement of the metal base together with the calibration plate. If necessary, repeat the measurement.

Use the **MODE** and **UNIT** buttons to calibrate the displayed thickness of the measured calibration plate, and shortly press the  button to proceed to the next point.



Repeat the procedure for each point of calibration.

After saving the last point, the display will show "8888",



and the device will switch to operating mode "P".

Repeat the procedure if necessary, for the second type of metal base.

Please note, if the calibration is done incorrectly on one of the metal base types, the device will be unable to automatically detect the type of substrate material and choose the suitable measurement method.

The new device's six-point calibration is identical to the factory calibration.

The device is calibrated at the factory using steel (magnetic induction method of measurement) and aluminum (eddy current measurement method) substrates.

## Checking the car body

You can find repainted spots by taking measurements in places of the car body that are more susceptible to damage. Every car is painted in the factory in an automated fashion, and the paint thickness is a relatively constant value. However, different car manufacturers may have a slightly different paint thickness.

Usually the paint coating thickness is within the range of 60 - 200 $\mu$ m (2.5-8 mils). In a single car, the coating thickness variance on different parts of the car should not exceed 20%.

If the measured thickness exceeds the average thickness in one or more spots by twofold, it indicates a second layer of paint. If the measured paint thickness exceeds the average thickness by more than twofold, such a spot was treated with putty. The thicker the paint thickness, the lower the quality of the repair job on the car body.

# Specifications

<p>Measuring range (normalized)</p> <ul style="list-style-type: none"> <li>- mm</li> <li>- <math>\mu\text{m}</math></li> <li>- mil</li> </ul>	<p>0-3 0-3000 0-118</p>
<p>Maximum measurable thickness</p> <ul style="list-style-type: none"> <li>- mm</li> <li>- <math>\mu\text{m}</math></li> <li>- mil</li> </ul>	<p>3.5 3500 137</p>
<p>Resolution (A mode)</p> <ul style="list-style-type: none"> <li>- mm (fixed)</li> <li>- <math>\mu\text{m}</math> (dynamic)</li> <li>- mil (dynamic)</li> </ul>	<p>0.01 1-10 0.01-1</p>
<p>Maximum resolution (M, P, Fe, nFe modes)</p> <ul style="list-style-type: none"> <li>- mm (fixed)</li> <li>- <math>\mu\text{m}</math> (fixed)</li> <li>- mil (dynamic)</li> </ul>	<p>0.01 1 0.01-1</p>
<p>Absolute measurement error</p> <ul style="list-style-type: none"> <li>- in the range of 0-700<math>\mu\text{m}</math> (0-27 mils) <ul style="list-style-type: none"> <li>mm –</li> <li><math>\mu\text{m}</math> –</li> <li>mils –</li> </ul> </li> <li>- in the range of 700-3000<math>\mu\text{m}</math> (27-118 mils) <ul style="list-style-type: none"> <li>mm –</li> <li><math>\mu\text{m}</math> –</li> <li>mils –</li> </ul> </li> <li>- in the range of 3000-3500<math>\mu\text{m}</math> (118-137 mils) <ul style="list-style-type: none"> <li>mm –</li> <li><math>\mu\text{m}</math> –</li> </ul> </li> </ul>	<p><math>\pm(1\%+0.01)</math> <math>\pm(1\%+1)</math> <math>\pm(1\%+0.04)</math> <math>\pm(1\%+0.01)</math> <math>\pm(1\%+10)</math> <math>\pm(1\%+0.4)</math> <math>\pm(3\%+0.01)</math> <math>\pm(3\%+10)</math></p>

mils –	$\pm(3\%+1)$
Operating conditions <ul style="list-style-type: none"> <li>- ambient temperature, °C</li> <li>- ambient temperature, °F</li> <li>- relative humidity, % not exceeding</li> </ul>	-25..+40 -13..+104 80
Storage and transportation conditions <ul style="list-style-type: none"> <li>- ambient temperature, °C</li> <li>- ambient temperature, °F</li> <li>- relative humidity, % not exceeding</li> </ul>	-25..+55 -13..+131 80
Supply voltage (battery type AAA), V	1,5
Current consumption, mA, not exceeding <ul style="list-style-type: none"> <li>- in sleep mode (off state)</li> <li>- in measurement mode</li> </ul>	0,5 60
Overall dimensions, <ul style="list-style-type: none"> <li>- mm</li> <li>- in</li> </ul>	104x43x29 4.1x1.7x1.2
Mass (without battery), not exceeding <ul style="list-style-type: none"> <li>- kg</li> <li>- oz</li> </ul>	0,05 1.76
Surface base dimensions, not less than <ul style="list-style-type: none"> <li>- mm</li> <li>- in</li> </ul>	1.0x30x42 0.04x1.2x1.6
Average service lifespan, years	5

The specifications given are general. Specifications of individual devices may vary. The specifications are subject to change without notice.

# Possible malfunctions and suggested remedies

Malfunction	Probable cause	Remedy
The device does not turn off, or turns on and immediately turns off.	Incorrect installation of the battery, reversed polarity. The battery is discharged, or its service lifespan has ended.	Check the battery polarity. If necessary, replace the battery.
The device turns off when the backlight is turned on, or the low battery indicator is displayed.	The battery is low, or its service lifespan has ended.	Replace the battery with a new one.
The device occasionally displays an incorrect result.	The measured surface or the sensor is dirty.	Check the measured surface and the device sensor for dust or dirt. The sensor should move smoothly without jerking or jamming. If necessary, clean the sensor and get rid of dirt.
The device displays an incorrect result when measuring a calibration plate.	Knocked device calibration. Dust present on the surface of the calibration plate.	Complete a two-point calibration. Clean the calibration plate from dust.
When measuring thickness on a metal surface without a coating, the device displays a non-zero result.	Knocked or incomplete calibration of the device.	Complete a zero deviation calibration or a two-point calibration.
The device does not take measurements, or the readings greatly vary from actual thickness.	Interference from metal objects or strong magnetic fields.	When turning on the device, it should be located not closer than 0.3 m from large metal objects and the measured surface. Use the device away from sources of strong magnetic fields.
During prolonged continuous measurement, the measurement error starts to increase.	Reduction in battery charge.	Stop the measurement and leave the device turned on, away from metal objects for 10-20 seconds. The device will automatically recalibrate.
The device selects the wrong method of measurement.	Knocked or incorrectly completed six-point calibration while in measurement mode P. Unable to determine the best measurement method.	Complete the six-point calibration for each method of measurement, if you're measuring in P mode. Select the desired method of measurement manually, using Fe and nFe modes.

When measuring on certain substrates, the thickness reading wrong.	The current calibration preset is unsuitable for the current substrate.	Complete a two-point calibration.
When the device is placed against the measured surface, the measurement does not occur.	Incorrect device positioning relative to the measured surface.	The device must be firmly pressed against the measured surface and remain fixed until the sound signal is emitted.
When measuring on convex or concave surfaces, the readings have a large error.	Unable to firmly press the device against the surface and hold it perpendicular to the surface.	Use the Fe and nFe modes with continuous measurement.

## Warranty

The manufacturer guarantees gratuitous elimination of device defects, arising from the fault of the manufacturer during the warranty period, subject to all warranty conditions and storage and operating conditions. The devices are not subject to warranty repair if: the warranty stickers are damaged, traces of corrosion or tampering (self-repair) are present, presence of dirt, insects and objects that are not part of this product; in the absence of a warranty card or receipt confirming the date and place of purchase of the device, with the obligatory indication of the name of the seller and the serial number of the device (the warranty period is counted from the date of purchase); in case of mismatch of the serial number in the warranty card (receipt) and on the device; in the presence of mechanical, electrical (smoke, traces of a short circuit, flooding) or other damage arising from violations of the operating and transportation conditions, or natural wear. Warranty repair and maintenance is carried out through an authorized dealer that sells it.

The warranty period for "CARSYS DPM-816 Pro" is 3 years from the date of purchase of the device by the buyer.

All the details are at <https://car-sys.com/en/>

The device is designed and manufactured by: CARSYS,  
Vladimir Chuvakin, Russia, 644007, Omsk, 80 Frunze st.

CARSYS ELECTRONICS LIMITED, 160 City Road, London,  
EC1V 2NX United Kingdom