

EM2210

Electromagnetic-acoustic Thickness Gauge



User's Manual

Saint-Petersburg
2015

CONTENTS

INTENDED USE	3
OPERATING PROCEDURE	3
TECHNICAL SPECIFICATIONS	4
PRODUCT DESCRIPTION	5
Product View	5
Calibration	6
Thickness measurement	6
Number of coherent integrations selection.....	7
Battery charge.....	7
Product operating features.....	8
PRODUCT TEST PROCEDURE.....	10
Test Procedure	10
Verifying Instruments.....	10
Test conditions.....	11
Test execution.....	11
MAINTENANCE WORKS	13
Transducer Replacement	13
Battery Replacement	13
TRANSPORTATION AND STORAGE.....	14
STANDARD EQUIPMENT	15
MANUFACTURER WARRANTY.....	16
WARRANTY CERTIFICATE	16
RECORD OF REPAIRS	17
RECORD OF TESTS	18

INTENDED USE

EM2210 electromagnetic-acoustic thickness gauge (product) measures thickness of steel pipes, flat steel, rods and other steel constructions, together with constructions made of aluminium and other metals. Measurements can be taken without usage of couplant, without advance surface preparation and across the operating gap between the transducer and the test object of up to 2 mm. Rust film, salt deposits or any other insulating coat (paint, varnish, enamel, plastic etc.) can serve as an operating gap.

OPERATING PROCEDURE

The product measures time during which the acoustic wave transits through the test object. Thickness is calculated using the time value and the specified acoustic speed.

When using electromagnetic-acoustic conversion the acoustic wave is generated directly in the test object and is not distorted by the contact media between the transducer and the test object surface. The gap (air, liquid, rust, paint plastic, etc.) between the gauge and the test object surface can be 2-3 mm.

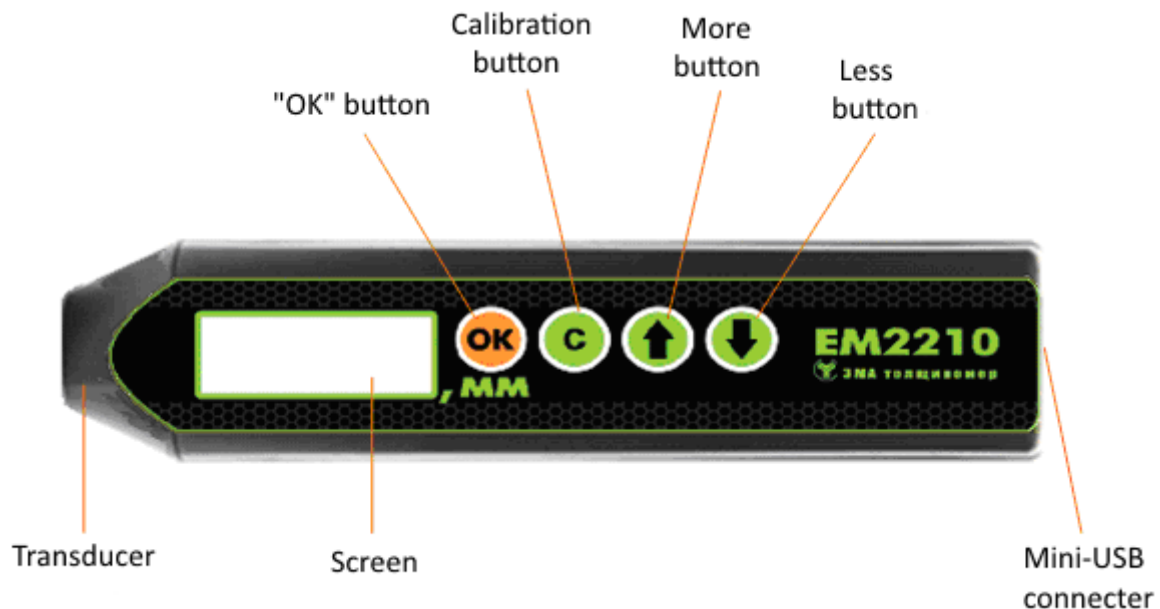
A special data processing algorithm designed by “Oktanta” company allows measuring thickness correctly even in the presence of disruptors such as metal anisotropy, several reflectors and external noise. The EM2210 eliminates influence of the human factor and makes measurements automatically.

TECHNICAL SPECIFICATIONS

Thickness range (steel)	2...60 mm
Measurement uncertainty	0,08 mm
Operating gap between the transducer and the test object	up to 2 mm
Operating transducer skew relative to normal to the test object surface	$\pm 25^\circ$
Operating radius of curvature of test object surface	≤ 10 mm
Maximum number of measures per second	16
Acoustic speed adjustment range	1000...9999 m/s in 1 m/s increments
Operating frequency range	3...5 MHz
Continuous work time on a single charge	5 hours
Operating temperature range	-20...+50°C
Dimensions	163 x 39 x 32 mm

PRODUCT DESCRIPTION

Product View



The product case is made of plastic and has a removable transducer at the front.

The product has a digital screen that displays the results of the measurements. The control buttons placed to the right of the screen perform the following functions:



«OK» button – switches on/off the product, menu navigation button



Calibration button – opens Calibration menu



More button – increases the adjusted parameter value










Less button – decreases the adjusted parameter value

Mini-USB connector is used to connect the charger as well as external devices such as a tablet or smartphone with Android OS.








Calibration

There are two calibration methods: using the specified test object thickness or using the specified acoustic speed.

Calibration using the specified thickness:

1. Switch on the product by pressing the  button;
2. Place the EM2210 on the surface of a test object with specified thickness;
3. Press the  button. Values on the display will start flashing;
4. Set the specified thickness of the test object using the  or  buttons.
If you hold down the  button or  button, the step of value changing will increase;
5. Press the  button.

Calibration using the specified acoustic speed:


1. Switch on the product by pressing the  button;
2. Press the  button twice. Values on the display will start flashing;
3. Set the specified acoustic speed value using the  or  buttons.
If you hold down the  button or  button, the step of value changing will increase;
4. Press the  button.

CAUTION!

The EM2210 measures using shear wave. The typical value of the propagation speed of a shear wave in steel is 3250 m/s.

Thickness measurement

To measure thickness, perform the following actions:





1. Switch on the product by pressing the  button. If there is no test object near the transducer, the thickness values on the screen will vary chaotically;
2. If it is necessary, calibrate the EM2210 (see “Calibration”);
3. Place the EM2210 on the surface of a test object. The measured thickness value will be displayed on the screen after a period of time from 100 ms to 3 seconds (depending on the selected number of coherent integrations).

Number of coherent integrations selection

The product can measure thickness using the coherent integrations algorithm that allows to increase the signal-to-noise ratio significantly and, thereby, to increase the accuracy of thickness measurement.

When the product measures thickness of a test object with poor surface quality and across a wide gap, it is recommended to increase the number of coherent integrations and, thereby, to increase the reliability of the measurements.

To change the number of coherent integrations, perform the following actions:

1. Switch on the product by pressing the  button;
2. Press the  button three times. A flashing **A0XX** appears on the screen, where XX is the selected number of coherent integrations;
3. Select required number of coherent integrations by pressing the  or  buttons.

The number of coherent integrations can be: 16, 32, 64, 128, 256, 512, 1024;




4. Press the  button.

Remember that as the number of coherent integrations increases the measurement time increases too. By default, the number of coherent integrations is 32.

Battery charge

When the battery charge level drops below 25 %, screen indication starts to flash. When the adapter is connected to the product, information on the battery charge level is displayed on the screen.

To check the battery charge level, perform the following actions:

1. Switch on the product by pressing the  button;
2. Press the  or  button. The letter “B” and three numbers showing the battery charge level appears on the screen. For example, “**B025**” means that the battery charge level is 25 %.

It takes at least two hours to charge a fully discharged battery to 100%. It is recommended to charge the product when it is switched off.

CAUTION!

Long-term storage of the battery in the fully discharged state can lead to a decrease in the capacity of the battery and a decrease in its service life. It is recommended to charge the battery as soon as possible when it is completely discharged. It is necessary to consider this requirement during long-term storage of the product.

Product operating features

The EM2210 has the electromagnetic-acoustic transducer with a permanent magnet that introduces a number of requirements for operation with the product:

1. Be careful when moving the product near knives, forks, needles and other sharp metal objects. This objects can be magnetized to the transducer casing and injure the user. To avoid this, it is necessary to take the product by the middle and back parts as far as possible from the transducer;
2. When placing the product on an unattached relatively light test object, hold the test object by hand;
3. The product can disable magnetic cards if it is placed too near to them;
4. In case of sharp inaccurate placement of the product on the test object, a stroke may occur due to additional acceleration caused by the magnetic field. It is recommended to place the product on the test object smoothly, without throwing and holding it by hand to increase the service life of the transducer;
5. It is recommended to place the product on the test object at an angle of 60 °. After touching the test object surface by the transducer the product should be straightened to a 90 ° angle.

It is necessary to monitor the integrity of the plastic coating of the EMT2210-1 electromagnetic-acoustic transducer during the product service life. If the plastic is

damaged and the coil wires are out of the coating, it is necessary to replace the transducer.

CAUTION!

Long-term operation of the product with a damaged transducer can lead to complete failure of the product. The contact of the damaged transducer (when the coil wires are out of the coating) with the metal can lead to sparking.

PRODUCT TEST PROCEDURE

Product test is carried out by the bodies of the Service of Legal Metrology or other authorized organizations that are accredited for carrying out such operations.

The result of the test is the confirmation of the suitability of the measuring instrument for use or the recognition of the measuring instrument as unfit for use.

If the measuring instrument is found to be suitable for use in the result of tests, then a verification mark is put in the product documentation or a Certificate of verification is issued.

With negative results of verification, the product is not allowed for further operation and a mark about unusability is put in the product documentation.

Test Procedure

During the product test the following operations should be performed:

1. External examination;
2. Functional test;
3. Measurement uncertainty calculation.

In agreement with the bodies that conduct the product test, the test may be performed not in full.

Verifying Instruments

Verifying instruments must have valid Certificates of verification or valid verification marks.

The product test is performed using the following control samples:

1. A KYCOT-180 set of standard samples of the equivalent ultrasonic thickness or a KMT-176M-1 (KMTC-97) set of ultrasonic thickness control gauge;
2. A set of plane-parallel samples made of one steel blank with the following parameters:

Thickness, mm	Roughness R _Z , micron, less than
2 ± 0,01	10
10 ± 0,015	20
60 ± 0,03	20

Verifying instruments can be different from those mentioned above but their characteristics must not be inferior to mentioned above and must be sufficient to obtain a reliable result. The use of such verifying instruments must be agreed with the bodies of the Federal Agency on Technical Regulating and Metrology.

Test conditions

Environmental conditions during the product test should conform to the following:

Air temperature	+5...+30 °C
Humidity	80% at a temperature of +25 °C
Atmospheric pressure	86...106 kPa

Test execution

External examination

The following requirements are checked during the external examination:

1. Standard equipment should be as specified in the user's manual;
2. The marking and the serial number of the product must comply with the marking and the serial number specified in the user's manual;
3. There must be no mechanical damage of the product that affects its performance and worsens its technical specifications.

Functional test

The function test of the product must be carried out in accordance with the instructions in the "Product description" chapter and using a control sample from the delivery set or other control sample that has the required certificate.

The function test is performed in the following order:

1. Calibrate the product using a control sample;
2. Measure the thickness of the control sample. The measured value of the sample thickness shall not differ from the actual value (10 mm) by more than 0.04 mm.

Measurement uncertainty calculation

Measurement uncertainty calculation is performed using a set of samples made from a single blank in the following order:

1. Place the product on a test object 2 mm thick;
2. Calibrate the product using a calibration method based on the specified thickness of the test object;
3. Perform 5 thickness measurements at five different points of the test object 2 mm thick;
4. Calculate the Δ maximum measurement uncertainty using the formula:

$$\Delta = \max(H_M - H_S)$$

where H_M is the result of the measurement; H_S is the thickness of the sample;

5. Repeat the operations specified in paragraphs 1 to 4 for control samples 10 and 60 mm thick.

The results of verification are considered positive if the calculated values of the product measurement uncertainty for each control sample do not exceed $\pm 0,04$ mm.

MAINTENANCE WORKS

Transducer Replacement

It is necessary to replace the transducer when its plastic coating wears out.

Transducer replacement can be performed in the Service Centre of the “Oktanta” Company or independently.

To replace the transducer, perform the following actions:

1. Unscrew the four screws that fasten the transducer to the product case;
2. Remove the damaged transducer;
3. Place the new transducer on the case;
4. Secure the transducer with four screws.

Battery Replacement

Battery replacement can be done **ONLY** in the Service Centre of the “Oktanta” Company. It is recommended to replace the battery every three years.

CAUTION!

It is prohibited to replace the battery yourself!!!

TRANSPORTATION AND STORAGE

Environmental conditions during storage and transportation should conform to the following:

Air temperature +5...+30 °C

Humidity 80% at a temperature of +25 °C

Store and transport the product only in the case supplied. In addition to the above, it is necessary to prevent mechanical damage of the case and the product.

The battery of the product is discharging during long-term storage. It may affect the operation of the product in the future. Therefore, it is recommended to check the battery charge level periodically (at least once a year) and, if necessary, to charge the battery (see “Battery charge”).

STANDARD EQUIPMENT

Basic configuration

EM2210 thickness gauge	1 piece
Package-case	1 piece
Adapter	1 piece
User's manual	1 piece

Extension configuration

Test block 10 mm thick	1 piece
Cover	1 piece
Tablet with ScanView program, cables and adapter	1 piece

MANUFACTURER WARRANTY

The warranty period is 24 months from the date of purchase. During the warranty period the manufacturer undertakes to rectify the faults of the product provided the integrity of the product case and the availability of warranty seals.

The manufacturer has the right to terminate the warranty liability before expiry of the warranty period in the following cases:

1. Use of the product other than intended in the present user's manual;
2. Violation of the conditions and requirements for the operation, storage and transportation of the product specified in the present user's manual;
3. Mechanical damage of the product caused by mishandling.

WARRANTY CERTIFICATE

Product type	<u>EMA thickness gauge EM2210</u>
Serial number	_____
Warranty period	_____
Manufacturer	<p>“Oktanta” Company 22-34, Mayakovskogo Street, Saint-Petersburg, Russia +7(812)385-54-28 info@oktanta-ndt.ru</p> <hr/> <p style="text-align: right;">signature, stamp</p>

RECORD OF REPAIRS

Date of handover to repair	Defect type	List of repair operations	Completion status (date, signature, stamp)

RECORD OF TESTS

Date	Expiration time	Signature