[A1040 MIRA]

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US 7,587,943 B2

ULTRASONIC TOMOGRAPH FOR CONCRETE INSPECTION

Ultrasonic tomograph A1040 MIRA is applicable for testing constructions from concrete, reinforced concrete and stone at one-side access to them to evaluate material integrity in the object, to search foreign inclusions, holes, flaws, cracks, honeycombs ducts inside the material as well as to measure objects thickness. Objects with thickness up to 2 meters can be inspected.

Results are presented in a form of cross section image (tomogram) of B-type, which makes result easier to understand and is convenient for the object condition quick analysis. Specialized software allows to reconstruct any tomogram from three-dimensional data massive and to produce 3D image of the object internal structure.

Tomograph A1040 MIRA is designed in a monoblock form. It is easy and convenient in work. It has built-in computer, memory, big display and control buttons, which provides a comfortable work.

Antenna array of the tomograph consists of dry point contact (DPC) transducers; therefore inspection is carried out without contact liquid. Tomographic data procession (SAFT-algorithm) used for compilation of data, provides clear graphic picture of the internal structure of a testing object.

The tomograph can be used at manual control and composed to automatic plants.

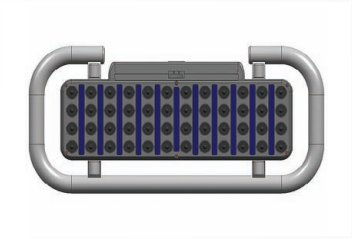
ADVANTAGES

- Visualization of the object internal structure at one-side access
- High efficiency – one tomogram reconstruction takes 3 seconds
- Easy to use
- High measurement accuracy and sensitivity to various reflectors
- The surface of the object doesn't need to be prepared preliminarily
- Wear-resistant transducer tips

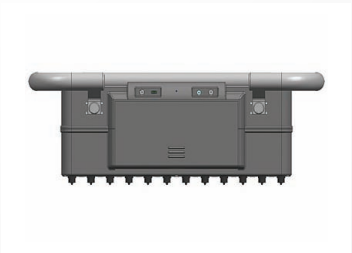
FEATURES

- Light-weight shockproof plastic body
- Quick-detachable battery
- Independent work with data without an external computer
- Dry acoustic contact
- Adaptation of antenna array to the rough object surface
- Automatic measurement of the ultrasonic wave velocity in the testing object
- 3D presentation of the testing object internal structure and B-, C-, D-scans of any object section

DEVICE DESCRIPTION



A1040 MIRA tomograph for concrete is a completely independent measuring unit, which is used to conduct collection and tomographic processing of the received data. The measuring unit contains a matrix antenna array with low-frequency broadband shear wave transducers with a dry point contact and wear-resistant ceramic pins. It provides prolonged lifetime even if used on rough surfaces. Each transducer has an independent spring load, which enables testing on uneven surfaces. Nominal operation frequency of array is 50 kHz.



The device has a built-in computer, which provides processing data in the process of testing, displaying them on the screen and saving them into the memory. Data can be transmitted to an external PC for processing them with the specialized software.

Large and bright TFT display and a keyboard allow to tune up the device easy for the testing object, to select operation modes and carry out control, watching received results, which makes the preliminary analysis possible.

Small light body and repositionable handle make it comfortable to use the device on horizontal, vertical and ceiling surfaces of the testing object.

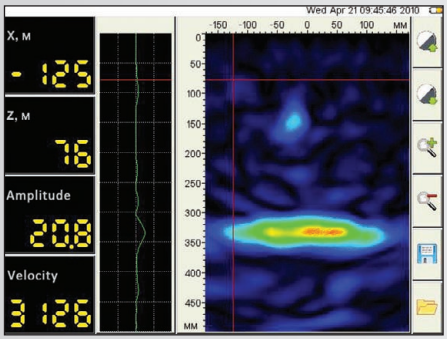
Battery provides up to 5 hours of continuous work. Battery can be easily replaced with an extra one (optionally delivered), which increases time of independent work. And power can be delivered directly from AC network to the tomograph.

Inspection is conducted according to the scheme of step-by-step testing object scanning with data unification and volume reconstruction under the whole scanned testing object area.

DATA PROCESSING AND REPRESENTATION ON THE DISPLAY OF THE TOMOGRAPH

Synthetic aperture focusing technique with combinational method of sounding (SAFT-C) is used in the device, and ultrasound is focused in each half-space point. As a result an obvious image of testing object section is given. Reflection power of each visualized object point is coded by different colours, depending on the chosen colour scheme.
Different types of data presentation on the display of the tomography can be selected depending on installed mode.

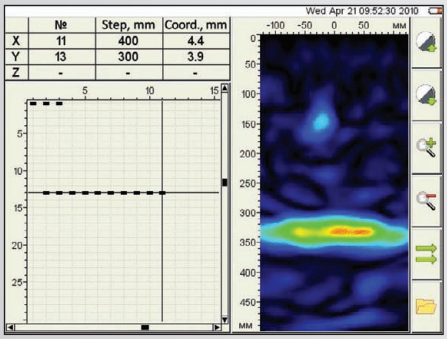
OPERATION MODES



REVIEW mode

The mode is used for quick viewing of internal structure of the testing object in random places. B-scan on the depth of up to 2 meters is presented on the display.
In this mode it is additionally possible:

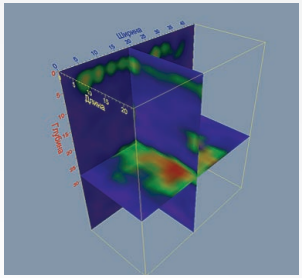
- To measure ultrasonic wave velocity automatically;
- To measure coordinates and levels of the image in the scan;
- To measure object thickness;
- To review A-scans.



MAP mode

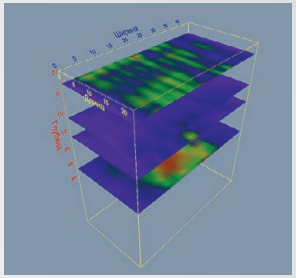
The mode is used for collecting data in a form of B-scan set (perpendicular to the surface) while inspection with an antenna array along marked lines with a fixed step. Any B-scan image can be displayed from the stored 3D data massive.

SOFTWARE

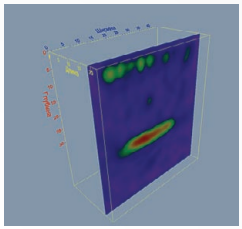


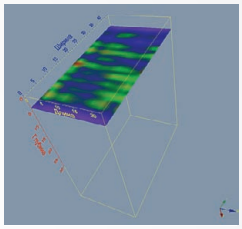
The device is delivered with specialized software for extended processing of collected data on an external PC.

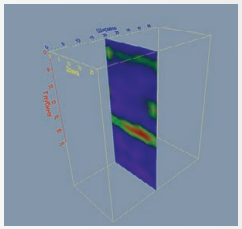
The software provides reading data from the device and presenting it in a form of tomogram as well as in 3D form, which makes it easier to understand the internal structure of the concrete object.

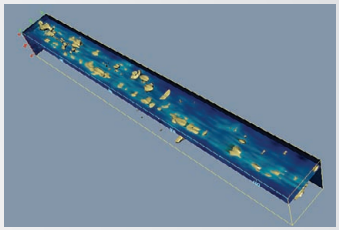


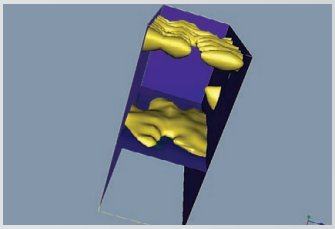
It is possible to locate each reflector occurrence coordinate in the testing object.











SPECIFICATION

Specification of the system

Minimal thickness of testing object	50 mm
Maximum thickness of testing object	2 m
Minimal size of detected reflector	sphere with a diameter of 50 mm at a depth of 100 meters in concrete grade M400
Size and type of the display	5,7'' TFT, color
Built-in memory	flash-memory
Power source	built-in quick-detachable battery/ac network
Battery operation time	5 h
Connection with a computer	USB
Operating temperature range	from -10 to +50 ^{0}C
Size	380 x 130 x 140 mm
Weight	4.5 kg

Transducer specification - elements of antenna array

Operating frequency	50 kHz
Bandwidth by the level – 6 dB in the emission/receiving mode	25 - 80 kHz
Operation type of waves	shear waves

DELIVERY KIT

- A1040 MIRA-tomograph ultrasonic unit
- Detachable battery
- Charging unit
- USB connection cable
- Check sample
- Notebook
- Sun shield
- Safety rope
- Additional stick-holder
- Transportation Case