TOMOGRAPHIC 5M

MULTIDEFECTOSCOPE

SPECIFICATIONS

RGDE 401.00.00.000 M

PURPOSE

Multifunctional flaw detector **TOMOGRAPHIC 5M** (an updated line of the **TOMOGRAPHIC UD4-TM** model) is a small-sized portable device designed for manual and automated non-destructive testing using ultrasonic, eddy current and resonance methods.
TOMOGRAPHIC 5M can be used in shipbuilding, railway, aviation, space, automotive, construction and other industries to control products, both during the manufacturing process and under operating conditions.

1. TOMOGRAPHIC 5M in ultrasonic testing mode:

1.1 Implements ultrasonic flaw detection methods based on the passage, reflection and transformation of ultrasonic vibrations (US) on inhomogeneities and discontinuities in materials (defects);

1.2 Designed for non-destructive testing of materials, products, welded joints for the presence of defects such as discontinuity, determining the coordinates of defects, measuring the amplitudes of echo signals from defects, measuring the propagation time of ultrasonic vibrations (UT) in materials;

1.3 Principle of operation. The voltage of the excitation pulse generator (EPG) is supplied to the piezoelectric transducer (PET). Ultrasound signals generated by the probe propagate in the test object, are reflected from the defect and are received by the device at different positions of the probe relative to the defect. The coordinate of the probe during movement is automatically recorded by the device for determining the position of the probe. A-scans are processed by a built-in processor and, together with the resulting set of data on defects, are displayed on the screen and (or) stored in the non-volatile memory of the device. With the help of special software for the Defectoscopy Technician's workstation on a PC, records with inspection results accumulated in the device's archive are transferred to a PC for further storage, processing, visual presentation, as well as generation and printing of inspection protocols.

2. TOMOGRAPHIC 5M in eddy current testing mode:

2.1 Implements eddy current flaw detection methods based on recording changes in the electromagnetic field of eddy currents induced by an exciting coil in an electrically conductive test object;

2.2 Designed for non-destructive testing of parts made of non-magnetic and ferromagnetic metals and alloys, for the presence of surface defects such as cracks, delaminations, sunsets, cavities, non-metallic inclusions, as well as for assessing the structure of the tested material.

2.3 Principle of operation. The excitation pulse generator (EPG) voltage is applied to the exciting coil of the eddy current transducer (ECT), as a result of which eddy currents are excited in the controlled material. In the presence of defects close to the surface, the trajectory of the eddy currents changes, which leads to a change in the signal induced in the ETC measuring coils. The received signal from the VTP measuring coils is analyzed by the amplitude-phase method. When the set response threshold (set by the strobe) is exceeded, an automatic defect alarm (ADS) signal is generated. The result of processing the received signal from the object under study is displayed on the device screen in graphical form and (or) entered into the non-volatile memory of the device. With the help of special software for the Defectoscopy Technician's workstation on a PC, records with inspection results accumulated in the device's archive are transferred to a PC for further storage, processing, visual presentation, as well as generation and printing of inspection protocols.

3. TOMOGRAPHIC 5M in resonance control mode:

3.1 Implements resonant flaw detection methods based on recording changes in the reverberation mode of ultrasonic vibrations induced by a contact piezoelectric transducer in the controlled area, depending on the presence or absence of inhomogeneities or discontinuities in the material.

3.2 Designed for diagnostics of structures and body parts made of solid composite materials to determine inhomogeneities, non-gluing and delamination.

3.3 Principle of operation. The voltage of the excitation pulse generator is applied to the emitting piezoelectric element of the contact probe installed on the test object, as a result of which reverberating ultrasonic vibrations are excited in the controlled material. If there are inhomogeneities or discontinuities in the control zone, the nature of the reverberation of ultrasonic waves changes, which leads to a change in the signal induced at the receiving piezoelectric element of the probe. The received signal from the receiving piezoelectric element of the probe is analyzed by the amplitude-phase method. When the set response threshold (set by the strobe) is exceeded, an automatic defect alarm (ADS) signal is generated.

A large number of software applications have been developed for TOMOGRAPHIC 5M:

Tomographic 1.1 – general purpose ultrasonic flaw detector;

Tomographic 1.2 – EMA/ultrasound thickness gauge;

Tomographic 1.3 – Certification of PEP (ARD diagrams);

Tomographic 2.1 – Ultrasonic testing of wagon wheel pairs according to RD07.09-97;

Tomographic 2.1.2 – Ultrasonic inspection of car wheel pairs according to STO Russian Railways 1.11.002-2008

Tomographic 2.1.3 – Ultrasonic testing of wheel pairs of passenger cars according to STO FPK1.11.001-2010;

Tomographic 2.2 – Ultrasonic testing of rough axes in accordance with RD 32.144-2000;

Tomographic 2.3 – Ultrasonic testing of locomotive parts;

Tomographic 2.5 – Eddy current testing of car parts according to RD 32.150-2000;

Tomography 2.6 – Ultrasonic inspection of welded seams of rails/switch crossings;

Tomographic 2.7 – Eddy current testing of parts of locomotives and MVPS;

Tomographic 2.8 – Ultrasonic testing of wheel sets of freight cars according to PRNA V.2;

Tomograph 3.1 – Resonance flaw detector;

Tomograph 3.2 – Acoustic strain gauge;

Tomograph 4.1 – Eddy current flaw detector.

FUNCTIONS OF TOMOGRAPHIC 5M SOFTWARE:

1. Visual interface for controlling the device hardware;
2. Selection of control modes;
3. Setting up and calibrating the device;
4. Software processing and display of A-scan;
5. Ensuring management of the control process;
6. Display test results on the screen and save them in the device archive;
7. Transfer of control results to a PC.

TOMOGRAPHIC 5M HARDWARE FUNCTIONS:

1. Formation of excitation impulses;
2. Reception of signals from converters;
3. Gain, AGC, VHF;
4. Signal digitization;
5. Hardware processing of the digitized signal;
6. Processing of strobes and ASD;
7. Formation of service signals

FUNCTIONAL FEATURES TOMOGRAPHIC 5M:

Programmable shape of the probing pulse;

Possibility of synchronization with other instruments and devices;

Work in combined and separate-combined mode;

Work with a path sensor is provided;

Communication of the device with a PC;

Possibility of remote control;

Stable control parameters through the use of modern digital technologies;

Software in Russian, adapted for the Customer.

TECHNICAL CHARACTERISTICS TOMOGRAPHIC 5M:

GENERAL TECHNICAL PARAMETERS OF THE DEVICE	
Supported non-destructive testing methods:	ultrasonic, eddy current, resonant
Transducer connection mode	separate / combined
Customizable digital data filtering block	available
Sound and light alarm for defect detection	available
Possibility of documenting control results	available
Possibility of transferring inspection results to a PC	available
Remote control	available
Operating position of the device	any convenient for the operator

DEVICE OPERATING DATA	
Time to establish the operating mode, min, no more	5
Time to completely reconfigure the device if available in the archive parameters of the probe and the material of the test object, min., no more	1
Time to completely reconfigure the device if it is not in the archive parameters of the probe and the material of the test object, min., no more	5
Operating temperature range, °C	From - 20 up to + 45
Relative humidity of ambient air, at a temperature of 35°C, %, no more	95
Degree of protection against penetration of dust and moisture	IP54
Average recovery time, h, no more	6
Average service life (excluding converter, scanner and battery), years, not less	5
Scanner parameters: relative permissible limit error in determining the coordinates of the defect, %, no more	5
Electrical power supply to TOMOGRAPHIC is provided from the following sources:	AC mains/ built-in battery
Electrical power supply to TOMOGRAPHIC from AC mains: - voltage, V; - frequency Hz	100 - 250; 50 - 60
Power consumption from AC mains, V•A, no more than: - when working without a battery; - when operating in battery charging mode	16 35
Continuous operation time of TOMOGRAPHIC when powered by AC mains h, not less	24
Electrical power from built-in battery: - voltage, V; - capacity, Ah	12; 6,8
Current consumed from the built-in battery at a nominal voltage value of 11.1 V, mA - no more	670

DEVICE OPERATING DATA	
Time of autonomous continuous operation of TOMOGRAPHIC from completely charged built-in battery under normal conditions under average screen brightness - 8 hours without recharging the battery h, no less	10
Average time between failures including maintenance, h, no less	10000
Average service life (excluding converters) years, not less	8
TOMOGRAPHIC screen: - type; - permission; - dimensions of the working field, WxH mm	TFT 320 x 240 115 x 86
Масса (со встроенным аккумулятором, без блока питания, комплекта преобразователей и кабелей), кг, не более	2,5
Overall dimensions of the device (without handle), HxWxD, mm, no more	135 x 220 x 120

Ultrasonic Channel Generator Parameters

PARAMETERS OF THE ULTRASONIC CHANNEL GENERATOR	
Nominal values of excitation pulse amplitude at a resistive load of 50 Ohm, V	75; 150; 225
Relative error in setting the pulse amplitude	±20%
Nominal frequency of the probing signal, MHz (smooth adjustment)	0,4 ... 10
Discreteness of setting the duration of GIB pulses, ns	12,5
Adjustable number of periods in the probing pulse	1 ... 8
Probing pulse repetition rate, Hz, not less	200

Ultrasonic channel receiver parameters

ULTRASONIC CHANNEL RECEIVER PARAMETERS	
Maximum receiver sensitivity at nominal frequencies 1, 2.5, 5, and 10 MHz with signal/noise ratio - 6 dB, μV, no worse	150
Receiver bandwidth at minus 3 dB, MHz	0,4 ... 10,0
Measuring range of signal amplitudes at the receiver input	40÷140 dB
Gain adjustment step, dB, no more	1
Limit of permissible basic error of amplitude measurement signals dB, no more, at the receiver input in the range: from 40 to 60 dB from 61 to 107 dB from 108 to 140 dB	 ± 1,0 ± 0,5 ± 1,0
Temporary instability of sensitivity TOMOGRAPHIC for 8 hours continuous operation, dB, no more	± 0,5
Limits of permissible absolute adjustment error threshold indicator (dead zone), dB	± 0,3
Temporary instability of the threshold response level indicator for 8 hours of continuous operation, dB	± 0,5
Operating mode	Combined/ separated
Radio signal sampling frequency, MHz, not less	40
Type of recorded signal	radio signal, video signal
Amplitude cut-off, %	0÷90
Cut-off adjustment step, %, no more	1
Sweep duration adjustment range, μs	8 ÷ 1000

ULTRASONIC CHANNEL RECEIVER PARAMETERS	
Number of strobes in each channel, pcs., no less	2
Gate logic	Excess/ decline
Range of measured time intervals, μs	from 0.2 to 1000
Time interval measurement error in the range from 0.2 to 75 μs, no worse, μs	± 0,025
Time interval measurement error in the range from 75 to 1000 μs, no worse, %	± 2
Ultrasonic testing speed setting limits, m/s	from 1000 to 12000
Minimum discreteness of ultrasonic testing speed setting, m/s	1
Measuring range of reflector depths, mm	from 6 to 2970
Speed of movement of the transducer at the test object, m/s	0 ÷ 0,3
Averaging by number of starts	from 1 to 16
Digital bandpass filter parameters: central frequency tuning range, MHz MHz band tuning range	 from 1 to 10 from 0,5 to 4
Parameters of the temporary sensitivity control system (TSC): VRF adjustment range, dB, min. Number of VRCH points, not less Minimum time sensitivity setting step, μs	 80 256 2

Parameters of the TOMOGRAPHIC ultrasonic channel, measured by lateral drilling with a diameter of 6 mm and a depth of 44 mm when working with a probe on a standard CO-2 sample according to GOST 14782

Symbol of PEP	Conditional sensitivity, dB	Noise level according to GOST 14782, dB	Sensitivity margin, dB	Rated frequency, MHz	Conditional resolution according to reflector depth, μs	The value of the probe input angles
P111-2,5-K12	120 ± 12	90	30	2,5	1,2	-
P111-5,0-K6	113 ± 12	90	22	5,0	0,8	-
P121-2,5-50°	90 ± 12	76	14	2,5	1,4	(50 ± 12)°
P121-5,0-50°	86 ± 12	76	10	5,0	1,0	(50 ± 12)°

Duration of the reverberation-noise characteristic (RSC) of the ultrasonic channel when working with a probe

Level, dB	Duration of reverberation-noise characteristic, μs Symbol of PEP			
	P111-2,5-K12	P111-5,0-K6	P121-2,5-50°	P121-5,0-50°
130	4	3	6	4
124	5	4	8	4
118	8	8	8	8
112	10	10	10	12
106	12	12	12	16
100	14	14	14	20
94	16	16	16	24
88	24	26	26	28
82	38	38	38	40
76	46	46	50	58
70	68	68	72	66
64	75	94	94	80
58	92	130	120	100

Note – RSH levels in the table are given in relation to 1 μV

Eddy current channel generator parameters

PARAMETERS OF THE EDGE CURRENT CHANNEL GENERATOR	
Nominal values of excitation pulse amplitude at a resistive load of 50 Ohm, V	10
Relative error in setting the amplitude of excitation pulses, %	±20%
Excitation pulse shape	rectangular
Nominal frequency of the probing signal, MHz (smooth adjustment)	0,1 ... 10
Number of periods in the probing pulse	8
Probing pulse repetition rate, Hz, not less	200

Eddy current channel receiver parameters

PARAMETERS OF THE EDGE CURRENT CHANNEL RECEIVER	
Maximum receiver sensitivity at nominal frequencies 0.1, 1, 5 and 10 MHz, mV, no worse	1
Receiver bandwidth, MHz	0,1 ... 10
Gain adjustment step, dB, no more	1
Operating mode	Apart-combined/ separated