

ULTRASONIC multi-channel



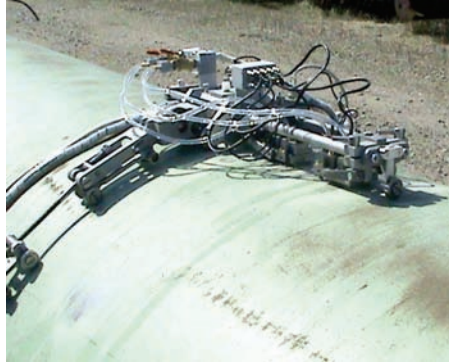
FLAW DETECTOR

UD4-94-OKO-01



PURPOSE

UD4-94-OKO-01 universal multi-channel ultrasonic flaw detector is intended for products testing for the presence of defects, such as material discontinuity and inhomogeneity of end items, semiproducts and welded (soldered) joints, for the defects detection, the recognition of their forms and orientations, the measurement of depths (coordinates) or conditional dimensions of defects. Flaw detector (as a part of mechanized and automated complexes of non-destructive testing as well) can be applied for the testing of products quality during their production and operation in various branches of industry.



APPLICATION FIELDS

UD4-94-OKO-01 universal multi-channel ultrasonic flaw detector is adapted and completely meets the requirements of regulatory documentation in force in various industrial sectors, such as:

- nuclear power engineering,
- metal production,
- pipe industry,
- rail transport etc.

FLAW DETECTOR ADVANTAGES

- high performance due to flaw detector multi-channeling;
- possibility of flaw detector implementation when performing mechanized and automated testing;
- exclusion of human factor influence (if it is used as a part of the mechanized testing system);
- operation simplicity due to the intuitive interface;
- flaw detector provides the defect form and orientation recognition, measurement of depths (coordinates) or conditional dimensions of defects;
- registration of all testing results and extended capacities of data analysis;
- application versatility and possibility of any configuration formation of NDT multi-channel system on the basis of flaw detector;

FLAW DETECTOR DISTINCTIVE FEATURES

- large color high-contrast TFT display;
- ALARM system: 4 three-color LEDs, sound alarm;
- various scanning units manipulation;
- RS232 support;
- encoder connection;
- A-scan display form: Envelope;
- any sounding schemes carrying out in automatic and manual modes;
- software application for different testing tasks: longitudinal and ring welded joints testing, rolled metals testing, etc;
- information display forms: A-scan, B-scan, orthogonal views.

TECHNICAL SPECIFICATION AND SERVICE FUNCTIONS OF THE INSTRUMENT

- possibility of the account taken of the real probe location in a scanner for the correct testing results processing during scanners manipulation;
- possibility of the delay time measurement in the probe wedge;
- possibility of the sound velocity measurement in the testing object;
- display of the measured coordinates of detected defects on B-scans and orthogonal views of B-scans;
- mode of max. signal accumulation in A-scan;
- possibility of compact-flash memory device (up to 2 Gb) installation in flaw detector;
- personal computer (PC) connection mode for the information input from flaw detector memory to PC, testing results processing and their printing, setups input from PC to flaw detector memory;
- possibility of testing results storage on the memory device such as compact-flash;
- possibility of the stored testing results viewing directly on the instrument.

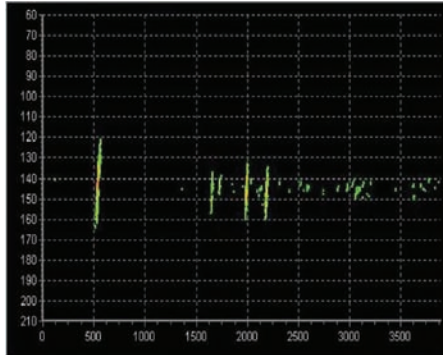
PERFORMED CONFIGURATIONS

By creating special searching systems or scanners and by reprogramming UD4-94-OKO-01 multi-channel instrument for a certain testing object, it is possible to carry out efficiently metal production flaw detection technologies in various branches of industry. All in all, UD4-94-OKO-01 flaw detector complete with scanners is a universal mechanized complex of non-destructive testing.

- **TESTING OF WELDED JOINTS OF TANKS, VESSELS AND OTHER SHEET PRODUCTS**

SCL-M portable system of mechanized ultrasonic testing on the basis of UD4-94-OKO-01 is intended for mechanized ultrasonic welded joints testing of tanks, vessels and other sheet products. The scanner is a mechanized

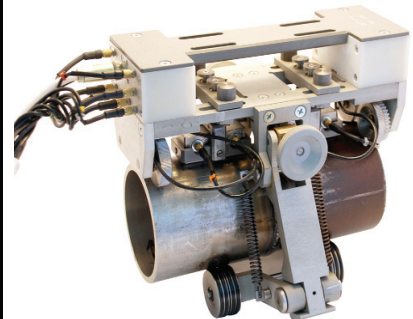
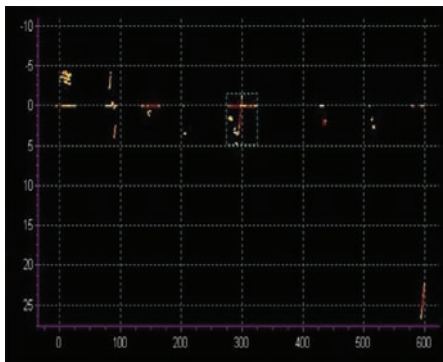
system which provides ultrasonic probes positioning in relation to the welded joint, probe pressing, probe movement along the joint with the guide for welded joint tracking.



- **TESTING OF RING WELDED JOINTS OF VARIOUS DIMENSION-TYPE PIPELINES**

A series of **SKT-M** scanners on the basis of UD4-94-OKO-01 is intended for mechanized ultrasonic testing of ring welded joints. Scanners are a mechanized system which pro-

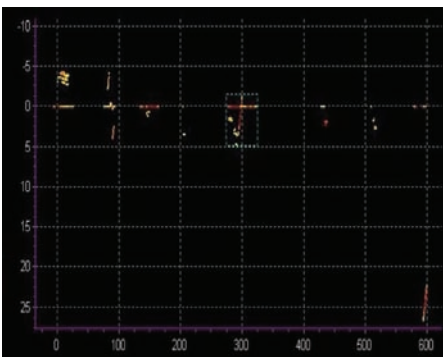
vides ultrasonic probes positioning in relation to the welded joint, probe pressing, probe movement along the joint.



- **TESTING OF MAIN PIPE BODY OF VARIOUS DIMENSION-TYPE PIPELINES**

SKTT-TS scanner on the basis of UD4-94-OKO-01 flaw detector is intended for performing mechanized ultrasonic testing of the pipe body with diameter of 168 - 355 mm, wall thick-

ness of 5 - 30 mm and length of 4 - 14 m for the purpose of detection of defects, such as longitudinal and transverse cracks and delaminations.

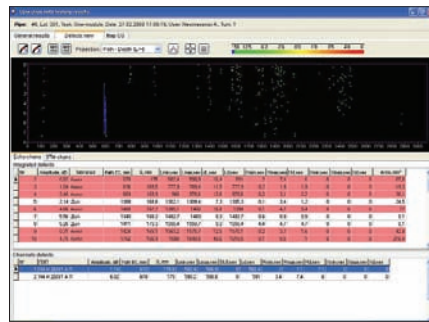
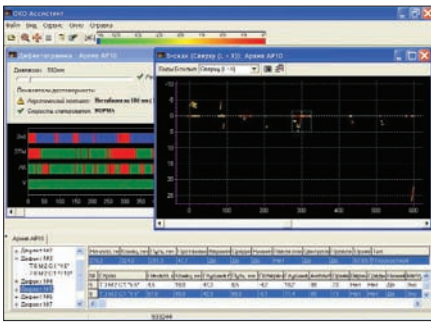


ADDITIONAL SOFTWARE

"OKO-Assistant" program is intended for testing results processing of OKO-01 universal ultrasonic flaw detector and serves for functionality expansion and instrument usability increase. The present program provides operation with the data stored on the personal computer.

MAIN ADVANTAGES OF PROGRAM APPLICATION ARE:

- convenient selection of testing schemes and archives for editing and viewing with the preliminary file information display;
- creation of new and editing of the existing instrument testing schemes with the checking of the input setups admissibility;
- input and storage of rejection criteria in the testing scheme;
- multi-channel interface allowing to work with several testing results (archives) at a time;
- flexible selection of various archives viewing types, including display of "raw" B-scans, B-scans projections and defectograms (B-scan, C-scan, D-scan);
- zooming, preset area increase, convenient diagrams scrolling;
- rejection criteria application on the basis of adjustable compound rejection condition;
- testing reliability indices calculation;
- creation of a total table of testing results 3D-defects;
- printing of ultrasonic testing report on the basis of an overall defectogram;
- printing of a table of 3D-defects and its component "planar" defects, and also printing of separate ultrasonic testing results: B-scans, projections;
- availability of the users list with the password system and possibility of access rights limitation.



MAIN SPECIFICATIONS

- Overall dimensions of flaw detector without a handle and with one ultrasonic unit and power unit no more than 320 x 180 x 140
- Weight of flaw detector with one ultrasonic unit and power unit no more than 6 kg
- Keyboard English, Russian
- Languages English, Russian
- Number of ultrasonic units max. 3
- Number of ultrasonic channels in ultrasonic unit 8 channels
- Connectors types Lemo-00, BNC
- Data storage flash card
- Independent power source NiMH storage battery of rated voltage 12 V and rated capacity 9 A/h
- Operation time (when powered from storage battery) 8 hours
- Power supply AC network of voltage (220 V ± 10%) and frequency (50 ± 1) Hz;
- Flaw detector electric power consumed from AC network no more than 30 V·A
- Time of flaw detector operation mode setup no more than 1 min.
- Display type NL8060BC21-03 (800 x 600 pixels)
- Screen dimensions (width, height, diagonal), mm 170 x 130 x 214
- Warranty 1 year

INTERFACES

- RS - 232 available
- Trigger I/O available
- Encoder output Single-coordinate encoder

MAIN METROLOGICAL PERFORMANCES

- The limits of admissible main absolute error of flaw detector during the measurement of depth δ_H and coordinates δ_X ; defects depth δ_Y
 - $\delta_H = \pm (0,5+0,02H_Y)$ mm
 - $\delta_X = \pm (0,5+0,02X)$ mm

- The limits of admissible main absolute error during the measurement of signals amplitudes ratio Δ_N at the reception path input in the gain range from 20 dB to 70 dB
 - $\delta_Y = \pm (0,5+0,02Y)$ mm
 - $\Delta_N = \pm (0,2+0,03N)$
 - Δ main absolute error during signals amplitudes ratio measurement, dB;
 - N numeric value of signals amplitude ratio, dB
- Time instability of flaw detector reception path sensitivity $\pm 0,5$ dB for 8 hours of continuous operation
- Protection level in operation IP 64
- Ambient temperature from minus 10° to +40° C
- Atmospheric pressure from 84 to 106,7 kPa
- Relative humidity (93 ± 3) % at the temperature 25 °C
- Flaw detector in shipping package is resistant to the influence of vibrations
 - s trokes with the peak shock acceleration value 98 m/s², impulse duration 16 μs, number of strokes 1000 ± 10 for each direction
- Flaw detector retains its parameters when it is influenced by electromagnetic interferences which do not exceed the following norms
 - harmonic interferences of magnetic field in the frequency band from 30 Hz to 50 kHz with the effective value of field intensity from 130 to 70 dB;
 - harmonic interferences of electric field in the frequency band from 10 kHz to 30 MHz with the effective value of field intensity 120 dB
- Full average flaw detector lifetime no less than 10 years
- Probability of no-failure operation no less than 0,9 for 2 000 h

PULSER

- Initial pulse type _____ Short pulse of negative polarity
- Initial pulse frequency _____ from 10 Hz to 1000 Hz
with a step of 1; 10; 100 Hz
- Amplitude _____ 180 V
- Duration _____ $60 \pm 10 \mu\text{s}$
- Rising edge duration _____ no more than $20 \mu\text{s}$
- Synchronization type _____ from an initial pulse,
_____ from an encoder

SETUPS MODE

- Automatic setups _____ calibration of time delay in the probe wedge
sound velocity measurement in a testing object
- Measurements _____ mm, μs
- Testing range _____ from 0 to 18000 mm,
with a step of 0.1; 1; 10; 100 mm
at the sound velocity 6000 m/s
- Velocity _____ from 1500 m/s to 8000 m/s,
with a step of 1; 10; 100, 1000 m/s
- Delay in a wedge _____ from 0 to 100 μs ,
with a step of 0.001; 0.01; 0.1; 1 μs .
- Range delay _____ from 0 to 6000 μs ,
at the velocity 6000 m/s,
with a step of 0.1; 1; 10; 100 μs
- Refracted angle _____ from 0 to 90° ,
with a step of 1° ; 10°

CYCLES/GATES

- Cycles amount _____ max. number of cycles 32
- Cycle duration _____ min. cycle duration $0,2 \mu\text{s}$
- Number of gates in a cycle _____ max. number of gates 3
- Beginning of a gate _____ from 0 to 3000 μs ,
with a step 0.1; 1; 10; 100 μs
- Gate width _____ from 0 to 18000 mm,
with a step 0.1; 1; 10; 100 mm
at the sound velocity 6000 m/s
- Gate fixation level _____ from 10 % to 95 % of vertical screen scale
- ALARM _____ when the signal goes beyond the rejection level,
_____ when the signal stays within the rejection level

RECEIVER

- Gain _____ from 0 to 100 dB
with a step of 0.1, 1, 10 dB
- Input signal _____ no more than 2 V from a peak to a peak
- Input reception path resistance _____ no more than 300Ω
- Pass band _____ from 0,4 to 10 MHz at the level - 6 dB
- Rectifier _____ Radio frequency, enveloping

MEASUREMENTS IN A-SCAN MODE

- Displayed parameters _____ 4 measuring parameters
are displayed in a status bar
- Gate 1 _____ A- amplitude of an echo-signal from a defect
in relation to the screen center, dB
_____ S - distance "by the beam" to a defect
_____ X - defect depth coordinate, mm
_____ Y - defect depth coordinate, mm
- Gate 2 _____ similarly Gate 1
- Gate 3 _____ similarly Gate 1
- TCG curve _____ max. number of points 30 per cycle,
dynamic range 35 dB,
vertical setup step 1 dB,
horizontal setup step 2 mm

MEASUREMENTS IN B-SCAN MODE

- "Raw" B-scan _____ max. amplitude of an echo-signal
from a defect in relation to the screen center, dB
_____ H - distance "by the beam" to a defect an echo-signal
from which has max. amplitude, mm
_____ dH - conditional length "by the beam", mm
_____ L - coordinate along the scanning path to a defect
an echo-signal from which has max. amplitude, mm;
_____ dL - conditional defect length, mm.
- Corrosion map _____ max. amplitude of an echo-signal
from a defect in relation
to the screen center, dB
_____ X depth coordinate of a defect an echo-signal
from which has max. amplitude, mm;
_____ dX - conditional defect width, mm;
_____ Y - depth coordinate of a defect an echo-signal
from which has max. amplitude, mm;
_____ dY - conditional defect height, mm;
_____ L - coordinate along the scanning path to a defect
an echo-signal from which has max. amplitude, mm;
_____ dL - conditional defect length, mm.
- "Corrosion map" mode _____ L - coordinate along the scanning path, mm
_____ X - longitudinal coordinate, mm
_____ Y - transverse coordinate, mm
_____ H - depth, mm