FLAW DETECTORS FOR ULTRASONIC TESTING OF RAILS AND WELDS

EN 12668-1 Compliant

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Series of UDS2-73 MR, UDS2-77 and UD3-71 flaw detectors is intended for ultrasonic testing of railway track and welded rail joints.

**PURPOSE**

**UDS2-73 MR ultrasonic double rail flaw detector:**

Double rail flaw detector is capable of testing both rails of the railway track at a time for defects detection along the running surface and entire rail section excluding the rail foot flanges and also is intended for conformity testing of separate rail sections using manual probes.

**UDS2-77 ultrasonic single rail flaw detector:**

Single rail flaw detector is capable of testing only one of the rails at a time for defects detection along the running surface and entire rail section excluding the rail foot flanges and also is intended for conformity testing of separate rail sections and welds using manual probes.

**UD3-71 ultrasonic flaw detector for the testing of welded rail joints with a set of manual probes and USR-01 scanner (Tandem Rig):**

Intended for re-testing of various type rails laid down in a track and also is used to carry out the before welding testing of end sections of new and used rails and welded joints.

**ADVANTAGES OF FLAW DETECTORS**

**UDS2-73 MR, UDS2-77**

- Rail complete sounding (excluding the foot flanges), due to the flaw detector multi-channeling.
- Built-in standard setups for channels operation.
- Defining the traveled distance and speed during the complete testing.
- Real-time display of testing results in B-scan mode (by 4 channels).
- Sounding and storing the information in every millimeter of traveled distance via all channels is provided in the flaw detector.
- Recording the testing results at different sensitivity levels.
- Registration of all testing results and advanced capabilities of data analysis.
- Application of the flaw detector with the base sounding scheme allows to detect all types of fatal defects, appearing while rail track maintenance.
ADVANTAGES OF UD3-71 FLAW DETECTOR

• High brightness color TFT display.
• Synchronization by encoder.
• Result display: A-scan, B-scan.
• Number of channels for complete testing: 26; (13 for UDS2-77).
• Number of channels for manual testing - 2.
• Techniques and schemes for rail head sounding.
• Application of base and additional schemes for rail sounding:
  – Pulse echo technique by angle-beam probes for testing of gauge and field face sides along and against the movement.
  – Pulse echo by angle-beam probes for testing of the rail head center along and against the movement.
  – Echo-mirror technique by angle-beam probes for testing of the rail head center along and against the movement.
  – Echo-mirror for testing of gauge and field face sides along and against the movement.
• Direct digital display of depth and distance of flaws.
• Internal memory (Micro SD card 8 Gb) for saving the testing setups and testing results.
• Special Test Rig for Tandem Testing Technique.
• Compact and light weight (0.9 Kg).

DISTINCTIVE FEATURES OF UDS2-73MR AND UDS2-77 FLAW DETECTORS

• Large high brightness color TFT display.
• Synchronization by encoder.
• Result display: A-scan, B-scan.
• Number of channels for complete testing: 26; (13 for UDS2-77).
• Number of channels for manual testing - 2.
• Techniques and schemes for rail head sounding.
• Application of base and additional schemes for rail sounding:
  – Pulse echo technique by angle-beam probes for testing of gauge and field face sides along and against the movement.
  – Pulse echo by angle-beam probes for testing of the rail head center along and against the movement.
  – Echo-mirror technique by angle-beam probes for testing of the rail head center along and against the movement.
  – Echo-mirror for testing of gauge and field face sides along and against the movement.
Techniques and schemes for the web sounding and its projection into the foot:
- pulse echo and echo-images techniques for detection of longitudinal horizontal cracks with straight-beam double-crystal probe;
- pulse echo technique for detection of transverse cracks and testing of weld joints with angle-beam probe.

**UDS2-73MR and UDS2-77 MAIN SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall dimensions of flaw detector without a handle and with one ultrasonic unit and power unit</td>
<td>no more than (1040 x 1640 x 1130) mm; in transport position, no more than (900 x 2060 x 600) mm</td>
</tr>
<tr>
<td>Equipped flaw detector weight</td>
<td>no more than - 75 kg (21 kg for UDS2-77)</td>
</tr>
<tr>
<td>Keypad</td>
<td>English, Russian</td>
</tr>
<tr>
<td>Languages</td>
<td>English, Russian</td>
</tr>
<tr>
<td>Number of multiplexer units (MUX)</td>
<td>4</td>
</tr>
<tr>
<td>Number of ultrasonic channels</td>
<td>28 channels (14 for UDS2-77)</td>
</tr>
<tr>
<td>Connectors</td>
<td>BNC, RS-19</td>
</tr>
<tr>
<td>Data storage</td>
<td>Flash-card</td>
</tr>
<tr>
<td>Independent power source</td>
<td>NiMH storage battery with rated voltage 12 V and rated capacity 17 A·h</td>
</tr>
<tr>
<td>Operation time</td>
<td>8 hours</td>
</tr>
<tr>
<td>Flaw detector consumed electric power</td>
<td>no more than 30 V·A</td>
</tr>
<tr>
<td>Time of flaw detector operation mode setup</td>
<td>no more than 15 sec.</td>
</tr>
<tr>
<td>Display type</td>
<td>800 x 480 pixels</td>
</tr>
<tr>
<td>Screen dimensions (width, height, diagonal)</td>
<td>155 mm, 95 mm, 180 mm (7.5 inch)</td>
</tr>
<tr>
<td>Warranty</td>
<td>1 year</td>
</tr>
</tbody>
</table>

**INTERFACES**
- USB: USB-A (host), USB-B (slave)
- Trigger O: available
- Headphones: available
- Encoder output: single-coordinate encoder
### MAIN METROLOGICAL PERFORMANCES

- Temporal instability of sensitivity of flaw detector reception path: 0.5 dB for 8 hours of continuous operation
- Protection level in operation: IP 64
- Ambient temperature: from minus 40°C to plus 50°C
- Atmospheric pressure: from 84 to 106.7 kPa
- Relative humidity: (93 ± 3)% at the temperature of 25°C
- Full average flaw detector lifetime: no less than 10 years
- Non-failure operation: no less than 0.9 for 2000 h

### PULSER

- Initial pulse type: short pulse of negative polarity
- Initial pulse frequency:
  - one channel mode - 250 Hz; complete mode - no more than 1000 Hz
- Amplitude: 180 V
- Duration: 60 ± 10 ns
- Rising edge duration: no more than 20 ns
- Synchronization type: from the initial pulse, from the encoder

### RECEIVER

- Gain: from 0 to 100 dB with a step of 0.1, 1, 10 dB
- Input signal: no more than 2 V from peak to peak
- Input reception path resistance: no more than 300 Ω
- Digital filter: 1 standard digital filter with centre frequency of 2.5 MHz
- Rectifier: envelope

### SETUPS MODE

- Measurements: mm
- Testing range: from 0 to 1000 mm, with a step of 1, 10, 100 mm
- Velocity: from 2000 to 8000 m/s, with a step of 1, 10, 100, 1000 m/s
- Probe zero: from 0 to 60 μs, with a step of 0.1, 1 μs
- Range delay: from 0 to 1000 μs, with a step of 1, 10, 100 μs
- Refracted angle: from 0 to 90°, with a step of 10°, 100°

### ALARM system

- Sound ALARM system: sound - separate for each rail and common (for a group of channels); range of pulse frequency setup of sound indicator of alarm system is from 0.5 to 5 kHz, with setup resolution 100 Hz
- Light ALARM: light - separate for each rail and common (via all sounding channels); visual by the screen - separate for each rail and each channel.

### Measurement in A-Scan mode

- Displayed parameters: 4 measuring parameters are displayed in a status bar
  - A - echo amplitude from the defect relative to the ALARM level, dB
  - S - distance “by the beam” to a defect
  - X - defect depth coordinate, mm
  - Y - defect depth coordinate, mm
- TCG curve: max. number of dots in a gate - 14, dynamic range -100 dB, vertically adjustable step - 1 dB, horizontally adjustable step - 2 dB.

### MEASUREMENTS IN B-Scan MODE

- “Raw” B-Scan
  - A - max. echo amplitude from the defect relative to the screen center, dB
  - H - distance “by the beam” to defect, the echo signal from which has the max. amplitude, mm
  - dH - conditional length “by the beam”, mm
  - L - coordinate along the scanning path to a defect, the echo-signal from which has the max. amplitude, mm
  - dL - conditional defect length, mm
## UD3-71 main specifications

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Range</td>
<td>1 - 6000 mm</td>
</tr>
<tr>
<td>Velocity</td>
<td>1500 - 15000 m/s in steps 1, 10, 100, 1000 m/s</td>
</tr>
<tr>
<td>Angle probe</td>
<td>0 - 90°</td>
</tr>
<tr>
<td>Delay</td>
<td>0 - 9999 mm depending on the set PRF value</td>
</tr>
<tr>
<td>Gain</td>
<td>0 -100 dB in steps 0.1, 0.5, 1, 10</td>
</tr>
<tr>
<td>Rectification</td>
<td>0 - 80 % FSH</td>
</tr>
<tr>
<td>Rectification</td>
<td>Full wave, positive half wave, negative half wave, RF</td>
</tr>
<tr>
<td>Receiver bandwidth</td>
<td>0.4 - 20 MHz (- 3 dB)</td>
</tr>
<tr>
<td>Digital Frequency</td>
<td>0.4, 1, 1.25, 2, 2.5, 3, 4, 5, 6, 7, 8, 10, 15 MHz</td>
</tr>
<tr>
<td>Test Modes</td>
<td>Pulse echo and transmit/receive.</td>
</tr>
<tr>
<td>Connectors</td>
<td>BNC</td>
</tr>
<tr>
<td>Measurement Gates</td>
<td>- 2 fully independent three-level gates for amplitude and TOFD</td>
</tr>
<tr>
<td></td>
<td>- Special gate of Automatic gain control (AGC)</td>
</tr>
<tr>
<td>Result display</td>
<td>A-scan, B-scan, simultaneous of up to 5 measured parameters</td>
</tr>
<tr>
<td>DAC/TCG</td>
<td>- Number of points is 32.</td>
</tr>
<tr>
<td></td>
<td>- Building TCG curve by DAC</td>
</tr>
<tr>
<td>DGS</td>
<td>- automatic building of curve for different equivalent diameters</td>
</tr>
<tr>
<td></td>
<td>- calibration at calibration blocks and testing objects.</td>
</tr>
<tr>
<td>Internal memory</td>
<td>Micro SD card 8 Gb is used for saving the testing setups and testing results</td>
</tr>
<tr>
<td>Tandem Technique examination</td>
<td>Special Test-Rig for tandem technique is provided for the Rail weld joint</td>
</tr>
<tr>
<td>Probe</td>
<td>Complete set of probes are provided for the Rail weld examination.</td>
</tr>
<tr>
<td>Display dimension (WxH, diagonal)</td>
<td>70 mm x 50 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>0.8 kg</td>
</tr>
<tr>
<td>Overall dimensions (HxWxL)</td>
<td>200 x 100 x 110 mm</td>
</tr>
</tbody>
</table>