

# ROBOSCOPE VTM-5000/RSP

FOR NON-DESTRUCTIVE TESTING OF  
RAIL WELDED JOINTS  
AT A RAIL WELDING PLANT



# 1 APPLICATION

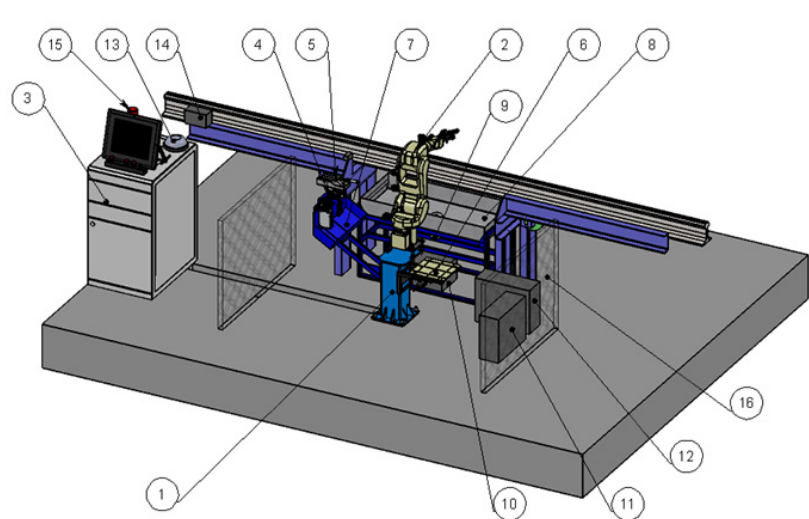
Laser scanning and flaw detection testing complex **Roboscope VTM-5000/RSP** in the configuration for nondestructive testing of rail weld joints at a rail-welding plant (hereinafter **Roboscope VTM-5000/RSP**) is a robotic nondestructive test bench which implements laser scanning and ultrasonic testing methods. Designed for nondestructive testing of rail welded joint types R50, R65, R75, welded by electric contact welding method.

**Roboscope VTM-5000/RSP** fits in a production process as an autonomous module and enables to carry out automatically:

- weld joint geometric parameters **laser gaging (including profilometry)**, video monitoring of particular zones,
- **ultrasonic testing** of the entire rail cross section **applying phased arrays**.

An electronic protocol generates for each weld joint according to the diagnostic results.

Full test cycle time is with in **5 minutes**.



- |                           |                           |                                  |
|---------------------------|---------------------------|----------------------------------|
| 1. Column                 | 6. Calibration table KS-1 | 12. Couplant preparation unit    |
| 2. Robotic arm            | 7. Tool pallet            | 13. Video recording camera       |
| 3. Control terminal       | 8. Pallet for couplant    | 14. Weld joint position encoders |
| 4. Tool cassette          | 9. Filter for couplant    | 15. Signal light                 |
| 5. Reference block SO-3R  | 10. Couplant collector    | 16. Safety barrier               |
| 6. Calibration table KS-1 | 11. Air-preparation unit  |                                  |

Fig. 1. General view of Roboscope VTM-5000 / RSP at a work cell

**1.1** The main functions of **Roboscope VTM-5000/RSP** are:

- moving and positioning of the robotic arm along the set trajectory;
- geometric measurement of a test piece at check points;
- ultrasonic testing to detect flaws in a test piece.

**1.2** General view and dimensions of the stand **Roboscope VTM-5000/RSP** are shown in Fig.1 and Fig.2.

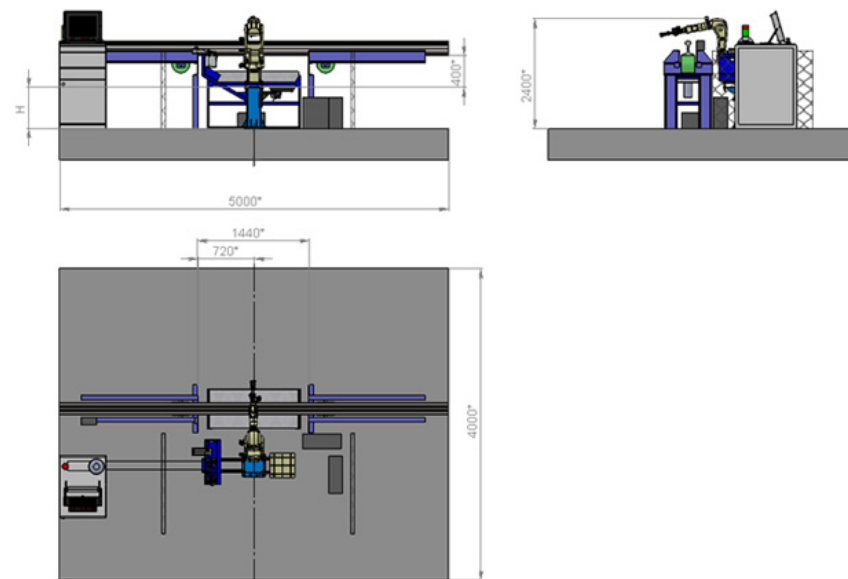


Fig. 2 Test bench dimensions

**1.3** Stand **Roboscope VTM-5000/RSP** meets the requirements of GOST R 52931, specifications TU 4276-001-83231613-16 and design documentation VTM 130.

## 2 TECHNICAL FEATURES

**2.1** Regarding the rate of operator participation in testing process **Roboscope VTM-5000/RSP** is rated as an automated machine and can operate autonomously and/or in the production process chain.

## 2.1 General specifications of Roboscop VTM-5000/RSP are shown in Table 1.

Table 1	
Features	Value
Supported nondestructive testing methods*: - laser measurement of geometric parameters, - ultrasonic (using PA)	+ +
Probe travel speed on a test piece, m/c	0 ÷ 1,0
Operating mode setting time, minutes, not more	10
Power supply parameters - mains voltage, V - frequency, Hz	380/220 50±1
Full test cycle time, min, not more	5
Continuous operation time, hours, at least	24
Operating temperature, °C	от +15 до +35
Relative humidity (at 35 °C), %, not more	95%
Mean time between failures, h, not less	10000
Maximum power consumption, kVA	3
Total weight of all equipment, kg, not more**	500
Control terminal overall dimensions (length, width, height), mm	600x800x1500
Mechanical part overall dimensions (length, width, height), mm	3000x2000x2400
Control, display and information processing means (industrial computer, general control terminal, touch display of information processing)	+
Self-diagnosis system	+
Sound and light defect detection alarming	+
Automatic couplant supply system	+

Features	Value
Couplant	oil
Automatic probe change	+
Safety barriers	+
* the number and type of channels is set by specifications ** depending on the number of components	

## 2.3 The features of a laser scanning module Roboscop VTM-5000/RSP are shown in Table 2.

Table 2	
Features	Value
Operating range of measured distances in the direction of a laser beam, mm	5÷1500
Geometry measurement error (depending on the measured distance range in the direction of laser radiation), %	±0,1
Basic coordinate system (number of measurement coordinates)	XoZ (2)
Wave length, nm	660
Data refresh rate, profiles / second, not less than	250

## 2.4 Parameters of UT-channel Roboscop-5000/RSP (basic configuration) are shown in Table 3.

Table 3	
Features	Value
Ultrasonic testing using phased array technology	+
Automatic gain control (AGC) to maintain the desired sensitivity rate of ultrasonic channels	+
Automatic acoustic contact check	+
Full automatic reset time, minutes, max	5

Features	Value
Measuring range of signal amplitudes at the receiver input, dB	67÷107
Absolute tolerance of threshold indicator setting (dead zone), dB	±0,3
Absolute tolerance of signal amplitudes measurement at a receiver input, dB	±0,5
Temporary instability of threshold indicator trigger level for 8 hours of operation, dB	±0,5
Reference tolerance of amplitude pulse setting, %	±20%
Referense tolerance setting of drive pulse generator (DPG) half-wave lenght, %	±10%
Maximum sensitivity at a frequency of 5 MHz at a signal/ noise ratio of 6 dB, mV	150
Receiver bandwidth at minus 3 dB, MHz	0,4÷10
Receiver sensitivity setting range, dB, not less than	90
Number of points to fit a distance–amplitude compensation (DAC) curve	256

**2.5.1 Control terminal** (operator's workplace or industrial cabinet) is located outside the safety barrier. It contents:

- central control module (industrial computer),
- electronic flaw detection unit,
- servo controllers of the robotic arm and other mechanisms (if available).
- touchscreen display,
- electric power equipment,
- keyboard and mouse (used during setup and maintenance),
- communication equipment,
- emergency power cutoff

Control terminal general view and places of marking are shown in Fig. 4.

**Control terminal main technical parameters:**

overall dimensions, mm.....600x800x1500

power supply: voltage, V.....380/220  
frequency, Hz.....50  
power (total), kW .....4,0  
emergency power cutoff..... +  
protective grounding..... +

### 2.5.2 Air and couplant preparation units

The **air preparation unit** is designed to prepare and supply air to pneumatic devices (pneumatic clamps and tool changers), contains filters, pressure reducers, pneumatic valves.

The **couplant preparation unit** is designed to prepare couplant for probes, contains a filter, a dosing pump, a couplant tank, a pressure reducer, a solenoid valve.

**2.5.3 The laser meter** is designed for non-contact measurement of a test piece size and its position. The laser meter can be mounted on the robot or be part of its changeable tooling. The laser meter type is depends on the technical task.

**Main technical characteristics of the laser meter**

Laser parameters:  
radiant power, mW, not more.....15  
wavelength, nm..... 440...660  
Supply voltage, V..... 9...36  
Power consumption, W not more.....5  
Protection class. ....IP67

**2.5.4 Reference blocks** (defect model measures) are designed to setup basic NDT parameters. Standard delivery set includes defect measures of MDS VOTUM set.

**Note** – a defect measure and reference block set is determined by Specifications.

**2.5.5 NDT probes** are designed to conduct testing of various test piece zones. The probes are installed in changeable blocks and placed in a cassette. The blocks are changed automatically.

**2.5.6 Changeable tools** are designed for additional automated operations in the testing process, for example, for marking of the test piece zones where flaws have been found. The tools are changed automatically.

**Note** – probe types and changeable tool set are set by specifications.

### 3 DELIVERY SET

Depending on the technical specification **Roboscop-5000/RSP** delivery set is selected in **Table 4**.

Table 4

Nº	Product name	Quantity
1	Kawasaki robotic arm	1 pcs
2	Probe changer	1 pcs
3	Control terminal, including:	1 pcs
3.1	Central control module	1 pcs
3.2	Ultrasonic testing electronic unit	1 pcs
3.3	Robotic arm servo controller	1 pcs
3.4	Touchscreen display	1 pcs
3.5	Keyboard, mouse	1 pcs
3.6	Electric power equipment	1 kit
3.7	Communication equipment	1 kit
4	Air and couplant preparation unit	1 pcs
5	Couplant collector	1 pcs
6	Mounting column for the robotic arm	2 pcs
7	Probe holding cassette	1 pcs
8	Set of ultrasonic probes*	1 kit
9	Defect measure set*	1 kit
10	Reference block «SO-3R»*	1 pcs
11	Set of connecting cables and fasteners	1 kit
12	Camera-recorder	2 pcs

Nº	Product name	Quantity
13	Spare parts kit	1 kit
14	Laser scanning and flaw detection test bench Roboscop VTM-5000. Operating manual VLNG 130 RE	1 original
15	Laser scanning and flaw detection test bench Roboscop VTM-5000. Calibration procedure VLNG130 CP	1 original
16	Laser scanning and flaw detection test bench Roboscop VTM-5000. Passport VLNG 130 PS	1 original
17	Additional documentation	1 kit
18	Software Roboscop VTM-5000	1 pcs