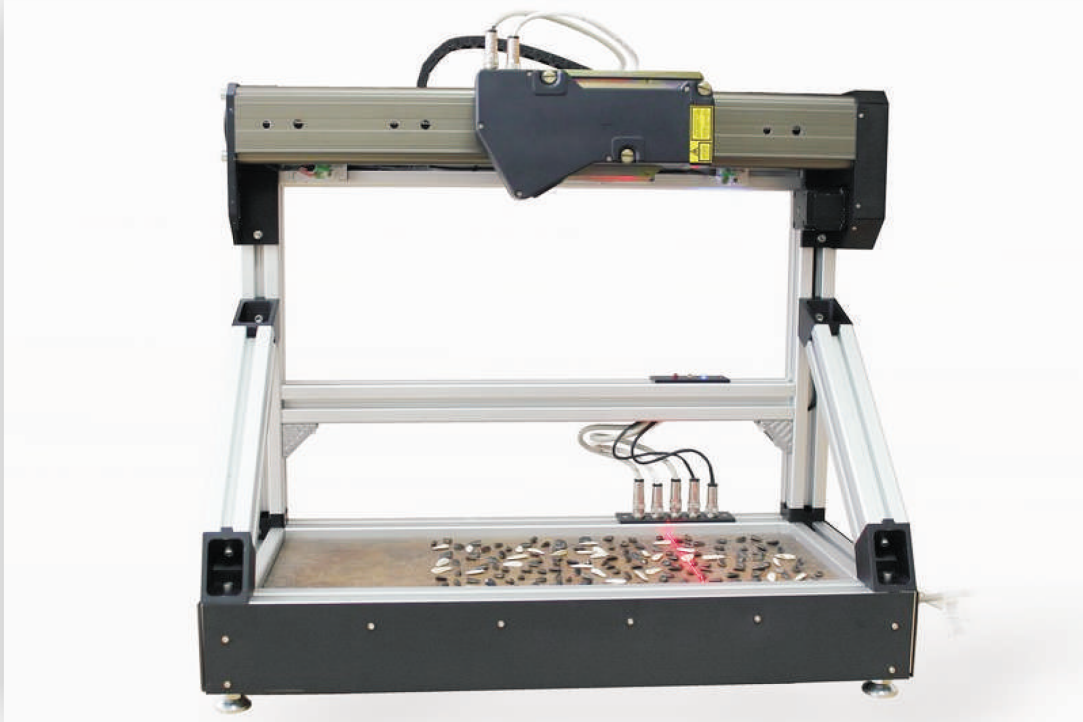




**RIFTEK**  
Sensors & Instruments



## **3D LASER SORTING MACHINE**

**RF1010SS Series**

**User's manual**

[www.riftek.com](http://www.riftek.com)  
[info@riftek.com](mailto:info@riftek.com)

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# 1 Safety precautions

- Use supply voltage and interfaces indicated in the machine specifications.
- In connection/disconnection of cables, the machine power must be switched off.
- Do not use machine in locations close to powerful light sources.
- To obtain stable results, wait about 20 minutes after machine activation to achieve uniform scanner warm-up.
- Avoid metal chips getting into the machine body;
- Do not allow foreign objects to get between moving and stationary parts of the measuring machine after turning it on;
- Do not obstruct the movement of moving parts of the machine;
- Friction parts of the ball screw assembly should be kept clean and be lubricated;
- The machine should be grounded and connected to ground line via a separate lateral line;
- It is not recommended to connect other devices and networks to the host computer.

# 2 Electromagnetic compatibility

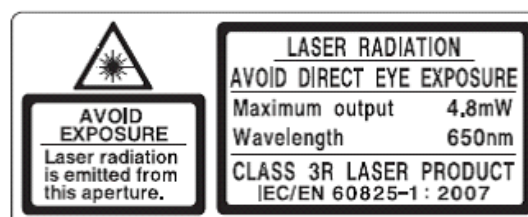
The machine has been developed for use in industry and meets the requirements of the following standards:

- EN 55022:2006 Information Technology Equipment. Radio disturbance characteristics. Limits and methods of measurement.
- EN 61000-6-2:2005 Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments.
- EN 61326-1:2006 Electrical Equipment for Measurement, Control, and Laboratory Use. EMC Requirements. General requirements.

# 3 Laser safety

The machine makes use of laser scanner. Laser scanner belongs to the 3R laser safety class according to IEC 60825-1:2007.

The scanner makes use of an c.w. 660 nm wavelength semiconductor laser. Maximum output power is 5 mW. The following warning label is placed on the body:



The following safety measures should be taken while operating the scanners:

- Do not target the laser beam to humans.
- Avoid staring into the laser beam through optical instruments.
- Use protective goggles when operating the sensor.
- Avoid staring into the laser beam.
- Do not disassemble the sensor.

# 4 General information

The measuring machine is designed for non-contact measurement of geometrical parameters of objects, specifically sunflower seeds, and is a standalone software/ hardware system.

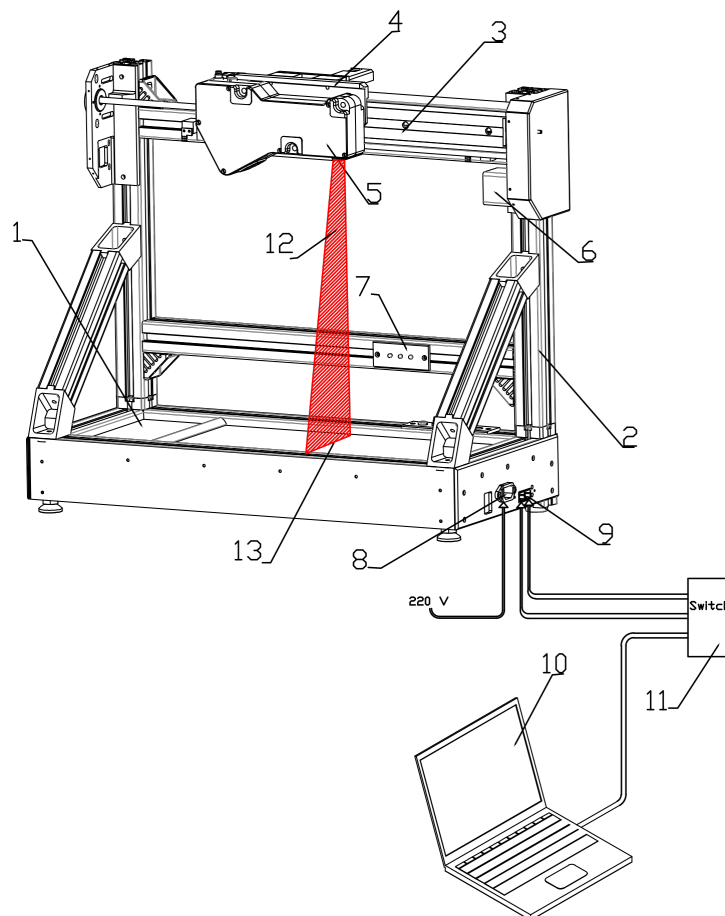
Technical characteristics of the machine can be changed for a specific task.

## 5 Structure and operating principle

The work of the machine is based on the principle of 3D laser scanning of object/objects with subsequent construction of a 3D computer model and determination of geometrical parameters from the model.

The machine structural design is illustrated in Figure 1.

The machine consists of a table 1 whereon a frame structure 2 is located with a guide 3. Installed on the guide 3 there is a carriage 4 with a laser scanner 5. The carriage 4 is driven by a stepper motor 6 by means of a ball screws assembly (not shown). In the extreme positions of the carriage 4 there are limit switches (not shown). An indicating unit 7 is mounted on the frame structure 2. On the side plate of the machine there is a power connector 8 (220V) and two network jacks 9 for Ethernet connection. Connection of the machine to PC 10 is via the network switch 11.



**Figure 1**

Laser radiation 12 of a scanner 5 is formed into a line 13 and is projected onto the table 1 where objects to be controlled are located. The laser line length corresponds to the table width. The resulting images of the contour (section profile) of the objects located on the table are analyzed by the scanner signal processor which calculates the distance to the object (Z coordinate of points) for each of a plurality of points along the laser line on the object (X coordinate of points).

The machine works as follows.

The laser scanner mounted on the carriage moves along the table 1, the direction of the movement being the coordinate Y. The laser scanner determines the coordinates of the object profile points (X, Z) at fixed regular linear intervals along the Y coordinate defined by the stepper motor drive. As a result, a 3D computer model of the scanned area is obtained in the form of a cloud of points with known coordinates (X, Y, Z). An example of the model is shown in Fig. 3. The required geometrical parameters of the object are calculated from the resulting 3D model.



Figure 2

## 6 Basic technical data

Parameter	Value
Scanning range Y-axis, mm	400
Scanning range, Z-axis, mm	300
Scanning range X (start of measurement, Z-axis), mm	130
Scanning range X (end of measurement Z-axis), mm	240
Measurement accuracy, X,Z axes, um	±150
Measurement accuracy, Y axis, um	±20
Sampling rate, profiles/s	250
Speed, mm/s	25
Parameters under control	length, width, height
Dimension, mm	730x415x180
Weight, kg	40
Power supply	alternating-current mains with sampling rate (50 ± 1) Hz, nominal power 220 with allowable stress ±10%
Power consumption, W	50
Environment conditions	Environment temperature: +1..+35°C Relative humidity at 25°C - 65%

## 7 Dimensions

The dimensions of the machine are shown in the picture 3.

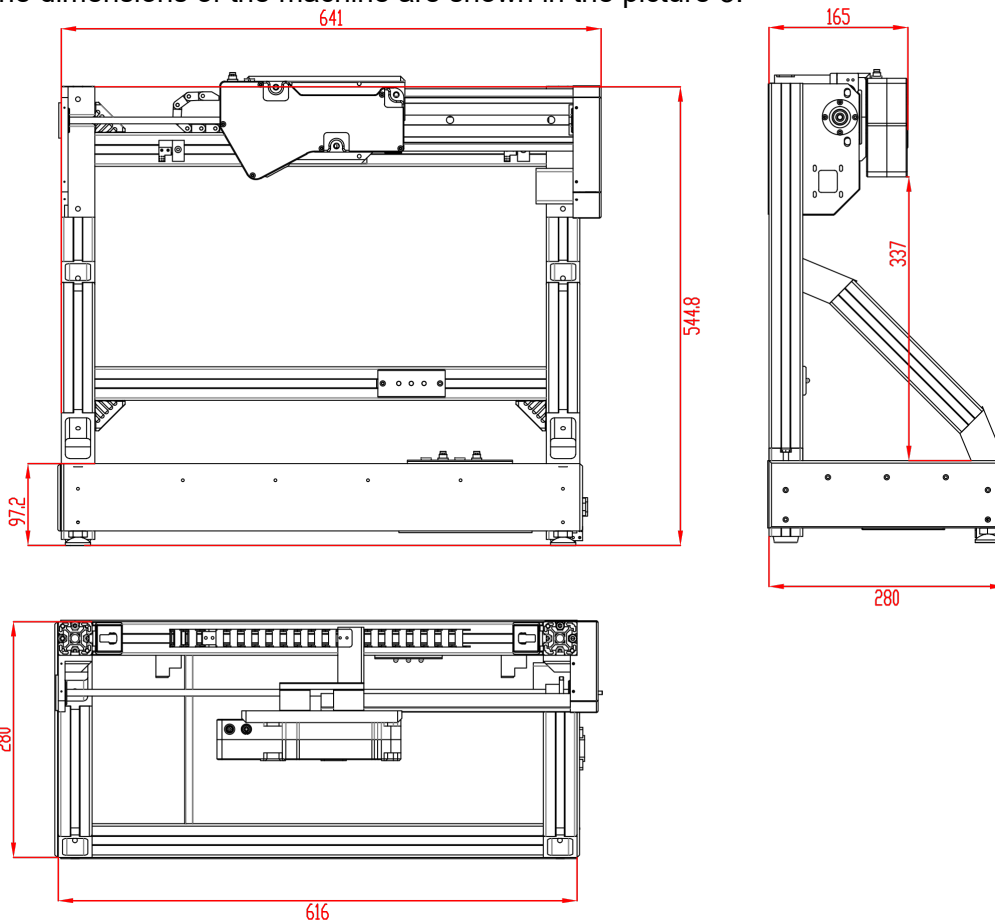


Figure 3

## 8 Preparation for work

- Connect the machine according to Fig. 1.
- Install Qt version 4.8.0 libraries, Microsoft redistributable package 2010. The library set up program vcsetup.exe is on CD which is part of the supply package. The software is adapted to the OS Windows XP, Vista, 7 environments.
- Perform network settings. Ethernet network address space is 192.168.1.X, mask word is 255.255.255.0. IP address of the PC should be in the space specified, X must not be equal to 10 (display unit address) and 15 (laser scanner address).
- It is not recommended to connect other network devices and networks to the host computer.
- Calibrate the machine in accordance with par. 9.4.

### 8.1 Necessary conditions

Necessary conditions to ensure correct operation of the machine are as follows:

- seeds should not be in touch with each other so that the size of the gap must be such that when the laser beam falls between the seeds the scanning area should be lit by the beam.
- seeds should not touch restrictive skirting around the table perimeter.

## 9 Operating the machine

The geometric parameters measurement cycle is fully automated and operation of the machine is reduced to the work with the program

The program ensures:

- control of the machine in the operation process and debugging modes,
- receiving data from the scanner and construction of a 3D model
- mathematical calculations
- input of sorting parameters
- logging of the results
- control of the machine status
- control of LED indications
- calibration of the machine

### 9.1 Working window of the program

Run the RFSeeds program. When run, the program automatically scans the network devices and connects to them. If the connection is successful the status line displays "System Ready", and the working window emerges which is shown in Fig. 4. Otherwise, description of the connection error emerges.

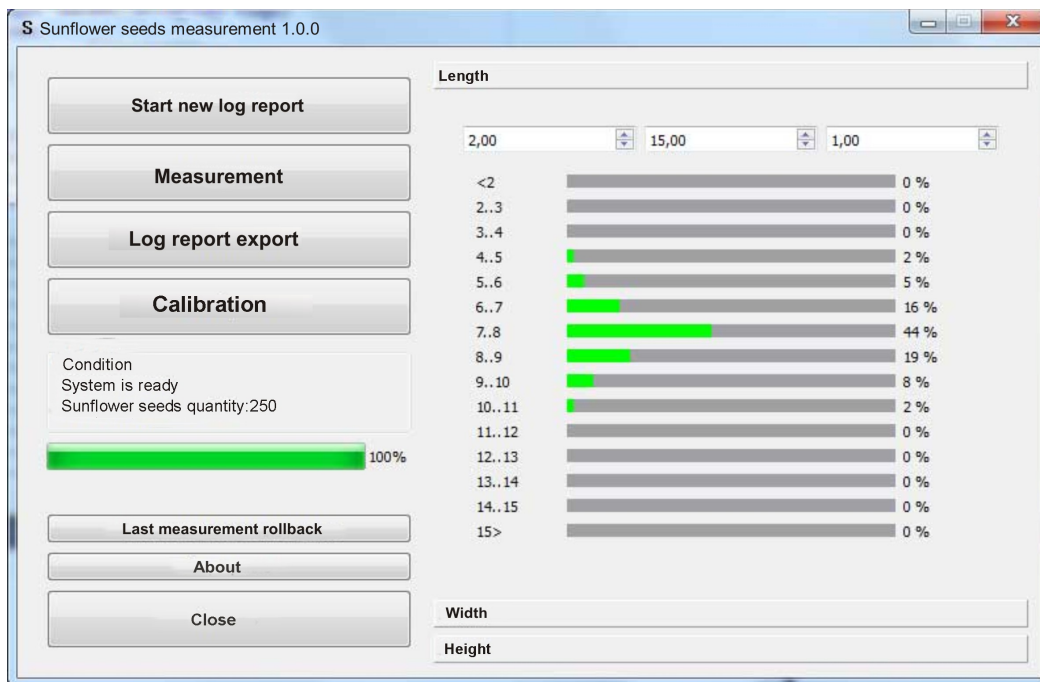


Figure 4

Control keys are located in the left part of the window. Key functions are as follows:

**Start new log report** – deletion of all accumulated data.

**Measurement** – start measurement procedure.

**Log report export** – formation of log report with measurement results.

**Calibration** – start calibration procedure.

**Last measurement rollback** – deletion of the last measurement out of data array.

The right part of the window contains:

three tabs – **Length**, **Width**, **Height**, and the field boxes common for the tabs:

the box for displaying the histogram of the distribution of seeds in size,

the box for setting the group interval as well as the upper and lower limits of the size range in histogramming.

## 9.2 Measurement procedure

- Check (form) the parameters of the histogram.
- Place the seeds on the table in accordance with the requirements of par. 8.1.
- Click the **Measurement** key. Scanning session will start. If the scanner is not located at the beginning of the range, it will first be moved to the starting position and then scanning will start. The slider in the center of the program window will display dynamics of the scanning process.
- When the scanning is finished, the program will display the number of scanned seeds and their size distribution.
- The result of each subsequent scanning is added to the previous results. To delete the accumulated data before scanning, click **Start new log report** key.
- If incorrect or incomplete scanning has been obtained, the results can be removed from the accumulated data using the **Last measurement rollback** key.

## 9.3 Logging the results

To obtain log report, click the **Log report export** key. An example of the report is shown below.

22.12.2012 16:15:55.330

**Total amount of  
sunflower seeds**  
Length

...4	1	0.813008 %
4..5	0	0 %
5..6	1	0.81 %
6..7	0	0 %
7..8	0	0 %
8..9	0	0 %
9..10	1	0.81 %
10..11	5	4.06 %
11..12	15	12.19 %
12..13	29	23.57 %
13..14	26	21.13 %
14..15	6	4.87 %
15..16	4	3.25 %
16..17	2	1.62 %
17..18	1	0.81 %
18..19	8	6.50 %
19..20	7	5.69 %
20..21	5	4.06 %

**: 123**

Width

...2	0	0 %
2..3	0	0 %
3..4	2	1.62 %
4..5	3	2.43 %
5..6	13	10.56 %
6..7	38	30.89 %
7..8	47	38.21 %
8..9	12	9.75 %
9..10	6	4.87 %
10..11	1	0.81 %
11..12	0	0 %
12..13	0	0 %
13..14	0	0 %
14..15	0	0 %
15...	1	0.81 %

Height

...1	0	0 %
1..2	0	0 %
2..3	2	1.62 %
3..4	24	19.51 %
4..5	66	53.65 %
5..6	28	22.76 %
6..7	2	1.62 %
7..8	1	0.81 %
8..9	0	0 %
9..10	0	0 %
10..11	0	0 %
11..12	0	0 %
12..13	0	0 %
13..14	0	0 %
14...	0	0 %

## 9.4 Calibration

For the first start of the machine and once a month it is recommended to calibrate the machine. To do this, remove all items from the working surface of the machine table and click **Calibration**. When the system status changes (e.g., because of transportation, reassembly), calibration must be carried in a mandatory manner.

## 9.5 Indicating lights

The indicating lights (see. Fig. 1) show the current status of the machine.

- Red LED is lit – failure.
- Blue LED is lit – machine is ready for operation.
- Yellow LED is lit – scanning is in process.



# 10 Maintenance

## 10.1 General instructions

Maintenance of the machine is carried out to ensure constant-ready status and continued availability of its work and to prevent premature failure.

## 10.2 Maintenance procedure

### 10.2.1 Daily maintenance work

Daily maintenance includes:

- Visual inspection of the machine.
- Checking of completeness.
- Inspection of the units and elements that make up the machine.
- Checking for any damage of the structural elements, power and instrument cables, indicators and connectors.
- Checking for weakening of screw connections and insulation failures.
- Before starting work, it is necessary to wipe the input and output laser scanner windows with a soft dry cloth.

### 10.2.2 Weekly maintenance work

Weekly maintenance includes:

- Cleaning of laser scanner windows with a dry soft lint-free cloth from contamination or dirt.
- Checking of free movement of the carriage.

### 10.2.3 Yearly maintenance work

Authenticated calibration of the laser scanner should be made once a year.

# 11 Routine repairs

Trouble-shooting instructions are given in the following table.

Trouble	Possible cause	Corrective actions
Incorrect measurements	Effects of extraneous illumination source	Remove extraneous illumination source or protect the machine against its effects
	Dirty laser scanner windows	Clean scanner windows
	Software malfunction	Reload the computer
	Seeds are in touch with each other	Fulfill condition in par. 8.1.
	Scanner displacement	Calibrate the machine
Scanner is out of the scanning range	Return scanner to the scanning range with the help of TestSignalBlock.exe program (included in delivery set)	
The program fails to connect with the scanner	Perform diagnostics of the scanner with the help of rf620et-sp.exe program and using description of the scanner. When adjusting the system the DHCP server may be necessary, it is included with the software (tftpd32) in the delivery set.	
Connection to the machine fails	Check network connections, run the TestSignalBlock.exe program with RFSeeds out of line. If LEDs are not controlled by clicking checkboxes in this program, it means that the indicating unit is out of order. If LEDs are controlled but there is no connection to motor (all motor setting field values = 0), it means that the motor drive is out of order.	
	Check Ethernet connection, the work of the network IC card (100 Mb/s connection should be used), firewall and antivirus program settings. The network should also allow broadcast access.	

## 12 Warranty policy

Warranty assurance for the 3D Laser Sorting Machine RF1010SS - 24 months from the date of putting in operation; warranty shelf-life - 12 months.

## 13 Distributors

### AUSTRALIA

**Applied Measurement Australia Pty Ltd**  
**RAILWAY INSTRUMENTS ONLY**  
 Thornton Plaza, Unit 5,  
 27 Thornton Crescent, Mitcham  
 VIC 3132, Australia  
 Tel: +61 39874 5777  
 Fax: +61 39874 5888  
[sales@appliedmeasurement.com.au](mailto:sales@appliedmeasurement.com.au)  
[www.appliedmeasurement.com.au](http://www.appliedmeasurement.com.au)

### BELGIUM

**Althen Sensors & Controls BV**  
 Verrijn Stuartlaan 40, 2288 EL,  
 Rijswijk, Leidschendam  
 The Netherlands  
 Tel: +31 0 70 392 4421  
 Tel: +31 0 61 396 7830  
 Tel: +31 0 64 323 8393  
[sales@althen.nl](mailto:sales@althen.nl)  
[info@althen.nl](mailto:info@althen.nl)  
[www.althensensors.com](http://www.althensensors.com)

### BOSNIA AND HERZEGOVINA

**ASCO RAIL sp. z o.o.**  
**EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT**  
 ul. Wielowiejska 53, 44-120  
 Pyskowice, Poland  
 Tel: +48 32 230 45 70  
 Fax: + 48 32 233 21 34  
[biuro@ascorail.pl](mailto:biuro@ascorail.pl)  
[export@ascorail.pl](mailto:export@ascorail.pl)  
[www.ascorail.pl](http://www.ascorail.pl)

### BRAZIL

**CAPI Controle e Automação Ltda**  
 Rua Itororó, 121, CEP 13466-240  
 Americana-SP, Brazil  
 Tel: +55 19 36047068  
 Fax: +55 19 34681791  
[capi@capicontrol.com.br](mailto:capi@capicontrol.com.br)  
[www.capicontrol.com.br](http://www.capicontrol.com.br)

### BULGARIA

**ASCO RAIL sp. z o.o.**  
**EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT**  
 ul. Wielowiejska 53, 44-120  
 Pyskowice, Poland  
 Tel: +48 32 230 45 70  
 Fax: + 48 32 233 21 34  
[biuro@ascorail.pl](mailto:biuro@ascorail.pl)  
[export@ascorail.pl](mailto:export@ascorail.pl)  
[www.ascorail.pl](http://www.ascorail.pl)

### CHILE

**MOL INGENIERIA LTDA**  
**EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT**  
 República de Honduras 11936  
 Las Condes, Santiago de Chile  
 Tel: +56 9 59200362  
[hconcha@molingeneria.com](mailto:hconcha@molingeneria.com)  
[www.molingeneria.com](http://www.molingeneria.com)

### CHILE

**Verne SpA**  
 Apoquindo 2818, oficina 31  
 Las Condes, Santiago, Chile  
 Tel: +56 2 228858633  
[info@verne.cl](mailto:info@verne.cl)  
[jsaavedra@verne.cl](mailto:jsaavedra@verne.cl)  
[www.verne.cl](http://www.verne.cl)

### CHINA

**Beijing Haiwei Lutong Technology Co., Ltd**  
 Yard 1, Tianxing Street, Fangshan  
 District, Beijing, China  
 Tel: +86 10 8366 1866  
 Fax: +86 10 8366 1866  
[info@haiwilt.com](mailto:info@haiwilt.com)  
[www.haiwilt.com](http://www.haiwilt.com)

### CHINA

**Chongqing Wolf Industrial Technology Co., Ltd**  
 Room 2307 / 2308, Light of City  
 international business building,  
 No. 19 Jiangnan Avenue, Nan'an  
 District, Chongqing, China  
 Tel: 023 62832618  
 Fax: 023 62832113  
[info@wolf-hk.com](mailto:info@wolf-hk.com)  
[www.wolf-hk.com](http://www.wolf-hk.com)

### CHINA

**Beijing Gemston Mechanical & Electrical Equipment Co., Ltd**  
**RAILWAY INSTRUMENTS ONLY**  
 Room 613, Anfu Mansion, Fengtai  
 District, Beijing, China  
 Tel: +86 10 6765 0516  
 Fax: +86 10 6765 6966  
 Mobile: +86 137 1755 1423  
[dh0526@163.com](mailto:dh0526@163.com)  
[www.baoft.cn](http://www.baoft.cn)

### CHINA

**Xi'an Win-Success Automation Technology Co.,Ltd**  
 Room 3-1-1039, Iduhui Building,  
 No.11 Tangyan South Road  
 High-Tech Zone, Xi'an  
 Shaanxi PRC, China  
 Tel: +86 29 81106280  
 Fax: +86 29 81106285  
 Mob: +86 133 19271405  
[info@maxsensor.com](mailto:info@maxsensor.com)  
[www.maxsensor.com](http://www.maxsensor.com)

### CHINA

**Micron-Metrology co., Ltd**  
 No.2, Kecheng Rd., Industrial Park  
 District, Suzhou,  
 Jiangsu Province., China  
 Tel: 0512 65589760  
 Mob: +86 189 1806 9807  
[sales@micron-metrology.cn](mailto:sales@micron-metrology.cn)  
[www.micron-metrology.cn](http://www.micron-metrology.cn)

**CHINA****Zhenshangyou Technologies Co., Ltd**

Rm 2205-2210, Zhongyou Hotel  
1110 Nanshan Road, Nanshan  
District 518054 Shenzhen, China  
Tel: +86 755-26528100/80111/8012  
Fax: +86 755-26528210/26435640  
[info@51sensors.com](mailto:info@51sensors.com)  
[www.51sensors.com](http://www.51sensors.com)

**DENMARK****BLConsult**

Ryssbält 294  
95 291 Kalix, Sweden  
Tel: +46 70 663 19 25  
[info@blconsult.se](mailto:info@blconsult.se)  
[www.blconsult.se](http://www.blconsult.se)

**FINLAND****TERÄSPYÖRÄ-STEELWHEEL OY****RAILWAY INSTRUMENTS ONLY**

Juvan teollisuuskatu 28  
FI-02920 ESPOO, Finland  
Tel: +358 400 422 900  
Fax: +358 9 2511 5510  
[steelwheel@steelwheel.fi](mailto:steelwheel@steelwheel.fi)  
[www.teraspyora.fi](http://www.teraspyora.fi)

**GERMANY****Finger GmbH & Co. KG  
OPTICAL MICROMETERS ONLY**

Sapelloh 172, 31606  
Warmßen, Germany  
Tel: +49 5767 96020  
Fax: +49 5767 93004  
[finger@finger-kg.de](mailto:finger@finger-kg.de)  
[www.finger-kg.de](http://www.finger-kg.de)

**INDIA****Influx Big Data Solutions Pvt Ltd**

No:2, Krishvi, Ground Floor,  
Old Airport Road, Domlur,  
Bangalore - 560071, India  
Tel: +91 73 37748490  
Tel: +91 94 48492380  
[milan@influxtechnology.com](mailto:milan@influxtechnology.com)  
[support\\_india@influxtechnology.com](mailto:support_india@influxtechnology.com)  
[www.influxtechnology.com](http://www.influxtechnology.com)

**CROATIA****ASCO RAIL sp. z o.o.  
EXCLUSIVE REPRESENTATIVE  
FOR RAILWAY EQUIPMENT**

ul. Wielowiejska 53, 44-120  
Pyskowice, Poland  
Tel: +48 32 230 45 70  
Fax: + 48 32 233 21 34  
[biuro@ascorail.pl](mailto:biuro@ascorail.pl)  
[export@ascorail.pl](mailto:export@ascorail.pl)  
[www.ascorail.pl](http://www.ascorail.pl)

**ESTONIA****FoodLab OÜ**

Haabersti linnaosa, Astangu tn 52  
13519 Eesti, Tallinn, Estonia  
Tel: +372 56 363110  
[foodlab.ee@gmail.com](mailto:foodlab.ee@gmail.com)

**FRANCE****BLET Measurement Group S.A.S.**

1 avenue du Président Georges  
Pompidou, 92500 Rueil  
Malmaison, France  
Tel: + 33 0 1 80 88 57 85  
Fax: +33 0 1 80 88 57 93  
[technique@blet-mesure.fr](mailto:technique@blet-mesure.fr)  
[www.blet-mesure.fr](http://www.blet-mesure.fr)

**GERMANY****ALTHEN GmbH Meß- und  
Sensortechnik**

Dieselstrasse 2, 65779  
Kelkheim, Germany  
Tel: +49 0 6195 7 00 60  
[info@althen.de](mailto:info@althen.de)  
[www.althensensors.com/de/](http://www.althensensors.com/de/)

**INDIA****Paragon Instrumentation  
Engineers Pvt. Ltd.**

**RAILWAY INSTRUMENTS ONLY**  
200, Station Road,  
Roorkee, 247 667, India  
Tel: +91 1332 272394  
[tanuj@paragoninstruments.com](mailto:tanuj@paragoninstruments.com)  
[www.paragoninstruments.com](http://www.paragoninstruments.com)

**CZECH REPUBLIC****ASCO RAIL sp. z o.o.  
EXCLUSIVE REPRESENTATIVE  
FOR RAILWAY EQUIPMENT**

ul. Wielowiejska 53, 44-120  
Pyskowice, Poland  
Tel: +48 32 230 45 70  
Fax: + 48 32 233 21 34  
[biuro@ascorail.pl](mailto:biuro@ascorail.pl)  
[export@ascorail.pl](mailto:export@ascorail.pl)  
[www.ascorail.pl](http://www.ascorail.pl)

**FINLAND****Kvalitest Industrial AB  
EXCEPT FOR RAILWAY  
INSTRUMENTS**

Ekbacksvägen 28,  
16869 Bromma, Sweden  
Tel: +46 0 76 525 5000  
[sales@kvalitest.com](mailto:sales@kvalitest.com)  
[www.kvalitest.com](http://www.kvalitest.com)  
[www.kvalitest.se](http://www.kvalitest.se)

**GERMANY****Disynet GmbH**

Breyeller Str. 2, 41379  
Brueggen, Germany  
Tel: +49 2157 8799 0  
Fax: +49 2157 8799 22  
[disynet@sensoren.de](mailto:disynet@sensoren.de)  
[www.sensoren.de](http://www.sensoren.de)

**HUNGARY****ASCO RAIL sp. z o.o.  
EXCLUSIVE REPRESENTATIVE  
FOR RAILWAY EQUIPMENT**

ul. Wielowiejska 53, 44-120  
Pyskowice, Poland  
Tel: +48 32 230 45 70  
Fax: + 48 32 233 21 34  
[biuro@ascorail.pl](mailto:biuro@ascorail.pl)  
[export@ascorail.pl](mailto:export@ascorail.pl)  
[www.ascorail.pl](http://www.ascorail.pl)

**INDONESIA****PT. DHAYA BASWARA  
SANIYASA**

Botanic Junction Blok H-9 NO. 7  
Mega Kebon Jeruk, Joglo  
Jakarta, 11640, Indonesia  
Tel: +62 21 2932 5859  
[management@ptdbs.co.id](mailto:management@ptdbs.co.id)

**ISRAEL****Nisso Dekalo Import  
Export LTD**

1 David Hamelech Street  
Herzlia 46661 Israel  
Tel: +972 99577888  
Fax: +972 99568860  
[nissodekaloltd@outlook.com](mailto:nissodekaloltd@outlook.com)  
[www.fly-supply.net](http://www.fly-supply.net)  
[www.aircraft-partsupply.com](http://www.aircraft-partsupply.com)

**ITALY****FAE s.r.l.**

Via Tertulliano, 41  
20137 Milano, Italy  
Tel: +39 02 55187133  
Fax: +39 02 55187399  
[fae@fae.it](mailto:fae@fae.it)  
[www.fae.it](http://www.fae.it)

**JAPAN****Tokyo Instruments, Inc.**

6-18-14 Nishikasai, Edogawa-ku,  
Tokyo, 134-0088 Japan  
Tel: +81 3 3686 4711  
Fax: +81 3 3686 0831  
[f\\_kuribayashi@tokyoinst.co.jp](mailto:f_kuribayashi@tokyoinst.co.jp)  
[www.tokyoinst.co.jp](http://www.tokyoinst.co.jp)

**LATVIA****FoodLab OÜ**

Haabersti linnaosa, Astangu tn 52  
13519 Eesti, Tallinn, Estonia  
Tel: +372 56363110  
[foodlab.ee@gmail.com](mailto:foodlab.ee@gmail.com)

**LUXEMBOURG****Althen Sensors & Controls  
BV**

Verrijn Stuartlaan 40, 2288 EL,  
Rijswijk, Leidschendam  
The Netherlands  
Tel: +31 0 70 392 4421  
Tel: +31 0 61 396 7830  
Tel: +31 0 64 323 8393  
[sales@althen.nl](mailto:sales@althen.nl)  
[info@althen.nl](mailto:info@althen.nl)  
[www.althensensors.com](http://www.althensensors.com)

**MALAYSIA****OptoCom InstruVentures**

H-49-2, Jalan 5, Cosmoplex  
Industrial Park, Bandar Baru  
Salak Tinggi, Sepang, Malaysia  
Tel: 603 8706 6806  
Fax: 603 8706 6809  
[optocom@tm.net.my](mailto:optocom@tm.net.my)  
[www.optocom.com.my](http://www.optocom.com.my)

**12****MONTENEGRO****ASCO RAIL sp. z o.o.  
EXCLUSIVE REPRESENTATIVE  
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ul. Wielowiejska 53, 44-120  
Pyskowice, Poland  
Tel: +48 32 230 45 70  
Fax: + 48 32 233 21 34  
[biuro@ascorail.pl](mailto:biuro@ascorail.pl)  
[export@ascorail.pl](mailto:export@ascorail.pl)  
[www.ascorail.pl](http://www.ascorail.pl)

**NETHERLANDS****Althen Sensors & Controls  
BV**

Verrijn Stuartlaan 40, 2288 EL,  
Rijswijk, Leidschendam  
The Netherlands  
Tel: +31 0 70 392 4421  
Tel: +31 0 61 396 7830  
Tel: +31 0 64 323 8393  
[sales@althen.nl](mailto:sales@althen.nl)  
[info@althen.nl](mailto:info@althen.nl)  
[www.althensensors.com](http://www.althensensors.com)

**NORWAY****BLConsult**

Ryssbält 294,  
95 291 Kalix, Sweden  
Tel: +46 70 663 19 25  
[info@blconsult.se](mailto:info@blconsult.se)  
[www.blconsult.se](http://www.blconsult.se)

**NORWAY****Salitec AS**

PB 468, N-1327  
Lysaker, Norway  
Tel: +47 23 891015  
Fax: +47 92101005  
[mail@salitec.no](mailto:mail@salitec.no)  
[www.salitec.no](http://www.salitec.no)

**PERU****Verne Perú S.A.C.**

Las Codornices 104,  
Surquillo, Lima, Peru  
Tel/fax: +51 992436734  
[info@verne.cl](mailto:info@verne.cl)  
[www.verne.cl](http://www.verne.cl)

**POLAND****ASCO RAIL sp. z o.o.  
EXCLUSIVE REPRESENTATIVE  
FOR RAILWAY EQUIPMENT**

ul. Wielowiejska 53, 44-120  
Pyskowice, Poland  
Tel: +48 32 230 45 70  
Fax: + 48 32 233 21 34  
[biuro@ascorail.pl](mailto:biuro@ascorail.pl)  
[export@ascorail.pl](mailto:export@ascorail.pl)  
[www.ascorail.pl](http://www.ascorail.pl)

**POLAND**

**RIFTEK EUROPE sp. z o.o.**  
ul. Domaniewska 17/19, 02-672  
Warsaw, Poland  
[info@riftek.com](mailto:info@riftek.com)  
[www.riftek.com](http://www.riftek.com)

**SLOVAKIA**

**ASCO RAIL sp. z o.o.**  
**EXCLUSIVE REPRESENTATIVE  
FOR RAILWAY EQUIPMENT**  
ul. Wielowiejska 53, 44-120  
Pyskowice, Poland  
Tel: +48 32 230 45 70  
Fax: + 48 32 233 21 34  
[biuro@ascorail.pl](mailto:biuro@ascorail.pl)  
[export@ascorail.pl](mailto:export@ascorail.pl)  
[www.ascorail.pl](http://www.ascorail.pl)

**SOUTH KOREA**

**PROSEN. CO., LTD**  
M-1001, Songdo techno park IT  
center, 32, Songdogwahak-ro,  
Yeonsu-gu, Incheon, 21984,  
Republic of Korea  
Tel: +82 32 811 3457  
Fax: +82 32 232 7458  
[trade@prosen.co.kr](mailto:trade@prosen.co.kr)  
[www.prosen.co.kr](http://www.prosen.co.kr)

**SWEDEN**

**Kvalitest Industrial AB**  
**EXCEPT FOR RAILWAY  
INSTRUMENTS**  
Ekbacksvägen 28,  
16869 Bromma, Sweden  
Tel: +46 0 76 525 5000  
[sales@kvalitest.com](mailto:sales@kvalitest.com)  
[www.kvalitest.com](http://www.kvalitest.com)  
[www.kvalitest.se](http://www.kvalitest.se)

**TURKEY**

**MAK Elektronik Malzeme  
Analiz ve Kalite Kontrol  
Cihazlari Dis Tic. Ltd. Sti.**  
Cenap Sahabettin Sokak, No:39,  
34718 Kosuyolu - Kadikoy /  
Istanbul - TURKEY  
Tel: +90 216 402 10 34  
Fax: +90 216 402 10 35  
[ulastac@metalografi.net](mailto:ulastac@metalografi.net)  
[www.makelektronik.com.tr](http://www.makelektronik.com.tr)

**PORTUGAL**

**Campal Inovacoes  
Ferroviarias Lda.**  
Lagoas Park, Edificio 7, 1° Piso  
Sul, 2740-244 Porto Salvo, Oeiras,  
Portugal  
Tel: +351 21 584 4348  
[campal@campal.pt](mailto:campal@campal.pt)  
[www.campal.pt](http://www.campal.pt)

**SLOVENIA**

**ASCO RAIL sp. z o.o.**  
**EXCLUSIVE REPRESENTATIVE  
FOR RAILWAY EQUIPMENT**  
ul. Wielowiejska 53, 44-120  
Pyskowice, Poland  
Tel: +48 32 230 45 70  
Fax: + 48 32 233 21 34  
[biuro@ascorail.pl](mailto:biuro@ascorail.pl)  
[export@ascorail.pl](mailto:export@ascorail.pl)  
[www.ascorail.pl](http://www.ascorail.pl)

**SPAIN**

**IBERFLUID Instruments S.A.**  
C/ Botanica, 122, 08908  
L'Hospitalet de Llobregat  
Barcelona  
Tel: +34 93 447 10 65  
Fax: +34 93 334 05 24  
[myct@iberfluid.com](mailto:myct@iberfluid.com)  
[www.iberfluid.com](http://www.iberfluid.com)

**SWITZERLAND**

**ID&T GmbH**  
Gewerbstrasse 12/a  
8132 Egg (Zurich), Switzerland  
Tel: + 41 44 994 92 32  
Fax: + 41 44 994 92 34  
[info@idtlaser.com](mailto:info@idtlaser.com)  
[www.idtlaser.com](http://www.idtlaser.com)

**TURKEY**

**TEKMA Mühendislik A.S.**  
Cevizli Mh. M. Kemal Cd.,  
Hukukçular Towers,  
A-Blok, No: 66-A/39  
Kartal - Istanbul  
Tel: +90 216 970 1318  
Tel: +90 850 840 2334  
[info@tekma.eu](mailto:info@tekma.eu)  
[www.tekma.eu](http://www.tekma.eu)

**SERBIA**

**ASCO RAIL sp. z o.o.**  
**EXCLUSIVE REPRESENTATIVE  
FOR RAILWAY EQUIPMENT**  
ul. Wielowiejska 53, 44-120  
Pyskowice, Poland  
Tel: +48 32 230 45 70  
Fax: + 48 32 233 21 34  
[biuro@ascorail.pl](mailto:biuro@ascorail.pl)  
[export@ascorail.pl](mailto:export@ascorail.pl)  
[www.ascorail.pl](http://www.ascorail.pl)

**SOUTH KOREA**

**BS Holdings**  
B-201, Wonpogongwon 1ro,  
59 Danwon-gu, Ansan-si,  
Gyeonggi-do 15455, Republic of  
Korea  
Tel: +82 31 411 5011  
Fax: +82 31 411 5015  
[bsh5011@hanmail.net](mailto:bsh5011@hanmail.net)  
[www.lasersolution.co.kr](http://www.lasersolution.co.kr)

**SWEDEN**

**BLConsult**  
Ryssbält 294,  
95 291 Kalix, Sweden  
Tel: +46 70 663 19 25  
[info@blconsult.se](mailto:info@blconsult.se)  
[www.blconsult.se](http://www.blconsult.se)

**THAILAND**

**Advantech Solution Co., Ltd.**  
20/170 Motorway Rd.,  
Kwang Pravet, Khet Pravet,  
Bangkok, Thailand 10250  
Tel: +662 1848705  
Fax: +662 1848708  
[sales@advantechsolution.com](mailto:sales@advantechsolution.com)  
[www.advantechsolution.com](http://www.advantechsolution.com)

**UKRAINE**

**KODA**  
Frunze st. 22, 61002,  
Harkov, Ukraine  
Tel/Fax: +38 057 714 26 54  
[mail@koda.com.ua](mailto:mail@koda.com.ua)  
[www.koda.com.ua](http://www.koda.com.ua)

UNITED KINGDOM,  
IRELAND

**Althen UK**

Northamptonshire  
United Kingdom  
Tel: +44 0 7823 921427  
[t.stoyles@althen.co.uk](mailto:t.stoyles@althen.co.uk)  
[www.althensensors.com](http://www.althensensors.com)  
[www.althencontrols.com](http://www.althencontrols.com)

USA

**Althen Sensors & Controls**

2531 Bradley St., Oceanside, CA,  
92056, USA  
Tel: 858 633 3572  
[r.ream@althensensors.com](mailto:r.ream@althensensors.com)

USA, CANADA, MEXICO

**Acuity Products of Schmitt  
Industries, Inc.**

2765 NW Nicolai Street  
Portland, OR, 97210, USA  
Tel: +1 503 227 7908  
Fax: +1 503 223 1258  
[sales@acuitylaser.com](mailto:sales@acuitylaser.com)  
[www.acuitylaser.com](http://www.acuitylaser.com)

USA, CANADA, MEXICO

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850 River Street, Troy,  
New York, USA  
Tel: +1 518 268-1636  
Fax: +1 518 268-1639  
[marketing@iem.net](mailto:marketing@iem.net)  
[www.iem.net](http://www.iem.net)