RD545

Acoustic leak detector

Operation Manual | Issue 2 | June 2009

Radiodetection
AN SPX COMPANY

90/RD545-OPMAN-ENG/02

Preface

Before you begin

Thank you for your interest in Radiodetection's RD545 water leak detection and location system.

Please read this user manual before attempting to use the RD545 system.

Radiodetection products, including this manual, are under continuous development. The information contained within is accurate at time of publication; however the RD545, this manual and all its contents are subject to change.

Radiodetection Limited reserves the right to modify the product without notice and some product changes may have taken place after this user manual was published.

Contact your local Radiodetection dealer or visit www.radiodetection.com for the latest information about the RD545 product family, including this manual.

Important notices

General

This instrument, or family of instruments, will not be permanently damaged by reasonable electrostatic discharge and has been tested in accordance with IEC 801-2. However, in extreme cases temporary malfunction may occur.
If this happens, switch off, wait and switch on again. If the instrument still malfunctions, disconnect the batteries for a few seconds.

Safety

This equipment should be used by fully qualified and trained personnel only.

Reduce audio level before using headphones to avoid damaging your hearing.

⚠ WARNING! This equipment is NOT approved for use in areas where hazardous gases may be present.

Training

Radiodetection provides training services for most Radiodetection products. Our qualified instructors will train equipment operators or other personnel at your preferred location or at Radiodetection headquarters.

For more information go to www.radiodetection.com or contact your local Radiodetection representative.

Trademarks

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Section 1 – Introduction

1.1 General information

The RD545 leakage detection system combines decades of experience and state-of-the-art sensor technique with the latest electronic technology. The RD545 allows an untrained operator to locate leakages with ease. Leakage-borne noises are amplified and interfering noises are filtered out. A major advantage of the RD545 is that it offers an automatic saving of measurement data to memory. In summary the RD545 features:

- Ease of operation.
- Leakage noise amplification.
- Advanced filtering.
- Rapid on-screen leak detection.
- Automatic backlit LCD.

1.2 System components

1 unit	RD545 central unit	1 unit	testrod
1 unit	leveling base	1 unit	charger
1 unit	headphones	1 unit	ground microphone including cable
1 unit	operator´s manual		

1.3 Display

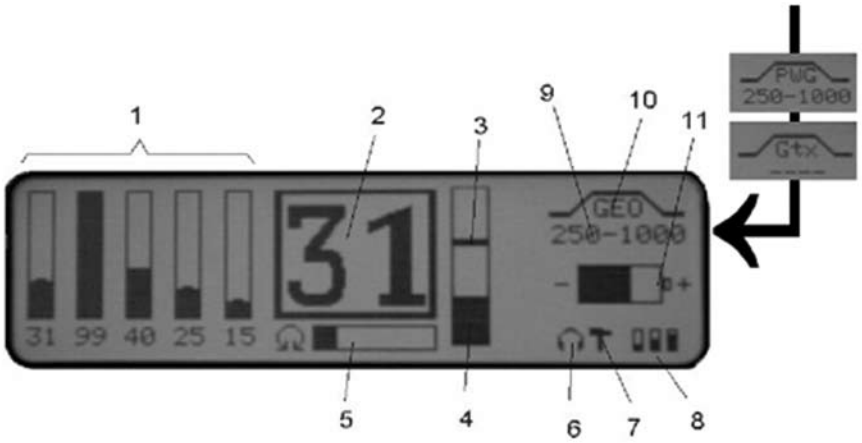


Figure 1: RD545 LCD

1. Saved minimum levels of previous measurements.
2. Minimum level of current measurement (numerical).
3. Present level of current measurement.
4. Minimum level of current measurement (graphical).
5. Adjustment of amplification sensitivity.
6. Display headphones.
7. Headphone noise reduction.
8. Automatic display modulation.
9. Frequency adjustment (geophone / PWG measurement).
10. Mode of operation (GEO – PWG – GTX).
11. Battery status.

1.4 Central unit

Controls:

1. LCD.
2. Start button.
3. Setting display sensitivity.
4. Headphone volume control.
5. Select frequency.

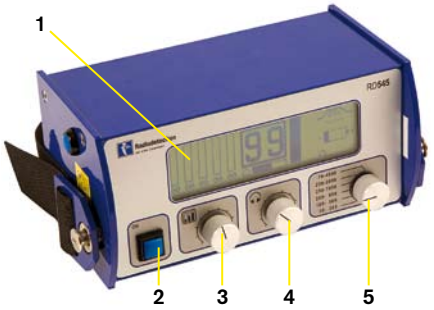


Figure 2: Controls.

Connections:

1. Battery charger.
2. Ground microphone input.
3. Headphones.
4. Photo sensor.

Figure 3: Connection sockets.

Adjustment control:

1. Adjustment control for automatic amplification.

Figure 4: Adjustment knob.

Section 2 – Operation

2.1 Charging the batteries

Connect the battery charger to the power supply (220 volt) and to socket 6 of the RD545.

The charging status is displayed while the battery is being charged. Charging is completed when the display reads O.K. Internal software prevents the batteries from being damaged or overcharged.

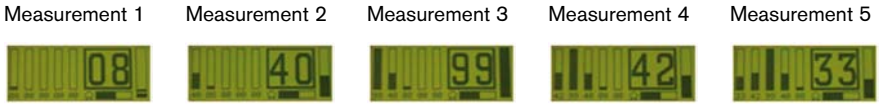
2.2 Switch on RD545

RD545 can be switched on either by pressing Start (2) on the central unit or by initiating a measurement via the handle of the connected sensor.

2.3 Battery control

The LCD displays the current voltage and reminds the user to charge the device, when necessary.

2.4 Level display and data memory



When the activation key on the handle of the sensor or the central unit is released, the system will save the current minimum value. The display shows the last 5 levels and the current level simultaneously.

2.5 Microphone connection

The input socket (2) for the ground microphone and the testrod is located on the side of the device.

2.5.1 Testrod

The testrod is used to listen to directly accessible contact points such as hydrants and valves to pinpoint the location of the pipe fracture.

2.5.2 Ground microphone

The broadband-type ground microphone (70 – 800 Hz) can locate all leak noise. It is used above ground and is suitable for use with soil types.

2.6 Adjustments

2.6.1 Headphone volume

You can adjust the headphone volume to suit your preferences by using the adjusting knob (4) or the receiver earpiece.

The headphone volume is automatically reduced for hearing shock protection purposes when the leak noise is too loud (symbol (7) hammer displayed).

2.6.2 Adjusting the level display

The signal received by the ground microphone is displayed on the LCD (2) as a 2 digit number in the range of 00 – 99. The signal's noise is also played through the headphones. You can adjust the position of the display using the amplification control (5) so that the displayed noise level is in the middle of the screen; this allows the user to view all possible peaks and troughs.

NOTE: Changing the position of the amplification control will overwrite displayed data.

2.7 Selecting operation mode

Pressing the adjustment control will allow the user to access the operation mode selection field. The display will show the selected mode as a flashing icon. Press the adjustment control key again to change the operation mode.

2.7.1 Operation modes

- GEO: Geophone or testrod measurement procedure.
- PWG: Search pipelines with the ground pick-up (pipeline to be irradiated acoustically by Pulse Wave Generator).
- GTX: Search empty pipelines (pipeline to be irradiated through loudspeakers).

2.8 Input settings

Input parameters: switch-off time

general setting for hearing shock protection

hearing shock protection for PWG measurement

display – serial number

2.8.1 Settings overview

Switch-off time

Period of time between the last geophone operation and the automatic switch-off of the RD545.

General settings for hearing shock protection

Strong short-term noises such as water hammer can potentially damage the user's hearing. To reduce risk the RD545 geophone features hearing shock protection. In the event of water hammer or other pipeline noised, the RD545 will automatically reduce amplification to help prevent damage to hearing. The user can adjust the sensitivity of the hearing shock protection to suit their preferences.

NOTE: The device must be switched off before setting the parameters.

Hearing shock protection for PWG measurement

Unlike regular geophone measurement procedures, the clearest noise is received by a PWG measurement. Therefore, the shock protection should be switched off.

NOTE: The RD545 has to be switched off before setting the parameters / displaying the device parameters.

Procedure:

1. Plug in power supply unit
2. When is displayed, press the adjust key and the switch-on key simultaneously.

The display will read OK and display a two-digit number representing a menu choice. By pressing the power key, the selected option will be initiated.

- 01 Switch-off time.
- 00 Pressing the adjust key cancels the menu.
- 05 Version number.
- 04 Serial number.
- 03 Set hearing shock protection for PWG.
- 02 General setting for hearing shock protection.

2.8.2 Settings

Press the adjustment control key to activate the menu for changes. A tick (✔) will be displayed, and the changes will be implemented. The start key selects the specific option.

01 Set the switch-off time

Calculation of the switch-off time as follows:

The set figure is 2.

Example: 20 sec. + 20 sec. X 2 = 60 sec.

Press the adjust key again to accept the setting. The display now shows a tick (v).

02 General setting for hearing shock protection

The figures represent:

- 1 High sensitivity.
- 2 Medium sensitivity.
- 3 Low sensitivity.
- 0 Hearing shock protection de-activated.

Press the adjust key again to accept the setting. The display now shows a tick (✔).

03 Setting hearing shock protection for PWG measurement

The figures represent:

- 1 (2,3): Shock protection activated.
- 0: Shock protection de-activated.

Section 3 – Leakage-borne noise

Every pressurized pipeline system creates leak noise at a fracture point. Different sizes and dimensions of pipeline cracks or fractures result in different noise volumes and frequencies. There are two ways of using the RD545 to detect leak noise..

3.1 Noise transmission through the pipeline

Fittings such as hydrants, valves and other metallic connections can transmit leak noise. Normally, fractures on plastic pipelines are accompanied by low frequency leak noise, and fractures on metallic pipelines generate high frequency leak noise.

3.2 Noise transmission through the soil

The soil around the leakage spot is activated due to the energy of the leaking fluid. The vibrations can be acoustically detected on the surface.

3.3 Above-surface noise pick-up method

Experience has shown that frequencies between 70 - 800 Hz are indicators of leak noise.

3.4 Noise detection at metallic fittings

The testrod point detects leak noise at a fitting (water meter, valve, hydrant, etc.). Depending on the pipeline material (for example plastic or metal), the frequencies picked up differ significantly.

Therefore the frequency band for this method is wider than the frequency band for the above-surface noise pick-up method.

Section 4 – Searching for leaks

You need a systematic approach when locating a leakage in a water pipeline. Before attempting to locate the leak, it's advised that you first trace the path of the pipeline. Then you must locate the general area of the pipe where the leak is located. Finally you must pinpoint the leak's location. With a systematic approach, the complete length of the pipeline must be checked until the leakage is detected.

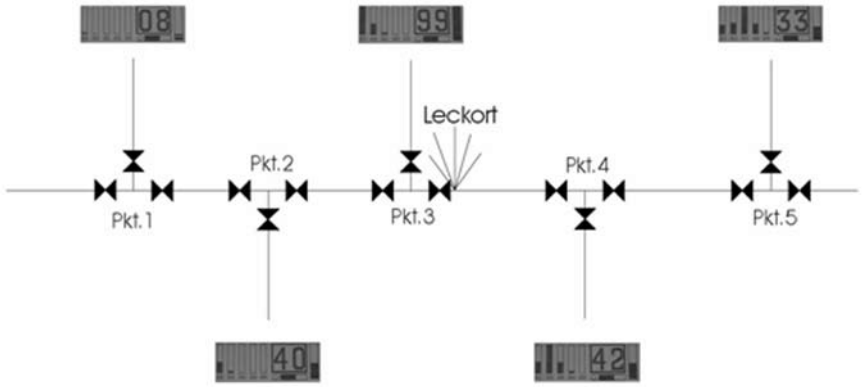
4.1 Locating the leakage area (testrod)

Use the testrod to check any accessible contact points along the pipe. The operator must ensure that the noises received are the result of a leakage (muffled sound) rather than the result of stopper neckings (high sound). Both sounds are useful when determining the general area of a leakage.

Note that flow noises can also be generated by regular discharges. Figure 5 shows how the leakage area can be narrowed by accessing the measurement data of the contact spot of the particular pipeline. The example below shows the highest figures between the measurement points 3 and 4. Therefore, the leakage must be located between these two contact spots. When narrowing a leakage, the operator has to make sure that no measurement data exceeds the scale range so that the maximum value can be identified.

If a measurement point shows a full-scale reflection, re-adjust the display with the control knob (3) or the adjusting knob (1) e.g. up to 50 so that an increase in reflection is visible. In the case of a reduced reflection, the pipeline section concerned has to be checked again in order to identify the actual increase and decrease of the volume and thus to identify the two maximum values.

The measurement data memory has proved to be an enormous advantage as the last data is at the user´s disposal until the next measurement procedure starts. The pipeline section with the highest noise intensity can be determined if the adjustments of the RD545 are not changed. The following above-surface leakage detection procedure then has to be carried out on the particular pipeline section.



Leckort = leakage spot

Figure 5: Locating leaks with the testrod

4.2 Pinpointing leaks

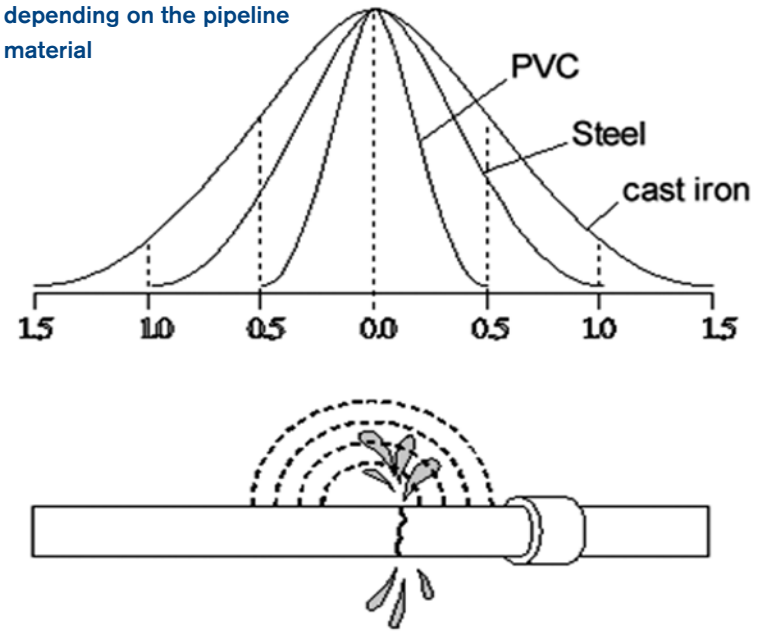
If the testrod has located a leak noise, you can apply the ground microphone to pinpoint the leak. When moving the ground microphone equipment, the operator must ensure that the sounding points are sufficiently close to each other otherwise the operator might miss the leak. Figure 6 below shows the recommended distances for:

- cast iron pipelines = 250 cm
- steel pipelines = 150 cm
- plastic pipelines = 75 cm

As shown in the chart above, to determine the exact location of the leak you should position the ground microphone directly above the pipeline. For example, an error margin of 1m can occur when searching for a leak on a plastic pipeline. If the path of the pipeline is not known, the operator might have to apply a search pattern; the coordination width of this pattern depends on the pipeline material (see above).

If the path of the pipeline is unknown and you do not follow a search pattern, then you may fail to pinpoint the leak.

Figure 6: noise propagation depending on the pipeline material



Section 5 – Appendix

5.1 Specifications

Amplification:	≧ 60,000fold with low noise factor
Input impedance:	1 MΩ
Filter (testrod):	70 Hz – 4,000 Hz 250 Hz – 2,000 Hz 250 Hz – 1,000 Hz
Filter (ground microphone):	200 Hz – 800 Hz 100 Hz – 500 Hz 70 Hz – 250 Hz
Data memory:	automatic (last 6 measurements)
Functions:	detecting pipeline fractures locating pipelines (receiver)
Adjust function:	display sensitivity automatically set
Display:	automatically illuminated LCD
Displayed data:	current value minimum value averaged value remaining battery capacity state of charging
Battery control:	through microcontroller
Output impedance:	≤ 10 Ù
Power supply:	7.2 volt
Operating time:	about 20 hrs. under normal conditions
Microphone socket:	bayonet type
Headphones socket:	6.3mm (mono) jack type
Operating temperature:	between -15°C and +55°C
Storing temperature:	between –25°C and +65°C
Dimensions L/W/H (central unit):	210 / 120 / 105mm
Weight (central unit):	about 1,700 gram

Specifications are subject to change without prior notice.

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