REED
INSTRUMENTS

Ultrasonic Thickness Gauge

REED R7900

HIGH
5900 m/s

| MENU | F1 | 5M | ALARM |

Ultrasonic Thickness Gauge

Ultrasonic Thickness Gauge

WARRANTY
1 YEAR
WARRANTY

Instruction Manual

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Introduction

Thank you for purchasing your REED R7900 Ultrasonic Thickness Gauge. Please read the following instructions carefully before using your instrument. By following the steps outlined in this manual your meter will provide years of reliable service.

Product Quality

This product has been manufactured in an ISO9001 facility and has been calibrated during the manufacturing process to meet the stated product specifications. If a certificate of calibration is required please contact the nearest authorized REED distributor or authorized Service Center. Please note an additional fee for this service will apply.

Security

Never attempt to repair or modify your instrument. Dismantling your product, other than for the purpose of replacing batteries, may cause damage that will not be covered under the manufacturer's warranty. Servicing should only be provided by an authorized service center.

Features

- Measures a wide range of material including; metals, plastic, ceramics, composites, epoxies, glass, and other ultrasonic conductive materials
- Easy-to-read backlit LCD display
- User selectable unit of measure (in/mm)
- Internal memory stores up to 500 measurements
- Displays sound velocity at the touch of a button
- Zero adjustment button
- User adjustable High/Low alarms
- Built-in two-point calibration function
- Auto sleep, shut off and low battery indicator

Specifications

Measuring Range:	0.03 to 15.7" (0.65 to 400mm)
Accuracy:	±0.04mm (< 10mm)
	±(0.1% rdg.+ 0.04mm) (< 100mm)
	±(0.3% rdg.) (> 100mm)
Resolution:	0.01mm or 0.1mm (< 100mm)
	0.1mm (>100mm)
Velocity Range:	1000 to 9999 m/s (0.039 to 0.394 in/μs)
Compatible Materials:	Ultrasonic conductive materials
	(ie. metals, plastics, ceramics,
	composites, epoxies, glass)
Sampling Time:	Less than 1 second
Display:	4-Digit, LCD
Backlit Display:	Yes
Probe Length:	3' (36")
Internal Memory:	Yes (up to 500 readings,
	5 files up to 100 each)
Low Battery Indicator:	Yes
Power Supply:	2 AA Batteries
Battery Life:	Approx. 100 hours (Alkaline)
Product Certifications:	CE
Operating Temperature:	32 to 122°F (0 to 50°C)
Storage Temperature:	-4 to 140°F (-20 to 60°C)
Operating Humidity Range:	20 to 80%
Dimensions:	5.9 x 2.9 x 1.3" (150 x 74 x 32mm)
Weight:	8.4oz (238g)

Included

- Ultrasonic Couplant Gel
- Probe
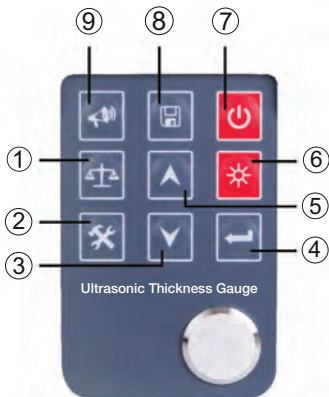- Hard Carrying Case
- Batteries

Instrument Description

1. LCD Display
2. Calibration Test Block
3. Probe Inputs
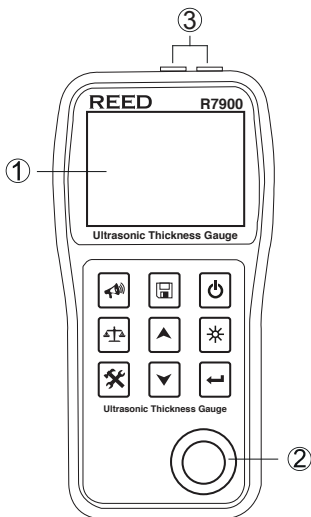
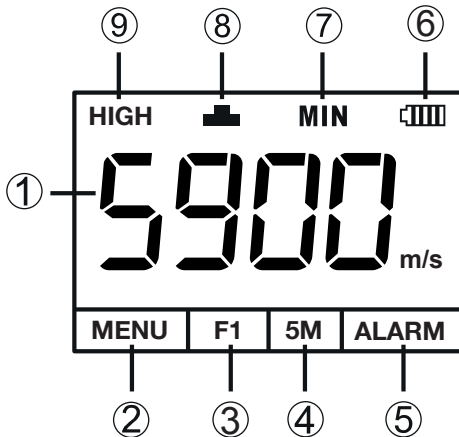## Keyboard Description

1. Zero Button
2. Mode Button
3. Down Button
4. Enter Button
5. Up Button
6. Backlight ON/OFF Button
7. Power Button
8. Save/Browse Button
9. Velocity Button

Display Description

1. Measured Value
2. Menu Settings
3. Saved File Name
4. Ultrasonic Sensor Frequency
5. Alarm Thickness Settings
6. Battery Indicator
7. Minimum Capture Mode
8. Coupling Indicator
9. Gain Indicator

Operating Instructions

1. Insert the ultrasonic sensor into the probe sockets on the meter.
2. Press, hold an release the (⏻) button for 2 seconds to turn the meter on. Press the (⏻) button to turn the meter off.
3. The LCD will briefly display information about the meter, and then show the current set sound velocity.

Setting Ultrasonic Sensor Frequency

1. Press the ✖ button to highlight the ultrasonic sensor frequency setting on the display.
2. Continuously press the ◀━ button to toggle between 2MHz, 5MHz, 7MHz, 10MHz and ZW frequencies.
3. To exit, press the ◀◊ button or by carrying out a measurement.

Zero Calibration

1. After setting the correct ultrasonic sensor frequency, set the sound velocity to 5900m/s (see *Adjusting the Sound Velocity* for details).
2. Select the proper receiving gain (see *System Setup* for details).
3. Coat the 4mm calibration test block with coupling gel (R7950) and place the sensor on the calibration test block while ensuring the coupling indicator "━━" appears on the LCD display.
4. Once the coupling indicator appears on the LCD display press the ⚖ button to initiate zero calibration.
5. The meter will beep and then the screen will indicate that the calibration is complete.
6. If zero calibration is not properly completed the meter will retain the original value.
7. To delete the calibration data, see *Memory Manager* section for details.

Adjusting the Sound Velocity

1. While the meter is on, press the ◀◊ button and the meter will display the current sound velocity.
2. Press the ◀◊ button to switch between the 5 pre-loaded sound velocities, or press the ▲ and ▼ buttons to match the sound velocity of the material under test as shown in the following table.

Material	Sound Velocity	
	(m/s)	(inch/µs)
Aluminum	6320 to 6400	0.250
Zinc	4170	0.164
Silver	3607	0.142
Gold	3251	0.128
Tin	2960	0.117
Steel, Common	5920	0.233
Steel, Stainless	5740	0.226
Brass	4399	0.173
Copper	4720	0.186
Iron	5930	0.233
Cast Iron	4400 to 5820	0.173 to 0.229
Lead	2400	0.094
Nylon	2680	0.105
Titanium	5990	0.236
SUS	5970	0.240
Epoxy Resin	2540	0.100
Ice	3988	0.222
Plexiglass	2692	0.106
Grey Cast	4600	0.180
Porcelain	5842	0.230
Glass (Quartz)	5570	0.220
Polystyrene	2337	0.092
PVC	2388	0.094
Quartz Glass	5639	0.222
Rubber, Vulcanized	2311	0.091
Teflon	1422	0.058
Water	1473	0.058

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Preparing the Measurement Surface

1. Clean any dust, dirt or rust off the object, and remove any coating such as paint.
2. Smooth the surface of the object by grinding or polishing it. You can also use a coupling gel with a high viscosity.

Important Note: In any ultrasonic measurement scenario, the shape and roughness of the desired test material are of great importance. Rough, uneven surfaces will prevent the ultrasonic sensor from seating properly against the surface, thus limiting the penetration of ultrasound through the material, resulting in unstable and therefore, unreliable measurements.

Taking Thickness Measurements

1. Set the sound velocity on the meter (see *Adjusting the Sound Velocity* for details).
2. Apply coupling gel on the material, place the sensor firmly against the desired measurement area.

Note: For most applications a single droplet of coupling gel is sufficient.

3. Verify that the coupling Indicator "▲" appears on the LCD display.
4. Read the measurement on the LCD display.
5. When you remove the ultrasonic sensor the value will stay on the LCD and the coupling indicator "▲" will disappear.
6. Press the 💾 button to save the measurement if applicable.
7. If the coupling indicator "▲" does not appear on the display, or the measured values appear to be erratic, verify that there is an adequate amount of coupling gel in between the ultrasonic sensor and the material under test. It is also important that the ultrasonic sensor sits flat against the material.

Auto Power OFF

To preserve battery life, the meter is programmed to turn itself after approximately 3 minutes of inactivity. To disable this option, please see *System Setup* section for details.

Sound Velocity Measurements of a Material with a Known Thickness

The sound velocity of a material can be measured using a test piece with a known thickness. Select a test piece with a minimum wall thickness of 20.0mm. Turn off the minimum capturing function (see *System Setup* section for details) prior to taking measurement.

1. Measure the test piece with a caliper or micrometer to confirm the thickness.
2. Apply coupling gel on the material, place the sensor firmly against the desired measurement area.

Note: For most applications a single droplet of coupling gel is sufficient.

3. Remove the ultrasonic sensor from the measurement area and adjust the measuring display until the actual thickness is met by pressing the ▲ and ▼ buttons and press the 🔊 button to confirm your selection.
4. The LCD will display the sound velocity.
5. Press the 💾 button to save the value if applicable.

Sound Velocity Calibration

1. Start by performing a zero calibration to the ultrasonic sensor.
2. Measure the actual thickness of the test piece with a caliper or micrometer.
3. Select a sound velocity from the pre-loaded list (choose any one).
4. Apply coupling gel on the material, place the sensor firmly against the desired measurement area.

Note: For most applications a single droplet of coupling gel is sufficient.

5. The LCD will display a measurement reading of the test piece.

Note: The reading will be off as the sound velocity is not correct.

6. Remove the ultrasonic sensor from the test piece, go into the velocity interface by pressing the 🔊 button and increasing the current sound velocity a little at a time by pressing the ▲ button.

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7. Take another measurement of the test piece to verify if the thickness reading is getting closer to the known thickness or not. If for some reason it is now farther away than before, reduce the velocity a little by pressing the ▼ button. Check the thickness again to make sure that you are getting closer. Continue adjusting the sound velocity until the thickness reading is correct.

8. Once you have reached the known thickness of the test piece, press the 🖫 button to confirm your sound velocity setting. From this point, the sound velocity is calibrated and you can now take measurements of the same material with confidence.

Two Point Calibration

1. Select two standard samples of the same material to be measured, among which one has a thickness equal to or slightly higher than the tested piece, and the thickness of another test piece is slightly lower than the tested piece.

2. Before carrying out 2-point calibration, turn off the "Minimum Capture" function and erase the CAL data in the "Memory Manager".

3. Set the 2-point calibration to ON in the "System Setup" menu.

4. Press twice on the ✖ button to return to the main display.

5. Press the ◄━ button at any time during measurement to enter the 2-Point CAL.

6. Measure the thinner standard test piece.

7. Remove the ultrasonic sensor from the test piece and use the ▲ and ▼ buttons to adjust the measurement to standard value.

8. Press the ◄━ button and the LCD will prompt to measure the thicker piece.

9. Measure the thicker standard test piece.

10. Remove the ultrasonic sensor from the test piece and use the ▲ and ▼ buttons to adjust the measurement to standard value.

11. Press the ◄━ button when the two-point calibration is completed.

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Setting Alarm Thickness Limits

The R7900 will alarm when the measured value is beyond the pre-set limits. When the measurement is lower than the low pre-set limit or higher than the high pre-set limit, the alarm will sound. To enter the alarm setting, follow steps 1 through 6 below.

1. Press the ✖ button to highlight the "Alarm" setting on the LCD.
2. Press the ← button to adjust the LOW limit.
3. Press the ▲ and ▼ buttons to adjust the user defined LOW alarm value.
4. Press the ← button to save the LOW limit, and to set the HIGH limit.
5. Press the ▲ and ▼ buttons to adjust the user defined HIGH alarm value, and press the ← button to save the HIGH limit.
6. To exit the limit setting, press the 🔊 button or by carrying out a measurement.

Minimum Capture Measurements

When the ultrasonic sensor couples with the test piece it will display the current measurement. When it is lifted away it will display the minimum value of the measurement carried out while the MIN Indicator flashes for several seconds. Measurements taken during the MIN indictor flashing cycle will continue to be part of the minimum value capturing. If you carry out measurements after the MIN Indicator stops flashing the minimum value capturing will re-start. The MIN indicator will only display when the minimum capture function is ON (see *System Setup* section for details).

Measurement Methods

There are three base measurement methods:

1. **Single measurement method**: This method involves measuring the thickness at a single point.
2. **Double measurement method**: This method involves performing two thickness measurements near a single spot rotating the ultrasonic sensor from 0 to 90° respectively, with respect to the split face (see Figure A).Take the smaller of the two indicated values as the thickness of the material.
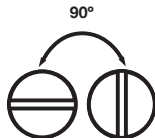
90°

Figure A

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3. **Multi-point measurement**: This method involves performing a number of measurements within a circle having a maximum diameter of about 1.18" (30mm) (see image below). Take the minimum indicated value as the thickness of the material.

Menu Options

The menu function controls the settings and functions of the meter. To enter the menu, press the ✖ button to highlight the menu option on the LCD and press the ⏎ button.

System Setup

1. While in the menu, highlight the "System Setup" option and press the ⏎ button to enter this menu.
2. Press the ▲ and ▼ buttons to scroll through the "System Setup" menu.
3. When the required setting as shown below, is highlighted, press the ⏎ button to select it and toggle between units.

Note: To set brightness, press ⏎ button to enter the setting, and use the ▲ and ▼ buttons to adjust the brightness.

4. Once completed, press the ◀﹚ button to save and exit.

System Setup Menu Settings are as follows:

1. **Measurement Units**: Metric and Imperial
2. **Receiving Gain**: LOW (resolution of 0.1mm) and HIGH (resolution of 0.01mm). LOW is mainly used for measuring coarse material with high scatter and small sound absorption, such as cast aluminum, cast copper, and other metallic parts.
3. **Minimum Capture Measurement**: OFF and ON
4. **2-Point Calibration**: OFF and ON
5. **Auto Down**: Power-saving mode ON (default)

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6. **Baud Rate**: 1200, 2400, 4800, 9600
7. **Set Brightness**: UP to darken, DOWN to lighten

Memory Manager

1. While in the menu, highlight the "Memory Manager" option and press the ⬅ button to enter this menu.
2. Press the ▲ and ▼ buttons to scroll through the "Memory Manager" menu.
3. Press the ⬅ button to select the required option as shown below:
   - **Erase File**: Clears selected files
   - **Erase All Data**: Clears all saved files
   - **Erase CAL data:** Clears calibrating data
4. Press the ⬅ button again to confirm (YES) or "Menu" to escape.

System Reset

While in the menu, highlight the "About Software" option and press the ⬅ button to enter this menu. Press the ⚖ button to restore the meter to its factory default settings for. Upon completion, the meter will shut down.

Internal Memory Operation

The internal memory is divided into 5 files, F1 to F5. Each file can save up to 100 measurement values.

Note: Before saving your data, be sure to set the file number first.

1. Press the ✖️ button to highlight the "Save File Name" on the LCD.
2. Press the ⬅️ button to scroll through the memory files, F1 to F5.
3. Press the 🔊 button to save and exit.

Reviewing Stored Data

1. Press the ✖️ button to highlight the "Save File Name" on the LCD.
2. Press the ⬅️ button to scroll through the memory files, F1 to F5.
3. Press the 🖫 button to select the appropriate file number and to view the saved values.
4. Press the ▲ and ▼ buttons to scroll through the saved values.
5. If required, press the ⬅️ button to erase the current saved value.

Maintenance

Cleaning the Test Piece

After taking a measurement, clean the test pieces to prevent them from rusting. If the pieces are not to be used for a long period of time, coat them with oil to prevent rust.

Protecting the Ultrasonic Sensor

Be sure to clean the ultrasonic sensor and cable after each use. Grease, oil and dust will cause the cable to dry out and shorten life expectancy. The temperature of the surface being measured should not exceed 140°F (60°C).

Replacing the Ultrasonic Sensor

The degradation and wear of the probe's interlayer plate will influence measurements. Replace the probe when the following occurs:

- If it always displays the same value when measuring different thicknesses or;
- When a measurement displays no value.

Battery Replacement

1. When the low battery symbol appears on the display, replace the batteries.
2. Remove the battery cover on the back and insert two new AA batteries.

Note: If the unit will not be used for a long period of time, remove the batteries to avoid battery leakage and corrosion of the battery contacts.

Applications

- Monitoring and verifying pipes and pressure vessels
- Industrial manufacturing

Accessories and Replacement Parts

- **R7900-PROBE** Replacement Probe
- **R7950** Ultrasonic Couplant Gel
- **R7950/5L** Ultrasonic Couplant Gel, 5L
- **R7950/12** Ultrasonic Couplant Gel, pack of 12
- **R9060** 5-Step Calibration Block
- **CA-52A** Soft Carrying Case
- **R8888** Hard Carrying Case

Don't see your part listed here? For a complete list of all accessories and replacement parts visit your product page on www.reedinstruments.com.

Appendix

Measurements on Cylindrical Surfaces

When measuring cylindrical material, such as pipes or oil tubes, it is important to properly adjust the angle between the ultrasonic sensor's crosstalk interlayer plate and the axial line of the material being measured.

1. Couple the sensor with the material being measures.
2. Make the sensor's crosstalk interlayer plate perpendicular or parallel to the axial line of the material under test.
3. Shake the sensor vertically along the axial line of the material under test, the readouts displayed on screen will change regularly.
4. Use the minimum readout.

The standard for selecting the angle between the sensor's crosstalk interlayer plate and the axial line of the material under test depends on the curvature of the material under test. For a pipe with a large diameter the sensor's crosstalk interlayer plate should be perpendicular to the axial line of the material under test. For a pipe with small diameter, the sensor's crosstalk interlayer plate can be both parallel and perpendicular to the axial line of the material under test, and take the minimum readout as the thickness.

Measuring Compound Profiles

When the material being measured has a compound profile (such as a bend in a pipe), one can use the procedures to measure cylindrical surfaces. The exception is that one should have two analyses and get two results when the sensor's crosstalk interlayer plate is both parallel and perpendicular to the axial line of the material under test. Take the minimum readout as the material thickness.

Measuring an Un-Parallel Surface

To get a satisfactory ultrasonic response, the other surface of the material under test must be parallel to or co-axial with the surface being measured, otherwise it will cause a measuring error or even provide no displayed reading.

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Influence of Material's Temperature

Both the thickness and transmitting speed of ultrasonic waves are influenced by temperature. If there is a high requirement of measuring accuracy, please use one of the comparison methods listed below:

1. Use a test piece of the same material being measured, under the same temperature.
2. Obtain the temperature compensation coefficient.
3. Use this coefficient to correct the actual measurement of the material being tested.

Material with Large Attenuation

Material with porous and coarse particles (such as fibre) will cause a large scatter and energy attenuation in the ultrasonic wave. This will cause abnormal readings or provide no readings on the display (generally, the abnormal readings are less than the actual thickness). These type of materials cannot be measured by our ultrasonic thickness gauges.

Measuring Castings

Castings will cause large attenuations in sound energy due to coarse crystal particles and a not-so-dense structure. The attenuation is due to the material's scatter and absorption of sound energy. Coarse out-phase structures and coarse crystal particles will cause abnormal reflection (i.e. a grass-shaped or tree-shaped echo) resulting in errors in the readings. When the crystal particle is coarse, the anisotropy in flexibility in metal's crystallizing direction will be obvious. This results in difference in sound velocities in different directions, with the maximum difference being up to 5.5%. The compactness in different positions of the workpiece is different, which will also cause difference in sound velocity. All of these will produce inaccuracies in the measurements.

While measuring castings pay attention to the following:

1. When measuring casting with an un-machined surface use engine oil, consistent grease, or water glass as a coupling gel.
2. Calibrate the sound velocity for the material under test with a standard test piece having the same material and measuring direction as that of the material being measured.
3. If necessary, take a 2-point calibration.

Preventing Errors

Reference Test Pieces

To maintain high accuracy when taking measurements of different materials, it is important to use a standard test piece that resembles the material and conditions being measured. The ideal reference test pieces should be a group of test pieces with different thicknesses made of the same materials that is going to be measured. The test pieces can provide calibrating factors for the meter (such as the microstructure of the material, heat-treating condition, direction of particles, surface roughness, etc.). To meet the highest requirements of accuracy a set of reference test pieces are critical.

Under most situations satisfactory measuring accuracies can be met with only one reference test piece. This should be the same material and similar thickness to the material under test. Take an even-surfaced object, measure it by using a micrometer, then use it as a test piece.

For thin material, when its thickness is near to the low limit of the sensor's measuring range, you can use a test piece to determine the accurate low limit. Never measure a material with a thickness lower than the low limit.

When the material under test is thick, especially an alloy with complex internal structure, select a test piece similar to the object from a group of test pieces, giving you an idea of calibration.

For most casting and forging, their internal structures have some direction. In different directions, the sound velocity will experience some change. To solve this problem, the test piece should have an internal structure with same direction as that of the material under test, and the transmitting direction of sound wave in it should also be same as that of the material.

Under certain circumstances, referring to a material speed-of-sound table can replace reference test pieces. The value in the speed-of-sound table may have some difference from the actual measured values due to difference in the material's physical and chemical characteristics. This is usually used for measuring low-carbon steel, and can only be taken as a rough measurement.

Ultra-Thin Material

An error will occur when the thickness of a material under test is less than the low limit of the ultrasonic sensor. When necessary, measure the minimum limit thickness by comparing it with test pieces. When measuring an ultra-thin material, sometimes errors called "double refraction" may occur. This results in a displayed measuring reading that is twice the actual thickness of the material under test. Another error result is called "pulse envelop or cyclic leap". This results in the measured value being larger than the actual thickness. To prevent these kinds of errors repeat the measurement to confirm the results.

Rust, Corrosion, and Pits

Rust and pits on the surface of the object will cause irregular change in the measured reading. In extreme situations it will even cause no readings on the display. To avoid errors, orient the sensor's crosstalk interlayer plate in different directions to take multiple measurements.

Error in Identifying Material

If you calibrate the meter with one material and then measure another material, an error will occur. Be careful in selecting the correct sound velocity.

Degradation of Probe

The surface of the probe is allyl resin. Over time its roughness will increase resulting in reduced sensitivity. If it is determined that this is the reason for the errors, grind the surface with sandpaper or oilstone to make it smooth again. If the readings are still not stable, the sensor must be replaced.

Overlapped Material and Compound Material

It is impossible to measure uncoupled overlapped material because the ultrasonic wave can't pass through an uncoupled space. Since the ultrasonic wave can't transmit in a compound material in even speed you cannot use an ultrasonic thickness-gauge to measure overlapped material and compound material.

Influence of Metal Surface Oxidation

Some metals can produce a dense oxidation layer on the surface, such as aluminum. Even though the layer is in close contact with the substrate and provides no obvious interface, the ultrasonic wave will have different transmitting speeds in these two materials which will cause an error.

In addition, different thicknesses in oxidation layers will cause different errors. Make a reference piece from a batch of objects by measuring with a micrometer or calliper, and using it to calibrate the instrument.

Abnormal Readout of Thickness

The operator should be able to identify an abnormal measuring reading. Generally the rust, corrosion, pit, and internal defect of the material under test will cause abnormal measuring readings.

Utilization and Selection of a Coupling Gel (R7950)

Coupling gel is used for transmitting high-frequency energy between the ultrasonic gel and the material under test. If the type of gel or utilization is wrong, or the utilization it will cause an error. For most applications a single droplet of coupling gel coated evenly is sufficient. When measuring a smooth surface use a gel with low viscosity (such as the coupling gel provided or light engine oil). When measuring a coarse object surface, vertical surface or top surface, use a gel with high viscosity (such as glycerin grease, consistent grease, and lubricating grease, etc.).

Product Care

To keep your instrument in good working order we recommend the following:

• Store your product in a clean, dry place.

• Change the battery as needed.

• If your instrument isn't being used for a period of one month or longer please remove the battery.

• Clean your product and accessories with biodegradable cleaner. Do not spray the cleaner directly on the instrument. Use on external parts only.

Product Warranty

REED Instruments guarantees this instrument to be free of defects in material or workmanship for a period of one (1) year from date of shipment. During the warranty period, REED Instruments will repair or replace, at no charge, products or parts of a product that proves to be defective because of improper material or workmanship, under normal use and maintenance. REED Instruments total liability is limited to repair or replacement of the product. REED Instruments shall not be liable for damages to goods, property, or persons due to improper use or through attempts to utilize the instrument under conditions which exceed the designed capabilities. In order to begin the warranty service process, please contact us by phone at 1-877-849-2127 or by email at info@reedinstruments.com to discuss the claim and determine the appropriate steps to process the warranty.

Product Disposal and Recycling

Please follow local laws and regulations when disposing or recycling your instrument. Your product contains electronic components and must be disposed of separately from standard waste products.

Product Support

If you have any questions on your product, please contact your authorized REED distributor or REED Instruments Customer Service by phone at 1-877-849-2127 or by email at info@reedinstruments.com.

Please visit **www.REEDInstruments.com** for the most up-to-date manuals, datasheets, product guides and software.

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