MODEL 247B

HOTSTICK LINE SNIFFER

Radar Engineers Inc.
9535 NE Colfax Street
Portland, Oregon 97220

FIELD INSTRUCTIONS: HOTSTICK LINE SNIFFER 247-B

1. **WHIP ANTENNA (VHF):** Use whip antenna (at ground level only) to indicate that you have located the pole with noise. Do not use whip antenna near energized conductors. (Volume on. Ultra-sonic off.)

2. **ROD ANTENNA (VHF):** Use the rod antenna to find the general area of noise source on the pole. To operate:
    a) Turn the volume control on. Set initially at full volume and reduce as desired.
    b) Ultra-sonic off.
    c) Remove whip antenna, if present.
    d) Extend rod antenna fully for maximum sensitivity, and with it scan pole and hardware and insulators.
    e) As you get closer to source you will note higher RF output. Push the rod in to decrease range and increase localizing accuracy.
    f) Once the general area of noise source is found, pinpoint it with the Ultra-sonic probe.

3. **ULTRA-SONIC PROBE:** To operate:
    a) Turn on Ultra-sonic switch; Adjust volume as desired.
    b) Push rod antenna completely in nullifying the VHF pick-up.
    c) Scan hardware and connections in area pre-located with rod antenna. Ultra-sonic is extremely sensitive and directional close to a noise source, provided the probe has line of sight to it. Orient probe to obtain line of sight.

4. **SAFETY:**

ONLY qualified electrical workers should operate the Hotstick Line-Sniffer.
ALWAYS follow approved work and safety practices: Exercise caution and maintain safe working distances.
ALWAYS use a hotstick with the Line-Sniffer.
ALWAYS inspect hotstick prior to use. Be sure it is clean, dry and defect free. Routinely test for dielectric integrity.
NEVER use the whip antenna in a switchyard or near a conductor.
NEVER cross phases or short to ground.
READ instruction book.

RADAR ENGINEERS INC 09/29/2022

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I. SAFETY NOTE

The Hotstick Line-Sniffer must be mounted on a hotstick for use near energized power lines and is to be used by qualified electrical workers only. IT IS NOT A VOLTAGE OR CURRENT SENSOR—the presence of high voltage or current will cause little, if any, response from the Line-Sniffer. Never short the instrument between phases or to ground. Maintain safe working distances, and observe safe working practices at all times. Regularly test, inspect and clean your Hotstick. Read this manual for additional safety information.

II. INTRODUCTION

A. Pinpoint Noise Source

The Model 247B Hotstick Line-Sniffer has been specifically designed to meet the needs of line crew personnel for an instrument to pinpoint RFI sources on energized power line poles or structures. Most often the structures that contain the RFI will have been identified previously by the use of other instruments such as the Radar Engineers Inc. Model 242 "AM-UHF RFI Locator" or the M-330 Mini RFI Locator. These prelocating tools are designed to identify the structure containing a noise source. The Hotstick Line Sniffer is then utilized to pinpoint the exact piece of hardware or equipment which is causing the sparking.

A VHF rod antenna on the Model 247B locates the general area of an RFI source on a structure. An ultrasonic probe pinpoints its exact site. The tool thus performs the functions of two separate instruments: a VHF detector and ultrasonic detector.

Ordinarily the Line-Sniffer will be used to pinpoint interference sources on distribution lines. Distribution lines are where most such interference occurs and where the Line-Sniffer is most effective. However, the device may also be used somewhat less

effectively on transmission lines.

The term RFI (radio frequency interference) is here used to include both radio interference (RI) and television interference (TVI).

B. Monitor Completed Work

Another valuable use of the Line-Sniffer is that of monitoring line work. In this way crews can confirm that the RFI sources have been eliminated upon completion of corrective work.

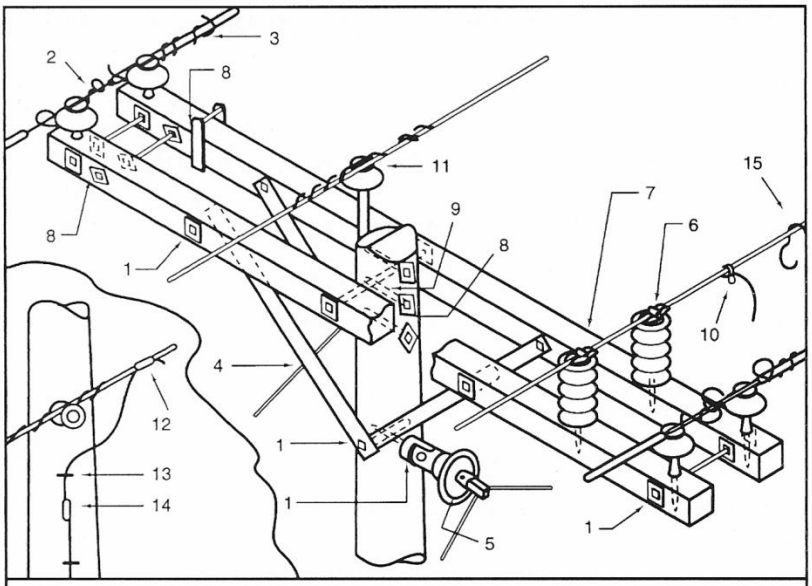
III. SPARKING & CORONA ON POWER LINES

A. Sparking Sources

On a power line sparking usually takes place in small gaps between hardware or equipment parts. When components in an electrical field or leakage path are slightly separated from one another, they usually assume charges with differing absolute voltage levels. The stress between these differently charged bodies may result in arcing or sparking. The separation of parts usually takes place as the result of corrosion build-up, vibration, wind uplift, storm damage, and contraction and expansion of parts resulting from temperature and humidity changes.

These separation points where sparking takes place are then interference sources. Typical source locations are at loose cross-arm braces, loose bonding, ground-wire staples, corroded ball-pins and sockets, pins and clevises of suspension-type insulators, corroded conductor clamp pins, and loose tie wires on pin-type insulators. See Figure 1.

A characteristic of RFI that can make locating a noise source unpredictable is its ability to radiate. RFI can radiate either through the air or along a conducting surface, such as a cross arm brace or a power line. Typically RFI only radiates a few spans but it has been detected on rare occasions up to ten miles from the noise source.



Possible sparking sites on distribution structures

1. Loose Hardware.
2. Loose Tie-Wire on Conductor.
3. Loose Tie-Wire on Insulated Conductor.
4. Guy Wire Touching Cross-Arm Brace.
5. Corroded and/or Loose Pin in Bell Insulator.
6. Conductor Loose in Post Insulator Clamp.
7. Clamp Loose in Pivot Screws, Post Insulator.
8. Insufficient Clearance on Wood Surface Between Hardware Parts.
9. Insufficient Clearance, Internal Hardware.
10. Corroded or Loose Hot-Line Clamp.
11. Loose Tie-Wrap on Porcelain.
12. Loose Connection to Neutral Conductor.
13. Ground Wire Loose in Staple.
14. Loose or Corroded Ground Wire Splice.
15. Foreign Object (Trash) on Conductor.

Fig. 1. Sparking Sources.

The radiation of noise frequencies from a wood pole line is shown in Fig. 2, with a single source present in the section of concern. This illustrates the importance of using a high frequency, for locating on the source pole. The low frequency will radiate a long distance while the higher frequency exists only near the source.

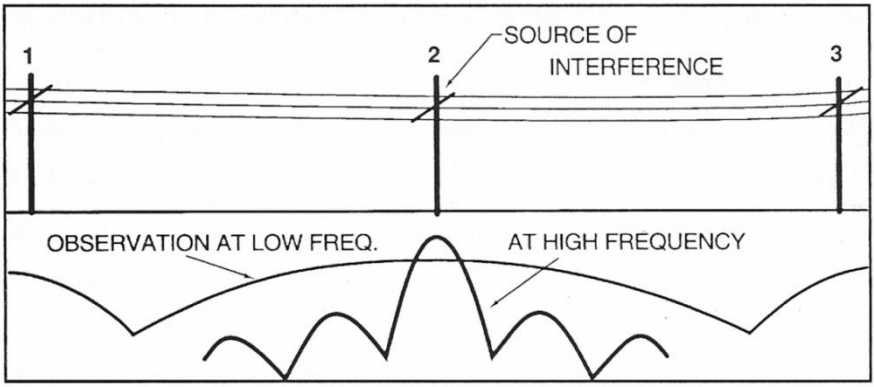


Fig. 2. Low and High Noise Frequencies Observed along Line from Single Source.

On older wood pole lines, several sources are often found in the area of the complaint. Each source contributes to the total interference level and should be eliminated.

Rain can complicate RFI locating because moisture normally shorts out the small gaps and suppresses sparking. After rain starts, it may take considerable time, perhaps an hour or more, for a sparking gap to be shorted out. Thus, interference can continue for limited periods during foul weather. Conversely, after a rain or heavy dew, sparking will not ordinarily reappear until the moisture has evaporated.

Wind can also effect sparking. Wind pressure on cross arms and conductors can change the size of a spark gap and thereby cause sparking to stop or start.

B. Corona Sources

The main purpose of the Model 247B is to detect sparking sources on distribution lines. It may also be used to detect the presence of corona sources (and sparking sources) on some higher voltage lines.

Corona may be classified as being either the foul-weather or the fair-weather type. In foul weather on extra high voltage transmission lines (345 kV and above), water droplets on a conductor are distorted into pointed shapes and corona will emanate from these points. Thousands of corona plumes may be present on a transmission span, causing radio and television interference to nearby residences. When foul weather corona interference is present, it will be obvious all along the EHV conductor and will not be a locating problem. (Either type of corona, foul or fair weather, will occur more readily in the lower atmospheric pressures of high elevations.)

Fair weather corona occurs where a pointed object protrudes into the air and is energized from high transmission line voltages. Fair weather corona is also called “point corona” and is usually caused by frayed conductors, sharp corners on hardware, sharp mold nibs on vibrator dampers and foreign objects on the conductor.

Fair weather corona causes radio interference. However, it has not been known to cause television interference because radiation from a point corona source is very weak at the high frequencies of television broadcasting.

Point corona sources are sometimes audible, but background noise may prevent one from locating such sources by ear. The best method of detection is by ultrasonic means, and the ultrasonic probe of the Line-Sniffer should be used. (On transmission lines above 35kV, the 15” probe tube is required. The probe helps the operator maintain the distance of the instrument from the high voltage conductor and minimize the effect of the high electric field itself which can cause 60 hz response from the instrument.

IV. DESCRIPTION

The Line-Sniffer consists of two essential parts: the upper portion, a metal-encased detector instrument, and the lower portion, a hotstick.

Mounted on the instrument case is an ultrasonic detection probe and a VHF rod antenna as shown in Fig. 3. A speaker is mounted in the bottom panel of the instrument case. A sounding horn screws into the bottom of the instrument at the threading coupling and acts like a megaphone.

The instrument detects the presence of ultrasonic as well as radio wave or VHF emissions. Ultrasonic detection is at 40,000 cycles per second (40 kHz) and radio wave detection is at approximately 110 million cycles per second (110 MHz). The Line-Sniffer response to the detection of either ultrasonic waves or very high frequency (VHF) radio waves consists of noise output.

V. OPERATION OF LINE-SNIFFER

After assembly of the instrument and hotstick in the desired configuration, it should be tested. Turn both the volume and the ultrasonic switches to the "ON" positions then rub your fingers or jingle keys in front of the ultrasonic probe. This will provide a loud output response and indicate that the instrument is ready for use.

Next, assuming you have prelocated the structure containing a noise source, begin the search for the hardware or equipment causing the noise. Start with the VHF retractable rod antenna to localize the area on the structure with the sparking. Then switch to the ultrasonic mode for pinpointing the spark. (When detected by the Line Sniffer, power line sparking sounds like bacon frying.)

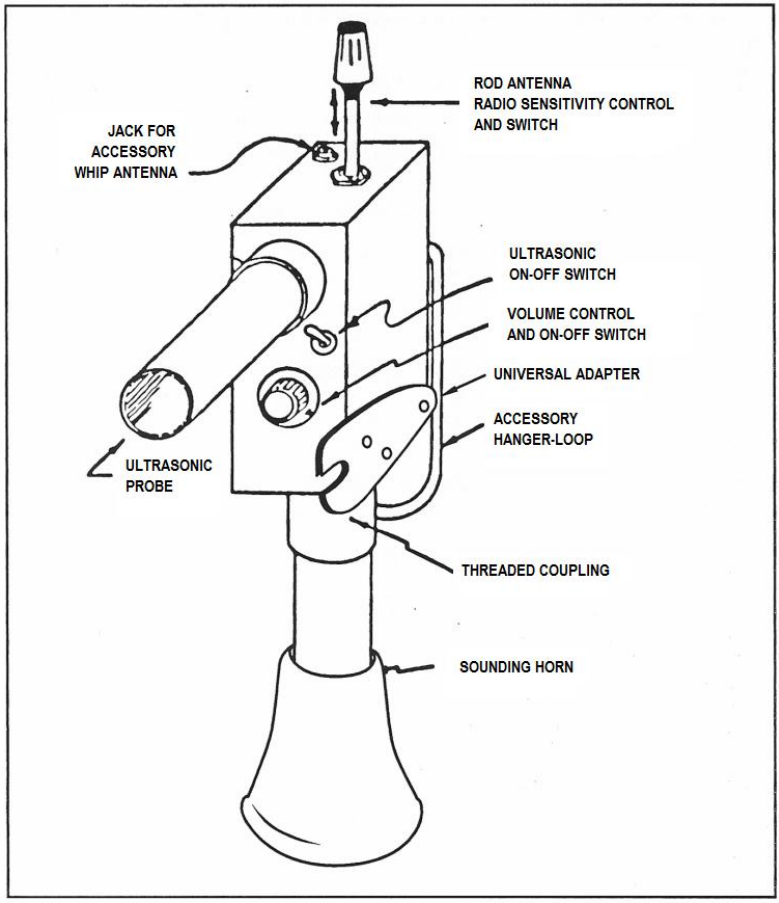


Fig. 3 Model 247 Hotstick Line-Sniffer

A. VHF Retractable Rod Antenna.

a) Turn volume control knob on to activate unit. Set initially at full volume and reduce as desired.

b) Turn off ultrasonic toggle switch.

c) Remove whip antenna if present.

d) Extend VHF Rod Antenna fully for maximum sensitivity and scan pole hardware with instrument assembled on Hotstick.

A circular search pattern is recommended.

e) As you get closer to the source, you will note higher RF output - Push the rod in slightly to decrease your range and increase your locating accuracy (The rod antenna is a "proximity locator." It is not directional.) Continue to scan.

f) Once the general area of noise is found, pinpoint it with the ultrasonic probe.

Fig. 4 shows the use of the antenna rod as a sensitivity control. Decreasing the sensitivity of the antenna rod greatly increases its pinpointing ability.

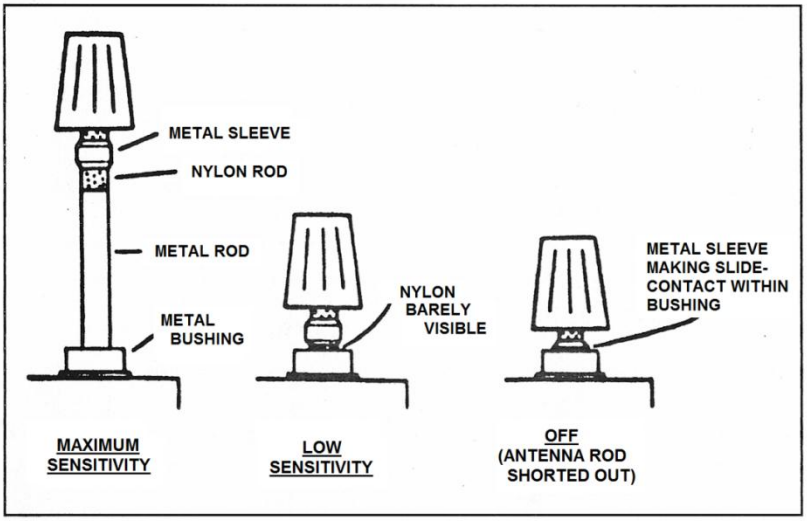


Fig. 4. Use of Antenna Rod as Sensitivity Control

B. Ultrasonic Probe

a) Turn on Ultrasonic Switch

b) Push rod antenna completely in. This shuts off the VHF circuit and nullifies the rod antenna pickup.

c) Remove whip antenna if present.

d) Scan hardware and connections in the area previously localized with the VHF rod antenna. The ultrasonic probe is extremely sensitive and directional close to a noise source and will readily react to close sources. However, for the ultrasonic to work, it must have an UNOBSTRUCTED line of sight to the source. (VHF does not depend on line of sight. If you cannot detect the source with ultrasonic, you should be able to narrow the area of suspicion to only two or three possible sites using the VHF rod antenna technique outlined in Section A above.)

C. False Sources

In some cases, when using the VHF Rod Antenna, an RFI source will seem to be in one location but will actually be elsewhere. That is a "false source." False sources are often caused by VHF radiation from the actual source along a conducting surface. The ultrasonic probe is not readily fooled by "false sources" because it does not respond to RF. It responds only to low frequency ultrasonic interference. See Fig. 5 below.

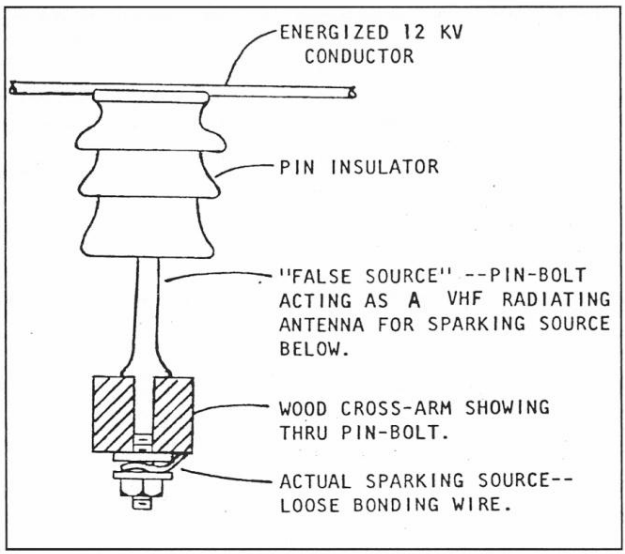


Fig. 5 "False Source" Detection by Radio Antenna

D. Internal Sparking

Sparking that occurs inside an enclosure, such as a transformer, presents special problems. Fortunately, such sparking is not common. In the case of a pole transformer with internal sparking, no detection by the ultrasonic probe should be expected, and here the VHF Rod Antenna must be used. The VHF output of such a source is usually quite weak, but if significant will be detected by the Line-Sniffer. Certain makes of power-line lightening arrestors are also found to cause radio and television interference as the result of internal breakdown. They can be similarly difficult to locate. (An AM radio with an adjustable antenna can be a helpful tool in locating internal sparking.)

E. Hotsticks

THE LINE-SNIFFER SHOULD ALWAYS BE USED WITH AN APPROPRIATE HOTSTICK.

SAFE WORKING PRACTICES AND DISTANCES MUST ALWAYS BE OBSERVED. Live-line tools/hotsticks should be stored in dry protected areas, routinely cleaned and checked for defects. Moisture, dirt, contamination or defects reduce dielectric insulation value. To insure continued safety, closely follow your utility's regulations on live-line tool care, testing and use.

VI. Correction of Sources

The correction of sources shall be performed according to standard utility practices. It is not the intent of this manual to discuss correction except to say that, in general, sparking sources are corrected by eliminating spark gaps. For example, tightening of hardware will usually eliminate interference - radiating gaps.

After corrective repairs are made by line crew personnel, the effectiveness of the work should be checked with the Line-Sniffer. The Hotstick Line-Sniffer is a convenient instrument for rapidly checking conditions before and after repairs are made.

VII. ACCESSORIES

A. Whip Antenna:

The Line-Sniffer is designed to pinpoint noise sources on power line structures, after the source structures have been first located by other instruments (such as Radar Engineers Inc. models 242 and M-330). With the addition of the accessory whip antenna, the Line-Sniffer can, in some cases, help locate the source structures itself. However, the whip antenna's effectiveness is usually limited to locating high level sparking sources. To use the whip antenna plug it into the jack on top of the Line Sniffer. Stand at the base of each pole that you suspect. The pole with the highest noise level will normally contain the source. Be sure to make careful comparisons. In doing so, the lowest possible volume should be used.

The whip antenna should never be used near energized lines or substation structures. Remove the whip antenna before using the Line Sniffer anywhere near energized conditions or structures.

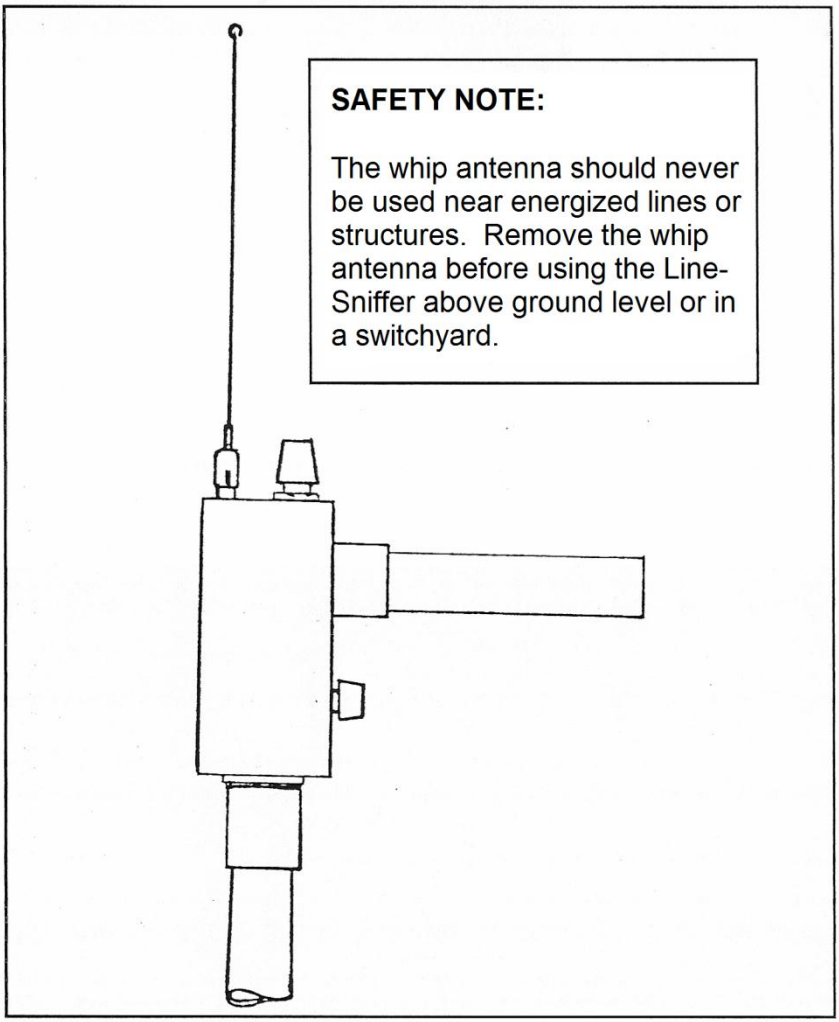


Fig. 6. Hotstick Line-Sniffer with Whip Antenna Installed.

B. Battery:

The battery recommended is a transistor-type, Eveready #522 9-volt (NEDA #1604A) or equivalent. The instrument will operate efficiently down to a 7-volt level. However, it is recommended that when the Line-Sniffer is being used continuously throughout the day the battery be replaced about every third day.

If carbon-zinc batteries are used, a feedback squeal may be heard from the instrument because of the high voltage of such batteries when first installed. This will be more noticeable when testing indoors.

VIII. WARRANTY AND NOTICE TO PURCHASER

The 247B manufactured by Radar Engineers Inc. is warranted against all defects in material and workmanship for a period of one year following shipment. Our liability is specifically limited to replacing or repairing, at our option, defective equipment.

THIS WARRANTY IS MADE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANDY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. NEITHER SELLER NOR MANUFACTURER SHALL BE LIABLE FOR ANY INJURY, LOSS OR DAMAGE, DIRECT OR CONSEQUENTIAL, ARISING OUT OF THE USE OF THIS PRODUCT.

All statements, technical information and recommendations contained herein are based on information believed to be reliable, but the accuracy or completeness thereof is not guaranteed. Before using, the user shall determine the suitability of the product for his intended use, and user assumes all risk and liability whatsoever in connection therewith.

All statements or recommendations not contained herein shall have no force or effect unless in an agreement signed by officers of seller and manufacturer.

IX. REPAIRS AND CUSTOMER SERVICE

Radar Engineers Inc. maintains a complete instrument repair service. Should this instrument ever require repairs, we recommend it be returned to the following address:

RADAR ENGINEERS INC.

9535 N.E. Colfax St.

Portland, Oregon 97220

When returning the instrument for repairs, it should be shipped Prepaid and Insured. A note should be included describing the defect and the name and phone number of the person to contact in case additional information is needed.

If you have questions regarding the operation of this instrument, call Radar Engineers Inc at:

(503) 256-3417.

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