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OPERATING MANUAL

FOR THE

MODEL 700 INTERFERENCE LOCATOR

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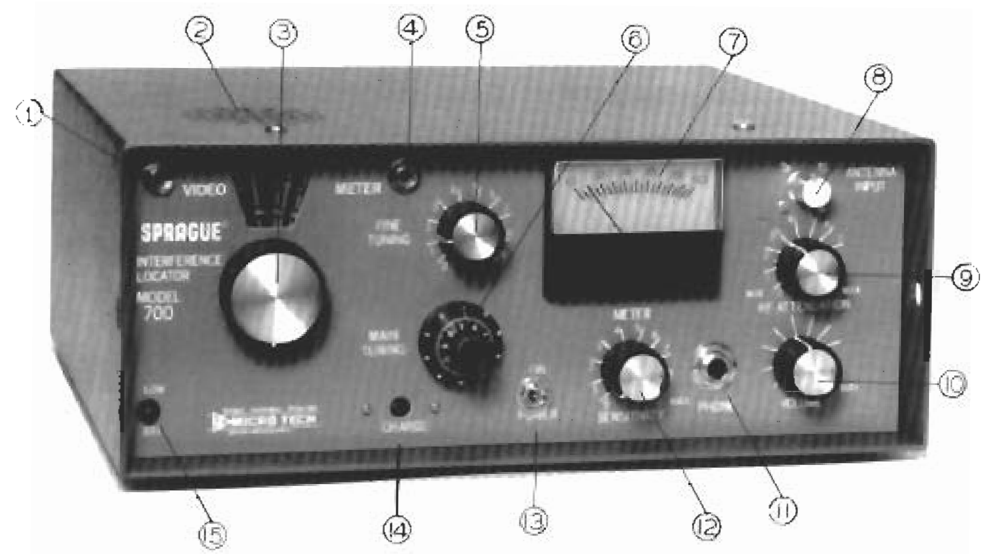

1. Video Signal Jack
2. Speaker
3. Main Tuning Dial
4. External Meter Jack
5. Fine Tuning
6. Main Tuning
7. Meter
8. Antenna Input Jack
9. RF Attenuator
10. Volume
11. Earphone Jack
12. Sensitivity, Meter and Video
13. On-Off Switch
14. Charger Input Jack
15. Low-High Battery Indicator

WARNING

DO NOT OPERATE THIS DEVICE BEFORE READING ALL OPERATING PROCEDURES. DO NOT OPERATE THIS DEVICE CONTRARY TO THE INSTRUCTIONS CONTAINED IN THIS MANUAL.

USE EXTREME CARE WHEN OPERATING THIS DEVICE (OR ANY SIMILAR DEVICE) IN THE PRIMARY FIELD OF POWER LINES. THIS IS ESPECIALLY TRUE WHEN THE CONDUCTORS ARE PHYSICALLY CLOSE TO THE OPERATOR, SUCH AS IN SWITCH YARDS AND AT THE TERMINALS OF GROUND-MOUNTED TRANSFORMERS AND BREAKERS. WHEN GAP-TYPE NOISE IS PRESENT, IT IS NOT NECESSARY TO GET PHYSICALLY CLOSE TO THE SOURCE TO PIN-POINT IT.

MAKE EVERY MOVE WITH THOUGHT AND CARE. FAILURE TO USE CARE WHEN IN CLOSE PROXIMITY TO ANY KIND OF ELECTRICAL POWER EQUIPMENT CAN RESULT IN INJURY OR ELECTROCUTION.

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OPERATING AND MAINTENANCE MANUAL FOR THE MODEL 700 INTERFERENCE LOCATOR

1. Introduction

1.1 General. The Sprague Model 700 Interference Locator is a rugged, wide-range, portable instrument designed especially to meet the needs of electric utilities, laboratories, industries and others concerned with the detection and location of sources of RF interference. Special attention has been given to the design details which contribute to the reliability and convenience of use.

1.2 Operating Frequencies and Sensitivity. The Model 700 Interference Locator covers a frequency span of 500 kHz to 250 MHz in one continuous tuning range. It has a sensitivity of 1 microvolt or better on all frequencies 2 MHz and above and a sensitivity of 2 microvolts or better for frequencies below 2 MHz, for a 50% output meter deflection.

1.3 Applications. The Model 700 Interference Locator is designed for the rapid detection and location of AM, FM, and TV signal interference sources. Other effective uses include:

a. location of communications interference sources (corona-type or GAP-type noise) by electric utilities.

b. maintenance programs, both preventive and otherwise, since many faults will begin to radiate RF noise before the actual failure occurs.

c. detection and location of RF transmissions within the tuning range of the instrument.

1.4 Specifications. Performance specifications and other data pertaining to the Model 700 Interference Locator are found in the Appendix on page 14.

1.5 Diagrams. The block diagram and schematic diagrams necessary for the maintenance of the instrument are found on pages 4 and 16.

2. Circuits

2.1 General. The Model 700 Interference Locator is engineered with special circuitry to provide an instrument which is ideally suited for interference location purposes. The frequency range of 500 kHz to 250 MHz is covered in one continuously-tuned band. These frequencies include the standard broadcast, short wave, FM and VHF television bands. The instrument operates from a self-contained rechargeable battery. The battery life is approximately eight hours under normal usage before re-charging is required.

2.2 Block Diagram. The block diagram for the complete instrument is shown in Figure 1.

2.3 Theory of Operation. The circuitry used in the Model 700 Interference Locator is of the superheterodyne type. However, four conversions of frequency are made instead of the typical single conversion. This permits the entire range of 500 kHz to 250 MHz to be continuously tuned without the use of switching circuits.

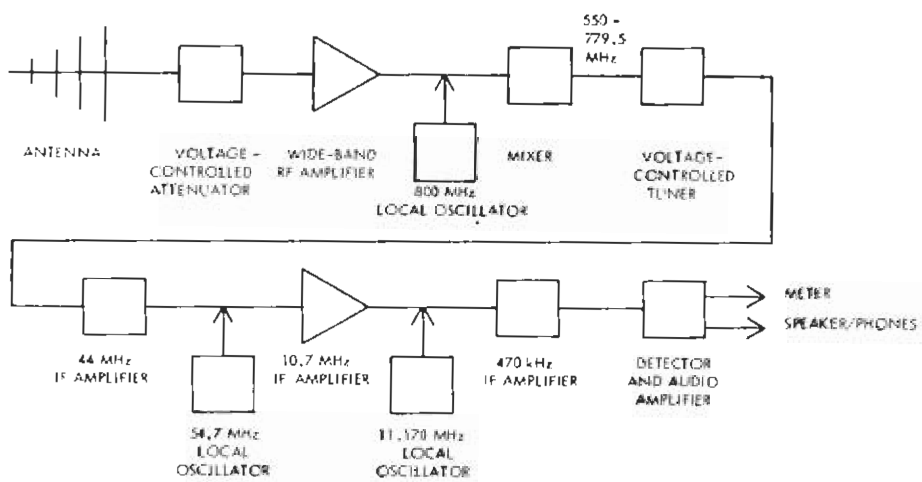


Figure 1

From the antenna connector, the signal passes through a voltage-controlled attenuator to a wide-band RF amplifier. The output of this amplifier is mixed with an 800 MHz local oscillator signal in a double-balanced mixer.

This mixer converts all received signals from a frequency range of 0.5 to 250 MHz to a range of 550 to 799.5 MHz. The signals are then amplified and mixed in a voltage-controlled tuner, which produces a 44 MHz IF signal from the desired frequency.

This signal is amplified in the 44 MHz IF amplifier and is then mixed with the signal from a second local oscillator operating at 54.7 MHz. The 10.7 MHz mixer output is then filtered and amplified.

The signal is again mixed with a third local oscillator operating at 11.17 MHz. The output from this mixer is an IF frequency of 470 kHz. This intermediate frequency is amplified and detected for use in the meter and audio amplifier circuits.

2.4 Power Supply Operation. The power supply for the Model 700 Interference Locator is a 12 volt, 2.5 ampere-hour rechargeable storage battery. Voltage from the battery is also fed directly to circuits such as the audio amplifier and IF amplifiers which operate at this voltage level. The battery voltage is also used to feed a d-c to d-c converter which increases the voltage to approximately 25 volts. This voltage is regulated to 15 volts for circuits requiring a source of this type. A second regulator provides a stable voltage used for tuning.

2.5 Low Battery Indicator. The battery voltage is monitored and sensed by IC4. When the battery voltage drops to 11.55 volts, the low battery indicator, D4, is turned on. This shows as a red glow in the bezel at the lower left corner of the front panel.

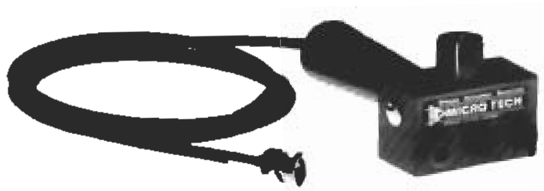
2.6 Meter Circuit. A portion of the 470 kHz IF signal is detected by diode D5 and is amplified by IC2. The gain of operational amplifier IC2 is controlled by the meter sensitivity control. This independent amplifier allows the instrument to indicate large meter swings for small changes in signal strength. The output of IC2 also provides a filtered video signal for observance on an oscilloscope.

3. Antenna Systems

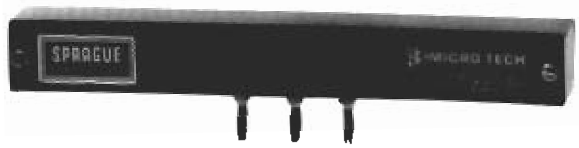
3.1 General. A complete set of antennas are furnished with the Model 700 Interference Locator, when ordered as a Model 700 Kit. In most cases, these should be all that are required for normal use. For special applications at specific frequencies, other antennas may be used providing they match the 50 ohm input impedance of the locator.

3.2 Model 546 Telescoping Rod Antenna. The telescoping rod antenna is terminated in a BNC-type connector for use directly on the Model 700 Interference Locator. The rod antenna is used as an untuned antenna over the frequency range of 0.5 MHz to 250 MHz.

3.3 Model 540 Antenna Handle Assembly. The antenna handle assembly is designed to be held in the hand and provides for support and tuning of various antenna elements which can be used with it. The antenna handle assembly comes with a 6 ft. coaxial cable with a BNC connector for attaching directly to the Model 700 Locator.

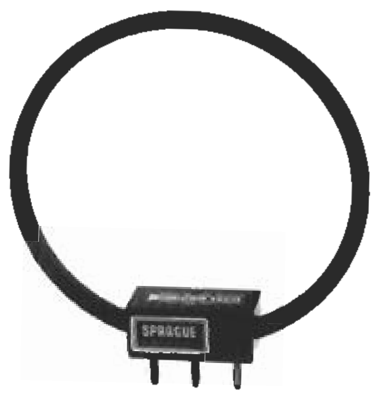


3.4 Model 541 Ferrite Rod Antenna. The ferrite rod antenna plugs into the antenna handle assembly. The frequency range of this antenna is 0.5 MHz to 3 MHz.

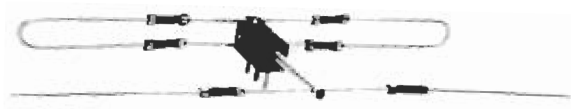


3.5 Model 542 12″ Loop Antenna. The 12″ loop antenna plugs into the antenna handle assembly. The loop is tunable from 6 MHz to 12 MHz utilizing the variable capacitor in the antenna handle assembly.

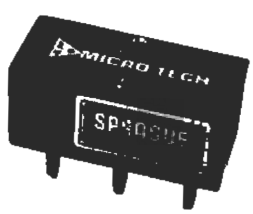
3.6 Model 543 6″ Loop Antenna. The 6″ loop antenna plugs into the antenna handle assembly. It is tuned over the range of 17 MHz to 34 MHz using the capacitor in the antenna handle assembly.



3.7 Model 544 Folded Dipole Antenna. This miniature, inductively-loaded folded dipole antenna is used in conjunction with the antenna handle assembly. Its frequency of operation is typically above 200 MHz.



3.8 Model 545 Probe Antenna. The probe antenna is a low-sensitivity antenna which plugs into the antenna handle assembly. The probe antenna is used to pinpoint noise sources which typically occur in dwellings.



3.9 Applications. The Rod Antenna is broad-band and it may be used to select the frequency at which to begin a search. The ferrite rod and loop antennas are used when a search must begin at frequencies below 34 MHz.

The folded dipole antenna is used when the interfering signal can be received above 200 MHz.

When the ferrite rod or folded dipole antenna is turned toward the direction of maximum signal strength, the source of that signal is in a direction at right angles to the plane of the antenna.

When using the loop antennas and the antenna is turned toward the direction of the weakest signal, the source of that signal is in a direction at right angles to the plane of the loop antenna.

4. Operation

4.1 General. The operating controls and procedures for using the Model 700 Interference Locator have been designed for ease of operation. Be sure that you have read and understand the operating instructions. This instrument has been specifically designed for the rapid location of RF interference and it does not operate like typical portable radios with which you may be familiar. If you have any difficulties in using this instrument, read and re-read the pertinent instruction paragraphs.

4.2 Attaching the Antenna. Select the antenna best suited to the application and attach it using the BNC antenna input connector on the front panel of the instrument. Information as to the type of antenna to use may be found in section 6, Location Procedures.

4.3 Applying Power. Turn the power on by placing the power switch toggle in the ON position. If the red low-battery light is seen, the batteries require recharging.

4.4 Battery Charging. The Model 700 Interference Locator comes with a battery charger designed to recharge the specific battery used to power the instrument. It is a two-step charger and automatically steps to a trickle current as the battery becomes fully charged. A red light emitting diode (LED) on the charger is ON during high rate charging and it may blink on and off, or flicker, as the battery approaches its fully-charged state.

Model 550 Battery Charger

When the battery is charged once per day on a repetitive basis, it may become necessary to charge the battery for 48 hours once a week. The charger will not overcharge the battery, so if you are ever in doubt about the state of the battery, recharge it.

4.5 RF Attenuation. Rotation of the RF Attenuation control to the MIN position provides maximum sensitivity, while clockwise rotation toward the maximum position provides increasing degrees of input signal attenuation up to 40 dB at 200 MHz and 50 dB at 30 MHz.

4.6 Volume. Clockwise rotation of this control increases the audio output level to either the internal speaker or external earphones. In either case, set this control to a comfortable listening level.

4.7 Meter Sensitivity. Clockwise rotation of this control increases the meter amplifier gain. Set this control so that the received signal produces less than a full-scale deflection on the meter. This control also controls the amplitude of the video signal at the VIDEO jack on the front panel. Always set to a level that does not peg the needle.

4.8 Meter. The readings on the meter are proportional to the signal strength of the RF signal received and the setting of the meter sensitivity control. When receiving weak signals, set the meter sensitivity control as high as possible without pegging the needle.

4.9 Fine Tuning. The fine tuning control has a range of approximately 6 MHz. Clockwise rotation increases the frequency received.

4.10 Main Tuning. The main tuning control covers a range of 0.5 MHz to 250 MHz in 10 turns of the dial. It is provided with a locking lever to prevent accidental turning after it has been set. Lift up to turn, push down to lock.

4.11 Charge. The charger input jack is used to connect the battery charger to the locator for recharging the internal batteries.

4.12 Low Battery. This signal indicates that the batteries require recharging before the instrument is used. When lighted, the battery needs recharging.

CAUTION: DO NOT ATTEMPT TO USE THE LOCATOR, OR TO STORE IT AWAY, WITH DISCHARGED BATTERIES.

4.13 Video. The video output jack is provided so that the received signal may be observed on an oscilloscope. The signal is detected and filtered and may be connected directly to a high-impedance vertical input on any 'scope. The amplitude of this signal is controlled by the meter sensitivity control.

4.14 Meter. The meter output jack is provided for the remote operation of a remote meter (such as might be mounted above a vehicle instrument panel) which provides the same readout as the meter on the instrument.

4.15 Tuning Dial. The tuning dial is provided so that the user has an approximate indication as to the frequency to which the locator is tuned. It is provided as a guide and is not intended as an accurate indication of received frequency.

The large knob attached to the tuning dial may be used for rapid traverse from one end of the dial to the other.

CAUTION: USE CARE AND AVOID SLAMMING THE DIAL INTO THE STOPS AT THE ENDS OF DIAL TRAVEL.

4.16 Phone. The panel-mounted speaker provides audio output unless headphones are used. Plugging a set of 8-ohm to 16-ohm headphones into the phone jack disconnects the speaker. This can be helpful in areas of high ambient noise, for greater sensitivity to weak signals and for reasons of security.

5. Tuning Procedures

5.1 General. The Model 700 Interference Locator has been specifically designed for the rapid location of interference sources. For this reason, we believe it to be the finest tool available for this purpose at any cost. The investigator will find it easy to tune and locate broad-band noise emanating from such sources as loose hardware on transmission and distribution lines.

The design innovations which make the Model 700 such an effective interference locator tend to minimize its use as a communications receiver.

Specific signals may be tuned in, such as radio stations. However, some skill and understanding of the instrument is required. The tuning procedures presented here will familiarize the investigator with the versatility of the Model 700 Interference Locator and will also demonstrate its limitations, which in no way detract from its intended application. The Model 700 is, in fact, not intended to be used as an entertainment receiver.

5.2 AM Broadcast Band Tuning. Connect the Telescoping Rod Antenna (Model 546) to the antenna input connector on the instrument. It is recommended that this antenna be used first each time a search is initiated. This antenna is wide-band and will operate over the entire tuning range of the Locator.

Turn the power switch ON. Turn the main tuning control counter-clockwise until it reaches the end of travel. The large dial knob may be used for rapid traverse.

The dial should indicate the AM band. Starting with the fine tuning control at the maximum clockwise position, slowly turn the fine tuning control counter-clockwise until a quieting effect is observed, along with a large meter deflection. At this point, the instrument is tuned to its own first local oscillator (equivalent to an input frequency of zero Hertz). It is normal, when tuned to this area, for squeals and birdies (oscillations) to occur.

Turn the fine tuning control clockwise from this point and you will begin tuning through the AM broadcast band. Note that the fine tuning control range is approximately 6 MHz. This means that with one-quarter of a turn of the fine tuning control you will tune the entire broadcast band. As you can understand, it will take care to tune in a specific broadcast station.

When using the rod antenna, the front end of the locator is untuned. This results in poor selectivity and sensitivity. If you wish to operate the Model 700 Locator in the AM broadcast band, or at any frequency below 3 MHz, it is recommended that you change to the ferrite rod antenna (Model 541) in conjunction with the antenna handle (Model 540).

5.3 Antenna Tuning. The Model 540 Antenna Handle Assembly provides for the tuning of the various antenna elements used with it. For proper operation, the antenna element must be plugged into the handle assembly with the RED arrow in line with the RED banana jack.

In order for the antenna to be efficient and directive, it must be tuned to the same frequency as the locator. For example, to observe a frequency below 3 MHz, plug the Model 541 Ferrite Rod Antenna into the handle assembly. The RED arrow must point to the RED banana jack. Turn the black tuning knob on the handle assembly until a peak is noted on the meter. The meter sensitivity may have to be adjusted to keep the meter reading below maximum. The antenna is now tuned.

The 6'' loop antenna (Model 543) and the 12'' loop antenna (Model 542) are tuned in a like manner. The folded dipole antenna is untuned and is broadband above 220 MHz. Turning the knob on the handle assembly will have no affect when using the folded dipole.

5.4 Tuning Frequencies Above the AM Broadcast Band. Turn the main tuning control until the dial indicates the general area of frequencies to be observed. Rotate the fine tuning control until the desired frequency is found. Clockwise rotation increases frequency. It may be necessary to reposition the main tuning control higher, or lower, if the signal is out of the fine tuning range.

5.5 Tuning FM Signals. FM signals may be received by SLOPE DETECTION. When an FM signal is received, it must be tuned to a point off-center from the received frequency. This provides a non-linear amplification of the frequency-shifted FM signal, in the IF stage. This produces an AM signal which is detected by the AM detector.

5.6 Tuning Drift. When a specific frequency is tuned in, it might be observed that the Model 700 Interference Locator will ''drift'' off the station or signal. This is normal and should cause no problems during an interference search. The slow drift is easily compensated for by small adjustments of the fine tuning control. Even though the local oscillator is quite stable, a drift of only 0.00125% of the 800 MHz local oscillator results in a 10 kHz shift in the tuned frequency input.

6. Location Procedures

6.1 General. There are three methods of monitoring and interpreting an RF signal (noise or interference). You can:

a. Listen to the audio output from the built-in speaker, or use headphones plugged into the Phones jack.

b. Observe the deflection of the meter indicator. Use of the meter is preferred because the human ear is sensitive only to relatively large changes in audio level. In cases where rotating the directional antenna produces only a small change in audio output, the meter readings must be relied upon in determining the direction from which the signal is coming. Use of the meter gain control permits the locator to indicate relatively large meter readings for small changes in a weak signal.

c. Observe the video output signal on an oscilloscope. In some instances, this may be the preferred method of locating the noise source, such as when several strong noise sources are located in the same area. Observation of the video signal allows the investigator to differentiate between the various signals.

6.2 Initial Readings. Initial attempts to locate the source of an interfering signal should begin in the area where the interference is present. It is suggested that the investigator visit the premises of the complaint and observe the equipment that is being affected.

A great deal of information can be gained from such customer contact. Note such things as the time of day, the type of noise (constant or intermittent), the weather conditions, and if the interference is present for the observer to experience it. It is vital that the investigator hear and/or see the offending signal, since there may be more than one possible interfering signal in the area.

Considerable time may be saved if the investigator's efforts are directed toward the interfering source and he does not track down several other sources in the area which are not causing trouble. Using the telescoping antenna on the Model 700 Interference Locator, scan through the band to determine the RF frequencies affected. Listen to the offending signal or noise and learn its characteristics, periodicity, timing and unusual features so you will be able to continually identify it during the search.

6.3 Low Frequency Search. Search through the band on the Model 700 Interference Locator to determine the frequency range of the interference source. It is much easier to use the highest possible frequency for locating because the propagation attenuation of higher frequencies is more rapid.

A gap-type noise, if followed at 1 MHz, may propagate for miles along a power line. The same gap-type noise will propagate at much shorter distances at 200 MHz. If the noise can be observed above 200 MHz, use a high-frequency search program (6.4).

When the offending signal can only be picked up at low frequencies, the ferrite rod or loop antennas should be used. The Model 541 Ferrite Rod Antenna is used below 3 MHz, the Model 542 12'' Loop Antenna is used between 6 and 12 MHz and the Model 543 6'' Loop Antenna is used from 17 to 34 MHz.

6.3.1 Tune the Locator to the interference. If the interference is wide-band, such as is produced from a gap-type noise source, select a frequency where the noise peaks between radio stations. This frequency should also be within the tuning range of one of the low-frequency antennas.

6.3.2 Install the antenna selected on the Model 540 Antenna Handle with the RED arrow pointing toward the RED banana jack. Tune the antenna using the black knob on the handle assembly. A sharp signal null should be observed when the signal arrives perpendicularly to the plane of the loop. If the ferrite rod antenna is being used, a signal peak will be observed when the signal arrives perpendicularly to the plane of the antenna.

6.3.3 A utility distribution line will act as an unterminated transmission line at frequencies generated by a broad-band source. A non-terminated transmission line has a standing wave pattern and the investigator will observe peaks and nulls in the signal as he travels parallel to the line.

CAUTION: WHEN USING A LOOP OR FERRITE ROD ANTENNA, MOVE AWAY FROM OVERHEAD POWER LINES AND OTHER METAL STRUCTURE.

If there are standing waves on the lines, take null bearings when using loop antennas, at the points of maximum signal strength along the line.

6.3.4 Triangulation. To determine the direction or general location of an interference source, the process of triangulation may be used. Take a null bearing, then proceed in one direction for some distance and take a second bearing. The two bearings, when plotted on a chart of the area, will cross at some point. This will be the location of or direction from which the interference source is located. Once you are in the correct area, then shift to a high frequency search.

6.4 High Frequency Search. Install the Model 544 Folded Dipole Antenna. Tune the Model 700 Interference Locator to a frequency at which the interfering signal peaks. This frequency must be above 200 MHz and should be between normal radio transmissions.

No antenna tuning is required when using the folded dipole antenna. The looped element end is the front of the antenna and will indicate from which direction the interference is coming. At frequencies above 200 MHz, the propagation attenuation is so high that just a short walk in the direction indicated should bring you to the source of noise.

As the signal strength increases, when approaching an interference source, the RF attenuation control should be increased to prevent saturation of the RF and IF amplifiers. If the amplifiers become saturated, you will no longer be able to tell the direction of maximum signal.

6.5 Isolation of a Noise Source. There are several methods of isolating a noise source and determining its specific cause.

a. Probing suspected areas with an RF probe is one method. It is suggested that the Model 545 Probe Antenna be used with the Antenna Handle Assembly to pin-point noise sources which are typically found in dwellings. For probing near higher voltage, it is suggested the Model 511A RF Probe be used. It is insulated for 15,000 volts at 60 Hz and is highly desirable for use in preventive maintenance programs on rotating machinery, power distribution systems, etc. The Model 511A Probe is used in conjunction with the Model 512 Coaxial Extension Cable.

b. A second method of isolating a gap-type noise source would be to use another locating device, designed to probe suspected areas. Such an instrument would be the Sprague Model 900 Little Snoop(TM). The Little Snoop is a small, hand-held or hot-stick mounted locator. It is unique in that it detects the fast rise time pulses which are generated by gap-type noise while it discriminates against man-made signals. It responds only to sources of RF noise. The Little Snoop is recommended for use on a hot-stick for probing suspected hardware on utility poles.

c. In some areas, isolation of a noise source to a specific pole may be a problem. In these cases, the problem may be the result of having several noise sources on adjacent poles. For maximum pole isolation, the Sprague Model 1010 RFI Gun, which can be tuned over the wide range of 470 to 806 MHz, is recommended. At 800 MHz, the attenuation (reduction in level) per 100 yards, is 4 times the attenuation at 400 MHz, and 16 times the attenuation at 200 MHz. These higher frequencies result in better discrimination between noise sources on adjacent poles.

7. Servicing, Maintenance and Alignment

7.1 General. The Model 700 Interference Locator is designed and constructed to give long, trouble-free service, but an occasional malfunction may occur. Most difficulties can be corrected by a qualified electronic technician by referring to the block diagram and schematic diagram, as well as to the parts list and alignment instructions contained in this manual.

7.2 Alignment. The Model 700 Interference Locator is not to be aligned by unqualified personnel. Certain adjustments, particularly in the high-frequency circuits, are extremely critical and require complete familiarity with such equipment.

The signal generator used for the alignment should contain an attenuator capable of reducing the generator's output to 0.5 microvolt at all frequencies between 470 kHz and 800 MHz. The input impedance of the Model 700 Locator is approximately 50 ohms. A generator with a 50 ohm output impedance must be used. Modulation will assist in identifying the signal from the generator, especially if the Model 700 Locator is very much out of alignment. Use 400 Hz to 1000 Hz modulation at about 30%.

Charge the battery completely before starting the alignment procedures. Turn the locator ON and allow it to stabilize for fifteen minutes.

NOTE!

READ THE ENTIRE ALIGNMENT PROCEDURES BEFORE MAKING ANY ADJUSTMENTS.

7.2.1 470 kHz IF Alignment. Remove the tuner output plug from J1. Do not allow P1 to touch the locator chassis.

Adjust the signal generator frequency to 470 kHz. Refer to Figures 2, 3 and 4 for the location of Test Points.

Connect the output of the generator to Test Point 1 through a 0.1 μF capacitor. DO NOT GROUND THIS POINT. (Test Point = TP)

Monitor Test Point 2 with a 'scope.

Adjust transformers T1 and T2 alternately to produce the maximum signal at Test Point 2. 100 microvolts of signal at Test Point 1 should be adequate to provide approximately 100 millivolts at Test Point 2.

7.2.2 10.7 MHz IF and Local Oscillator Alignment. Remove the signal generator from TP 1 and connect it through a 0.1 μF capacitor to TP 3.

Adjust the frequency of the signal generator to 10.7 MHz. Monitor the output at TP 2 as in 7.2.1.

Adjust T3, L2 and L3 for maximum signal.320 microvolts from the signal generator should produce about 125 millivolts peak-to-peak at TP 2 with a 30% modulated signal.

NOTE: L3 IS A LOCAL OSCILLATOR FREQUENCY ADJUSTMENT. IT SHOULD BE ADJUSTED TO 11.170 MHz. THIS SHOULD BE THE CASE WHEN L3 IS ADJUSTED FOR A MAXIMUM SIGNAL AT TP 2 WITH A MINIMUM AMOUNT OF TUNING OF THE L3 SLUG.

7.2.3 44 MHz IF Amplifier Alignment. Set the signal generator to provide an output of 44 MHz at 10 microvolts with 30% modulation.

Connect the generator to J1 on the IF amplifier board.

Adjust C15 and C16 for a maximum reading at TP 2.

Adjust potentiometer R24 for a reading of 110 millivolts at TP 2.

Re-connect P1 to J1 on the IF amplifier board. Set the RF attenuation to maximum. Set the meter sensitivity to a level where internal noise may be observed on the RF meter. Adjust the tuner coil for a maximum noise indication on the RF meter. (See Figure 5.)

7.2.4 800 MHz Local Oscillator. The 800 MHz local oscillator is inside the converter module. Do not attempt to take readings inside the converter since removing the cover will de-tune the oscillator.

The 800 MHz local oscillator frequency is not critical. Errors in the oscillator frequency are compensated for when adjusting the main tuning dial tracking.

Tune the signal generator to 800 MHz and set it for an output of 100 microvolts.

Set the RF attenuation to minimum and connect the generator to the antenna input jack. Tune through the low end of the tuning range until the signal from the generator is located.

If the signal cannot be found, adjust R46 on the Power Supply Board.

After finding the injected signal, turn the signal generator OFF. Do not move the tuning dial. Turn the 800 MHz tuning adjustment a little at a time until it is indicated on the meter. (See Figure 5.)

The 800 MHz Local Oscillator is now correctly tuned.

7.2.5 Tuning Dial Tracking. Tuning is accomplished by changing the voltage to the varactor tuner. Fine tuning control R5 and main tuning control R6 are fed through a voltage divider to select the tuning voltage.

A 50,000 ohm Trimpot (R7) adjusts the lower end of this voltage divider and sets the level of minimum tuning voltage. The divider obtains its voltage from an adjustable voltage regulator. This regulator is adjusted with R46 and is set for the maximum tuning voltage required.

R46 adjusts the low end
of the dial
R7 adjusts the high end
of the dial

Move the main tuning dial to the low end dial stop (AM BC band).

Set the fine tuning control to the center of its range.

Adjust R46 for maximum local oscillator signal as indicated on the RF meter. (R46 is located on the right side of the power supply board).

Set the signal generator to 250 MHz at 10 microvolts.

Connect the generator to the antenna input jack.

Set the main tuning dial to the high end dial stop (250 MHz end).

Set the fine tuning control to the center of its range.

Adjust R7 until the 250 MHz signal is received. R7 is located on the left, bottom corner of the power supply board.

7.2.6 54.7 MHz Local Oscillator Injection Level. Set the signal generator to a frequency at or near 125 MHz, 30% modulation and 0.5 microvolt output.

Connect the signal generator to the antenna input jack.

Adjust R48 on the IF amplifier board for the best signal-to-noise ratio. This can best be done by observing the output meter. Compare meter readings as the signal generator is shifted on and off frequency. Excessive injection will cause spurious signal reception.

7.2.7 Meter Sensitivity Adjustment. Turn the main tuning control to 250 MHz on the dial. Set the RF attenuation to maximum. Set the Meter Sensitivity to the maximum clockwise direction for maximum sensitivity.

Adjust R26 on the IF amplifier board, to give a meter reading of 10.

7.2.8 Low Battery Indicator. Disconnect the negative (−) lead of the 12 volt internal battery from the chassis ground.

Connect an external, variable d-c power supply by connecting its negative (−) lead to chassis ground and the positive (+) lead to the positive end of the battery. Adjust the power supply to 11.55 volts using an accurate meter. Adjust R53 on the power supply board to the point where the low battery indicator (light emitting diode) LED just begins to glow.

Turn the Model 700 Interference Locator OFF. Turn the external power supply OFF.

Remove the leads from the external power supply and re-connect the negative battery lead to chassis ground.

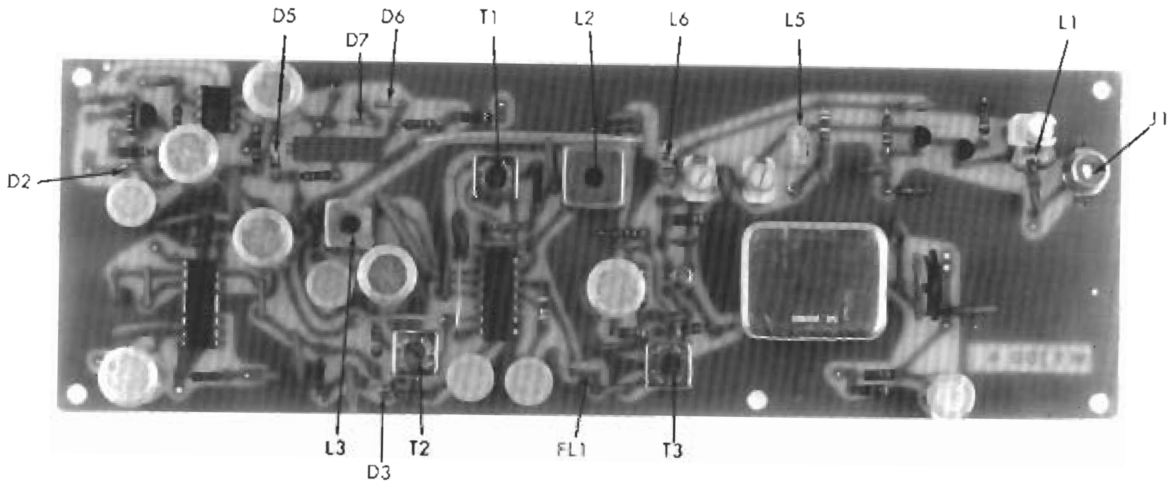


Figure 2
TRANSFORMERS, INDUCTORS, AND DIODES RECEIVER PRINTED WIRING BOARD.

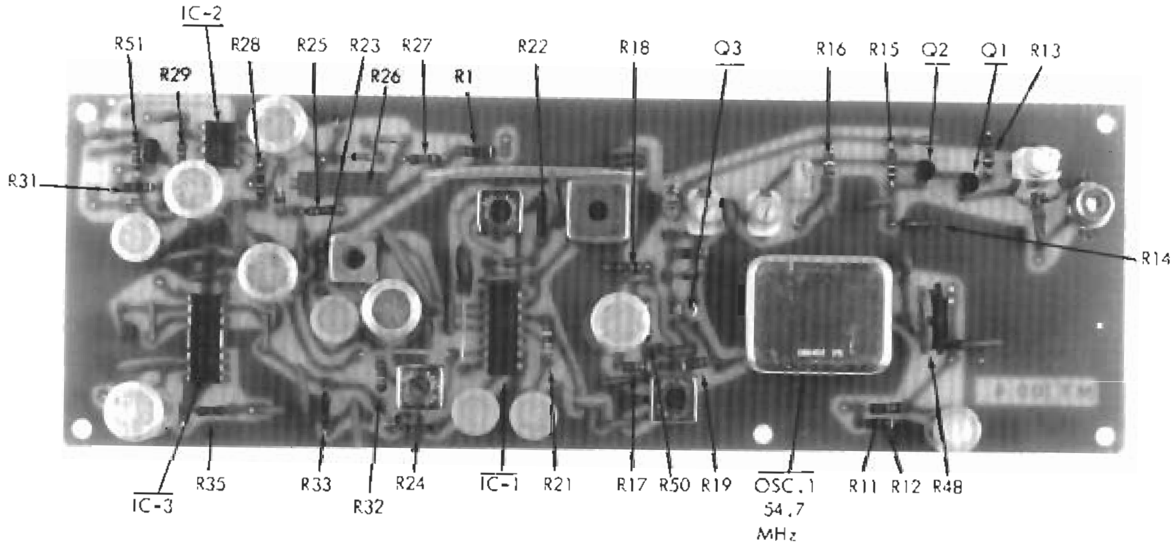


Figure 3
RESISTORS, TRANSISTORS, AND INTEGRATED CIRCUITS RECEIVER PRINTED WIRING BOARD.

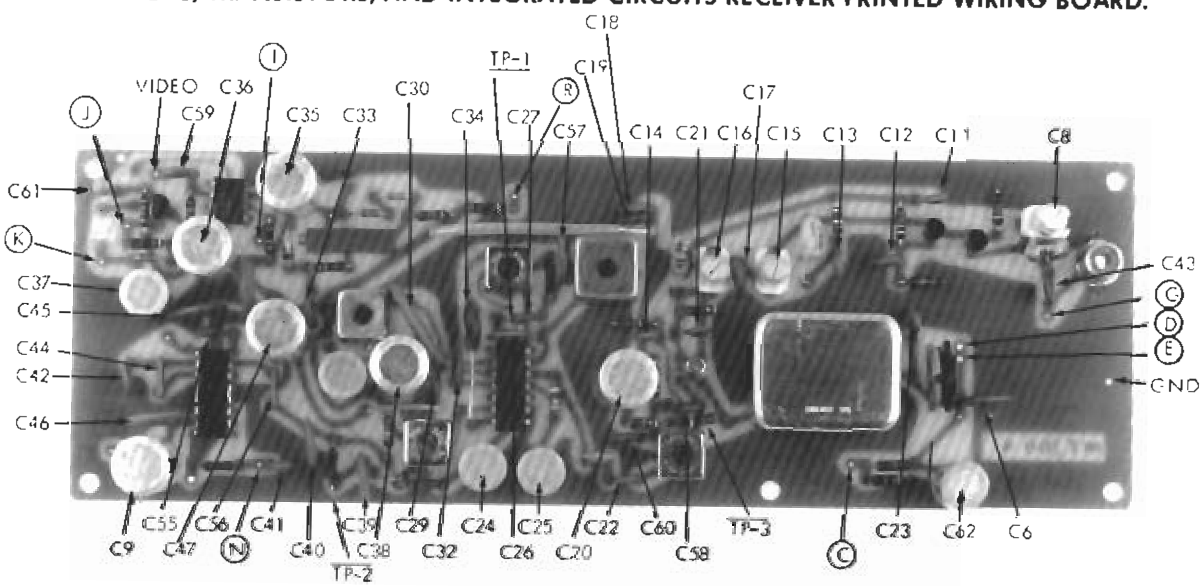


Figure 4
CAPACITORS AND SIGNAL ACCESS POINTS RECEIVER PRINTED WIRING BOARD.

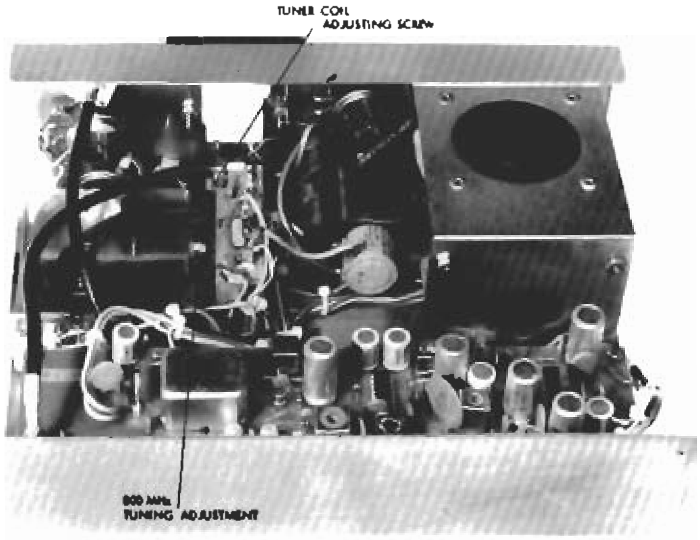
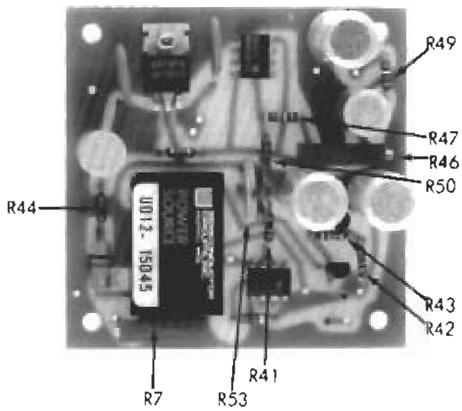
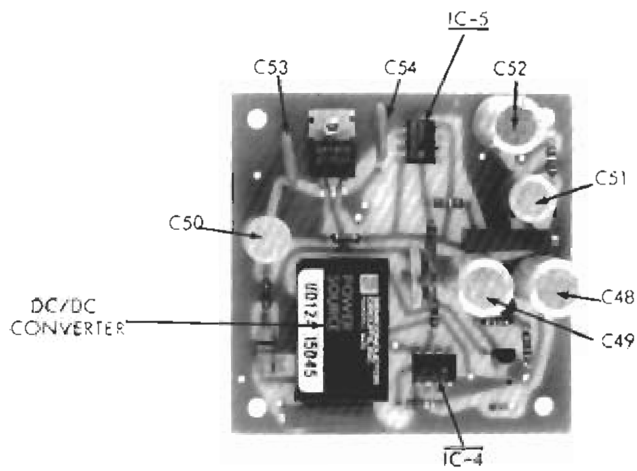


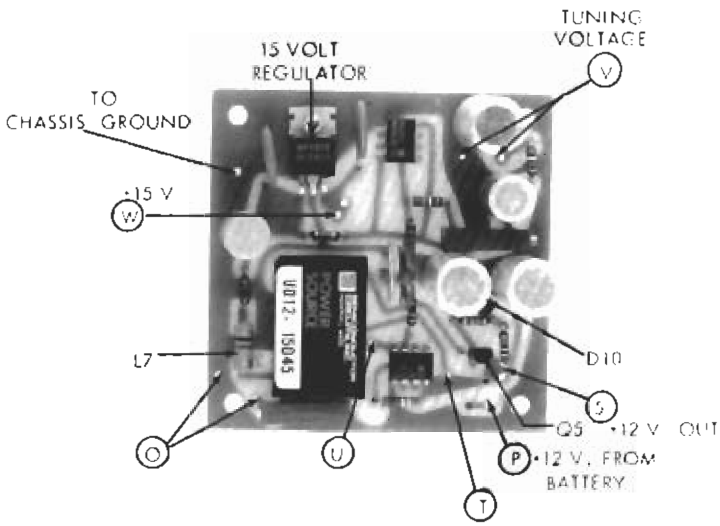
Figure 5



RESISTOR LOCATIONS
POWER SUPPLY PRINTED WIRING BOARD.



CAPACITORS, INTEGRATED CIRCUITS, AND D-C TO D-C CONVERTER LOCATIONS
POWER SUPPLY PRINTED WIRING BOARD.



SIGNAL ACCESS POINTS, DIODES, VOLTAGES, AND TRANSISTOR LOCATIONS
POWER SUPPLY PRINTED WIRING BOARD.

APPENDIX
Specifications and Performance Characteristics

1. **Size.** The Model 700 is 4¼" high x 10⅛" wide x 9½" deep (10.8 cm x 25.7 cm x 24.1 cm) including controls and under-cabinet feet.

2. **Net Weight.** 11 pounds, including batteries.

3. **Mounting.** The instrument is mounted in a sturdy, compact, blue-finished metal case.

4. **Accessories Supplied.**

4.1 When ordered as a Model 700 Kit, the Model 549 Antenna Kit, which contains the following; is included:
a. Model 540 Antenna Handle Assembly
b. Model 541 Ferrite Rod Antenna
c. Model 542 12" Loop Antenna
d. Model 543 6" Loop Antenna
e. Model 544 Folded Dipole Antenna
f. Model 545 Probe Antenna

4.2 Model 546 Telescoping Rod Antenna.

4.3 Model 550 Battery Charger.

4.4 Carrying Strap.

4.5 Operating/Maintenance Manual.

5. **Tuning Range.** 500 kHz to 250 MHz in one continuous band.

6. **Sensitivity***

6.1 1.0 microvolt or better at all frequencies between 2 MHz and 250 MHz.

6.2 2 microvolts or better at all frequencies below 2 MHz.

7. **Battery Life.** Eight hours continuous operation. Longer life under intermittent operation.

8. **Video Output.** The video output, fed to a high-impedance vertical input oscilloscope jack will supply a signal of 5 volts peak-to-peak, providing the received signal is strong enough to cause a 50% RF meter deflection.

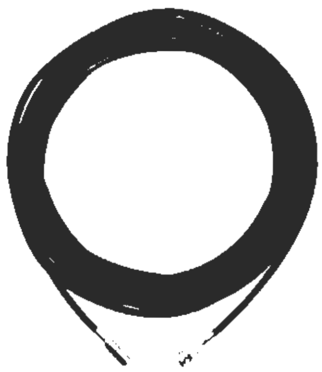
9. **Meter Output.** 1 milliampere, 1000 ohms, full scale.

10. **Phone Output.** 8 ohms, minimum load impedance.

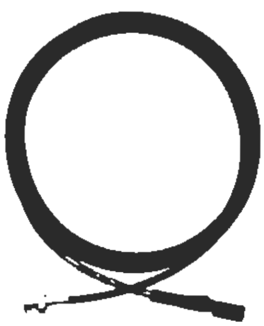
11. **Optional Accessaries.**

11.1 **Model 511A RF Probe.** This probe is insulated for 15,000 volts, 60 Hz. It is used for pinpointing RF noise sources associated with higher voltages. It is highly desirable for use in preventive maintenance programs on rotating machinery, power distribution systems, etc. The Model 511A RF Probe is used in conjunction with the Model 512 Extension Cable.

11.2 **Model 512 Coaxial Extension Cable.** This 25 ft. vinyl-covered coaxial cable permits directional loop antennas, VHF dipoles and RF probes to be used remotely from the Model 700 Interference Locator. It is also used for connecting directional antennas mounted on the roof of a vehicle to an interference locator within the vehicle. This extension cable is required when the Model 511A Probe is used. The cable is fitted with BNC connectors at each end.



11.3 **Model 513 Antenna Cable.** The Model 513 Antenna Cable is 8 ft. long and is especially made for connecting to a standard auto radio antenna on one end, and to the BNC connectors on the interference locator on the other end. This cable is used when patrolling distribution and transmission lines in an automobile, where a directional antenna is not required.

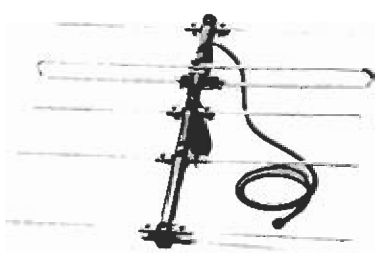


*Sensitivity: Where sensitivity is the input voltage required to produce a 50% full-scale meter deflection, above internally-generated noise, using a 50% modulated signal.

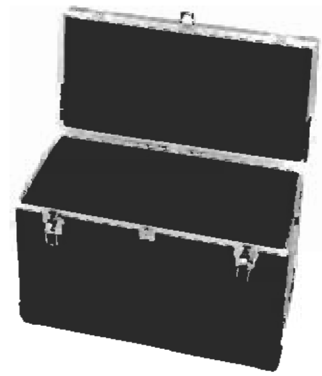
11.4 Model 514 Headphones. These headphones are highly desirable when the Model 700 Interference Locator is to be used in noisy street locations, near motors, and for security reasons. They are furnished with the standard cord and PL-55 phone plug.

11.5 Model 530 Yagi Antenna. This antenna is tuned for a center frequency of 216 MHz. It connects to the Locator with a 6 ft. length of coaxial cable, which is furnished.

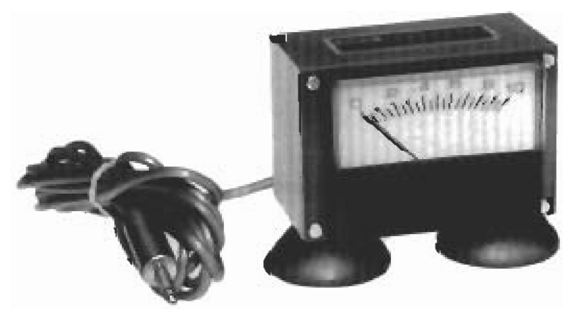
Ruggedly-built, the Model 530 Antenna is also lightweight. It weighs just 23 ounces (436 grams). It measures 22.5 in. (57 cm) long and 27.5 in. (70 cm) wide. Fitted with a comfortable, formed handle, the antenna collapses for ease of transporting and storing.

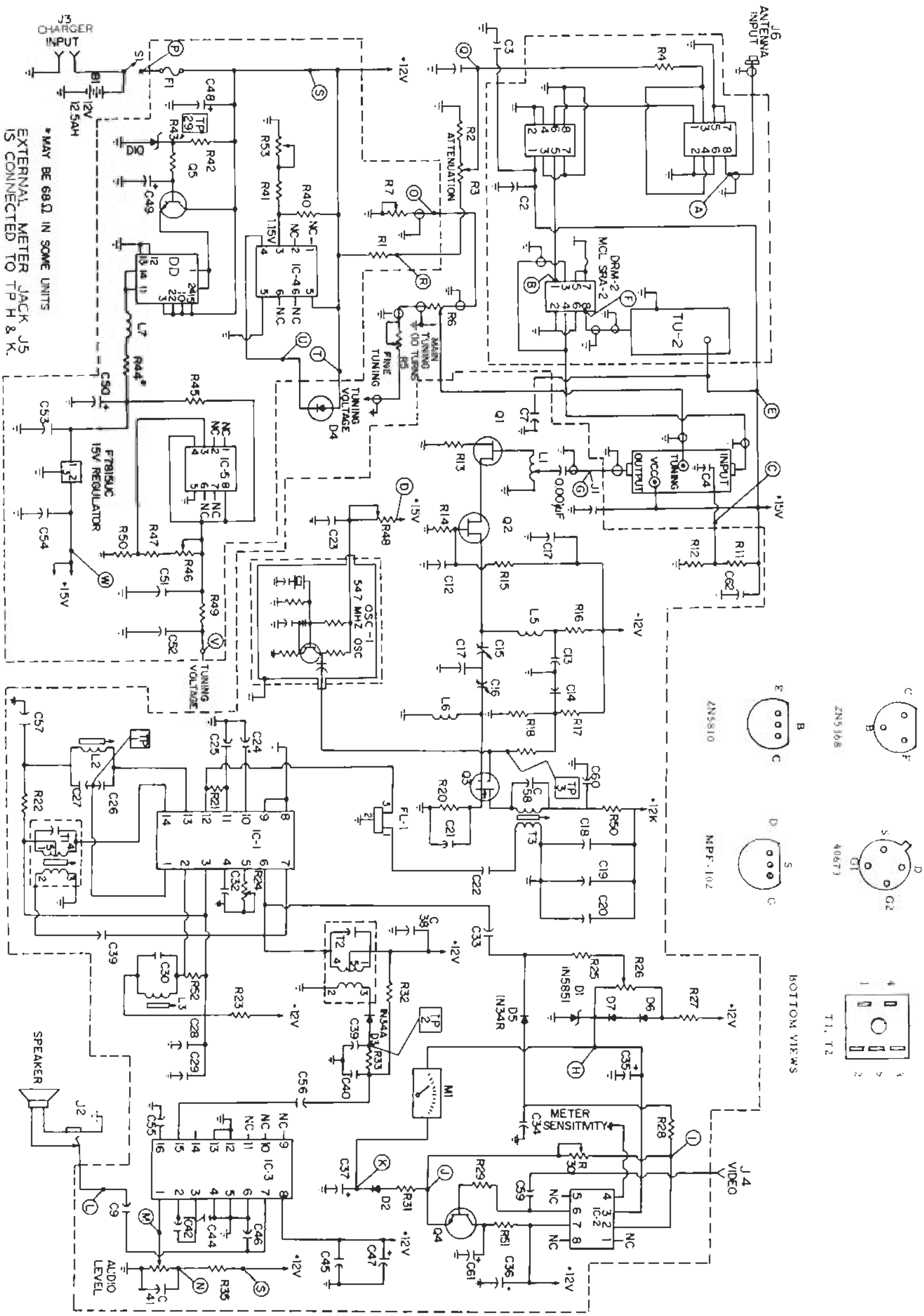


11.6 Model 523 B Carrying Case. This rugged fibre case is designed for transporting and storing the Model 700 Interference Locator and accessories. All corners are reinforced and the center cover latch adds to the security as it can be locked. A set of keys is included.



11.7 Model 551 External Output Meter. The Model 551 Meter is especially useful when the Interference Locator is used in a moving vehicle. The meter mounts on the dash by means of suction cups. It connects to the locator with a 10 ft. cable, which is furnished.




J3 CHARGER INPUT
B1 12V 12.5AH
*MAY BE 68Ω IN SOME UNITS
EXTERNAL METER JACK J5 IS CONNECTED TO TP H & K.
J6 ANTENNA INPUT
ATTENUATION
DRM-2 MCL SRA-2
TU-2
MAIN TUNING
FINE TUNING
TUNING VOLTAGE
F7815UC 15V REGULATOR
OSC-1 547 MHZ OSC
METER SENSITIVITY
J4 VIDEO
SPEAKER
AUDIO LEVEL
BOTTOM VIEWS
T1, T2

List of Maintenance Parts

Circuit Symbol	Description
B1	Battery, 2V, 2.5AH; Gates 0810-0004 (6 required)
C1, C2, C19, C22, C43, C44, C60	Capacitor, disc ceramic; 0.001μF, ±10%; 250 WVDC; 255-D10.
C3, C4, C11, C12, C13, C14, C18, C21, C23, C29, C41, C55, C59	Capacitor, disc ceramic; 0.01μF, −20, +80%; 25 WVDC; HY-520.
C33, C34	Capacitor, disc ceramic; 75pF, N2200; 1000 WVDC; 10TCY-Q75.
C8, C15, C16	Capacitor, trimmer, 2-10pF, GTH-10000.
C17	Capacitor, disc ceramic; 300pF, ±20%; 1000 WVDC; 5GA-T30.
C9, C20, C35, C36, C38, C47, C48, C49, C52	Capacitor, aluminum electrolytic; 330μF; −10, +100%; 20 WVDC; 672D337H020DM5C.
C24, C25, C50, C62	Capacitor, aluminum electrolytic; 10μF; −10, +75%; 25 WVDC; 502D106G025CC.
C26	Capacitor, disc ceramic; 100pF, N750; 1000 WVDC; 10 TCU-T10.
C27	Capacitor, disc ceramic; 1500pF, ±10%; 250 WVDC; 2SS-D15.
C28, C37, C51	Capacitor, aluminum electrolytic; 33μF; −10, +50%; 50 WVDC; 502D336F050CD1C.
C30	Capacitor, disc ceramic; 390pF, N750, 1000 WVDC; 10TCU-T39.
C31	Capacitor, disc ceramic; 0.05μF, ±20%; 500 WVDC; 5GA-S50.
C32	Capacitor, Manolythic ceramic; 0.68μF, ±20%; 50 WVDC; 3CZ5U684X0050C5.
C39	Capacitor, disc ceramic; 0.005μF, ±10%, 250 WVDC; 2SS-D50.
C40	Capacitor, disc ceramic; 0.02μF, ±20%; 100 WVDC; 2SS-D50.
C42 thru C56	Capacitor, Manolythic ceramic; 0.47μF, ±20%; 50 WVDC; 3CZ5U474X0050C5.
C58	Capacitor, disc ceramic; 50pF, ±20%, 1000 WVDC; 5GA-Q50.
C61	Capacitor, solid tantalum electrolytic; 5μF, ±10%; 10 WVDC; 196D475X9010.
DD	Converter, d-c to d-c; UD12-15D45.
D1	Diode, Zener; 6.8V; 1N5851.
D2, D6, D7, D8, D9	Diode, glass, 1N914.
D3, D5	Diode, germanium, glass package, 1N344.
D4	Diode, light-emitting; low battery indicator; Dialight 559-0101-003.
D10	Diode, Zener; 1N58608.
FL1	Filter, ceramic; 10.7 MHz, Murata SFE.
IC1	Integrated Circuit, AM radio chip; μA720.
IC2	Integrated Circuit, meter amplifier, μA741TC.
IC3	Integrated Circuit, TV Sound Channel, ULN-2221B.
IC4	Integrated Circuit, low voltage indicator, ICL8221I.
IC5	Integrated Circuit, regulator (tuning) ICL8212.
IC6	Integrated Circuit, 15V regulator; F7815UC.
J1	Jack, Keystone 572 coaxial.
J2	Jack, phono, H. H. Smith 276.
J3	Jack, NT-T6-200PTR-2A.
J4	Jack, Switchcraft.
J5	Jack, Switchcraft 41 (K-H ext. meter).
J6	Jack, crimp type; BNC panel, AMP 1-331694-0.
L1	Coil, Micro Tech, S616-A-23-L1.
L2	Coil, shielded, J. W. Miller 9050.
L3	Coil, shielded, J. W. Miller 9105.
L4	Not used.
L5	Coil, Micro Tech S616-A-12-L5.
L6	Coil, Micro Tech S616-A-12-L6.
L7	Coil, 82μH RFC, J. W. Miller 9250-823.

OSC-1	Oscillator, 54.7 MHz, Int'l Crystal, OE-1.
Q1, Q2	Transistor, JFET, MPF102.
Q3	Transistor, MOSFET, dual gate, 40673.
Q4	Transistor, 2N5810.
Q5	Transistor, 2N5368.
R1	Resistor, carbon-film, 820Ω, ±5%, ¼W, RA-8245.
R2	Resistor, carbon-film, 36kΩ, ±5%, ¼W, RA-3625.
R3	Resistor, 500kΩ, variable AB-JA1G0A0S-504UA.
R4	Resistor, carbon-film, 47Ω, ±5%, ¼W, RA-4705.
R5	Resistor, 2500Ω, variable AB-JA1G040S-252UA.
R6	Resistor, ten turn pot., 100kΩ, clarostat 73 JA-100k.
R7, R26, R46	Resistor, 50kΩ, variable, Bournes 3006R-1-503.
R8, R10, R23, R42, R45, R50, R51	Resistor, carbon-film, 330Ω, ±5%; ¼W, RA-3315.
R9, R44	Resistor, carbon-film, 22Ω, ±5%, ¼W, RA-2205.
R11	Resistor, carbon-film, 12kΩ, ±5%, ¼W, RA-1235.
R12	Resistor, carbon-film, 10kΩ, ±5%, ¼W, RA-1035.
R13	Resistor, carbon-film, 150Ω, ±5%, ¼W, RA-1015.
R14	Resistor, carbon-film, 6.8kΩ, ±5%, ¼W, RA-6825.
R15, R18	Resistor, carbon-film, 27kΩ, ±5%, ¼W, RA-2735.
R16, R21, R49	Resistor, carbon-film, 390Ω, ±5%, ¼W, RA-3915.
R17	Resistor, carbon-film, 68kΩ, ±5%, ¼W, RA-6835.
R19	Resistor, carbon-film, 47kΩ, ±5%, ¼W, RA-4735.
R20	Resistor, carbon-film, 120Ω, ±5%, ¼W, RA-1215.
R22	Resistor, carbon-film, 680Ω, ±5%, ¼W, RA-6815.
R25, R28, R41	Resistor, carbon-film, 100kΩ, ±5%, ¼W, RA-1045.
R27	Resistor, carbon-film, 56kΩ, ±5%, ¼W, RA-5635.
R29	Resistor, carbon-film, 1.8kΩ, ±5%, ¼W, RA-1825.
S1	Switch, SPDT, On-(None)-On, SMT-123.
TU-1	Tuner, UHF, General Instrument 54-41007-2, Mod. 232-40.

Warranty

The Sprague Electric Company warrants each new instrument to be free from defects in material and workmanship, and to perform according to applicable specifications, if properly operated, for a period of one year from the date of original purchase. Sprague Electric's liability is limited to service work performed at the factory of its Micro Tech Mfg. Opns. Specifically excluded from this Warranty are transistors, tubes, bulbs, fuses, and batteries that have given normal service.

Before this Warranty is effective, the following conditions must be met: (1) The warranty registration card must have been returned within 30 days after the date of original purchase, (2) The instrument must be returned to the Sprague Electric Company, (3) Subsequent examination by Sprague Electric must disclose in Sprague Electric's judgment that the instrument is defective within the terms of this Warranty.

This Warranty is in lieu of all other warranties, expressed or implied. If the return of this instrument is deemed necessary, advise the Sprague Electric Company, Micro Tech Mfg. Opns. in Worcester, MA 01605, giving full details, including model and serial number. The Sprague Electric Company will reply with complete shipping instructions.

No adjustments will be made unless factory permission for the return of the instrument is obtained BEFORE making shipment.

NOTE: Returned instruments must be packed carefully, marked "Fragile," and shipped prepaid.

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