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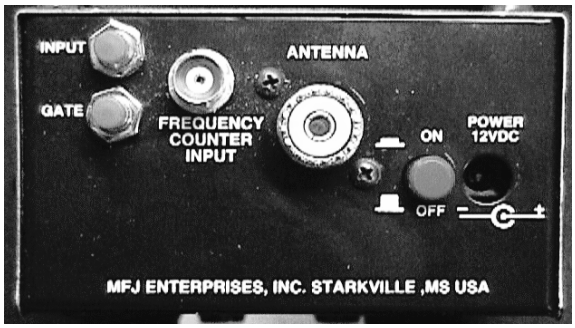
Antenna Analyzer: Tips for Using



Top View:

INPUT select - When the analyzer is ON, a red light in the upper right corner of the display will be flashing and some digits will be visible in the FREQUENCY COUNTER window. If the counter displays all zeros, press the INPUT button one time. The zeros should be replaced by a string of digits that represent the instrument's present frequency setting:

GATE select - When the analyzer is ON, pressing the GATE select button will cycle the instrument through several ranges of frequency display resolution. Press the button several times in succession and observe FREQUENCY COUNTER display and the flashing light. The best setting for our purposes is when the display shows four digits to the right of the decimal and when the light is flashing at its fastest rate.

FREQUENCY COUNTER INPUT - Not used for antenna measurements.

ANTENNA jack - attaches to the coaxial cable feedline at the radio end. Use adapters as needed to attach your ship's coax to the analyzer.

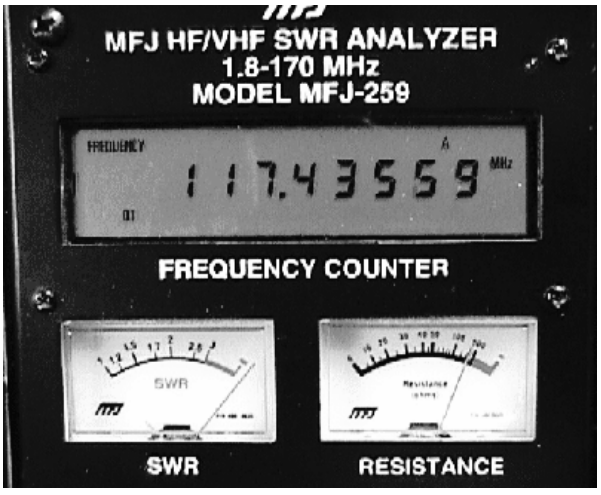
POWER ON/OFF controls internal battery power to the instrument. Turn off while not in use to conserve batteries.

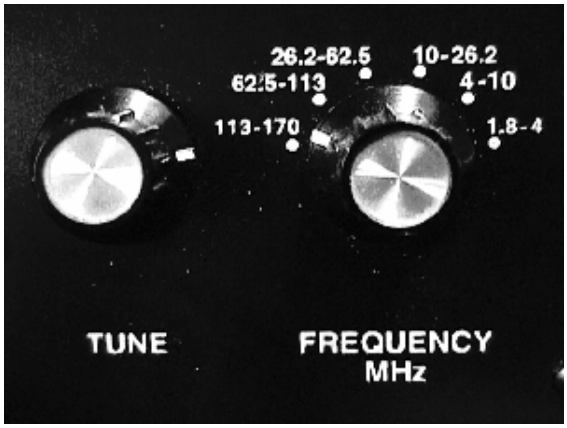
Instrument Displays:

FREQUENCY COUNTER window shows the current test frequency of the instrument. Note that the resolution displayed here has 5 digits to the right of the decimal. Cycle the GATE button until there are only 4 digits to the right of the decimal.

SWR meter will display measured standing wave ratio for the antenna system at the frequency displayed in the counter window.

RESISTANCE meter will display measured antenna system impedance at the frequency displayed in the COUNTER window.





Front Panel Controls:

TUNE knob is a multi-turn control to adjust the test frequency. Rotation will span the range of frequencies bounded by the range select knob.

FREQUENCY MHZ range select knob. Shown here in the 113-170 MHz range for COM and VOR antennas, the knob may be moved clockwise one notch to cover the 75 MHz frequency for marker beacon antennas.

Antenna Analysis and Trimming:

Connect antenna system to be tested to the ANTENNA jack on the top panel.

Turn analyzer ON and set the range switch to 113-170 (VOR/COMM antenna) or 62.5-113 (Marker Beacon antenna).

Set the INPUT and GATE selections per instructions above.

Observe SWR and RESISTANCE readings while rotating the TUNE knob over the full range of frequencies ad depicted on the FREQUENCY COUNTER display

At some frequency in near the range of interest, the SWR indicator should "dip" to the left. In a perfect antenna system, some test frequency will produce an SWR of 1:1 . . . while the RESISTANCE meter will show an impedance of 50 ohms. Note that the SWR meter red-lined at 3:1 and above. For all practical purposes, an SWR of 3:1 or less over the range of interest is acceptable.

Adjust the TUNE knob to achieve the lowest SWR reading. This is the "center frequency" for your antenna system. For builder fabricated antennas, the goal is to adjust the antenna's physical length so that it's center frequency is in the center of our operating range of interest. For example, LOC/VOR signals are received over a range of 108 to 118 MHz therefore a VOR antenna would be optimized at the center of this range or 113 MHz. Communications takes place over the range of 118 to 135 MHz, a VHF Comm antenna would be centered at 126.5 MHz. A marker beacon antenna operates at a single frequency of interest, 75 MHz.

The conventional technique is to fabricate the antenna initially too long and use the antenna analyzer to assist in trimming the antenna to optimum length. Proximity of the antenna to other materials on the aircraft have an effect on it's center frequency so it's always best to trim the antenna while installed in it's final location on the aircraft. Trim short pieces (typically 1/4") from the antenna and find where the lowest SWR occurs . . . as an antenna gets shorter, it's center frequency will rise.

Note:

A 1/2-wave dipole antenna (coax feedline attaches to the center of two, identical elements) needs to be trimmed equally on both ends keeping the coax feedpoint in the center of the finished antenna. A 1/4-wave monopole or whip antenna gets trimmed in one place only . . . at the extreme end of the antenna.

When the antenna's SWR dip is centered on the range of interest, sweep the TUNE knob over entire range of interest while making note of SWR readings at 0.5 MHz intervals. For best performance, the SWR should not be greater than 3:1 at any point over the range of interest.

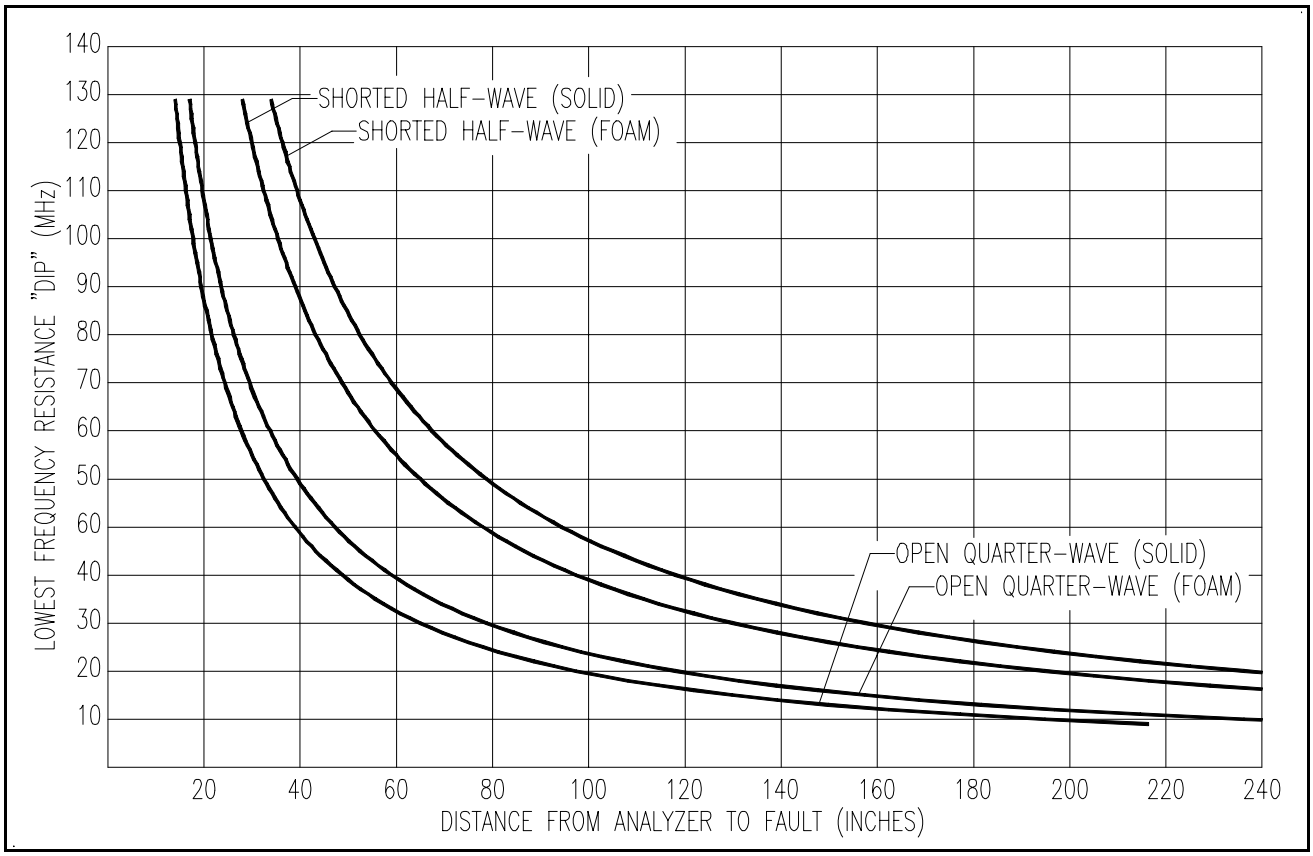
Feedline Fault Location:

The analyzer may be used to locate a shorted or open coaxial feedline. With the far end un-terminated (disconnected from the antenna) the RESISTANCE of the coax feedline varies with FREQUENCY depending on the length of the feedline. A feedline that is shorted will display a very low RESISTANCE at it's half-wavelength frequency. A feedline that is open will present a very low RESISTANCE at it's quarter-wavelength frequency.

If you suspect a faulted feedline, disconnect the feedline from the antenna and use an ohmmeter to measure for continuity between the coax's center conductor and it's outer shield. If the resistance is very high (usually off the ohmmeter's upper range) then the coaxial cable is NOT shorted. The distance from analyzer to fault will be read in the 1/4-Wave Shorted curve of the graph opposite the "Lowest Frequency for RESISTANCE Dip. IF an ohmmeter check shows continuity on the order of a couple of ohms or less, the feedline is shorted. The distance from analyzer to fault will be read from the 1/2-Wave Open curve of the graph.

Note:

An ohmmeter is used to measure DC resistance to see if the feedline is open or shorted. The RESISTANCE meter of the antenna analyzer is a display of AC impedance at the test frequency. While both measurements are expressed in OHMS, they are unrelated to each other. A DC resistance check is to simply confirm whether or not the feedline is SHORTED.



There are two curves each for the "shorted" and "open" condition. One curve represents the characteristics of coax cable with a solid plastic insulation between the center conductor and the shield. The other curve is for coax with foam insulation.

To use the analyzer to locate a fault, set the FREQUENCY MHz range switch to the 4 to 10 MHz range and adjust the TUNE knob over the range while observing the RESISTANCE meter. What you're looking for is a rather well defined 'dip" in the RESISTANCE reading. If no dip is found, move to the next higher range and repeat the scan. What you're looking for is the lowest frequency at which a dip can be produced.

When the "dip" frequency is located, enter the frequency versus inches opposite the measured frequency until you intersect the curve appropriate to the type of coax cable and whether you're trying to locate a short or open feedline. Drop down to obtain the distance in inches from analyzer to the fault in inches.

Opens usually occur at connectors. They can also occur if the coaxial cable has become entangled and physically cut in two. Shorted lines can also occur at poorly installed or contaminated connectors. Check also for pinched coax cable where the inner insulation is mashed bringing the outer braid in contact with the inner conductor.

Batteries:

The analyzer uses 8 AA Alkaline cells. If the analyzer stops functioning, you may access the battery holders by removing four recessed head screws on each side of the instrument and sliding the rear cover off.

Packing for Return:

Remove any adapters used and return them to their containers attached to the analyzer's case straps.

Grab the analyzer by the lower end near the TUNE and FREQUENCY knobs and Insert the analyzer into its case, connectors first. This reduces the possibility that someone will put a thumb through the FREQUENCY COUNTER display when the analyzer is gripped for the next removal.

Pack in original container if possible. Send via priority mail or UPS ground insured for $250.