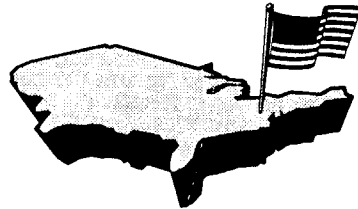


SM-1 SINAD METER TEST SET
Quick Reference Page Guide

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This Quality Electronics
Product was designed and
packed in the USA

Price: \$5.00
Ramsey Publication No. MSM-1
Instruction manual for:
RAMSEY MODEL NO. SM-1
SINAD METER TEST SET

RAMSEY

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Printed on
Recycled Paper

AUTOMATIC SINAD TEST SET

Ramsey Electronics Model No. SM-1

Need a sinad meter that's dependable, easy to use and priced right? This hard working, reliable sinad test meter has the latest in digital technology, so it won't drift. Just connect it to a speaker or other audio point and you're done.

- **Make reliable sensitivity checks on pagers, radios and other receivers - the first time, every time.**
- **Superior quartz crystal timing ensures accuracy. No more critical tuned filters that drift.**
- **Automatic Gain Control circuitry with over a 50dB range ensures precise operation.**
- **Exclusive "Level OK" LED lets you know when your reading is right or not. Why guess?**
- **Just connect it to a speaker or audio point and you're done.**
- **Rugged and handsome metal case assures good looks and reliable service for years to come.**
- **So easy to use, you won't believe it!**
- **Detailed instructions tell you everything that you need to know about the meter (and maybe a bit more, too!)**

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- LC-1 Inductance-Capacitance Meter



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SM-1 Automatic Sinad Test Set

Ramsey Electronics publication No. MSM-1 Revision 1.1
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INSTRUCTION MANUAL FOR

AUTOMATIC SINAD TEST SET

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Note: This unit sold for \$249.95 in January 1997.

Welcome to the SM-1 Automatic Sinad Test Set. We feel that you have purchased a quality product that will be a pleasure to own. In order to properly operate and maintain your meter, please read the instructions carefully.

Your sinad meter is a precise tool for measuring the calibration of FM receivers. Using the latest designs in digital circuitry, the SM-1 uses crystal controlled filters, automatic gain control circuitry with over a 50dB dynamic range and a high quality meter to ensure accurate readings. Also, our exclusive LEVEL OK LED tells you when the signal is locked and when it's not. But the best part about it is it's ease of use. Just hook it up to a set of speaker connections or audio points and you're all set. It works with almost any receiver and signal generator with FM modulation.

What is a sinad meter?

If you've never heard of a sinad meter before, the first thing that you will probably say to yourself is "I don't need it, let alone know what it is." Well, if you do any type of radio repairs or service, chances are that you do. The good news is that the Ramsey SM-1 is really easy to use!

A sinad meter is a tool used to tune up or measure the sensitivity of a receiver. To perform a sinad test, a 1 KHz sine wave modulated on an FM carrier is injected into the receiver using a signal generator. Ideally, the output waveform should be an identical 1 KHz sine wave. After all, your receiver is made to accurately demodulate any audio signal modulated on the carrier signal that it receives. And, if you were able to tune or notch out the 1 KHz tone, you would not hear any other signal. In real receivers, however, there is always a change in the received signal because of noise and the tuning of the receiver. One of the laws that made some guy named Fourier famous (not rich, probably!) is that every wave is made up of many sine waves at multiples of the original frequency. So a wave that comes out of your radio that is distorted or clipped will actually be made up of many sine waves at different frequencies.

Here's the beautiful thing in all of that wave theory. Our sinad meter notches out the original 1 KHz signal and measures the level of what is left. This means that what the meter sees is all of those extra sine waves. Why do we want to know if they are there? Well, remember, if the receiver was perfect, there wouldn't be any extra waves at all. By seeing how much distortion and noise remains after passing through the receiver, you can now adjust the receiver so that there is as little noise as possible, thus optimizing its operation. Later, we'll go over how to measure this.

CIRCUIT DESCRIPTION

Although it looks very simple outside, your sinad meter actually has quite a clever and complex circuit inside. There are five basic parts to the circuit. These are; the AGC, or Automatic Gain Control, a 1 KHz notch filter, a crystal clock circuit, a power supply section and the detector circuit.

The AGC circuit is located to the upper left on the schematic, and spans all of the way to C8. It is the job of the AGC circuit to insure an even signal level going into the circuit. This helps smooth out the signal, and ensures that the signal level stays constant for an accurate reading. Next, the level adjusted audio signal is put into the notch filter circuit. The notch filter circuit is a very selective 1 KHz filter. It utilizes a Switched Capacitor Digital Filter (SCDF). This will completely blank out a 1 KHz sine wave so that any distortion or frequency error can be easily detected.

The quartz crystal circuit is an extremely accurate timing circuit that feeds a 100 KHz square wave into the notch filter circuit. The two flip-flops (74HC74) simply divide the signal by a factor of four to reduce the 400 KHz crystal frequency down to the 100 KHz needed. Using a crystal instead of a tuned capacitor circuit, the sinad meter is able to provide extremely accurate measurements that ensure peak receiver performance.

The detector circuit is an active circuit that feeds the AF signal through the meter in one direction only, much like a diode bridge. It boasts an op-amp to counteract the voltage drop across the four diodes for fast, accurate measurements. Plus, it has an extremely accurate meter that is large enough to read easily.

Finally, there is the power supply circuit. The power circuit simply reduces the incoming 9V to 5V. It also helps to smooth out any noise that may be present in the incoming DC power.

Setup

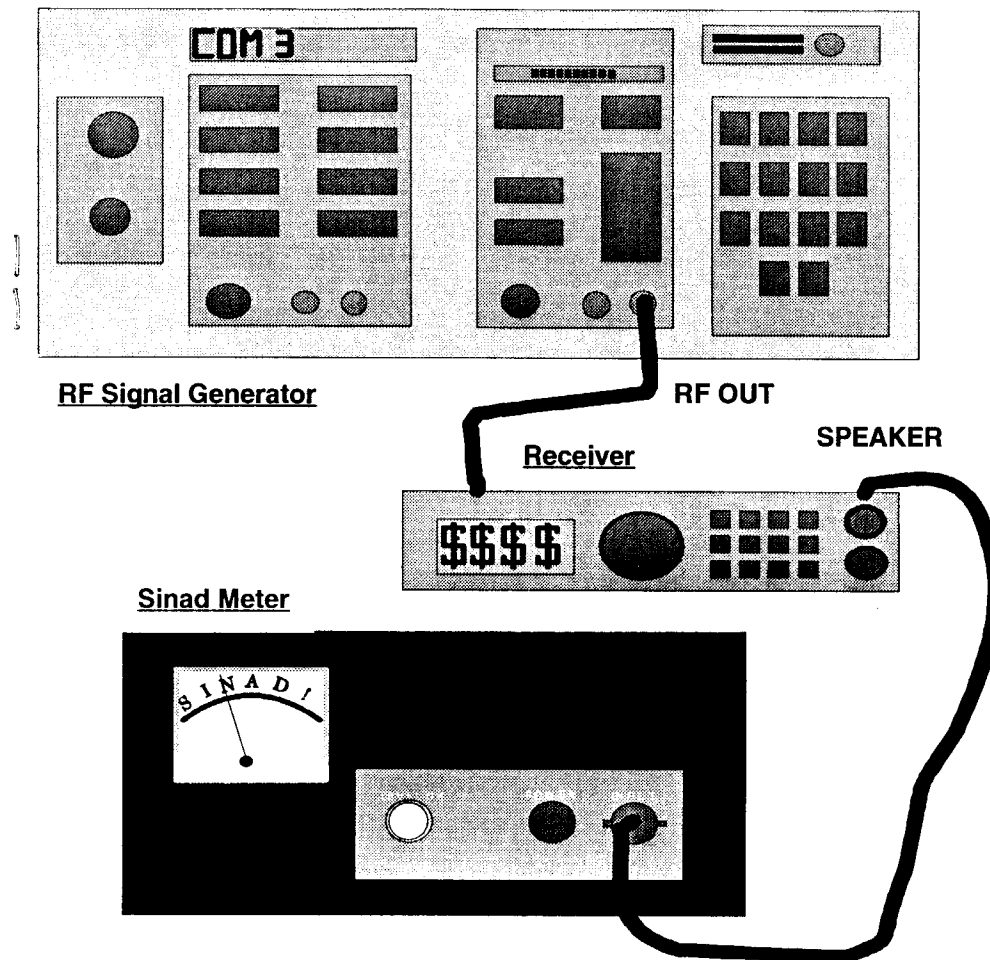
Setting up your SM-1 Sinad Meter should prove to be very simple. You should have a basic understanding, along with access to a signal generator capable of FM modulation, and the receiver to be tested. You must also be familiar with their setup and operation.

- 1. Remove your SM-1 from it's packaging, inspecting it for any damage or defects. Be sure to inspect the power supply supplied with the unit also. If you find anything wrong, please refer to the warranty information in the rear of this booklet.

- ❑ 2. Plug the power supply into both the rear of the unit and the wall. Your meter requires 12V AC or DC at 100mA with the positive connection in the center.

You are now ready to take your first measurements.

- ❑ 3. First set up the receiver to be tested and inject an FM wave modulated with a 1 KHz sine wave at 3 KHz deviation. The radio should be tuned to this frequency, and you should hear the tone coming from the speaker. Adjust the volume until there is between 10mV and 1V peak across the speaker wires.
- ❑ 4. Next, using a piece of coaxial cable with a BNC connection at the meter end, connect one end to the meter, and the other end across the two wires leading to the speaker. Change volume until the LEVEL OK light is glowing brightly. You should now see the meter deflecting. The farther it is to the right, the greater distortion the signal contains.
- ❑ 5. Making various adjustments inside of your receiver, you should try to make the meter read as low as possible. When you cannot get it to go any lower, your receiver is working at it's optimum performance. We suggest that you pay particular attention to the frequency range of the receiver. An off frequency tone is very easily detected on the sinad meter, and may play a big role in helping you to tune it in properly. By reducing the output level of your signal generator, you can take an accurate measurement of the sensitivity and ability to reproduce a signal at certain levels. Generally, FM narrow band communications receivers are specified at their 12 dB sinad sensitivity - usually on the order of .25 - .50 uV.

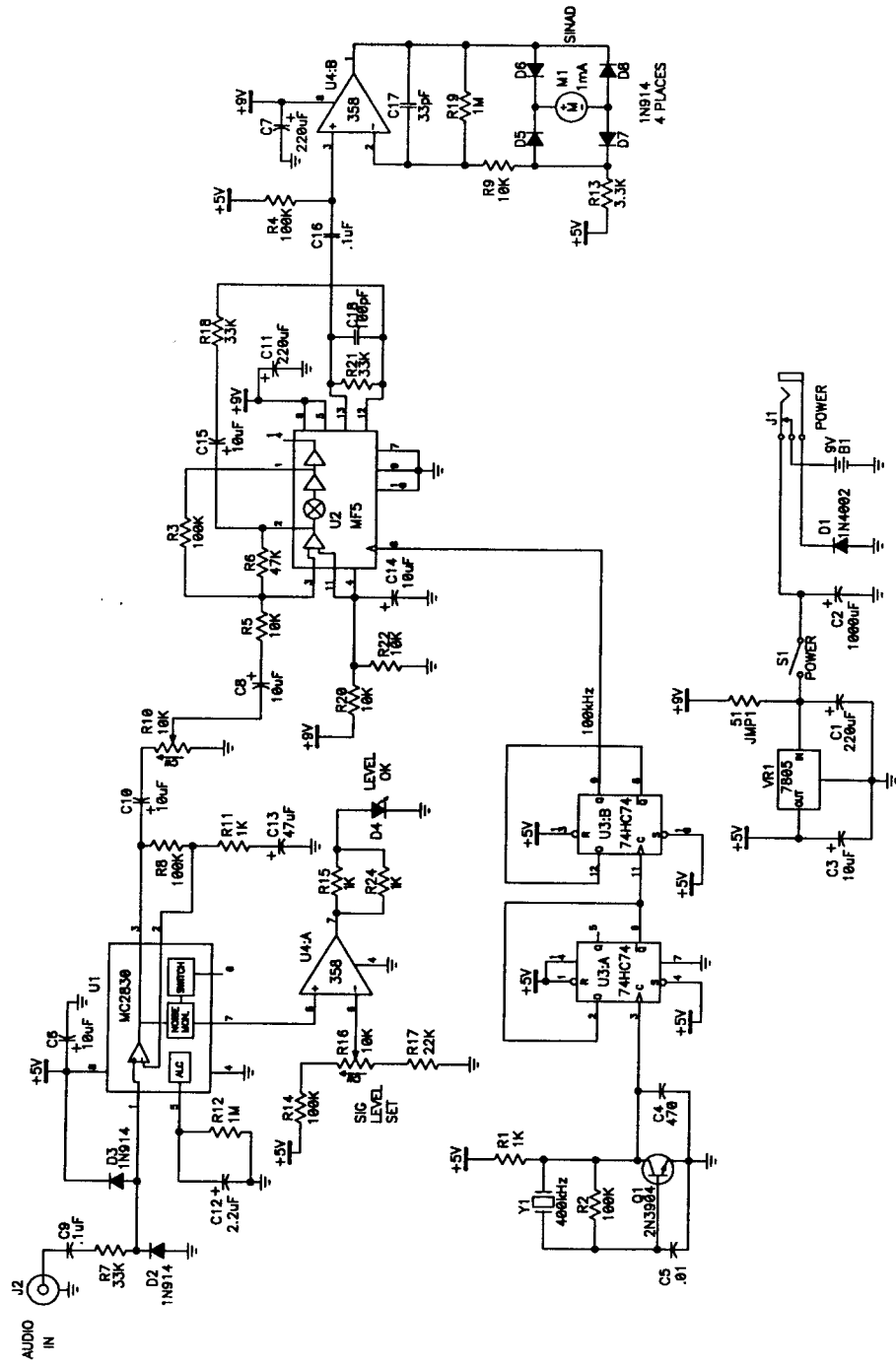


A typical setup

In the above diagram, the sinad meter is setup to take a typical measurement. To do this, there must be two connections. One is from a signal generator or service monitor, and the other is from the receiver's speaker output to the sinad meter.

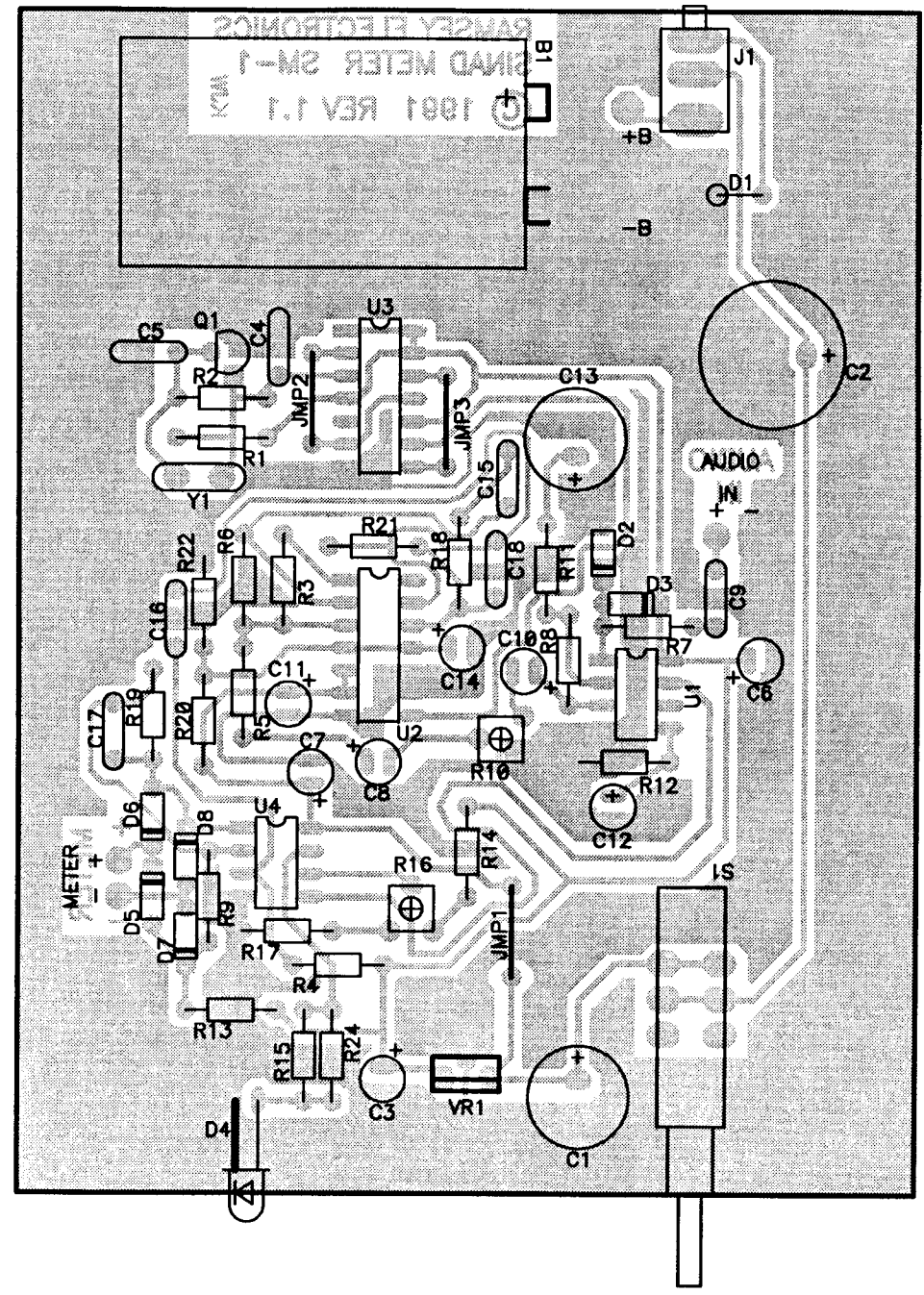
- ❑ 1. The signal generator or service monitor must produce a 1 KHz sine wave with a 3 KHz, deviation modulated on a carrier at the receiver's frequency. To test the sinad levels at different levels of input, simply change the output on the signal generator.
- ❑ 2. The Ramsey SM-1 is equipped with an automatic gain control. Therefore, there are no touchy setup steps. When inputting a signal, you are getting an accurate reading when the LEVEL OK light is on.

SM-1 Schematic Diagram



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SM-1 Parts Layout Diagram



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END OF DOCUMENT

Note: Ramsey did not provide instructions for adjusting R10 and R16.