

SMD

Audio MultiMeter

AMM-1

Owner's Manual



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The purpose of the AMM-1

The purpose of this tool is to enable the user to:

- Measure True Amplifier Power output into any load reactive or resistive
- Measure Common DC voltages
- Measure DC voltage drops during quick transients on cable runs or battery / charging systems
- Measure Impedance of speakers at any power or frequency from 20Hz - 1kHz (box rise)
- Measure Phase Difference between Voltage and Current into reactive loads (Power Factor)
- Find Tuning Frequency of subwoofer enclosures
- Tune subwoofer enclosures for maximum power transfer
- Measure AC Volts (amplifier output)
- Measure AC Amps (amplifier output)
- Measure apparent power (VA)
- Measure Frequency of a Sine Wave

What is included?

- The AMM-1 tool
- Protective silicon rubber boot
- Harness
- This manual
- Pride of ownership

About the design

When you pick up the AMM-1 know that you are holding a precision piece of equipment. If treated as such it should provide you with many years of reliable service. We have chosen a 9V battery as a power source for a few reasons:

- They are readily available
- Isolating the AMM-1 from the electrical system under test, this guarantees that it will only measure what it is supposed to measure.

Specifications

Everyone hides these in the back of the book. We are proud of our specs, so we are put them up front.

- DC Voltmeter -100 Volts to +100 Volts
- AC Voltmeter 0 - 150 V_{RMS}
- AC Ammeter 0 - 100 A_{RMS}
- AC Apparent Power 0 - 15,000 VA
- Power Factor 50 - 100%
- Frequency 10 - 20,000 Hz
- AC Impedance 0 - 200 Ohms
- True Power Dyno 0 - 15,000 Watts
- Auto-shut off timer 8 - 10 minutes after ON button is pressed
- Battery self-test and display of condition when AMM-1 is initialized

Power requirements

Pull the silicon rubber boot off of the unit by starting at one end and pulling off towards the other end. On the back side you will see the battery compartment. Slide battery compartment cover off towards bottom end of unit to reveal the 9V battery compartment. Insert a fresh 9V battery, make sure the wires are routed around the battery. (If they are under or on top of the battery the door may not close properly) You are ready to go. **Do not run this unit off of any power source other than a 9V battery. Wall adapters are electrically noisy, as are vehicle electrical systems.**

How to Use:

A note about using the AMM-1

The AMM-1 is a tool that can measure several different key electrical properties useful for understanding what is happening within a system. As such, there are endless uses for the tool and there would be no way to list them all in this manual.

Some of the more common uses for this tool (as used in audio) are listed here, with a short description of how to use the feature. Since the AMM-1 can measure many electrical properties, the tool has uses outside of the audio world. An example would be measuring the AC power consumption of a household light bulb, or microwave oven.

CAUTION: The voltages produced at the output of an audio amplifier can be dangerous, just as household AC voltages are. Use caution when attempting to measure!

Menu System

The AMM-1 uses a menu system to select the mode of operation. The tool has 7 modes of operation. They are accessible by pressing the MODE button. It is a circular menu and is setup like such:

DC Voltage ---> DC Min/Max ---> AC Volts & Amps --->
VA & Power Factor ---> Frequency & Impedance --->
Real Time Power ---> Dyno Power -----> back to
beginning.

Once the AMM-1 is fully connected to the system under test, the modes can be changed without changing the setup.

Measuring DC Voltage

1. Power on the AMM-1 by pressing the ON button
2. Unit will power up, display internal battery condition, and then land on the DC Voltage Screen.
3. Connect the probes to the banana jack inputs on the AMM-1
4. Connect the probes across the DC Voltage source

Measuring DC Voltage Drop (Min/Max Mode)

Example, on a cable:

1. Power on the AMM-1 by pressing the ON button
2. Unit will power up, display internal battery condition, and then land on the DC Voltage Screen.
3. Press the MODE button once to get to the DC MIN/MAX screen.
4. Connect the probes to the banana jack inputs on the AMM-1
5. Connect the other end of the probes to cable of interest. One probe at one end, the other probe at the other. Once probes are connected press the RESET button.
6. Activate equipment that draws current through the cable of interest, the DC voltage drop will be captured and displayed.

Note: The mode is also useful for measuring the voltage drop on a battery during startup, voltage sag during amplifier drawing high peak currents (with beat of music) alternator's voltage regulator response and many other uses.

Measuring AC Voltage and AC Current

The AMM-1 can perform True RMS reading of AC Voltage via the probes and True RMS reading of AC Current via the current transducer mounted within the AMM-1. It can also make these reading simultaneously, a necessity for any tool that measures true power and power factor.

To measure an AC Voltage:

1. Power on the AMM-1 by pressing the ON button
2. Unit will power up, display internal battery condition, and then land on the DC Voltage Screen.
3. Press the MODE button twice to get to the AC Volts & AC Amps screen.
4. Connect the probes to the banana jack inputs.
5. Connect the other end of the probes AC Voltage of interest.
6. Reading will be displayed on AMM-1

To measure an AC Current:

1. Power on the AMM-1 by pressing the ON button
2. Unit will power up, display internal battery condition, and then land on the DC Voltage Screen.
3. Press the MODE button twice to get to the AC Volts & AC Amps screen.
4. Shut off AC current source (amplifier for instance)
5. Disconnect one of the wires from the load of interest (amplifier output for instance)
6. Run the wire through the hole on the center of the AMM-1, and reconnect the wire to the load.
7. Power up AC current source (amplifier) and apply a signal.
8. The AMM-1 will display the RMS Current reading on the screen.

VA and Power Factor

What is VA, and what is Power Factor?

VA is the product of Volts RMS * Amps RMS. This is the number that one would get if taking a conventional AC Voltmeter and an AC Current clamp and then multiplying the numbers together. Unlike DC where the voltage and current are constantly flowing in one direction, AC electricity has the voltage and current switching direction back and forth in a circuit. Since Voltage and Current are two different things, the changing of direction of the voltage and current back and forth can happen at different times. Clearly if the voltage and current directions are opposite at any time there would be no POWER happening and a True Power measurement would be zero watts! Though multiplying Volts RMS and Amps RMS in this case would give you a reading, the Power Factor would be **zero**. The Power Factor is the difference in time (or phase) between the Voltage and Current expressed in a way that tells the user what percentage of the VA is actual power (Watts).

This feature of being able to read the VA and Power Factor is useful for several reasons. Here is one example:

A SPL competitor plays a 50Hz tone, with a voltage clamp and current clamp he measures 100VRMS and 50ARMS output from his amplifier to his subwoofers. He might say the amplifier put out $100 * 50 = 5000$ Watts. That is incorrect. It would be 5000 VA. Now since the subwoofers are not pure resistors the voltage and current will likely be slightly out of phase. With the AMM-1 the competitor repeats the test and finds the output was 5000 VA with a power factor of 78%.

VA and Power Factor (cont.)

This means that the true power being delivered to the subwoofers is $5000 \times 78\% = 3900$ Watts. Now he can use this tool to make changes to his box tuning, or even something as small as rounding the corners inside the box or the port itself can move the power factor around. Typically the power factor will be the highest around the port tuning frequency of a ported enclosure. In the case illustrated here, the user could find the subwoofer's tuning frequency by using **Impedance Mode (page 11)**. Then make adjustments to the tuning frequency by playing with the port, placement, bracing, damping, stuffing, etc. to try to increase the Power Factor at the frequency used in competitions for most efficient transfer of power from the amplifier to the subwoofers.

How to measure VA and Power Factor

1. Power on the AMM-1 by pressing the ON button
2. Unit will power up, display internal battery condition, and then land on the DC Voltage Screen.
3. Press the MODE button three times (or hold down) to get to the VA & Power Factor screen.
4. Shut off AC source (amplifier)
5. Disconnect one of the wires from the load of interest (subwoofer)
6. Run the either the negative or positive speaker wire through the hole on the center of the AMM-1, and reconnect the wire to the load. (Doesn't matter which one, but only use ONE of them)
7. Connect the voltage harness to the banana jacks and then to the amplifier speaker outputs (+) and (-)
8. Power up AC current source (amplifier) and apply a signal with a tone generator or tone CD.
9. The AMM-1 will display the VA and the Power Factor

Measuring AC Frequency and Impedance

The AMM-1 allows the user to measure impedance of a speaker load at any frequency from 20Hz - 1kHz at any power level (up to approx 15,000 Watts). This is very powerful information to have when designing subwoofer enclosures. For lots of information on impedance sweeps and what they mean, please visit our website www.DAMoreEngineering.com and visit our products section. Here you will find our IM-SG tool. There is a Free Download to the owner's manual for that tool there that contains lots of useful info on this topic. Enjoy

How to measure AC Frequency

1. Power on the AMM-1 by pressing the ON button
2. Unit will power up, display internal battery condition, and then land on the DC Voltage Screen.
3. Press the MODE button four times (or hold down) to get to the AC Frequency and Impedance screen.
4. Connect the voltage harness to the banana jacks and then to the amplifier speaker outputs (+) and (-) or the AC source of interest. As long as the signal input is over a few volts the frequency of the sine wave will be displayed

Measuring AC Freq and Imp (cont.)

How to measure AC Impedance

1. Power on the AMM-1 by pressing the ON button
2. Unit will power up, display internal battery condition, and then land on the DC Voltage Screen.
3. Press the MODE button four times (or hold down) to get to the Frequency & Impedance screen.
4. Shut off AC source (amplifier)
5. Disconnect one of the wires from the load of interest (subwoofer)
6. Run the either the negative or positive speaker wire through the hole on the center of the AMM-1, and reconnect the wire to the load. (Doesn't matter which one, but only use ONE of them)
7. Connect the voltage harness to the banana jacks and then to the amplifier speaker outputs (+) and (-)
8. Power up AC current source (amplifier) and apply a signal with a tone generator or tone CD.
9. The AMM-1 will display the Frequency and Impedance

Real Time Power Mode

In this mode the AMM-1 will show the True Power compensated for both Power Factor and clipping of the signal in a live mode.

How to measure True Power

1. Power on the AMM-1 by pressing the ON button
2. Unit will power up, display internal battery condition, and then land on the DC Voltage Screen.
3. Press the MODE button five times (or hold down) to get to the Real Time Power screen.
4. Shut off AC source (amplifier)
5. Disconnect one of the wires from the load of interest (subwoofer)
6. Run the either the negative or positive speaker wire through the hole on the center of the AMM-1, and reconnect the wire to the load. (Doesn't matter which one, but only use ONE of them)
7. Connect the voltage harness to the banana jacks and then to the amplifier speaker outputs (+) and (-)
8. Power up AC current source (amplifier) and apply a signal with a tone generator or tone CD.
9. The AMM-1 will display the True Power in Watts, compensated for both clipping and Power Factor.

Dyno Mode

In this mode the AMM-1 will act like our AD-1 Amplifier Dyno. The highest True Power reading during a "run" will remain on the display. The power reading is compensated for both Power Factor and clipping of the signal.

How to use Dyno Mode

1. Power on the AMM-1 by pressing the ON button
2. Unit will power up, display internal battery condition, and then land on the DC Voltage Screen.
3. Press the MODE button six times (or hold down) to get to the Dyno Power screen.
4. Shut off AC source (amplifier)
5. Disconnect one of the wires from the load of interest (subwoofer)
6. Run the either the negative or positive speaker wire through the hole on the center of the AMM-1, and reconnect the wire to the load. (Doesn't matter which one, but only use ONE of them)
7. Connect the voltage harness to the banana jacks and then to the amplifier speaker outputs (+) and (-)
8. Power up AC current source (amplifier) and apply a signal with a tone generator or tone CD at a low - moderate volume level
9. The AMM-1 will display the True Power in Watts, compensated for both clipping and Power Factor.
10. Now grab your volume knob and roll it up until you see the red Clipping LED illuminate.
11. The AMM-1 now displays the maximum clean True Power in Watts (RMS).
12. To reset the reading press the CLEAR (On) button for 1 second.

Limited Warranty

D'Amore Engineering warrants this product to be free of defects in materials and workmanship for a period of one year.

This warranty is not transferrable and applies only to the original purchaser from an authorized D'Amore Engineering dealer. Should service be necessary under this warranty for any reason due to manufacturing defect or malfunction, D'Amore Engineering will (at its discretion), repair or replace the defective product with new or remanufactured product at no charge. Damage caused by the following is not covered under warranty: accident, misuse, abuse, product modification or neglect, unauthorized repair attempts, misrepresentations by the seller. This warranty does not cover incidental or consequential damages. Cosmetic damage due to accident or normal wear and tear is not covered under warranty. **Warranty is void if the product's serial number has been removed or defaced.**

Any applicable implied warranties are limited in duration to the period of one year beginning with the date of the original purchase. No warranties shall apply to this product thereafter. Some states do not allow limitations on implied warranties; therefore these exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

If you need service on your D'Amore Engineering product:

All warranty returns should be sent to D'Amore Engineering accompanied by proof of purchase (a copy of the original sales receipt). Warranty expiration on products returned without proof of purchase will be determined from the manufacturing date code. Non-defective items received will be returned COD. Customer is responsible for shipping charges and insurance in sending the product to D'Amore Engineering. Shipping damage on returns is not covered under warranty.

**To obtain service worldwide please e-mail
D'Amore Engineering at
Warranty@DAmoreEngineering.com**

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