

# SMD

**Distortion Detector**

**DD-1**

**Owner's Manual**



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## **The purpose and benefit of the D'Amore Engineering / SMD Distortion Detector.**

The purpose of this tool is to enable the installer to set the gain of an audio amplifier to match the source unit's output level, accurately and quickly. It can also be useful for detecting distortion in the audio signal caused by poorly designed or malfunctioning audio equipment.

### **What is included?**

- The Distortion Detector (DD-1)
- Protective silicon rubber boot
- Calibrated Test tone CD
- 9V Battery
- Harness
- This manual
- Pride of ownership

## About the design

When you pick up the DD-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 DD-1 from the vehicle's electrical system for power, guarantees that it will only measure what it is supposed to measure; distortion in the audio signal, not noise in the charging system

We also chose an RCA input connector for a few reasons:

- It makes it pretty easy to measure the output of a headunit directly, if you choose to do so
- Should the harness become damaged it is easily replaceable or repairable in the field

## Specifications

Everyone always hides these in the back of the book. We are proud of our specs, they aren't lies, so we are putting them up front.

- The Distortion Detector's circuitry is 100% analog
- Distortion Detection trigger level > 1.0% Harmonic Distortion

- Guaranteed operating range of input signal is 1.2Vrms – 125Vrms. (15,000 Watts at 1 ohm) Autoranging
- Signal Present LED trigger voltage 750mVrms
- Low Battery LED trigger battery voltage < 5.6Vdc
- Auto-shut off timer 8 - 10 minutes after ON button is pressed

## 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.**

## Measuring a headunit only

1. This procedure will determine where the maximum unclipped volume setting of the headunit is. This is accomplished by setting the bass, treble, ect, to zero; and any EQs and crossovers in the headunit to flat. Later, when you set the amplifier gain(s); you can reset these to where you feel the customer will set them, or where you will set them for your own system.
2. Next you need to connect the DD-1 to the headunit's outputs. Just plug the RCA outputs into the RCA input of the DD-1. If you are using speaker level outputs from the headunit, use the included harness. Red to speaker (+) and Black to speaker (-).
3. Play track 1 on test CD, turn the volume control up until you see the signal detect LED illuminate.
4. Continue turning up the headunit and you should see the 40Hz Detect LED illuminate.
5. Slowly continue turning up the headunit until the Distortion LED illuminates, then turn headunit down slowly until it goes out. Note the volume setting.
6. Next change the track to track 2. Repeat the steps 3-5 above, this time noting the 1kHz Detect LED.
7. Now take the noted maximum volume settings from the 40Hz test and the 1kHz test and average them. This is your maximum undistorted volume setting for the headunit.

## Measuring the headunit through an amplifier

1. This procedure will determine where the maximum unclipped volume setting of the headunit is. This is accomplished by setting the bass, treble, ect, to zero; and any EQs and crossovers in the headunit to flat. Later, when you set the amplifier gain(s); you can reset these to where you feel the customer will set them, or where you will set them for your own system. This time we are going to use the amplifier to boost the signal of the headunit. The DD-1 can measure the headunit's distortion THROUGH the amplifier!
2. With the headunit connected to the amplifier, connect the DD-1 input to one of the amplifier outputs using the included harness. **Red to speaker (+) and Black to Amplifier Ground.** (Note on some amplifiers, usually the right channel of a multichannel amplifier, the Speaker (-) terminal is where the signal actually comes out. In this case you connect the **Red to speaker (-) and Black to Amplifier Ground.**
3. Turn the gain of the amplifier to its minimum position
4. Set crossover switch to Flat. (Note if this is a subwoofer amplifier and there is no crossover switch to set to flat, turn the crossover frequency all the way up).
5. Play track 1 on test CD, turn the volume control up until you see the signal detect LED illuminate.
6. Continue turning up the headunit and you should see the 40Hz Detect LED illuminate.

7. Slowly continue turning up the headunit until the Distortion LED illuminates, then turn headunit down slowly until it goes out. Note the volume setting.
8. If you have a full range amplifier, change to track 2. Repeat the steps 3-5 above, this time noting the 1kHz Detect LED.
9. Now take the noted maximum volume settings from the 40Hz test and the 1kHz test and average them. This is your maximum undistorted volume setting for the headunit.



## Setting the gain of a full range amplifier

1. This procedure should only be done AFTER you have ensured the headunit puts out a clean undistorted signal, AND you know where the maximum undistorted volume setting is.
2. Turn the gain setting of the amplifier to minimum
3. Set crossover to full range / all pass/ bypass
4. Disconnect all speakers connected to the amplifier. (This has already been calculated into the equation and provides 1- 3dB more gain overlap on unregulated power supply amplifiers and 0dB more gain overlap on regulated power supply amplifiers).
5. Using included harness, connect DD-1 to output of amplifier. Connect the red harness lead to the Left Speaker (+) terminal, connect the black to **Amplifier Ground**. (Note: Most multichannel amplifiers have the signal on Left (+) and Right (-)).
6. Play track 4 or 6 on test CD (Track 4 will ensure maximum sound quality, Track 6 will result in a louder system). Your choice.
7. Set the headunit's bass, treble, EQ's, crossovers to flat
8. Set the headunit's volume to the maximum undistorted volume setting that was measured with the DD-1 previously

9. The Signal detected LED and the 1kHz LED should illuminate.
10. Slowly turn up the amplifier's gain setting until the Distortion detected LED illuminates continuously, then back down slowly until it just goes out.
11. You are finished with the gain setting of this amplifier. Now disconnect the DD-1, connect the speakers to the amplifier, and set the crossover to the desired position. See **Where do I set my crossovers** section if you need help with this.
12. Congratulations, you have just set the gain like a Pro.

## Setting the gain of a subwoofer amplifier

1. This procedure should only be done AFTER you have ensured the headunit puts out a clean undistorted signal, AND you know where the maximum undistorted volume setting is.
2. Turn the gain setting of the amplifier to minimum
3. Turn the crossover frequency control to it's highest frequency setting.
4. If you have an infrasonic filter (sometimes erroneously called *Subsonic filter*) control or switch, set it to it's lowest frequency setting or "off".

5. If you have a “bass boost” switch set it to where you think it will be set when used.
6. If you have a bass boost knob or level control knob, set them to the middle of their range. This will allow a slight adjustment up or down to preference after the gain is set.
7. Disconnect all speakers connected to the amplifier. (This has already been calculated into the equation and provides 1- 3dB more gain overlap on unregulated power supply amplifiers and 0dB more gain overlap on regulated power supply amplifiers).
8. Using included harness, connect DD-1 to output of amplifier. Connect the red harness lead to the Speaker (+) terminal, connect the black to **Amplifier Ground**. (Note: if amplifier is bridged or strapped to another amplifier the procedure remains the same. If amplifiers are “linked” then you just need to set the gain on the Master)
9. Play track 3,5 or 7 on test CD (Track 3 will ensure maximum sound quality, Track 7 will result in a louder system, Track 5 is a compromise). Your choice.
10. Set the headunit’s bass, treble, EQ’s, crossovers to flat
11. Set the headunit’s volume to the maximum undistorted volume setting that was measured with the DD-1 previously.
12. The Signal detected LED and the 40Hz LED should illuminate.
13. Slowly turn up the amplifier’s gain setting until the Distortion detected LED illuminates

continuously, then back down slowly until it just goes out.

14. You are finished with the gain setting of this amplifier. Now disconnect the DD-1, connect the speakers to the amplifier, and set the crossover to the desired position. See **Where do I set my crossovers** section if you need help with this.
15. Congratulations, you have just set the gain like a Pro.

## Troubleshooting:

**Problem:** The Distortion detected LED is always on

**Solution:** The headunit can't handle a 0dB track. Use the -5 or -10dB tracks or replace headunit.

**Problem:** The Distortion detected LED is always on even when using -5 or -10dB tracks.

**Solution:** Make sure all EQs and Bass, Treble ect. are set to Flat or 0. If problem still exists, headunit may be defective and not able to produce a clean signal. Replace headunit.

**Problem:** The signal, 40Hz or 1kHz detected LEDs won't illuminate

**Solution:** The headunit may not be able to put out the required 1.2Vrms to be within the operating range of the DD-1. See section **Measuring the Headunit Through an Amplifier**.

**Problem:** The Distortion detected LED is still on

**Solution:** Make sure amplifier gains are all the way down, if the Distortion detected LED is still on; the amplifier may be defective. Try another source unit, if it doesn't change the problem replace amplifier.

**Problem:** While setting gains the Distortion detected LED blinks on then off.

**Solution:** This is not a problem at all, this is an artifact of the DD-1 being 100% analog. Analog is faster than digital, and as such the DD-1 detects distortion in the signal when the auto ranging circuit is switching ranges. Think of a nice clean sine-wave, and then it gets

suddenly squished down by the auto ranging circuit. Kind of like hitting a speed bump. When this happens the signal **IS actually** distorted for a couple of hundred milliseconds. The DD-1 is capable of measuring such distortions lasting only 500 nano-seconds!

One should interpret the distortion LED staying on continuously as the level you are looking for when setting gains. When this level is found, slightly back the gain down until the LED just turns off.

**Problem:** The DD-1 keeps turning off

**Solution:** The DD-1 has an auto turn off timer, it will operate for 8-10 minutes after the "ON" button is pressed. This is to prevent it from eating your battery when you forget to turn it off.

**Problem:** Low battery LED is on

**Solution:** Really?

## Where do I set my crossovers?

This could be debated for days, and it really comes down to user preference. Here are some guidelines for the novice as a good place to start. If you hear the full range speakers “popping” or “bottoming out” when you play it at high volumes after using value in the chart below, turn up the crossover frequency until it stops.

Speaker Size	12dB/oct High Pass	24dB/oct High Pass	12dB/oct Low Pass	24dB/oct Low Pass
3 – 4 inches	250Hz	200Hz		
5.25	160Hz	125Hz		
6.5	125Hz	100Hz		
6x9	100Hz	80Hz		
8, 10			100	125
12			80	100
15,18			63	80

## Where do I set my infrasonic (subsonic) filter?

Again this is up for debate, here are some starting points for the less experienced.

Speaker Size	Sealed or 4 <sup>th</sup> order bandpass with 12dB/oct filter	Sealed or 4 <sup>th</sup> order bandpass with 24dB/oct filter	Ported or 6 <sup>th</sup> order bandpass with 12dB/oct filter	Ported or 6 <sup>th</sup> order bandpass with 24dB/oct filter
8	35	30	Just below tuning frequency of port	½ octave below tuning frequency of port
10	30	25		
12	25	20		
15,18	Not needed	Not needed		



NOTES:

**Track list on DD-1 CD:**

<b>Track</b>	<b>Title</b>	<b>Duration</b>
1	40Hz -0dB	5 Min
2	1kHz -0dB	5 Min
3	40Hz -5dB	5 Min
4	1kHz -5dB	5 Min
5	40Hz -10dB	5 Min
6	1kHz -10dB	5 Min
7	40Hz -15dB	5 Min
8	1kHz -15dB	5 Min
9	Pink Noise	20 Min

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