



Dear consumer,

It has come to our attention after numerous service calls from homeowners in Central Florida who requested our firm to repair their distributed audio system that a significant amount of homes are improperly wired. These homeowners are experiencing ongoing problems relating to uneven volume levels, lack of music clarity and limited volume range when listening to music simultaneously in three or more rooms of their home at a time. In addition, music, when walking from room to room within the home is louder in one room than the other. These homeowners have also experienced momentary changes in volume and periodic distortion of their music program.

After examination of each system we discovered one common characteristic shared amongst them. The use of 16 gauge speaker wiring directly connected between the room's speaker and the system amplifier. Upon further trouble shooting and analysis we discovered the root of the problem.

The smart phone changed household music system installations. In recent years it has become popular to operate your household music system using your smart phone and/or from an in-wall keypad or touch panel. Prior to this technology, in-wall volume controls were commonly installed. These rotary knob volume controls contained impedance matching transformers inside of them, the transformer would ensure the amplifier and speakers were receiving matching electrical information. Since the removal of the volume control and its impedance matching transformer in modern residential sound system designs, the installing contractor must now become cognizant of the music source input impedance into the amplifier and the distance of the speaker from the amplifier. In all cases we discovered the installing contractor failed to calculate the resistance based on the distance of the speaker from the amplifier based on its source input impedance.

The problem was inconsistent. In some situations the homeowner typically operated their music system two or three rooms at time for several years, this isn't too uncommon, then once or twice a year they turn on all or a majority of the rooms when hosting a gathering or they just get a whim to do so. Better amplifiers can handle multiple speaker connections simultaneously before exhibiting indicators that result in volume or distortion issues without the use of transformers, but they can't handle more than 3 pairs or six speakers at a time for any respectable period of time.

Get confirmation. We highly recommend that you test your system to its fullest extent before signing off on any completion documentation or make a final payment to the electronics contractor or home builder. Any system should be designed to handle the maximum you can give it for satisfying sustained period of time and you should be pleased with what you are hearing, music programs should be clear of distortion and there are no volume inconsistencies as you walk from room to room.

2890 W. Airport Boulevard, Sanford, FL 32771

Phone: 407-878-4283 Fax: 407-878-4391

www.infinityavfl.com

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The costly solutions. The only solutions to correct the problem are to retrofit larger gauge wiring into the home, which ensures the highest quality performance but the most invasive of procedures. Operate one or two rooms at a time and hope the amplifier can sustain the impedance drop for a few hours (some amplifiers can operate two or three pairs of speakers safely without damaging itself, some amplifiers cannot). Or add matching impedance transformers within the signal chain which reduces the fidelity of the sound, but solves the electrical problem. Imagine talking with a cloth placed over your mouth, yes you can be heard, but your true voice is altered. For homeowners with two story homes, the former isn't an option in most situations, so the latter two are the only resolves, given the fidelity loss, this is a disappointing outcome.

You can't disregard science. The following chart, provided by Orlando based wire manufacturer, Tributaries Cable, explains the maximum distance a speaker can be installed from its amplifier based on the gauge or thickness of the wiring. As you can see 48 feet is the maximum for a 16 gauge cable with an input impedance of 8ohm, the standard for residential installations and thus the reason this gauge of cable is the most popular size used in Central Florida homes. Considering an average wall height is 10 foot and the wiring is installed from the equipment location, behind the drywall up the interior wall into the attic, then brought up another four to six feet higher to avoid it being trampled on in the attic, then additional footage is required to move around obstructions like HVAC ducts and to avoid high voltage cabling, the speaker wire then arrives at its final destination in the ceiling above your master bedroom or dining room. That only leaves about 25' of wire to travel the distance of your attic and transition into the speaker, without calculating for service loops before the speaker and header transitions. If your home is over 2,000 sq. feet then you can quickly see that a good portion of your speaker wire is under sized for the distance it must travel.

Resistance

Resistance is another consideration when choosing a speaker cable. In simple terms: larger size conductor will lower the cable's resistance and provide higher current capability. Lowering the inductance and resistance means it's easier for the amp to drive the signal down the cable. Sonically, the sound is smooth and fluent as well as more dynamic, due to better definition. Cable resistance is expressed in ohms per unit. For instance, 500 feet of 16-gauge wire has a resistance of about 4 ohms. With speaker cables this becomes an issue. Because speakers exhibit input impedances in the range of 2 to 8 ohms, the resistance of the cable can add significantly to the overall load. For example, if a 4-ohm speaker is connected to an amplifier with a cable that exhibits a 4-ohm resistance, the cable will dissipate half of the amp's power before it even gets to the speaker! Tributaries offers a full line of speaker wire with gauges from 11AWG to 16 AWG for your consideration. Below is a handy guide for choosing the correct size speaker wire for your unique installation.

Maximum Wire Lengths for Two Conductor Copper Wire				
Wire Size	2 Ω load	4 Ω load	6 Ω load	8 Ω load
16 AWG	12 ft	24 ft	36 ft	48 ft
14 AWG	20 ft	40 ft	60 ft	80 ft
12 AWG	30 ft	60 ft	90 ft	120 ft
10 AWG	50 ft	100 ft	150 ft	200 ft

Explanation and chart provided courtesy of Tributaries Cable of Orlando Florida, a manufacturer of audio/video and communications cable.

Getting what you paid for. When your home is being built it's fairly common to meet with the sound system installer or homebuilder representative in advance of the installation. Many of the homeowners we performed service calls for were given options to choose between a type of speaker and brand of speaker to establish an

overall system budget. Imagine that homeowner who chose to spend \$200 per speaker rather than spend \$100 per speaker or \$500 per speaker, they choose somewhere in the middle, maybe because they were unsure of the performance differences and made a comfortable conservative decision. Unfortunately they realized no benefit from the additional expenditure, due to the impedance issue stemming from the use of an improperly gauge of wire. After having the impedance issue resolved by us, the clients who choose to add transformers were not ultimately pleased to spend a thousand dollars only to lose sound clarity because of the addition of these transformers.

Where do homeowners go from here? It's not a stretch to assume there are hundreds of owners of household music systems still out there whose enjoyment has been limited by the undiagnosed problem of improper wire gauging. Some of these homeowners will sell their home and move into another new or existing home and may choose to forego a wired sound system solution due to the fact expectations were not met the first time around. It's not uncommon for these dissatisfied pool of homeowners to invest in \$200 powered speakers from Sonos or Amazon Alexa and plug them into electrical outlets around the house in order to create a similar system. Though not on par with a wired solution and marred in its own problems of Wifi strength, network issues, digital privacy and sound hot spotting (a phenomena where the sound is too loud in one location and too low in others) the wireless speaker revolution is, rooted in its economics to serve the masses, however nothing sounds and operates as well as a properly designed wired speaker system.

Don't give in to incompetency. Don't give in to poor implementation that it ruins your aspirations to enjoy a quality music system in your existing or next home. Take the time to have your music system properly designed, documented on blue prints, just like your air conditioning (HVAC) and electrical and plumbing contractors must do before beginning a project. This accountability ensures your investment has a better chance to provide the results you are seeking and not become an unused and wasted feature of the home.

For an article on the differences between wired and wireless household music systems read our report available for download here
<https://infinityavandsecurity.com/assets/files/Wired-V-Wireless.pdf>

Coming soon! For an article on the differences in sound contractors read our report on the state of professional installation in Central Florida, what you don't know could cost you thousands of dollars.