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A2625 Choosing The Right Fuse

By David Navone & Richard Clark

Selecting and installing the correct main power fuse has been a topic of paramount importance for at least the last 15 years. Guided by the rules of competitive autosound, a fuse rating is determined and the master fuse is typically installed within the prescribed distance from the positive battery post. Contests are won and lost over minor variations in this narrow facet of car audio. Each week we receive hundreds of questions about the type, rating, quality, and installation of main power fuses, but seldom do we get asked about the purpose.

Some installers feel that proper fusing at the positive battery post will protect their amplifiers. Others assume that the fuse must be present to save the alternator and battery. However, the majority of installers know that the real purpose of this fuse is to prevent massive current from flowing in the main power cable in the event of a catastrophic event (i.e. a wreck). If the main power cable becomes pinched in the car's chassis, the main power fuse will open and prevent the driver and passengers from burning to death in a fire started by car stereo equipment. For this reason, the car stereo industry has strongly, and appropriately, advised including short circuit protection on the main power lead in the near vicinity of the positive battery post.

Kamikaze Komponent

Fuses are one of our oldest electric components and date back to the times of Faraday, Ampere, Volta, and anyone else involved with the practice of connecting wires to a battery. A main power fuse is a suicide device that self-destructs in order to protect a circuit. The energy in a car's battery is tremendous and is measured in hundreds of amps per hour, which equates to thousands of amps per minute or tens of thousands of amps per second. Since car audio power amplifiers must operate on a nominal 12 volts, the size of the power cables connecting the car's battery to the amplifiers) in a modest system can be #4 AWG or larger. So the question becomes, "What size fuse element will melt open before the #4 AWG wire will turn white hot?"

Recalling that a chain is only as strong as the weakest link, a successful fuse can rightfully be described as the weak link in the power delivery system. We've seen a relatively small 50-amp main power fuse installed on giant competition systems using huge #000 AWG power cable from the positive battery post back to the amp rack. There is always the concern that the main power fuse could be restricting the car audio system. After all, the pencil lead sized fuse element is miniscule in comparison to the power cabling. Perhaps the gold plating on the fuse holder can somehow make up for this problem? To the engineering world, gold plating around a fuse makes about as much sense as gold plating a toilet seat for an outhouse.

High-Tech Fuses?

A fuse is not a high-tech component. We're not saying that catastrophic short circuit protection requires a high-tech device, we're just pointing out that showcasing fuse holders and fuses does little to impress the world outside of car audio. When is the last time a house or building in your neighborhood was wired with a fuse panel? They quit using fuses in homes and buildings sometime in the middle of the last century.

The reason that vehicles are factory wired with fuses is one of economics. Fuses are cheap. What about boats and airplanes? The last time a pilot had to look for a replacement fuse on an airplane was in the 1950s. Even our very first manned space flights in 1961 were devoid of fuses.

Power Wiring in the 2000s



The obvious high tech-replacement for the antiqued fuse is the circuit breaker. Fifty years ago, circuit breakers worked by heating a bi-metallic element that eventually "tripped" a mouse-trap-like switch. The heating element had to cool down before the breaker could be reset. Today, circuit breakers are extremely sophisticated and include a switch so that the main power can be easily controlled while working on a system. Also with circuit breakers, the exposed wiring is minimized.

Types of Circuit Breakers

There are many manufactures of low-voltage circuit breakers that are suitable for car audio applications. One type of breaker is the temperature-independent Hydraulic Magnetic Circuit Breaker that can always carry 100 percent of its rated current but will trip at 125 percent. It works by routing the current over a hermetically sealed solenoid containing an iron core, a spring, and dampening fluid. This breaker can be immediately reset and comes in virtually any size.

Magnetic circuit breakers use a trip mechanism that is triggered by an electromagnet and an armature. As the current exceeds the limit, the magnetic field strength of the electromagnet changes and pulls the armature to trip the breaker. There are combinations of magnetic and thermal breakers that offer the best of both worlds.

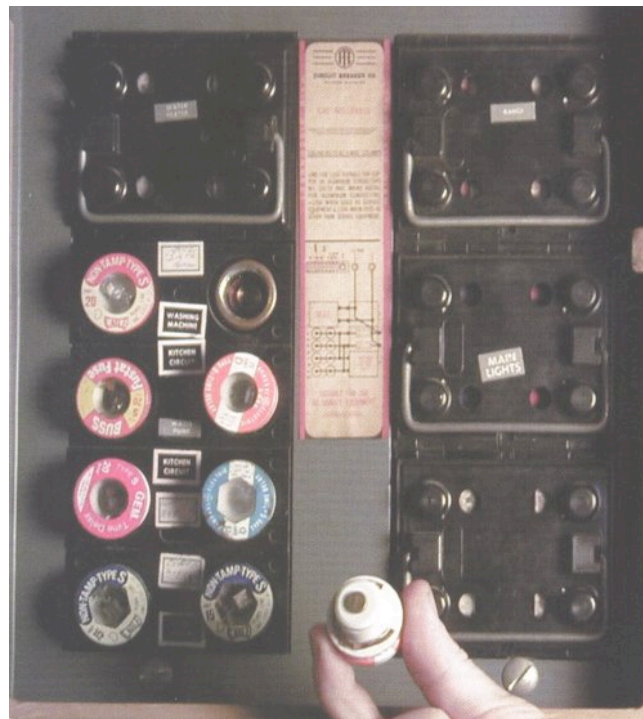
Monster Performance Car sells these high quality magnetic breakers.

Check it Out

Recently there was some terrible misinformation on the Internet about circuit breaker failures and the superiority of fuses. The article dealt with failure modes resulting in short circuits. After reading the article, we were supposed to drive down to Home Depot and load up on fuses to replace our household breakers. Yeah right! We're not here to sell circuit breakers but if anyone believes that a fuse has any advantage except price, just try selling a fuse to NASA or the military.

If you want to score extra points in competition this year, we highly suggest looking into the latest generation of circuit breakers. (Of course it will take a technical-minded installation judge to recognize the advantages of a circuit breaker.) When more and more competitors choose circuit breakers, the distributors will add housings, monitoring accessories, and remote options. It won't take long for mainstream car audio to begin showcasing circuit breakers in demo cars and magazine layouts. And when we see the first gold-plated circuit breaker accessories, we'll know that car audio has finally arrived in the 2000s.





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