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<http://www.lightningrodparts.com/surge.html>

Delta Lightning Arrestors

<http://store.altenergystore.com/Delta-Lightning-Arrestors/m25/>

WHY A DELTA SILICON LIGHTNING ARRESTOR IS MORE EFFECTIVE

Conventional valve type arrestors are based on a 1935 patent. The basic design is a spark gap for the lightning to arc over, and a series resistor which is intended to limit the flow of follow current from the line.

For many years this was the best design on the market, but now there is something better.

The DELTA silicon oxide varistor (SOV) arrestor offers a number of improvements over the 1935 design.

The basic design of the **DELTA** silicon oxide varistor (SOV) **lightning arrestor** is a pair of metal electrodes separated by a silicon oxide compound. Under normal conditions, the silicon oxide is a good insulator so that no line current flows between the electrodes to ground. When an excessively high voltage occurs on the electrodes, the high energy electrical field ionizes the silicon oxide, changing it from a compound to silicon separate from oxygen. Since the silicon ion is a good conductor, the high energy current is conducted to ground. When the voltage falls toward normal, the silicon and oxygen recombine, forming silicon oxide and shutting off the conduction.

The reason the DELTA silicon oxide varistor (SOV) design works so much more effectively is that there is no series resistor to limit the flow of current. In valve arrestors, the resistor is there to limit the flow of the line current, but it also impedes the lightning discharge. Since the DELTA silicon oxide varistor (SOV) *lightning arrestor* needs no resistor, it can conduct more current much faster.

The DELTA silicon oxide varistor (SOV) **lightning arrestor** has no spark gap. Valve arrestors have a spark gap to prevent line leakage current and to determine the sparkover voltage. Since the DELTA silicon arrestor conducts at the ionization potential, no spark gap is needed. This is more effective because spark gaps cause high-intensity voltage spikes which act as surges and damage electrical equipment.

The DELTA silicon oxide varistor (SOV) lightning arrestor works equally well in both directions. Valve arrestors do not. Valve arrestors customarily have a pointed electrode on one side of the spark gap and a flat electrode on the other. Therefore, they conduct less in one direction. Since lightning is positive 90% of the time and negative 10% of the time, an arrestor must work as well in both directions. The DELTA silicon lightning arrestor has uniformly shaped electrodes, and conducts equally in both directions.

[Product Name ↓](#)

[Price](#)

	Product Name ↓	Price
	Delta CA-302-R AC Surge Capacitor	\$41.96
	Delta La-302-R Ac Lightning Arrestor	\$42.00
	Delta La-303 3-Phase Lightning Arrestor	\$40.99
	Delta LA301 Lightning Arrestor	\$27.46
	Delta La302 DC Lightning Arrestor	\$32.00
	Delta LA602 High Voltage DC Lightning Arrestor	\$40.79
	Delta LA603 High Voltage Lightning Arrestor	\$56.16

How to Choose Surge Protection for Your Home

You may not realize it, but your stereo system, home computer, television, VCR, microwave oven -- anything with internal electronic circuits -- is under attack every day. The attacks are silent, but destructive.

The culprit -- **POWER SURGES**. Power surges are extremely brief spikes in electrical power that burn up the electrical circuits inside appliances and electronics. For more detail about what power surges are and where they come from, read *Facts about Power Surges*.

Not only can power surges destroy appliances and electronics, they can ruin electrical outlets, light switches, light bulbs, air conditioner components, and garage door openers. How can you protect yourself?

Surge protection devices can prevent the damages from most power surges. There are two types:

1. Service entrance surge protection device, which is mounted at or near the incoming electrical service
2. Point-of-use surge protection device, which is used at the appliance being protected and includes the type of surge protectors that plug into a wall outlet

For the typical home, many experts recommend a minimum surge protection network consisting of:

1. Service entrance surge protection device protecting the incoming electrical power line, incoming telephone line, and cable TV and satellite dish cable.

This can be done with a single surge protection device that is capable of protecting all types of incoming lines (electrical, telephone, cable TV, and satellite dish cable) or separate surge protection devices at each incoming line. Protection of the incoming electrical line can be located at the main electrical panel or electric meter.

2. Point-of-use surge protection devices with a 330-volt clamping voltage at all expensive electronics and appliances, such as TVs, VCRs, stereos, and computers; all have electronic circuits which are susceptible to power surges.

Susceptible appliances can be identified because many times they have electronic push buttons, electronic clocks, or digital displays. If the appliance has other wires connected to it (such as telephone lines, cable TV cable, antenna cable, or satellite dish cable), those wires or cables must run through the point-of-use surge protection device as well to provide protection on all lines.

- For home office or special medical needs, additional and different protection from other types of electrical power interruptions may be appropriate as well.

There is no surge protection device or system that can protect against all power surges. A direct lightning strike to the house's electrical system may be too great for the surge protector(s) to handle. The two-stage surge protection system recommended in this article should protect against most of the power surges.

Why is it Better to Have a Two-Tiered Surge Protection System?

By combining a service entrance surge protector with point-of-use surge protectors located at all sensitive electronics, a better protection system is created.

1. Using a service entrance surge protection device provides protection for the entire electrical system. They protect things such as motors, lights, outlets, light switches, and all the other "hard wired" items in the house that do not plug into an electrical outlet and can't be connected to a point-of-use surge protection device.
2. If the power surge is created by a lightning strike or power fluctuation on the utility lines, the service entrance surge protection device can reduce the power surge to a lower level before it gets to the point-of-use surge protection device. This helps:
 - a. Prevent damage to the point-of-use surge protection devices from surges too strong for them to handle
 - b. Reduce the level of the power surge at the appliance being protected. (The power surge's energy level is reduced at the service entrance device and again at the point-of-use device.)
3. **Service entrance surge protection devices do not eliminate the need for point-of-use surge protection devices.**
 - a. The power surge may not be generated on the incoming utility lines. For example, lightning may hit an outside light fixture creating a power surge on the circuit powering the light. If there are outlets on the same circuit as the outside light

fixture, any electronics plugged into those outlets will be better protected if a point-of-use surge protection device is used.

- b. The point-of-use surge protection devices help protect appliances against surges that are generated within the home.
- c. Good quality point-of-use surge protection devices have the ability to reduce power surges to lower levels than typical service entrance surge protection devices.

Examples of Service Entrance Surge Protection Devices

There are service entrance surge protection devices that mount in or on your main electrical panel, or at the base of the electric meter. Several examples are shown in this article. Only one service entrance surge protection device is needed if it protects all incoming lines, including electrical, telephone, and cable TV lines. As an alternative, separate devices can be installed on each incoming line.



Service Entrance Surge Protection at the Main Electrical Panel

(Both of these devices will require additional surge protection devices on the incoming telephone and cable TV lines because neither provide protection of those lines as an integral part of the device.)





Service Entrance Surge Protection at the Main Electrical Panel (with face cover removed)

(This device protects the electrical service, telephone service, and cable TV service lines.)

Service Entrance Surge Protection at the Electric Meter

(This device requires additional protection devices on the telephone and cable TV lines.)

Point-of-Use Surge Protection Devices

There are also several types of point-of-use surge protection devices.

Point-of-use surge protection devices (plug-in type):

You may be familiar with the plug-in type surge protectors. They look like plug strips, having several plug-in locations on one device. **A regular plug strip, unless it specifically says so, does not provide surge protection. Be careful when buying such items to make sure that you are getting the surge protection you need.**



Plug-in (Point of Use) type Surge Protector

Surge protection electrical outlets: Special electrical outlets contain surge protection in those places that you don't have room for or don't want a plug-in type surge protector, such as at a countertop microwave oven.



Electrical Outlet with Built-in Surge Protection

Surge Protection Terminology

Surge protection and the associated protection devices on the market can be confusing to a homeowner. Understanding the terminology can help.

Surge Protection Devices have several names: surge protectors, surge suppressors, transient voltage surge suppressors (TVSS), or secondary surge arresters. But they essentially have the same function of protecting against power surges. Other common terms you may hear when shopping for surge protection devices are listed below.

Surge Protector: For the type of products one would find around the home, this a general term that can refer to TVSS or secondary surge arresters. These devices are designed to protect equipment "downstream" against power surges by reducing the amount of voltage they let through.

Many electric utility companies also use secondary surge arresters and devices called lightning arresters throughout their electrical grid to protect their equipment from lightning damage. The devices they use are more durable, but can't reduce the power surge down to the lower voltage levels that in-home products can.

However, the utility company's surge protection measures can help the homeowner by reducing the energy level of a power surge before it gets to the home.

Secondary Surge Arrester: These devices are designed to go on the inside or outside of the house. If tested, they are tested according to the recommendations of the Institute of Electrical and Electronics Engineers (IEEE) standard C62.11, Metal Oxide Surge Arresters for Alternating Current Power Circuits, with a 10,000-volt, 5,000-amp power surge. IEEE C62.11 is not a test and does not assign a clamping voltage for secondary surge arresters. This makes it difficult to compare the capabilities of one product to the next.

These devices include the meter-mount surge protectors and the plug-on surge protectors that snap into the electrical panel.

Transient Voltage Surge Suppressor: TVSSs are generally designed to go on the inside of the house. If tested, they are tested according to Underwriters Laboratory (UL) standard UL 1449 with a 6,000-volt, 500-amp power surge. UL 1449 assigns a clamping voltage to the TVSS which can be used for comparison from one product to the next.

These devices include the point-of-use surge protectors and service entrance surge protectors mounted on the electrical panel.

Clamping Voltage: TVSSs should have a clamping voltage specified. Clamping voltage is the voltage at which a surge protector begins to work by redirecting the power surge to ground. The lower the clamping voltage of the surge protector, the lower it will reduce the power surge voltage.

UL 1449 2nd Edition: This is a test standard that was developed by UL in conjunction with industry to certify product ratings and ensure proper markings on TVSS products. Through this test, the clamping voltage is determined.

IEEE C62.11: This standard, written by the Institute of Electrical and Electronics Engineers, has recommendations on how to test secondary surge arresters. [IEEE C62.11: Standard for Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV)]

Let-Through Voltage: This is the residual surge voltage that passes through a surge protector after the protector has "clamped" in response to the power surge.

The clamping voltage does not determine the level of let-through voltage for all power surges. For example, if a point-of-use surge protection device has a clamping voltage of 330-volts, that means the device will let-through no more than 330-volts if the power surge is exactly the size, shape and duration of the 6,000-volt surge required in the test standard, UL 1449.

If the same device (with a 330-volt clamping rating) is subjected to a power surge with a higher energy level (voltage, amperage, or duration), the let-through voltage will most likely be above 330-volts.

Metal Oxide Varistors (MOVs): MOVs are a common technology (not the only type) and are at the heart of the surge protector's (TVSSs) ability to protect against power surges. Generally, the larger they are and the more there are equates to better protection and a more durable, longer-lasting surge protection device.

MOVs redirect the electrical current in the event of a power surge. How an MOV works is easier to understand if you think of it as a water spigot. Under normal conditions, without power surges, the MOV is a "closed valve" allowing current to flow in the electrical circuit and not through the MOV.

If there is a power surge, the MOV clamps the voltage by redirecting the electrical current (opening the valve) from the electrical circuit into the grounding system until the surge voltage drops below the clamping voltage of the protective device. When the power surge is over, the MOV returns to the "closed-valve" position.

During the power surge, all of the excess energy of the surge is diverted by the MOV, causing it to get hot. The temperature of an MOV disc can vary from room temperature to several hundred degrees after a power surge has been redirected.

The higher the voltage of the power surge, and the longer it lasts, the more energy that must be diverted and the hotter the MOV becomes. MOVs are sacrificial, meaning they will divert a finite number of power surges until they are eventually destroyed. They may reach end-of-life after only a single large surge or over several years from several smaller surges.

Thermal Fuse Protection: Because MOVs heat up when handling a power surge, there is a potential for the surge protection device or material surrounding the surge protection device to catch fire. The 2nd Edition of UL 1449 tests the fire safety of the TVSS surge

protection devices by requiring severe overvoltage tests, causing the MOVs to fail.

The surge protection device passes if it does not create a fire or electrocution hazard. This is commonly accomplished by the use of thermal fuse protection. Under the previous version of UL 1449 surge conditions could cause the surge protector to overheat and catch fire. The thermal fuse reduces that risk.

L-N, L-G, & N-G Protection: The electrical system in your home is typically a three-wire system. The wires are the ground, line (hot), and neutral. A power surge can exist across any of these wires. The surge protection should protect against surges coming through any of these wires. When a surge protection device indicates the following, you know all wires are protected: Line to Neutral (L-N), Line to Ground (L-G), and Neutral to Ground (N-G). Secondary surge arresters installed at the service entrance have only Line to Neutral (L-N) protection because there is no ground wire in the locations where they are installed.

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[State Farm®](#) believes the information contained in this article is reliable and accurate. We cannot, however, guarantee the performance of all items demonstrated or described in all situations. Always consult an experienced contractor or other expert to determine the best application of these ideas or products in your home.

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<http://www.naturalhandyman.com/iip/infelectrical/infsurgeprotect2.html>

How to Choose Surge Protection for Your Home

(Part 2)

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Shopping Tips

Here are some shopping tips to use when purchasing your surge protection system...

Service Entrance Surge Protection

Service entrance surge protection devices will either be a TVSS or a secondary surge arrester. It is not possible to compare the capabilities of a TVSS to a secondary surge arrester because they are tested differently. State Farm is not recommending one type over another. We will offer suggested specs for both.

- **Tested Product:** It is very important that the device has been tested. Look for a secondary surge arrester that is tested according to the recommendations of IEEE C62.11 or a TVSS that has been tested in accordance with UL 1449, 2nd Edition.
- **Fuse Protection:** Look for a TVSS device that has thermal fuse protection. If the device is a secondary surge arrester, make sure it is fused.
- **Clamping Voltage (Rating):** TVSS service entrance surge protectors will typically have a clamping voltage higher than 330 volts.

We do not currently have a recommendation for a minimum clamping voltage for TVSS service entrance surge protectors. For information purposes only, it appears most of the established manufacturers of these devices have a clamping voltage no higher than 800 volts.

The lower the clamping voltage the better the protection.

Service entrance surge protection devices classified as secondary surge arresters will not have a clamping voltage because they are not tested to UL 1449. Purchase a device that is tested according to the recommendations of IEEE C62.11. Talk with the manufacturer about the device's capabilities. Since there is no standardized test method for secondary surge arresters, each manufacturer may test their product differently, making a performance comparison between products difficult or impossible.

- **Surge Protection on All Electrical Wires:** Verify the surge protection is on all electrical wires. TVSS devices should indicate protection for Line to Neutral (L-N), Line to Ground (L-G), and Neutral to Ground (N-G). Secondary surge arresters mounted on the utility side of the electrical panel will have only L-N protection.
- **Telephone and Cable TV Protection:** Install surge protection on the incoming telephone and cable TV lines as well as the electrical line. It is possible to accomplish this with one surge protection device or separate surge protection devices at each utility line.
- **Working Indicator Light:** Most all service entrance surge protection devices

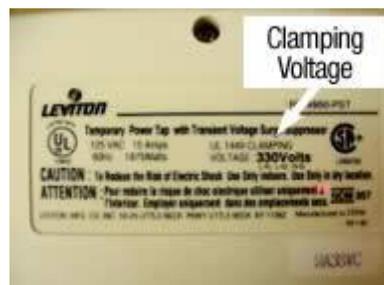
have indicator lights that will signify if there are any problems with the protection. Be sure the device you buy has this feature. Most of these devices, if the surge protection capabilities are destroyed, will still conduct electricity. The indicator lights are a way to check to make sure the device is still protecting.

- **Good Warranty:** Find an established manufacturer with a good reputation. Their warranty should cover any damage to the equipment that is protected by their product.
- **Joule Rating:** The joule rating indicates how much energy a surge protection device can handle. Because testing to determine joule ratings has not yet been standardized, the joule rating cannot currently be used for comparing products.

* Point-of-Use Surge Protectors*

1. **Tested Product:** These types of surge protectors all fall under the category of TVSS. Purchase only devices that have been tested to UL 1449, 2nd Edition.
2. **Thermal Fuse Protection:** Look for a device that has thermal fuse protection.
3. **Clamping Voltage (Rating):** Purchase TVSSs with a listed clamping voltage of 330-volts, the best rating given under UL 1449. It will not be difficult to find TVSSs that plug into outlets and have a clamping voltage of 330-volts. However, we could not find surge protection outlets with clamping voltages less than 400-volts.

The clamping voltage can be found on the surge protector's rating plate (see below)



4. **Surge Protection on All Electrical Wires:** Make sure the surge protection is on all electrical wires. The device should indicate protection for Line to Neutral (L-N), Line to Ground (L-G), and Neutral to Ground (N-G). A clamping voltage of 330-volts should be listed for all three wires.
5. **Fax/Modem and Coax Protection:** When purchasing a point-of-use type surge protector for a computer, VCR, or TV, look for a device with telephone and coax cable jacks for protection of those lines if the item being protected has those types of hookups. Remember, power surges can enter through the electrical, telephone, or coax lines.
6. **Loss of Power After Catastrophic Failure Feature:** Look for point-of-use surge protection devices that no longer conduct electricity once the capacity to protect against power surges has been lost.

Surge protection devices are designed to sacrifice themselves for the equipment they are used to protect. Once they have had too many surges, they no longer protect. However, if they still conduct electricity, a homeowner may never be aware the device has lost its ability to protect. With this feature, once the protection has been destroyed by a power surge, the surge protector outlets will no longer be powered.

7. **Ground Wire Indicator Light:** A convenient feature to have is a plug-in type surge protector that has a light that will indicate whether or not the outlet it is being plugged into is properly grounded. Grounding is required for the surge protection device to work most effectively.
8. **Good Warranty:** Find an established manufacturer with a good reputation. Their warranty should cover any damage to the equipment that is connected through their surge protection device.
9. **Joule Rating:** The joule rating indicates how much energy a surge protection device can handle. Because testing to determine joule ratings has not yet been standardized, the joule rating cannot currently be used for comparing products.

Proper Grounding Imperative

Without proper grounding a surge protection device's ability to protect is greatly diminished or impeded. For more information about this, read the article, *The Importance of Proper Grounding*. **This is important information to have if you are designing or building a new home or remodeling.**

Do not connect a plug-in type point-of-use surge protection device to an electrical outlet by using a two-prong extension cord. The surge protection device's ability to protect against power surges will be diminished. And many surge protection device warranties will not cover any damage if this is done.

Planning of Electrical Circuits

If you are building a new home or remodeling, properly organizing the electrical circuits can reduce exposure of power surges to sensitive equipment. Don't place wall outlets that are going to be used for computers, TVs, microwaves, and stereos on the same circuits powering large appliances with motors, such as refrigerators or freezers.

Costs

Service entrance surge protection at the main electrical panel or electric meter requires installation by a qualified electrician. Installing it at the electric meter also requires the approval of the utility company. Service entrance surge protection (for the electrical system only) can also be accomplished with plug-on devices that snap into the electrical panel just like a circuit breaker.

Costs for service entrance surge protection can start at \$80 (material and labor) for the plug-on type devices inside the electrical panel. For those mounted on the outside of the main electrical panel or installed at the electrical meter, the range is \$150 to \$500 (material and labor).

Costs can range from \$20 to over \$100 for better quality point-of-use type surge protection devices that plug into electrical outlets.

Surge protection outlets, which require the services of a qualified electrician, cost around \$40 (material only) as compared with a typical electrical outlet that costs around \$2 to \$4 (material only).

Conclusion

Why hasn't damage from power surges been a problem before now? Power surges have always existed. Appliances and products going into our homes, however, have changed.

Sensitive electronic circuitry is appearing in more and more appliances in the typical American home. Also, the amount of electronic equipment in the home is increasing -- DVD players, satellite TV, video games, stereo systems, and personal computers are

becoming commonplace.

The electronic circuitry is getting more dense and compact, making the circuitry more vulnerable to damage from power surges. Equipment and appliances are becoming more interconnected with one another and more connections will be made with phone lines and coax cable lines. Electric utility companies are deregulating at a time when there will be more demand for electrical power. All this increases the chances of damage from power surges.

The cost and number of electronics and smart appliances in the home will continue to increase. Combining this with the potential increase in power surges means damage from power surges will cost us more in the future.

The cost is not borne solely by insurance companies. The consumer loses also. Most power surges do not originate from lightning strikes. Damage from power surges created by the utility company or generated within the home is either not covered or has coverage limitations in most insurance policies.

Even for damage caused by lightning, coverage is often limited (depending on type of insurance coverage) because of the depreciation on the piece of equipment and the deductible. Because of the potential financial loss to the homeowner, a good surge protection plan should be considered, no matter where you live in the country.

Understanding the problem and knowing what options are available to you puts you ahead in the protection of your property.

[State Farm®](#) believes the information contained in this article is reliable and accurate. We cannot, however, guarantee the performance of all items demonstrated or described in all situations. Always consult an experienced contractor or other expert to determine the best application of these ideas or products in your home.

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Questions and Answers About Lightning and Thunder

What



Intense cloud-to-ground lightning caught using time-lapse photography. Norman, OK March, 1978 c. C. Clark

some
that
to-
this

yard

steps

causes lightning?

Lightning originates around 15,000 to 25,000 feet above sea level when raindrops are carried upward until of them convert to ice. For reasons are not widely agreed upon, a cloud-ground lightning flash originates in mixed water and ice region. The charge then moves downward in 50-sections called step leaders. It keeps moving toward the ground in these and produces a channel along which charge is deposited. Eventually, it

encounters something on the ground that is a good connection. The circuit is complete at that time, and the charge is lowered from cloud to ground.

The return stroke is a flow of charge (current) which produces a luminosity much brighter than the part that came down. This entire event usually takes less than half a second.

What causes thunder?

Thunder is caused by lightning. The bright light of the lightning flash caused by the return stroke mentioned above represents a great deal of energy. This energy heats the air in the channel to above 50,000 degrees F in only a few millionths of a second! The air that is now heated to such a high temperature had no time to expand, so it is now at a very high pressure. The high pressure air then expands outward into the surrounding air compressing it and causing a disturbance that propagates in all directions away from the stroke. The disturbance is a shock wave for the first 10 yards, after which it becomes an ordinary sound wave, or thunder.

Thunder can seem like it goes on and on because each point along the channel produces a shock wave and sound wave.

How far away from a storm can lightning strike?

It's not clear what the maximum possible distance might be. Lightning has been known to strike more than 10 miles from the storm in an area of clear sky above.

How long can a lightning bolt be?

Recent research from Vaisala-GAI's LDAR and LDAR II lightning detection networks show that lightning can travel 60 miles or more. They find the longest bolts originate in the front of a squall line and travel 62 miles horizontally back into the trailing stratiform region behind the squall line. The longest bolt they have seen to date was 118 miles long in the Dallas-Ft. Worth, TX area. Since 3-D lightning measurements are relatively new, however, scientists are learning more every day and these numbers may change.

Where does lightning usually strike?

Lightning comes from a parent cumulonimbus cloud. These thunderstorm clouds are formed wherever there is enough upward motion, instability in the vertical, and moisture to produce a deep cloud that reaches up to levels somewhat colder than freezing.

These conditions are most often met in summer. In general, the US mainland has a decreasing amount of lightning toward the northwest. Over the entire year, the highest frequency of cloud-to-ground lightning is in Florida between Tampa and Orlando. This is due to the presence, on many days during the year, of a large moisture content in the atmosphere at low levels (below 5,000 feet), as well as high surface temperatures that produce strong sea breezes along the Florida coasts. The western mountains of the US also produce strong upward motions and contribute to frequent cloud-to-ground lightning. There are also high frequencies along the Gulf of Mexico coast westward to Texas, the Atlantic coast in the southeast US, and inland from the Gulf. Regions along the Pacific west coast have the least cloud-to-ground lightning.

Flashes that do not strike the surface are called cloud flashes. They may be inside a cloud, travel from one part of a cloud to another, or from cloud to air.

Can lightning be detected?

Since the 1980s, cloud-to-ground lightning flashes have been detected and mapped in real time across the entire US by several networks.

In 1994, the networks were combined into one national network consisting of antennas that detect the angle from ground strike points to an antenna (direction-finder antenna), that detect the time it took for them to arrive at an antenna (time-of-arrival method), or a combination of both detection methods. The network is operated by **Global Atmospheric**, owned by [Vaisala](#) who manufactures environmental and industrial measurement products.

Flashes have also been detected from space during the past few years by an optical sensor. This experimental satellite covers the earth twice a day in tropical regions. The satellite also detects flashes that do not strike the ground, but cannot tell the difference between ground strikes and cloud flashes.

How many flashes are there?

Over the continental 48 states, an average of 20,000,000 cloud-to-ground flashes have been detected every year since the lightning detection network covered all of the continental US in 1989. In addition, about half of all flashes have more than one ground strike point, so at least 30 million points on the ground are struck on the average each year in the US. Besides cloud-to-ground flashes, there are roughly 5 to 10 times as many cloud flashes as there are to ground.

What types of damage can lightning cause?

Cloud-to-ground lightning can kill or injure people by direct or indirect means. The lightning current can branch off to a person from a tree, fence, pole, or other tall object. It

is not known if all people are killed who are directly struck by the flash itself. In addition, flashes may conduct their current through the ground to a person after the flash strikes a nearby tree, antenna, or other tall object. The current also may travel through power or telephone lines, or plumbing pipes to a person who is in contact with an electric appliance, telephone, or plumbing fixture.

Similarly, objects can be directly struck and this impact may result in an explosion, burn, or total destruction. Or, the damage may be indirect when the current passes through or near it. Sometimes, current may enter a building and transfer through wires or plumbing and damage everything in its path. Similarly, in urban areas, it may strike a pole or tree and the current then travels to several nearby houses and other structures and enter them through wiring or plumbing.

How to stay safe when lightning is around: use the 30-30 Rule!

The best defense is to plan ahead and avoid exposure to lightning when a thunderstorm occurs. Know where safe shelter is located and leave enough time to reach safe shelter before your danger level is high. Don't be an isolated tall object, and don't be connected to anything that may be an isolated tall object.

NSSL's scientists and collaborators did a study to find out how close is too close. They found that 80% of the next lightning strikes in a storm are within 2 to 3 miles of each other in Florida, but as far as 6 miles from each other in Oklahoma. Use the 'flash-to-bang' method to find the distance to lightning. Safe shelter must be reached by the time a flash is within 30 seconds flash-to-bang. In most cases, then, when you can hear thunder you are no longer safe. Lightning safety is also considered at:

- [National Lightning Safety Institute](#)
- [Lightning Safety from NOAA](#)

But there is often blue sky in some direction while lightning is occurring nearby, and it may not be raining, so pay much more attention to the lightning than the rain. A particularly difficult situation is the first flash from a storm--watch for a storm that is growing quickly, such as when a storm is becoming very dark at its base or is growing very tall. An equally dangerous situation is when a storm appears to be finished, and only light rain and/or occasional thunder are heard, but the cloud overhead continues to be fairly dark. The most common situation for a lightning death or injury in Florida was found NOT to be in the heaviest rain area with lots of flashes, but after or before the time when rain and lightning was the most intense. So, the weak storm without too many flashes, at the edge of a larger storm, or early or late in the life of a storm is most dangerous.

The best shelter is a substantial building that has plumbing and wiring--in other words, one that is used or lived in by people for a major portion of the day. A very unsafe building for lightning has only a roof and some supports, but no wiring or pipes extending into the ground. A vehicle with a metal roof provides good shelter, and is much

better than being in the open or in an ungrounded building, but is not as good as being in a building that is grounded by wires and pipes.



Call to Action!

Bill Roeder recently shared these levels of safety with the National Weather Association (<http://www.nwas.org>):

The most important statement for everyone to understand, memorize and to act on is: **NO PLACE OUTSIDE IS SAFE from lightning NEAR THUNDERSTORMS!**

Level-1: Plan your activities around the weather to avoid the lightning strike hazard. If you are going to be outside, know the weather forecast beforehand. Know the local weather patterns.

Level-2: While outside, use the "**30-30 Rule**" to know when to seek a safer location.

- When you see lightning, count the time until you hear thunder. If this time is **30 seconds** or less, go to a safer place. If you can't see the lightning, just hearing the thunder is a good back up rule to use to take cover.
- Wait **30 minutes** or more after hearing the last thunder before leaving the safer location.
- The "30-30 Rule" will not work well for "first-strike" lightning from locally developing thunderstorms. Watch for brewing convection and seek shelter before the first lightning is produced.

Level-3: Go to a safer location when required. Don't hesitate; go to a safer place immediately! The safest place commonly available is a large fully enclosed substantially constructed building, e.g. a typical house. Once inside, stay away from any electrical conducting path from the outside, e.g., corded telephones, electrical appliances, and plumbing. If you can't get to a substantial building, a vehicle with a solid metal roof and metal sides is a reasonable second choice. Avoid contact with conducting paths going outside. Convertibles and open-framed vehicles do not count as lightning shelters.

Level-4: If you can't get to a safer location, avoid the most dangerous locations and activities. Avoid higher elevations, wide-open areas, tall isolated objects, water-related activities, and open vehicles. Avoid unprotected open structures like picnic pavilions, rain shelters, and bus stops. **DO NOT GO UNDER TREES TO KEEP DRY DURING THUNDERSTORMS!**

Level-5: USE THIS ONLY AS A DESPERATE LAST RESORT! If you are outside and far away from a safer place, proceed to the safest location. If lightning is imminent, it will often give a few seconds of warning: hair standing up, tingling skin, light metal objects vibrating, seeing corona discharge, and/or hearing a crackling or "kee-kee" sound. If you are in a group, spread out so there are several body lengths between each person. Once spread out, use the lightning crouch - put your feet together, squat down, tuck your head, and cover your ears.

When the immediate threat of lightning has passed, continue heading to the safest place possible. Remember, this is a desperate last resort; you are much safer following the previous guidance and avoiding this high-risk situation.

Level-6: The first step in lightning first aid is to call 911. All deaths from lightning are from cardiac arrest or stopped breathing at the time of the strike. CPR or mouth-to-mouth-resuscitation is the recommended first aid.

No lightning safety guidelines will give 100% guaranteed total safety, but these steps will help you avoid the vast majority of lightning casualties.

Lightning is THE underrated weather hazard. Fortunately, the vast majority of these casualties can be easily avoided.

This article courtesy of the [National Severe Storms Laboratory](#), a research laboratory associated with the [National Oceanic and Atmospheric Administration](#).

<http://www.naturalhandyman.com/iip/infelectrical/inflightning.html>

7 Delta Lightning Arrestors

Everything priced on this page is in-stock and ready to ship.

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Delta Lightning / Surge Arrestors are an important safety device which helps you put a power surge where it will do the least

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A small investment for peace of mind.

We stock both the d.c. model (302DC) and the a.c. model (302R).



Delta Lightning Arrestors:

SOV (silicon oxide varistors) with a maximum current of 60,000 amps.

Waterproof and easily mounted in a 1/2" knockout.

The DC version (302DC) is used for lightning/surge protection on incoming wires from the PV array, wind generator or hydroelectric turbine.

It will handle up to a 300 volt d.c. system.

The AC version (302R) can be mounted in your load center and on AC wiring running outside of the building.

Both are simple to install.

This is one item that most people leave out of their system plan until after the damage is done.

Unfortunately we sell many of these to customers whose charge controller or inverter have been damaged from a near lightning strike and did not have protection.

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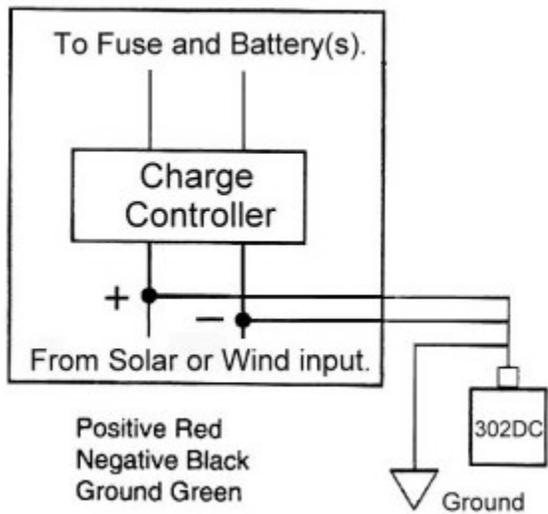
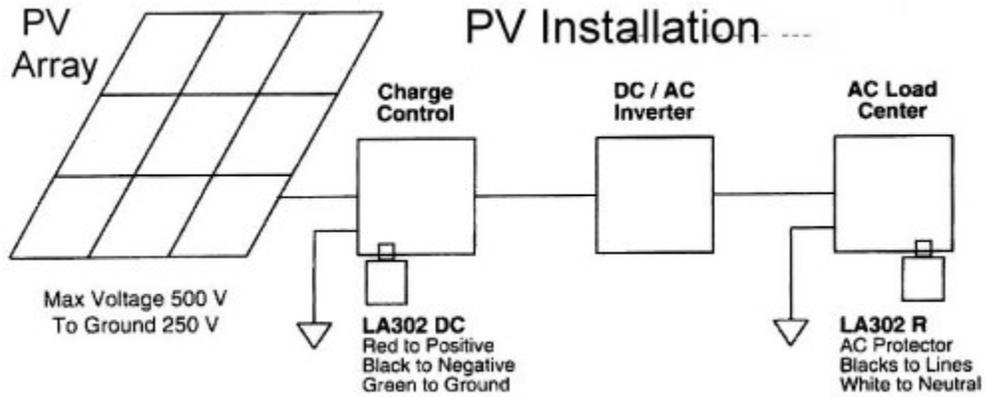


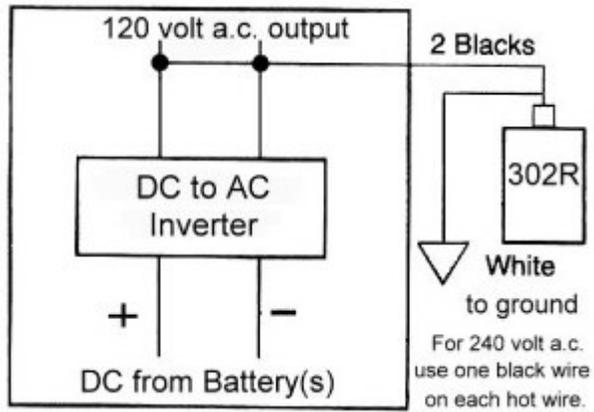
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