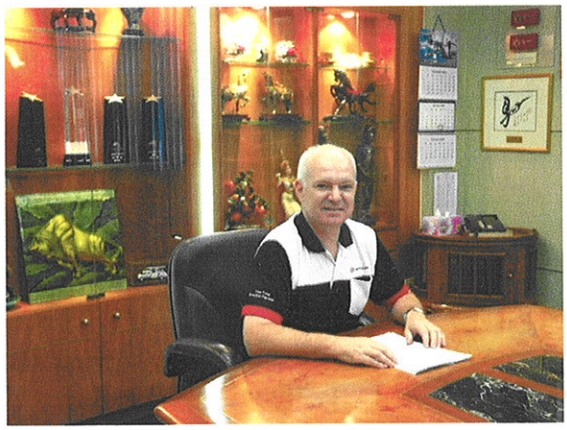
Active & Intelligent Lightning Protection Seminar

Friday March 20, 2009

Atrium Hotel

It gives me great pleasure to welcome you to our seminar today.



Singapore experiences one of the highest rates of lightning strikes in the world. However, the general knowledge of how to reduce the risks of lightning damage to valuable equipment in limited. Many people continue to believe that the presence of a lightning rod is sufficient protection. Those with more knowledge will install surge arrestors.

Despite these precautions equipment continues to be damaged by lightning.

During today's seminar we will describe how active and intelligent lightning protection systems can complement existing lightning rods and surge arrestors to provide protection from the more damaging secondary effects of a lightning strike: Direct Energization, Low Side Surge resulting from Ground Potential Rise and Near Field Coupling resulting from Electro Magnetic Pulsing.

We will also demonstrate the importance of having a good ground or earth connection.

The ILD product line is unique. It is able to detect the risk of lightning strikes **BEFORE** they occur and provide outputs that allow preventative action to be taken automatically.

I hope that at the end of today's seminar you will have a better understanding of the risks associated with lightning strikes and the ways in which these risks can be reduced.

Richard Stuart
Managing Director
IPS Securex Pte Ltd

ISO 9001 : 2000 Cert.No. : 1692

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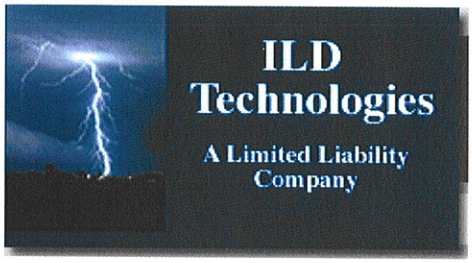


ILD Technologies manufactures, installs, and supports our systems, the premier line of active and intelligent lightning protection equipment.

The heart and soul of ILD exists in our small office in San Antonio, Texas. In 2006, we purchased the patented lightning protection technology from Rabun Labs and its inventor Dan Young. We had big ideas about its potential and our ability to turn it into something more. Since then we've continued manufacturing and installing our legacy products while developing the next generation of equipment protection systems.

We're now just beginning to see our big ideas become reality while we continue facing the daily challenges of our business. Thanks to our variety of distributors, strong relationships in neighboring industries, extensive technical capabilities and wealth of experience in every aspect of our business, we're a small company with a tremendous presence.

By remaining small we've been able to focus on the quality of our company and the necessary steps to point it in the right direction. The progress we've made and will continue to make forces us to grow, never ignoring the things that really matter.

Our products detect nearby lightning strikes, isolate sensitive electronic equipment, and reconnect automatically. Destructive surges that can develop on incoming lines and through ground paths never reach electronic equipment and the building's systems can continue normal operation.

Thousands of units employing our patented technology provide the highest level of facility protection for industrial, commercial and utility customers worldwide.

Based in San Antonio, Texas, we're here to help protect your electronic equipment and keep your business operating safely.

Insurance Information Institute
110 William Street, New York, NY 10038 Tel. 212 346-5500

Lightning Striking Again and Again: New I.I.I. Study Finds Increase in Lightning Claim Costs

NEW YORK, June 21, 2007 — They say that lightning never strikes in the same place twice, but for insurers, it strikes over 250,000 times per year, causing hundreds of millions of dollars in damages. In fact, the total cost of homeowners claims for damage due to lightning strikes has increased dramatically—up 20 percent over the last three years,

According to a new Insurance Information Institute (I.I.I.) analysis of homeowners insurance data, there were 256,000 lightning claims in 2006, causing about $882 million in insured losses. The I.I.I. puts the average claim for lightning at $3,446. By comparison, in 2004, there were about 278,000 lighting claims, which caused about $735 million in insured losses with the average claim totaling $2,646. The average cost per claim rose 30 percent between 2004 and 2006 even as the actual number of claims fell by nearly 8 percent.

"The paid losses are likely to increase to nearly one billion dollars in 2007, despite the declining number of claims, in part, because of the explosion in the number and value of consumer electronics in homes," said Loretta Worters, vice president of the I.I.I. "Wide screen TVs, home entertainment centers, multiple computer households, gaming systems and other expensive devices are having a significant impact on claims losses."

HOMEOWNERS INSURANCE CLAIMS AND PAYOUT FOR LIGHTNING LOSSES (1)

	2004	2005	2006	Percent change 2004-2006
Number of paid claims	278,000	265,700	256,000	-7.9%
Insured losses ($ millions)	$735.5	$819.6	$882.2	20.0
Average cost per claim	$2,646	$3,084	$3,446	30.3
(1) Based on Insurance Information Institute estimates.				

CUSTOMER FEEDBACK

"We have finally found a solution to our surge protection issues. Since we have been using the system the loses to our control room equipment have been eliminated, resulting in better customer relations as well as a savings to them on their insurance rates"
Jerry Long, Vice President of Engineering, Electroguard,

"Working with GPS equipment, we have experienced lightning strikes which resulted in damaged equipment and loss of valuable data. Your equipment provided us with a practical solution to this problem."
Gregory L. DeAngelo, National Oceanic and Atmospheric Administration, United States Department of Commerce

"During a particularly bad thunderstorm, the building in which our office is located was bit by lightning. The lightning protection system did exactly what it was supposed to do. When we came into the office on Monday morning, we discovered that the tenants in the other offices in this building had sustained considerable damage to all their computers, printers, faxes, etc. We sustained no damage at all."
Lesley S. Zajac, Director, Research Administration, Jaeb Center for Health Research,

"Since we have installed the systems in our West Gate Scale, North Truck Scale and Administration Buildings, IMS is happy to announce that no damage has occurred to equipment that is protected by your system, equipment such as: Radiation Detection Systems; Bucket Weighing Computer System; Two-way Radio Communication System; Telephone Systems; RF Communication System"
Brian Washington, Project Engineer, IMS,

"I am writing to say, 'thank you'. The model AL – 1800 lightning protection system has done an excellent job of protecting our five asphalt plant control systems from lightning damage. The year before your installation Ajax spent in excess of $50,000 to repair damage from lightning to our control systems."
Jack Dahlmann, Division Manager of Manufacturing and Material, Ajax Paving Industries Inc

"We have had the equipment installed for six years now, protecting the electrical circuits into our computer room, and also our phone lines. We have 'survived' countless thunderstorms, including at least one lightning strike to our building's rooftop, with absolutely no damage to our critical server and communication

systems. Also, by using your system in conjunction with battery backups, we haven't incurred any downtimes as a result of lightning."
Dick McCandless, CPCU, CAN, Information Technologies Manager, South & Western General Agency, Inc.

"We have now completed installation of your system at all of our fifteen asphalt plants. I am delighted to advise you that none of our facilities has suffered any damage from lightning after installation of your system. Is it luck? We still have thunder storms. We still have massive steel structures extending over eighty feet up into the air. We still have electrical components that are very susceptible to voltage surges. The only thing that has changed is that we have a very reliable device that monitors atmospheric conditions and warns of approaching storms."
James E. Crocker, Jr, Manager of Quality Control, Sloan Construction Company, Inc.

"It has been almost seven years since the installation of your lightning detection/ protection systems. I am happy to announce that no lightning damage has occurred to equipment that was protected by your devices. Equipment such as: Televisions, Video Cameras, Video Lines, Trane AC Tracer Unit, Data Lines, HVAC Equipemnt, Satellite Dishes, Telephone Lines, VCRs, Personal Address and Sound Equipment. Your Equipment has saved us substantial dollars in losses due to lightning."
Rick Thompson, Lightning Protection Coordinator, Orange County Public Schools

"Due to the unique design of our facility, The Florida Aquarium's exhibit filtration systems are located both within the physical structure of the building, as well as externally around its perimeter. The exterior filtration yards are extremely vulnerable to lightning strikes. Although the existing lightning protection system does an adequate job protecting the building, animals and human life within the facility, it does not protect the equipment that is susceptible to high-voltage spikes. The installation was completed in early Summer and, to date, the Aquarium has not been affected by a lightning strike-related sensor failure in this yard."
Gary Osborne, Chief Engineer, The Florida Aquarium

"Our M1000 system, which protects all 130 of our institution's security cameras & video equipment, is working beautifully."
Chris Douglas, Maintenance Superintendant, Charlotte Correctional Institution

"On June 5th we experienced a major lightning storm. As a result of this storm, the Main Power Transformer, located approximately 200 yards south, of the Radio Building and the Emergency Generator, located about 300 yards to the north, were both hit by lightning. Upon my arrival I found the M1000/120 had gone into Detection Mode seven times. The Main Radio was still working. However, the four

remote radio units and the main computer which were not protected by your system were all damaged." *John H. Griswold, Manager, Electronics Department, Maintenance Dept – Electronics, Madison Correctional Institution*

"The pieces of equipment connected to the system have survived an entire lightning season. Here in Florida, that is really saying something. We connected our master radio system, the complete on site computer network, the telephone system including all on site lines, intercom system, perimeter security system main computer, camera system switching and monitoring, and even the compressors for the freezers and coolers at the warehouse. To the best of my knowledge we have not lost one single item that your system was protecting."
Johnny Williams, Supervising Construction Projects Administrator, Florida Dept of Corrections

"Your assistance really helped us to put it on our Motorola MSF5000 Base Station and it works great. Your company's technical help was great and I highly recommend your product to anyone who needs added protection for equipment. It's a small price to pay to protect a $10,000 to $15,000 radio system. We installed at a remote site where power continually went out because of storms. We have a battery revert on the Base Station and when a bad storm comes, the model 100 unplugs AC, switches to battery back up, then it turns back on when the storms passed. This gives a tremendous peace of mind to the customer in helping to protect an expensive piece of equipment."
Tom Parker, Sales Manager, Motorola

CMF Distribution

1626-G Sweetwater Road # 271
National City, CA 91950
Phone (619) 454-3640 Fax (619) 330-4532

9/18/07

Jerry Christenson
Vice President of Business Development
ILD Technologies, LLC
121 Interpark Blvd., Suite 406
San Antonio, TX 78216

Dear Jerry:

I'm sending this letter to express my appreciation for the products and technical services that I have received from your company in support of our international business efforts.

As you know, CMF deals extensively with irrigation systems throughout Asia as a distributor of Toro and other fine product lines. We have utilized Rabun lightning protection systems very successfully since 2004 to protect critical components of our systems, including the irrigation control computers and sensitive network components. Damage from lightning is a common occurrence in our sales territory and our customers have come to expect the highest level of equipment protection and reliability for the systems that we provide as well as in replacement parts. We are happy to include Rabun products as part of the total solutions that we offer.

I look forward to a continued successful relationship with your company and many more opportunities to specify your outstanding products.

Sincerely,

Ramon M. Castillo

Ramon Castillo
Manager of International Marketing

FLORIDA
DEPARTMENT of
CORRECTIONS

Governor
CHARLIE CRIST

Secretary
JAMES MCDONOUGH

An Affirmative Action/Equal Opportunity Employer

http://www.dc.state.fl..us

9/19/07

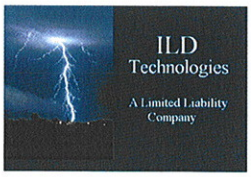
c/o: Jerry Christenson
ILD Technologies, LLC
121 Interpark Blvd., Suite 406
San Antonio, TX 78216

To Whom It May Concern:

I am the Maintenance Superintendent for a Florida prison with two complete compounds housing up to twenty-three hundred inmates. We installed the Rabun Labs Lightning Detection system about two years ago. My experience has been that the system works very well and has saved us a lot of down time, effort, and money.

In my opinion, this system will pay for itself in one season and possibly in one strike, depending on the value of the equipment connected to it. It has, without a doubt, added to the security of this institution by protecting and preventing lightning damage to valuable equipment.

Johnny Williams
Maintenance Superintendent



ACTIVE AND INTELLIGENT LIGHTNING PROTECTION

Industry Applications

- **Communications Industry**
  - Cell Towers
  - Ham Radio Operators
  - Radio & TV Stations
  - Internet Service Providers(set top converters)
- **Construction Industry**
  - Asphalt & Concrete Batch Plants
  - Building grounding
- **Correctional Facilities**
  - Over all Site
  - Perimeter Fencing
  - CCTV
  - Integrated Security Electronic control system
  - Site Grounding and Bonding
- **Education Industry**
  - School early warning systems
  - Stadium Scoreboards and Audio systems
  - CCTV Systems
  - Computer networks
  - Fire Alarm system
- **Government/Military**
  - Radar installation facilities
  - Security camera systems
  - Military Base Security
- **Health Care Industry**
  - Hospitals/Clinics
  - Laboratories
  - Data centers
  - Wireless communications systems
  - Phone systems
- **Homes**
- **Hotels & Motels**
- **Industrial Security**
  - CCTV systems
  - Perimeter Fence intrusion Alarms
  - Radio communications systems
  - Exterior Lighting
  - Vehicle Loops
  - Access control systems

    - PLC based control systems
- **Oil and Gas Industry**
    - Pipeline operators
    - Refineries
    - Drilling & Exploration
- **Petrochemical Industry**
    - Processing Plants
    - Transmission Pipelines
    - SCADA Systems
- **Transportation Industry**
    - Airports
    - Boating
- **Turf & Irrigation Industry**
    - Golf Course Protection
    - Agriculture
- **Water & Waste Water**
    - Pumps and Controls
    - Distribution Pipelines
    - SCADA Systems
    - Waste Water Treatment Plants



FEATURE AR

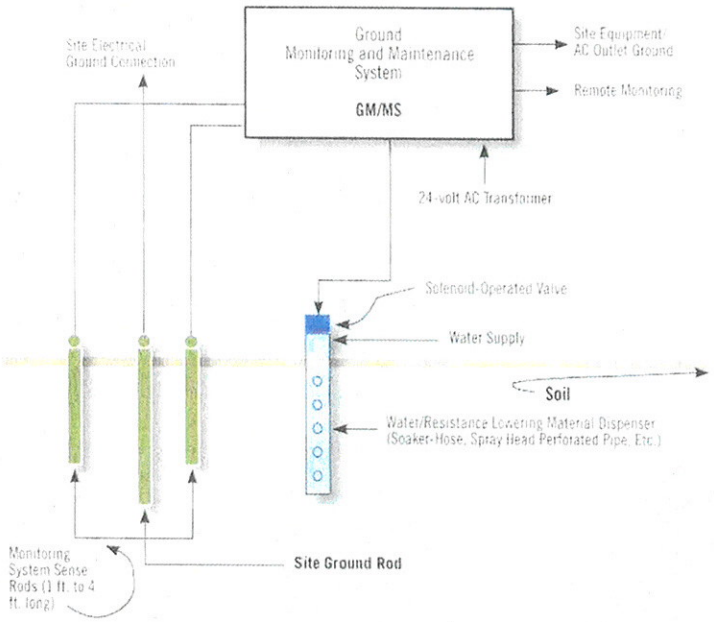
Many power quality problems that result from lightning can be traced to electrical grounding, but now there's a new solution

Solving An Old Grounding Problem

BY DAN YOUNG
President
Rabun Labs, Inc.
Mason, Texas

There's an age-old problem in electrical grounding. During the more than 15 years that I have been actively involved in equipment protection, over and over again, I have heard clients air their many concerns, frustrations and problems regarding electrical grounds, lightning and power quality issues resulting in malfunctioning or damaged equipment.

Figure 1 - Ground Monitoring and Maintenance System



Courtesy Raburn Labs, Inc.

In many of these cases, the root cause of erratic or improper equipment operation, as well as the inability of some equipment protection devices to properly function, turned out to be the electrical ground that the equipment is connected to.

Widely used surge suppressors, lightning rods and air terminals (for facility, satellite dish sites, broadcast and communications tower protection and the like) are typically completely ground-dependent to perform their protective functions.

In other words, a low-resistance electrical ground connection should always be available and working at the time of a surge or lightning strike. In addition, a reliable and consistent low-resistance ground connection is also important to reduce electrical noise in the protected equipment, and is especially desirable to enable radio-frequency transmitting and receiving equipment to operate efficiently.

A great deal of time and effort is usually spent ensuring that the electrical ground at a facility is properly installed and that the resistance reading is within acceptable limits for the area. Even with the best grounding system and components, unfortunately, the resistance increases from moisture evaporation during a dry season. Usually this resistance increase occurs with no one aware that it changed, and even if they did know, how would they correct it to assure there is a *consistently low* resistance?

Regardless of whether a single ground rod is used or an extensive "system" or grid, the electrical ground's ability to perform is directly affected by how good the "connection" is between the soil and the ground system components, commonly referred to as the resistivity of the soil.

The amount of moisture in the soil where the ground system components are located has a great impact on this "connection" (soil resistivity) and the ability of the ground system to function.

A NEW TECHNOLOGY

In view of this longstanding issue, there was clearly the need for a technology to ensure that low soil resistivity is continuously maintained, which would enhance the electrical grounding system's ability to perform consistently.

Specifying TVSS

When specifying TVSS, it is important to highlight that overcurrent protection shall allow both protection during high surge (kA) events and during temporary overvoltage conditions, as well as protection for small fault currents.

Surge current rating is another parameter of TVSS. IEEE recommends testing service entrance TVSS units to only 10 kA, but the majority of manufacturers suggest specifying 250 kA per phase surge current rating for service entrance TVSS because of life expectancy. However, a 160 kA per phase surge current rating is appropriate for TVSS located in distribution panelboards, and a 90-120 kA per phase surge current rating is appropriate for TVSS located in branch circuit panelboards.

The routing and length of conductors connecting the TVSS is an important concern addressed in NEC Section 285. Connecting the TVSS with the shortest conductor length possible provides the most effective protection. A TVSS installed as an internal part of a panelboard provides the optimal design.

In response to this need, a technology was developed that continuously monitors the resistivity of the soil, as shown in Figure 1 (p.28). This is accomplished through the use of two dedicated sensing rods (typically 1 ft. to 4 ft. in length) that are in the area of the grounding system and are spaced a distance apart so that the resistance of the soil can be measured. A low DC voltage is connected to one of the sense rods, and it's return path is the second sense rod. The voltage drop between the two sense rods is indicative of the resistivity of the soil, which is determined primarily by the amount of moisture in the soil. The "composition" of the soil also affects soil resistivity, but it is the moisture level or content that varies, affecting the electrical ground's resistance adversely during dry and hot conditions.

The voltage drop across the two sense rods is compared to a stable reference voltage, allowing a threshold or set point to be established. This set point is the point at which the electronic circuitry determines that the ground system's resistance has increased to a point that the soil needs moisture to restore the ground resistance and soil resistivity to a level that will allow proper function of the electrical grounding system.

When the circuitry senses it's upper set-point limit has been exceeded, it responds by activating a solenoid-operated valve that is connected to a water source. What happens next is much like an irrigation system. Water is gently applied to the soil in areas where the electrical ground system is located. The water can be applied through the use of a "hollow" ground rod near the electrical system's ground rod, if only one is used. For grounding systems that cover a large area or have multiple rods or grids, a soaker-type hose can be used, either on the surface of the soil or buried a few inches. Small spray heads and multiple solenoid valves may also be used if the grounding system is in multiple areas like many broadcast, communications and satellite receiving sites.

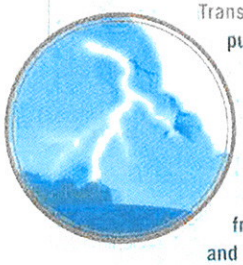
But unlike an irrigation system, the circuitry in this new technology is also continuously monitoring the soil resistivity as the environmentally friendly water is being applied. Once it is sensed that the soil's resistivity is once again below the set-point limit, the valve is de-energized and water flow ceases. Alternatively, a ground-lowering material could be used in place of water or diluted with water and applied to the soil.

The continuous monitoring and corrective action (controlled water application) of this new technology provide the ability to automatically maintain an electrical ground system's operational readiness. The technology also incorporates visual and audible annunciation for indicating status and has dedicated dry contacts to interface with remote monitoring equipment if desired.

Since the system has the sense rods in the area of the electrical grounding system components, an additional capability was incorporated to provide monitoring of a facility or site's ground. This function is to confirm that equipment, AC outlets, etc. are connected to the electrical ground. If an open circuit is detected, indicating that there is a "ground anomaly," the system provides audible and visual alerting and also has dedicated dry contacts for remote monitoring of this function.

This technology, for which a patent was recently received by its developers, addresses the long-time need to monitor and maintain an electrical ground system, automatically and with no human intervention.

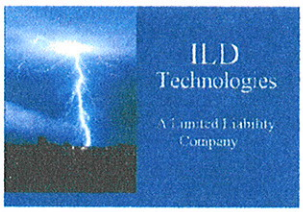
Suppressing Transient Voltage Surges



Transient voltage surges, or voltage spikes, are typically electrical pulses of very high magnitude and extremely short duration. The primary source is usually—but not always—lightning.

Surge suppressors are rated by their single-pulse, maximum surge current per mode. However, a number of other criteria should be considered, such as how they respond to the various ANSI/IEEE waves and the relative let-through current resulting from each of the waves—i.e., B3, B3/C1 combination wave and C3. A single surge suppressor on the service entrance of a facility won't provide adequate protection for sensitive electronic drives, microprocessor-based systems, personal computers and other solid-state, electronic equipment in today's corporate and institutional facilities. As a minimum, a service-entrance-rated surge suppressor should be installed on the main switchboard; a panelboard-rated surge suppressor should be installed on the branch circuit panel feeding the sensitive equipment; and an equipment-rated surge suppressor should be installed at the utilization equipment.

The one element of installation that is most critical for the performance of the system is the routing and length of the conductors connecting the TVSS to the distribution system. In fact, conductor length should be kept to an absolute minimum, and conductor runs should include few bends, preferably none. Necessary bends should be sweeping, not 90 degrees. Finally, keep the conductor properly sized for the equipment. These steps should keep conductor impedance to a minimum and reduce the clamping voltage to its minimum value.



ILD Technologies, LLC Lightning Protection
CCTV, Security Systems & Access Control

Security and Surveillance Equipment capabilities have continued to reach new levels as more and more microprocessors and other sensitive electronic components are developed and utilized in this equipment. The electronic components that enable these equipment enhancements to be developed are also much more sensitive to damage from lightning.

A comprehensive approach to lightning protection "technology" far more effective than the conventional passive arrestors and suppressors is needed for today's advanced security/access control system equipment.

The ILD Technologies, LLC approach to Equipment Protection is to utilize technology that is so different it is patented* and has been proven to be the most effective defense against lightning damage. It is an approach that is as "low tech" as lightning itself, yet as advanced and complex as the equipment it protects, but does not have vulnerability to lightning damage. This unique approach and technology results in an intelligent and active Protection System that reacts to the threat or equipment damage and takes action automatically.

Today's security/surveillance equipment inherently has basically two types of vulnerability:

1. The power source operating the equipment

2. The coax cable/twisted pair and/or low-voltage control wiring connected to the equipment. Long runs of video and control wiring allow induced voltages which can easily be several thousand volts from just a nearby cloud-to-cloud lightning strike. The more damaging cloud-to-ground lightning strike produces the little known, but extremely damaging, low side surge. Low side surge is explained as follows:

   The millions of volts and thousands of amps that characterize a typical lightning event do not just magically disappear upon striking earth. This energy is dissipated into the ground, raising the surface potential to several thousand volts in the area radiating from the strike point and for a distance of as much as 2000 yards or more depending upon soil conditions and other factors. If this voltage gradient develops in the same surface area in which a grounding system is connected, a surge will occur through the ground wiring (the "low" side) itself and propagate into connected equipment.

The ILD Technologies, LLC Equipment Protection System addresses the needs of today's equipment because it detects the presence or lightning and/or an atmospheric corona charge buildup when it is a safe distance away, typically 1-2 miles. When the charge or lightning reaches intensity that is likely to cause equipment damage, the system triggers and automatically takes action to protect equipment by performing the following actions, simultaneously:

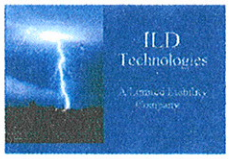
1. Power Source Protection: Automatic disconnect/isolation of equipment from the commercial power source by initiating the start-up of a standby generator and/or switching its power source to a UPS. This allows uninterrupted equipment operation, but is electrically the same as if you had "pulled the power plug". This is the most effective way to protect equipment. If you use a UPS as the standby power source, its AC input is disconnected from the power source and shunted to ground so lightning cannot flow through it and into the protected equipment. Near or far strikes to the power line will not be felt on equipment, therefore eliminating the path for damage. Equipment is automatically reconnected to the commercial power source once the storm has moved a safe distance away and/or

no lightning has been detected.

2. Disconnects/isolates circuits providing power to the AC outlets where selected non-critical, but sensitive, electrical or electronic equipment is plugged in, from the AC Power Source, and grounds those outlets for a minimum of 6 minutes or until the storm moves a safe distance away, then automatically restores all connections and normal equipment operation resumes.

3. Disconnects/isolates/grounds the control wiring to remote located card readers, gate controls, CCTV cameras, pan & tilt units and coax video lines that run between a control location and the remote equipment (which are very susceptible to induced high voltages from a nearby lightning strike). The disconnect/isolation/grounding action can be as short as 5 seconds each time a lightning strike is detected (so, in effect, the equipment remains in operation), to a complete equipment shut-down for 20 minutes or until the storm moves a safe distance away, then automatically restores all connections and normal equipment operation resumes. Isolating, then grounding the wiring going to remote-located equipment from it's associated control equipment, even for short periods (i.e. 5 seconds) each time a lightning strike is detected, assures that any lightning-induced voltage in the wiring is safely dissipated to ground and not fed directly into either the remote-located or control equipment, that would likely cause damage.

4. The protection of intercom & paging systems, telephones & telephone equipment, modems and fax machines is also addressed: Each time a lightning strike is detected, the System performs a 5 second interrupt action, which automatically "shunts" the telephone and/or intercom line to ground for approximately 5 seconds, then restores. If you are using the telephone when this occurs, it sounds like a "call waiting" click, and you do not lose your connection, your equipment or your hearing from the loud "pop" lightning can cause to be present in a telephone earpiece or operator headset.



ILD Technologies, LLC Lightning Protection
Data, Intercom, Telephone & Telecommunications Equipment

Since Data, Intercom, and Telephone equipment is connected to AC Power and literally miles of wire, a tremendous vulnerability exists for equipment damage during a thunderstorm. A significant amount of damage to equipment occurs when lightning strikes close to your facility, but lightning a mile or so away can also be very damaging to equipment. Many people think that for lightning to cause equipment damage, it has to strike an earth object or be right outside their window. Not so. All that's needed is a flash between two clouds and there's plenty of trouble for solid-state equipment. Why? Because the sudden change in the electric field that occurs during a cloud-to-cloud discharge can typically be 70 volts per meter, a mile away from the flash. What this means is that the massive re-distribution of the electric charge a mile away can induce a surge up to 70,000 volts on only a 1000 meter length of data, intercom, or telephone line!!! The protection provided by the ILD Technologies, LLC Equipment Protection System is due to the ability to detect lightning, while it's still a safe distance away (typically 2-3 miles) and do something about it! When the threat reaches a level of possible equipment damage (regardless of the distance away), the ILD Technologies, LLC Equipment Protection System automatically shunts the connected equipment wiring to ground for approximately 0.4 seconds. The equipment then automatically resets, waits for another strike, and repeats the process as required until the storm subsides.. Calls or connections are not lost or disconnected when the ILD Technologies, LLC Equipment Protection System is in the protection mode, rather it is simply stopped for 0.4 seconds (400 millisecond) and sounds like a "call waiting" click. It's that simple and that safe! The ILD Technologies, LLC system is a proven, state-of-the-art, active equipment protection system that gives you peace of mind when the next storm comes. In addition, your equipment is protected even if power is lost during a storm. The ILD Technologies, LLC Equipment Protection System features a built-in rechargeable battery to continue system operation for typically 2-3 hours which is usually more than enough time for a storm to move out of the area.

In addition to providing equipment protection from damage coming in on the data, intercom, or telephone wiring, the ILD Technologies, LLC Equipment Protection System simultaneously disconnects your data/communications control equipment from AC power for approximately 6 minutes and automatically places it on standby power, typically a UPS, when lighting is detected. After the 6 minute time period, the system automatically restores power connections until the next detected strike, then repeats. It is highly recommended to have a UPS on the data/communications control equipment to buffer it from damage via the power line and to allow communications to continue for a period of time after commercial power is lost. The active and intelligent ILD Technologies, LLC Equipment Protection System shouldn't be confused with the ordinary surge suppressor. Surge suppressors can provide protection against a limited number of harmful line transients, voltage spikes, or surges that are present for very short periods of time and do not exceed specific levels of energy during that time. The ILD Technologies, LLC Equipment Protection System is different from any type of surge suppression devices in that it reacts to the potential threat of damage to your equipment from an electrical storm and protects it *before* damaging voltage spikes, transients, or surges can develop on equipment wiring. The system also has built-in protection circuitry for it's lightning detector during the period when potentially damaging conditions exist. This system is so different that it's patented!*

All units feature a pushbutton test so you can to simulate lightning detection and ensure the protect function. In addition, there are LED indicators to let you see that the system is operational and to indicate when the equipment protection circuitry has been activated. Units are equipped with a standard AC outlet is to provide power for the data/communications control equipment with a maximum of 10 Amps, or 1200 Watts. The basic system includes the *Model 2000 Central ControlDisplay Unit* with a built-in 6-line switcher and a *Remote Detection Unit.* You can add remote-controlled switchers so the system can be easily expanded to protect any number of lines and easily integrated into existing installations. Switchers are available for 3, 6, and 25 lines. In addition, remote controlled coax switching relays allow protection of equipment operated via coax cable (LANs, CCTV , etc.)

For More Information, Contact:

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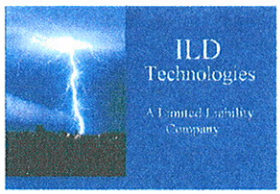
(210) 545-4171



ILD Technologies, LLC Lightning Protection
For Energy Management, Automation and Control Systems

Advancements in technologies have found their way into Energy Management, Automation and Control Systems providing capabilities never available in years past. These new systems are filled with microprocessors and other equally sensitive integrated circuits and electronic components. While the advancements provide cost-savings and improved equipment operating efficiency, they also increase vulnerability to damage and failures caused by lightning. This is because these types of systems inherently utilize long wiring runs between the central control unit and remotely located sensors & controls which provide a path for damaging induced voltage levels from nearby lightning.

The use of proper grounding techniques and correctly applied Transcient Voltage Surge Suppressors (TVSSs) will address failures due to surges present on signal or power lines, but the possibility of damage from a low side surge still exists. Low side surge is explained as follows:

> The millions of volts and thousands of amps that characterize a typical lightning event do not just magically disappear upon striking earth. This energy is dissipated into the ground, raising the surface potential to several thousand volts in the area radiating from the strike point and for a distance of as much as 1000 yards or more depending upon soil conditions and other factors. If this voltage gradient develops in the same surface area in which a grounding system is connected, a surge will occur through the ground wiring (the "low" side) itself and propagate into connected equipment.

So, this means that there are 3 paths that can allow lightning to enter and damage or destroy equipment: I) The AC Power; 2) Sensor/Control wiring and 3) Electrical Ground.

To combat this problem, ILD Technologies, LLC Lightning Detection/Equipment Protection Systems react to the threat of equipment damage by actually detecting lightning while it's a safe distance away, then automatically performs the following functions to protect your equipment, while keeping it fully operational:

1. Isolating your equipment AC Power input from the commercial power source and switching it to a standby source, such as a UPS or Standby Generator. Isolation time is user selectable and can be as short as a few minutes, allowing UPS recharge until another strike it detected.

2. Each time a strike is detected, the wiring from remote-located sensors and controls is momentarily disconnected (user-selectable time from a fraction of a second to seconds) and shunted to ground, then automatically reconnected.

3. By isolating and shunting the electrical I/Os of the main control equipment when lightning is detected, equipment is safe from any potential felt on the electrical ground.

ILD Technologies, LLC Lightning Detection/Equipment Protection Systems are totally automatic and require no human intervention or operation. All systems and connections automatically return to normal when the lightning subsides or moves a safe distance away.

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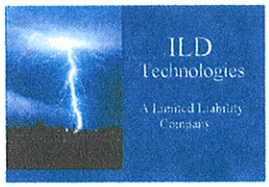

ILD Technologies, LLC Lightning Protection
For Hotel and Lodging Facilities

The quantity and complexity of the electrical and electronic equipment in Hotel & Lodging facilities continues to grow as more and more new technology products become available. The protection of these valuable assets from lightning damage has presented serious challenges due to the common use of sensitive microelectronics components in just about everything that has a power cord, telephone line or coax cable connected to it.

The ILD Technologies, LLC Equipment Protection System is different from passive surge suppressor/arrestor type of protection devices in several ways. First, it is a state-of-the-art active protection system that interfaces with all of the various components of your equipment and provides the proper level of protection each requires. Second, it automatically reacts to the threat of equipment damage by detecting lightning while it's still a safe distance away and with no human intervention.

The ILD Technologies, LLC System detects lightning when it is typically 1-2 miles away and when it reaches an intensity that is likely to cause equipment damage, the System performs the following functions simultaneously:

1. For equipment that must remain in operation during an electrical storm, the System can initiate automatic start-up of a stand-by generator and/or switch equipment to UPS operation, either of which completely isolates connected equipment from the commercial power source. This mode of operation would remain in effect for a minimum of 6 minutes after the last detected lightning strike. At the end of the protection event, equipment operation is automatically switched back to normal and the stand-by generator shut down.

2. Disconnects/isolates circuits from the AC Power source that provide power to outlets serving non-critical but sensitive equipment, and grounds those outlets for a minimum of 6 minutes or until the storm moves a safe distance away. The System then automatically restores all connections and normal equipment operation resumes.

3. Disconnects/isolates/grounds the control wiring to remote located card readers, gate controls, CCTV cameras, pan & tilt units and coax video lines that run between a control/monitoring locations and remote equipment (which are all very susceptible to damaging induced voltages from a nearby lightning strike). Also included is Satellite, CATV and MATV equipment including Internet Routers and other devices. The disconnect/isolation/grounding action can be a short as 0.4 seconds each time a strike is detected (in effect, the equipment remains in operation), to a complete equipment shut-down for 20 minutes or until the storm moves a safe distance away. The System then automatically restores all connections and normal equipment operation resumes. Isolating and grounding the wiring going to the remote-located equipment from it's associated control equipment, even for short periods (i.e. 0.4 seconds) each time a nearby lightning strike is detected, assures that any lightning-induced voltage in the wiring is safely dissipated to ground and not fed directly into either the remote-located or control equipment.

4. The protection of intercom & paging systems, telephone equipment, modems and fax machines is also addressed: Each time a nearby lightning strike is detected, the System performs a brief "interrupt action", which automatically shunts the telephone and/or intercom line to ground for the duration of the surge event and then restores. If you are using the telephone when this occurs, it sounds like a "call waiting" click, and you do not lose your connection, your equipment or your hearing from the loud "pop" lightning can cause to be present in a telephone earpiece.

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Rabun™ Lightning Protection
For Aggregate and Process Plants

The quantity and complexity of the electrical and electronic equipment in use at aggregate and process plant facilities continues to grow as more and more new-technology products become available. Equipment such as control instrumentation, computers, telephone and radio systems, remote-controlled valves & bins, load cells & scales or weighing equipment, VFD and PLC controls, are all susceptible to damage from induced voltages from lightning. It is also known that motors are damaged when operated at low voltages, whether they are constant-speed or controlled by a Variable Frequency Drive system. This equipment represents a very significant investment, regardless of the size of the operation, and many times the ability to operate is adversely affected or even stopped when equipment is damaged from lightning. The protection of these valuable assets from lightning damage has presented new challenges due to the common use of extremely sensitive microelectronic components in just about everything that has a power cord, telephone line or coax cable connected to it. Rabun™ products provide the level of protection these sensitive new-technology products/assets require.

The Rabun™ Equipment Protection System is different from passive surge suppressor/arrestor type of protection devices in several ways. First, it is a state-of-the-art active protection system that interfaces with all of the various components of your equipment and provides the proper level of protection each requires. Second, it automatically reacts to the threat of equipment damage by detecting lightning while it's still a safe distance away and with no human intervention.

The Rabun™ System detects lightning when it is typically 1-2 miles away and when it reaches an intensity that is likely to cause equipment damage, the System performs the following functions simultaneously:

1. For equipment that must remain in operation during an electrical storm, the System can initiate automatic start-up of a stand-by generator and/or switch equipment to UPS operation, either of which completely isolates connected equipment from the commercial power source. This mode of operation would remain in effect for a minimum of 6 minutes after the last detected lightning strike. At the end of the protection event, equipment operation is automatically switched back to normal and the stand-by generator shut down.

2. Disconnects/isolates circuits from the AC Power source that provide power to outlets serving non-critical but sensitive equipment, and grounds those outlets for a minimum of 6 minutes or until the storm moves a safe distance away. The System then automatically restores all connections and normal equipment operation resumes.

3. Disconnects/isolates/grounds the control wiring to remote located card readers, gate controls, CCTV cameras, pan & tilt units and coax video lines that run between a control/monitoring locations and remote equipment (which are all very susceptible to damaging induced voltages from a nearby lightning strike). Also included is Satellite, CATV and MATV equipment including Internet Routers and other devices. The disconnect/isolation/grounding action can be a short as 0.4 seconds each time a strike is detected (in effect, the equipment remains in operation), to a complete equipment shut-down for 20 minutes or until the storm moves a safe distance away. The System then automatically restores all connections and normal equipment operation resumes. Isolating and grounding the wiring going to the remote-located equipment from it's associated control equipment, even for short periods (i.e. 0.4 seconds) each time a nearby lightning strike is detected, assures that any lightning-induced voltage in the wiring is safely dissipated to ground and not fed directly into either the remote-located or control equipment.

4. The protection of intercom & paging systems, telephone equipment, modems and fax machines is also addressed: Each time a nearby lightning strike is detected, the System performs a brief "interrupt action", which automatically shunts the telephone and/or intercom line to ground for the duration of the surge event and then restores. If you are using the telephone when this occurs, it sounds like a "call waiting" click, and you do not lose your connection, your equipment or your hearing from the loud "pop" lightning can cause to be present in a telephone earpiece or operator headset.

5. For radio equipment, the System has a coax switching relay that isolates the antenna from the radio transceiver equipment. The System can either disconnect the equipment (isolate & ground the antenna), or, if operation of the radio cannot be interrupted, the System can place the equipment on a stand-by power source, such as a UPS or generator (isolating it from the commercial power source), then isolate & switch the antenna to ground for 0.4 seconds each time a lightning strike is detected.

6. For motors, the AI-1800 System has a Power Quality Monitoring function built-in. When the line voltage exceeds +/- 10%, the System can provide an audible & visual operator alert and/or an automatic disconnect/shut-down of the motor to protect it, and automatic re-start when the line voltage is within the +/- nominal limits.

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Active Lightning Management Systems For Modern Airport Facilities

By: Keith Brashear, ILD Technologies, LLC

The requirements for airports have increased in complexity and scale since the earliest days of flying. Before World War II the landing and takeoff distance of most passenger-transport aircraft was at most 600 meters (2,000 feet). Additional clear areas were provided for blind landings or bad-weather runs, but the total area involved rarely exceeded 500 acres (200 hectares). Today, more than 100 airports around the world now handle at least 10 million passengers each per year; nearly half of these are in the United States. Dozens of airports regularly move more than 30 million passengers on a yearly basis—Chicago's O'Hare International Airport and the Hartsfield Atlanta International Airport in Georgia each handle more than 75 million. The Memphis (Tennessee) International Airport, the home airport of the FedEx Corporation's cargo service, and the Hong Kong International Airport are the world's largest cargo shippers, each of which handled nearly four million tons in 2007.

In order to meet the increasing demand for air travel, large transport aircraft powered by multiple jet and turboprop engines have been built. Such aircraft require extensive ground facilities, runways, taxiways, fire-fighting and rescue services, passenger- and cargo-handling facilities, access to car parking and public transport, lighting, navigational and approach aids, and various support facilities such as catering, meteorology, and governmental inspection. In order to be attractively convenient, the complex of activities and facilities that make up a modern airport must be located sufficiently close to the main centers of world population. At the same time, they must be adequately distant, so that the environmental problems associated with the noise of large aircraft and the activities of large numbers of passengers, workers, and visitors do not become intolerable to the cities that are served.

Among the numerous risks that must be managed in a modern airport operation, lightning is of major concern. With over 2000 lightning producing thunderstorms occurring in the world at any given time, there are literally thousands of direct strikes on airport facilities worldwide each year. Additionally, even more numerous near strikes and overhead atmospheric discharges (cloud to cloud lightning) represent a very real danger to the long-term reliability and proper operation of critical and highly sensitive electronics including those found in navigational systems, communications, fuel handling and other critical sub-systems. This paper addresses some of the typical aviation applications to which active lightning detection and protection methodology can be effectively employed for increased safety and operational reliability. A properly designed and fully integrated active lightning management system should meet the requirements of the International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs.)

Passive vs. Active LP Systems

Before discussion of specific aviation facility applications, it is important to draw a clear distinction between active and passive lightning systems.

Passive systems, including air terminals (lightning rods) and transient voltage surge suppressors (TVSS's or SPD's) consist of devices that operate primarily by diverting strike energy directly to a low resistance grounding system for dissipation into earth. While excellent for the prevention of fire and direct damage to structures, air terminals and TVSS's only provide limited protection for sensitive electronic systems. These devices are limited in their ability to protect owing to the fact that they do not begin to operate until dangerous energy levels are *already present* on the

system. Additionally, the two most damaging effects of lightning to microprocessor or CMOS electronic components are Ground Potential Rise and Near Field Coupling, neither of which is addressed in any way by simple passive devices. Finally, these systems are completely dependent upon the effectiveness of the facility bonding and ground system to operate properly in a lightning event. Unfortunately, it is only in the rarest of cases that grounding systems are specifically designed for the high frequency-high energy transients associated with lightning. In short, improper application of these devices into a facility protection strategy can actually *increase* susceptibility of damage to electronics by lightning.

Active systems operate in a completely different way. Continuously monitoring the atmosphere in order to detect lightning or even weather conditions that may produce lightning, they can place critical systems (at very high speeds) into safe, electrically isolated modes or onto isolated backup power in a strike event before dangerous energy can develop on network pathways and return it to normal state at the conclusion of the event. Fully automatic, network ready and requiring no operator intervention, these systems are not dependent upon ground system design.

All recommendations made in this paper are based upon active lightning systems.

Service Classifications

1. Airport services related to the aircraft are frequently referred to as airside. These fall into three primary sub-classifications, as follows:

   Navigational/Communication Systems

   Electronic systems used for navigation, communication, landing and takeoff of aircraft, the maneuvering and positioning of aircraft on the ground, and for the parking of aircraft in order to load and discharge passengers and cargo. These are supplemented by airfield markings, signs and signals, and air traffic control facilities.

   Ramp Systems

   Many of these services are concentrated on the apron, or ramp, which is that part of the operational surface adjacent to the terminals where aircraft are maneuvered or parked. They include the apron handling of aircraft, airside passenger transfer to the aircraft, the handling of baggage and cargo, aircraft fueling, catering and cabin cleaning, engine starting, deicing, ground power and air-conditioning, and minor maintenance engineering.

   Airside Services

   These services include runway inspection, lighting, fire fighting and rescue, airside maintenance, and air traffic control. Physical facilities include runways, taxiways, aprons, and strips, Support facilities include field meteorology stations, fire and rescue stations, power and other utilities, aircraft maintenance, and airport maintenance.

2. Airport services related to the passenger activities are frequently referred to as landside. These fall into three primary sub-classifications, as follows:

   Landside Services

   Services related to ground passenger handling. These include check-in, security, customs and immigration, baggage delivery, information, catering, cleaning and maintenance, shops and concessionary facilities, automobile rental, ground transportation, porters, special help for the elderly and handicapped, automobile

parking, and public transportation (including taxis). In addition, because airports employ such a large number of workers, extensive provision must be made for their daily requirements.

Landside Facilities

Passenger and cargo terminals and the access system, which includes parking, roads, public transport facilities, and loading and unloading areas.

Airport LP System Design Criteria

Of the sub-categories listed above, all can benefit from active LP systems. However, the areas that represent the most likely candidates for inclusion (in order of priority) in an integrated lightning management system include:

1. Communications Systems
2. Navigational Aids
3. Fuel Handling and Critical Ramp Operations
4. Fire and Rescue

Communications Systems

Systems associated with airport communication include an extensive network of local and extended range radio, telephone and data network systems. Destruction of telephone systems is among the most common forms of lightning damage recorded, owing to the extensive footprint of a modern wiring network and the difficulty in creating a low impedance equi-potential ground in such systems. It is also commonly observed that when telephone systems are integrated with electronic switching and data management devices, as is common in airports, the problem is even more widespread.

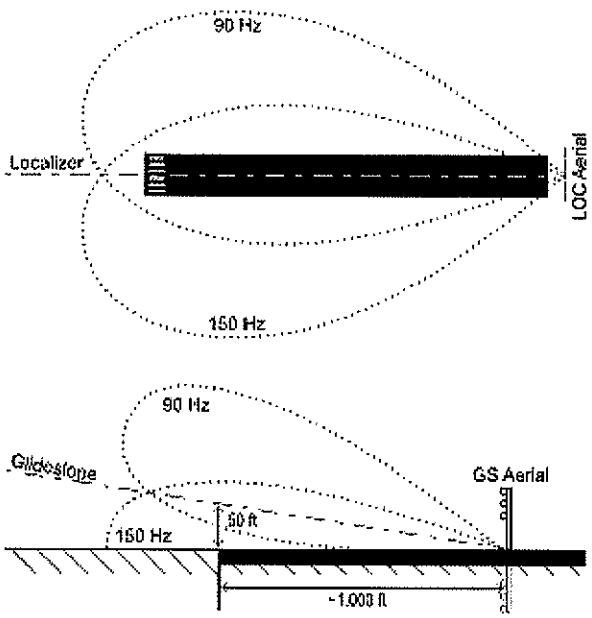
Because these communications systems must operate during any weather conditions and therefore cannot tolerate any loss of service, the following basic design concepts must be employed as part of the lightning management system:

- The system lightning detection range should be no less than 10 miles and capable of being configured for up to 40 mile range. This is typically accomplished by a combination of gain adjustment and antenna site selection.
- The system must be capable of placing all connection points and network nodes into a safe mode during an actual strike event. This requires a high speed momentary interrupt of all conductive pathways of 100-400 milliSeconds, during which all system branches are in an equi-potential state.
- Antenna/Coax Switching Units should be employed in conjunction with standard lightning arrestors in order to effectively isolate externally mounted antenna systems during actual strike events.
- Temporary isolation of mains power serving network switches, radio systems, and network controllers or servers during the overall storm event (typically 10 – 30 minutes) and automatic switchover to Un-interruptible Power System (UPS) or standby power.
- Automatic system restoration upon cessation of storm activity.

Navigational Aid Overview

ILS Systems

A typical ILS consists of two independent sub-systems, one providing lateral guidance (Localizer), the other vertical guidance (Glideslope or Glide Path) to aircraft approaching a runway. Aircraft guidance is provided by the ILS receivers in the aircraft by performing a modulation depth comparison.



The emission patterns of the localizer and glideslope signals. Note that the glideslope beams are partly formed by the reflection of the glideslope aerial in the ground plane.

A localizer (LOC, or LLZ in Europe) antenna array is normally located beyond the departure end of the runway and generally consists of several pairs of directional antennas. Two signals are transmitted on one out of 40 ILS channels between the carrier frequency range 108.10 MHz and 111.95 MHz (but only the odd kHz, so 108.10 108.15 108.30 and so on are LOC frequencies but 108.20 108.25 108.40 and so on are not). One is modulated at 90 Hz, the other at 150 Hz and these are transmitted from separate but co-located antennas. Each antenna transmits a narrow beam, one slightly to the left of the runway centerline, the other to the right.

A glideslope or Glidepath (GP) antenna array is usually sited to one side of the runway touchdown zone. The GP signal is transmitted on a carrier frequency between 329.15 and 335 MHz using a technique similar to that of the localizer. The centerline of the glideslope signal is arranged to define a glideslope of approximately 3° above horizontal (ground level). The beam is 1.4° deep; 0.7° below the glideslope centerline and 0.7° above the glideslope centerline.

Localizer



In addition to the previously mentioned navigational signals, the localizer (typically mounted a runway end) provides for ILS facility identification by periodically transmitting a 1020 Hz morse code identification signal. For example, the ILS for runway 04R at John F. Kennedy International Airport transmits IJFK to identify itself, while runway 04L is known as IHIQ. This lets users know the facility is operating normally and that they are tuned to the correct ILS. The glideslope transmits no identification signal, so ILS equipment relies on the localizer for identification.

Marker Beacons



On most installations marker beacons operating at a carrier frequency of 75 MHz are provided. When the transmission from a marker beacon is received it activates an indicator on the pilot's instrument panel and the tone of the beacon is audible to the pilot. The distance from the runway at which this indication should be received is promulgated in the documentation for that approach, together with the height at which the aircraft should be if correctly established on the ILS. This provides a check on the correct function of the glideslope. In modern ILS installations a DME is installed, co-located with the ILS, to augment or replace marker beacons. A DME continuously displays the aircraft's distance to the runway.

Outer Marker



Blue outer marker

The outer marker should be located 7.2 km (3.9 NM) from the threshold except that, where this distance is not practicable, the outer marker may be located between 6.5 and 11.1 km (3.5 and 6 NM) from the threshold. The modulation is repeated Morse-style dashes of a 400 Hz tone. The purpose of this beacon is to provide height, distance and equipment functioning checks to aircraft on intermediate and final approach. In the United States, an NDB is often combined with the outer marker beacon in the ILS approach (called a Locator Outer Marker, or LOM); in Canada, low-powered NDBs have replaced marker beacons entirely.

Middle Marker



The middle marker is located so as to indicate, in low visibility conditions, the missed approach point, and the point that visual contact with the runway is imminent, ideally at a distance of approximately 3,500 ft (1,100 m) from the threshold. It is modulated with a 1300 Hz tone as alternating dots and dashes at the rate of two per second.

Inner Marker



The inner marker, when installed, indicates in low visibility conditions the imminence of arrival at the runway threshold. This is typically the position of an aircraft on the ILS as it reaches Category II minima. Ideally at a distance of approximately 100 ft (30 m) from the threshold. The modulation is Morse-style dots at 3000 Hz.

DME

Distance measuring equipment (DME) provides pilots with a slant range measurement of distance to the runway in nautical miles. DMEs are augmenting or replacing markers in many installations. The DME provides more accurate and continuous monitoring of correct progress on the ILS glideslope to the pilot, and does not require an installation outside the airport boundary. When used in conjunction with an ILS, the DME is often sited midway between the reciprocal runway thresholds with the internal delay modified so that one unit can provide distance information to either runway threshold.

Monitoring

It is essential that any failure of the ILS to provide safe guidance be detected immediately by the pilot. To achieve this, monitors continually assess the vital characteristics of the transmissions. If any significant deviation beyond strict limits is detected, either the ILS is automatically switched off or the navigation and identification components are removed from the carrier.[1] Either of these actions will activate an indication ('failure flag') on the instruments of an aircraft using the ILS.

Approach Lighting



Some installations include medium or high intensity approach light systems. Most often, these are at larger airports. The approach lighting system (abbreviated ALS) assists the pilot in transitioning from instrument to visual flight, and to align the aircraft visually with the runway centerline.

Again, because these radio-based navigational systems must operate during any weather conditions and therefore cannot typically tolerate any loss of service, the following basic design concepts must be employed as part of their inclusion in the lightning management system:

- The system must be capable of placing all antenna connection points into a safe mode during an actual strike event. This requires a network interrupt to the system controller as well as a high speed momentary interrupt of all RF signal pathways of 100-400 milliSeconds, during which all system branches are in an equi-potential state. In all cases, no more than a 2 second isolation period should be employed.
- Antenna/Coax Switching Units should be employed in conjunction with standard lightning arrestors in order to effectively isolate externally mounted antenna systems during actual strike events.
- Temporary isolation of mains power (if possible) serving ILS radio systems, and network controllers or servers during the overall storm event (typically 10 – 30 minutes.)
- High power isolation units should be employed for temporary isolation of devices operating above 24VAC.
- Automatic system restoration upon cessation of storm activity.

Fuel Handling and Ramp Operations

Typically, all ramp operations are stopped during storm events in the interest of operating personnel and passenger safety. This creates unique criteria for this aspect of the lightning management system. These include:

- The system lightning detection range should be no less than 2 miles and capable of being configured for up to 15 mile range. This is typically accomplished by a combination of gain adjustment and antenna site selection.
- Ramp detection systems should be able to communicate serial data to/from main facility systems in order to ensure coordinated activity.
- Locally mounted visible (flashing strobe lamps) and audible indicators (sirens) should be employed to positively notify ramp personnel to cease outside operations.
- Portable (truck/vehicle mounted) systems should be utilized to interlock fuel handling pumps so that fuel transfer is automatically interrupted during storm activity.
- Temporary isolation of mains power (if possible) serving aircraft HVAC and local power systems during the overall storm event (typically 10 – 30 minutes.)
- Automatic system restoration upon cessation of storm activity.

Fire and Rescue

Because these emergency communications systems must operate during any weather conditions and therefore cannot tolerate any loss of service, the following basic design concepts must be employed as part of the lightning management system:

- The system lightning detection range should be no less than 10 miles and capable of being configured for up to 40 mile range. This is typically accomplished by a combination of gain adjustment and antenna site selection.

- The system must be capable of placing all telephone connection points and network nodes into a safe mode during an actual strike event. This requires a high speed momentary interrupt of all conductive pathways of 100-400 milliSeconds, during which all system branches are in an equi-potential state.
- Station detection systems should be able to communicate serial data to/from main facility and ramp operations systems in order to ensure fully coordinated activity.
- Antenna/Coax Switching Units should be employed in conjunction with standard lightning arrestors in order to effectively isolate externally mounted antenna systems during actual strike events.
- Temporary isolation of mains power serving network switches, radio systems, and network controllers or servers during the overall storm event (typically 10 – 30 minutes) and automatic switchover to Un-interruptible Power System (UPS) or standby power.
- Automatic system restoration upon cessation of storm activity.

Future Enhancements

The advent of the Global Positioning System (GPS) provides an alternative source of precision approach for aircraft. In the US, the Wide Area Augmentation System (WAAS) has been available to provide guidance to Category I standards since 2007, and the equivalent in Europe, the European Geostationary Navigation Overlay Service (EGNOS), is currently undergoing final trials and will be certified for safety of life applications in 2010. Other methods of augmentation are in development to provide for Category III minimums or better, such as the Local Area Augmentation System (LAAS).

The FAA Ground-Based Augmentation System (GBAS) office is currently working with industry in anticipation of the certification of the first GBAS ground station in Memphis, TN; Sydney, Australia; Bremen, Germany; Spain and Newark, NJ. All four countries have installed GBAS systems and are involved in technical and operational evaluation activities. The Honeywell and FAA team are working on the System Design Approval of the world's first Non-Federal U.S. approval for LAAS Category I operations; expected in first quarter 2009 and compliant with International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs) Category I LAAS.

Therefore, present lightning management system design should contemplate interface with these and other modern additions as they become more widely employed.

LIGHTNING CONCEPTS



ILD Technologies, LLC

ILD Technologies, LLC

- We are specialists in Electronic Equipment Protection. With patented **Active and Intelligent Lightning** protection systems that works to extend the life of your electronics, and provide real defense for the catastrophic and incipient damage caused by lightning to electronic systems.
- Industries served
- We also provide to our customers in the United States many other services such as:

With over 50 years of experience

- At ILD, we offer extensive testing to ensure you receive the best possible protection. Our common tests include:
- **Ground Impulse Test** to determine ground sufficiency or required remediation
- **Ground Impedance Test** – Inductance (L) and Inductive Reactance (Xi)
- **Ground Resistance Testing** (4 Point Fall of Potential)
- **Power Quality Analysis Datalog**
- **High Frequency Electrical Noise Testing**
- **Transient Voltage Surge Suppression Application Survey**
- ***NFPA* Lightning Protection Audit**
- With the experience of designing and controlling hundreds of control and monitoring systems worldwide, we know the challenges of meeting requirements and the necessary steps to protecting your systems completely.

What we will cover today

- Lightning Education
- Electronic Equipment Protection
- Human Safety – Early Warning

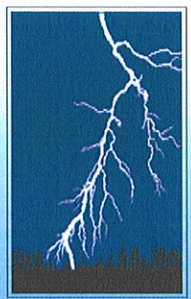
Cloud Charge Potential

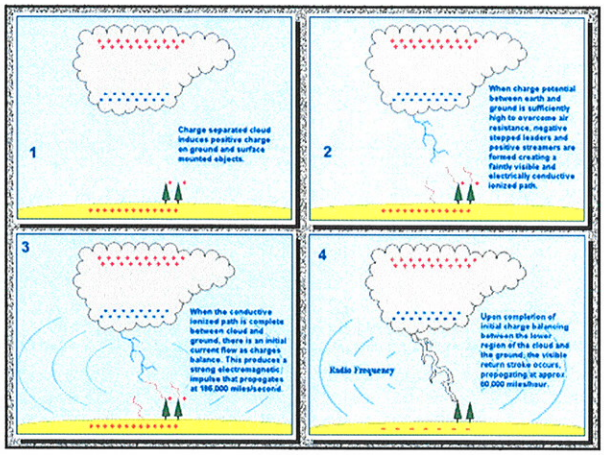


- Cloud to Ground (CG) lightning is the natural equalization of a charge potential existing between a cloud and the surface of the earth.
- Current theories suggest that upward movement of water droplets colliding with falling ice particles present in cumulonimbus clouds results in charge separation in the cloud.
- A lightning strike can deliver up to 300,000 Amperes of electrical current at 100 million Volts.

CG Lightning Strike - Sequence of Events

- When the charge potential of a cloud becomes large enough to overcome the resistance of the air, negatively charged stepped leaders are produced by the cloud and are attracted downward to the positively charged earth.
- One or more positively charged streamers form at the earth's surface and migrate upward toward the stepped leader.
- When a leader and streamer meet, a complete ionized path from earth to ground is formed and the subsequent full discharge strokes (typically 4-25) occur along this path.

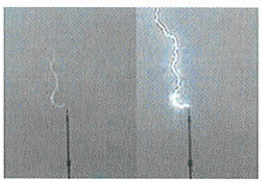






Strike photograph showing highly illuminated return stroke with an unsuccessful stepped leader and upward moving positive streamer.

Streamers & Step Leaders



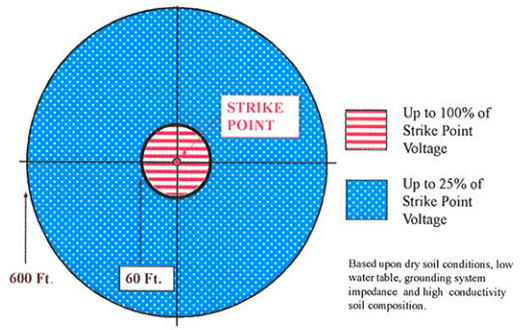




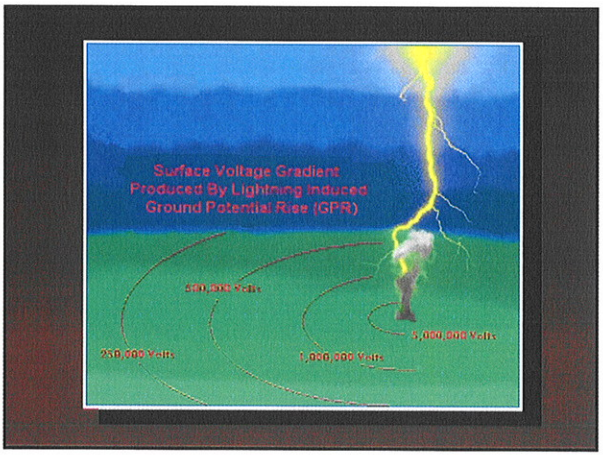
Characteristics of a Typical Lightning Bolt

- Discharge stroke is approximately 30 microseconds in duration.
- 4 – 25 strokes per bolt.
- Total bolt duration of 21 milliseconds.
- Temperature of 50,000 degrees F.
- Radius of primary surface electrical influence = 60 feet
- Power Produced .....

3×10^{12} Watts per Bolt !!!



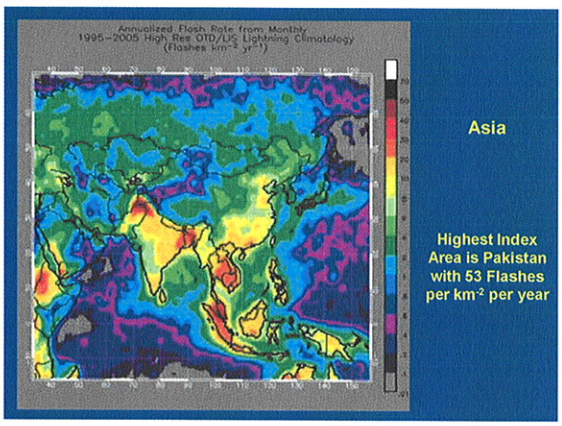
Lightning Strike Ground Potential Gradient Chart



Lightning Statistics

- CG lightning strikes occur about 20 million times per year in the US.
- One in every 50 (1/50) US CG lightning strikes result in an insurance claim payout… approximately one claim every eighty seconds.
- Lightning Strike Claims Paid per year (US) = $332,000,000.00 **
- Lightning claims payouts represent approximately 5% of all US insurance company distributions.
- Average Home Owner Claim = $1100.00
- Average Commercial/Governmental Facility Claim = $41,000.00

Notes:
All data this page courtesy of the US Insurance Institute and is representative of private sector data only
*** Claims paid per year listed above do not include US government property losses.*



Asia

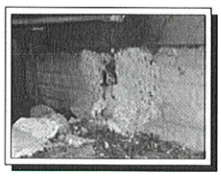
Highest Index Area is Pakistan with 53 Flashes per km^{-2} per year

Effects of Direct and Near Lightning Strikes On Facility Equipment

Direct Strikes

- Destruction of sensitive equipment due to excessive electrical energy - Over Voltage/ Over Current Conditions.
- Fire as a result of extreme heat and electrical energy dissipation.
- Damage due to thermodynamic expansion of air and vaporization of construction materials.
- Serious health and safety hazard for all persons in immediate vicinity of the strike.





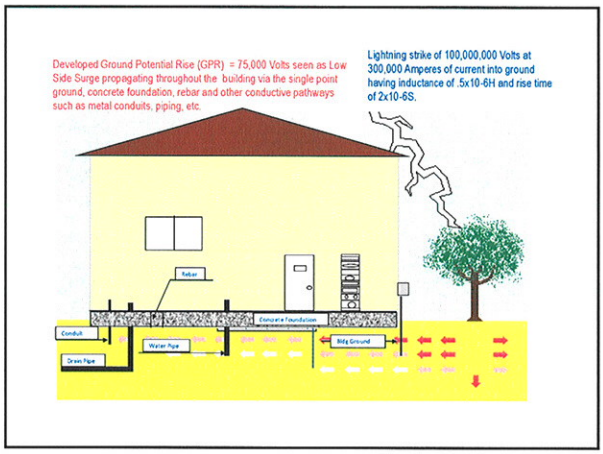
The Three Secondary Effects

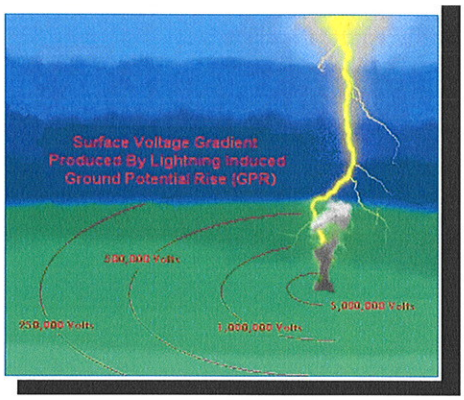
1. Ground Potential Rise (GPR)
2. Direct Energization
3. Electro-Magnetic Pulse (EMP)

Near Strikes

- **Low Side (Ground) Surge**
  Uncontrolled voltage increase on an electrical network as a result of Ground Potential Rise (GPR) through ground connections, conductive structural materials, or other unintended or unprotected pathways including concrete, plumbing, utility service lines, etc.
- **ElectroMagnetic Pulse (EMP)**
  Observed in CG , Cloud to Cloud (CC) and Inter-Cloud (IC) strikes. Results in induced current on adjacent electrical networks or systems through the action of near inductive coupling caused by the creation of exceptionally high electric fields associated with lightning strikes. Field strengths of up to 70 volts/meter are commonly observed, meaning that an EMP could raise the voltage on 1000 meters of incoming power or telephone line up to 70,000 volts for the duration of the pulse.

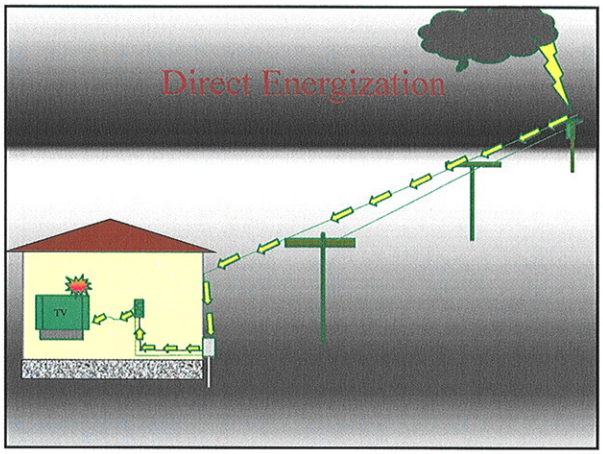
Near strikes and their destructive effects are approximately 2000 times more likely to occur than a direct strike and are the predominate cause of lightning damage to facility electronic systems !!!





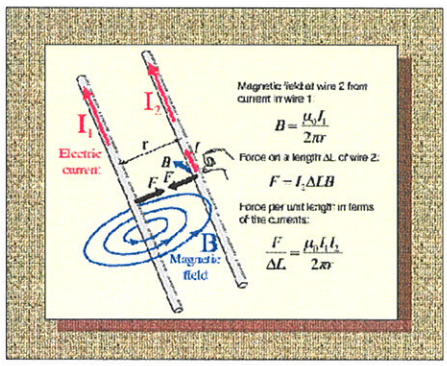
The Second Effect of a Near Strike

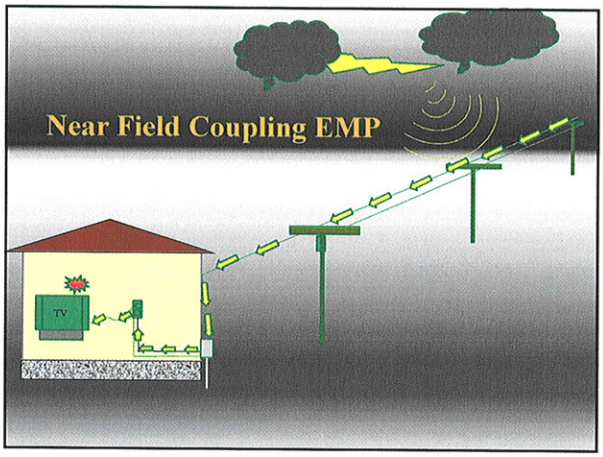
Direct Energization



The Third Effect of a Near Strike

Electro-Magnetic Pulse
LEMP





Lightning Protection Systems

- **Passive Systems**
  Includes air terminals, lightning rods, conductive construction features, static dissipation terminals, etc.
- **Active Systems**
  Control systems or devices specifically designed to respond to changing system conditions and automatically perform circuit adjustments intended to significantly reduce or eliminate potential of hazardous over voltage/over current conditions.
- **Grounding/Bonding Systems**
  Earth potential distribution systems that provide a zero voltage reference and a low resistance pathway for uncontrolled or destructive electrical energy through various methods.

Passive Systems

Advantages

- Provides outstanding protection from the effects of direct lightning strikes if properly maintained and when used with a very low impedance grounding system.
- Relatively inexpensive to install in all but the most complex of installations.
- Low technology solution that places minimal stress on facility maintenance staffs and outside service providers.

Disadvantages

- Useless and/or dangerous when used with a poorly maintained grounding system or with a grounding system operating above 5 ohms total impedance. (You do not want to attract lightning without having a safe path upon which to divert it!)

Active Systems

Transient Voltage Surge Suppressors (TVSSs) and Gas Discharge Tubes (GDTs)

Advantages

- Provides outstanding protection from effects of minor power distribution voltage supply and switching surges if properly maintained and when used with a very low impedance grounding system.

Disadvantages

- Completely ineffective when used in conjunction with a poorly maintained grounding system or with a grounding system operating above 5 ohms total impedance.
- Protection degrades with each surge cycle.
- Not rated to handle power levels typically seen in a lightning strike.
- Designed to protect incoming pathways only. Provides no protection from the most common danger - Low Side Surge.

Conventional Surge Suppression

- TVSS Transient Voltage Surge Suppressors
- Gas Discharge Tubes

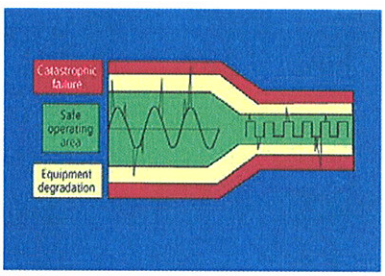
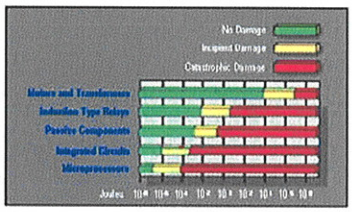


Illustration of the relationship between surge affected input power or signal lines and their corresponding output signals

TVSS Performance Goals

- Clamp circuit potential levels (Voltage Limiting) at critical reference junctions at or below a precise threshold value.
- Divert potentially dangerous currents to a zero-potential ground point and away from sensitive electronic systems



Rule of Thumb For IC's and Microprocessors:

Limit the voltage on all circuit ground planes and conductive pathways to an absolute maximum value of 0.5 Volts or less in order to avoid development of destructive reverse currents

Transient Voltage Surge Suppressors in Lightning Protection Service

There are two main problems associated with the use of surge suppressors in lightning service:

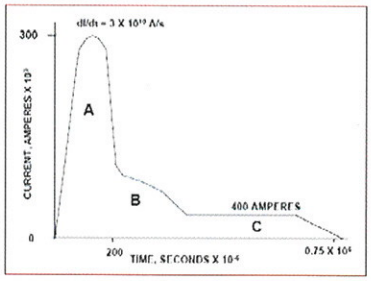
- Problem #1 – Transmission Issues
- Problem #2 – Ground Potential Rise

The following slides will address each problem separately

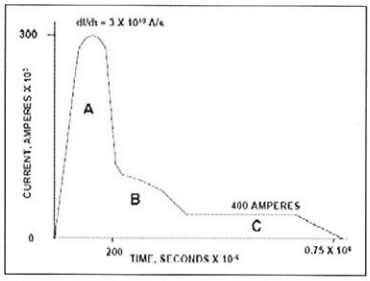
Problem #1 – Transmission

Is Lightning DC or AC?

Typical Initial Lightning Strike Waveform



Typical Initial Lightning Strike Waveform

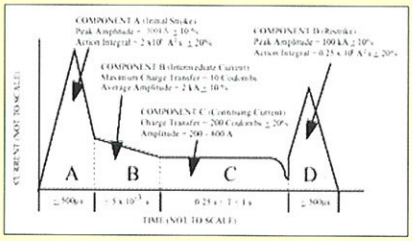


Characteristic: DC Impulse with 2nd Order Decay

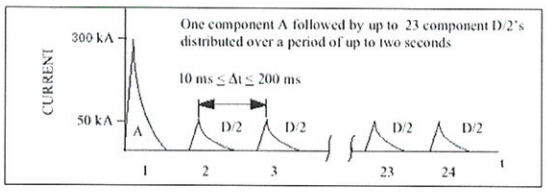
However .....

- Few strike events consist of single impulses
- Impulse rise time is extremely fast
- There is the matter of restike potential to consider.
  - Typical number of restrikes: 4
  - Maximum number of restrikes: 24

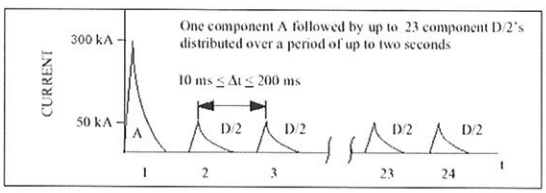
Typical Restrike Transition Waveform



Continuing Lightning Strike Waveform



Continuing Lightning Strike Waveform



Characteristic: A series of high speed *DC Impulses* that exhibit the transmission characteristics of *High Frequency Alternating Current!*

A Continuing Lightning Strike is a series of high speed *DC Impulses* that exhibit the transmission characteristics of *High Frequency Alternating Current.*

As such, device performance analysis must consider the following:

Total Impedance (Z)
Frequency (f)
Inductance (L)
Inductive Reactance (X_L)

Inductance

An electric current i flowing in a circuit produces a magnetic field and hence a magnetic flux Φ through the circuit. The ratio of the flux to the current is called inductance, or more accurately the self inductance of the circuit. It is customary to use the symbol L for inductance in honor of physicist Heinrich Lenz. The definition of inductance in SI units is

$$L = \frac{\Phi}{i}$$

In honor of Joseph Henry, the unit of inductance has been given the name **henry (H)**: 1H = 1Wb/A.

The equation relating inductance and flux linkages can be rearranged as follows:

$$\Phi = Li$$

Taking the time derivative of both sides of the equation yields

$$\frac{d\Phi}{dt} = L\frac{di}{dt} + i\frac{dL}{dt}$$

In most physical cases, the inductance is constant with time and so

$$\frac{d\Phi}{dt} = L\frac{di}{dt}$$

By Faraday's Law of Induction we have

$$\frac{d\Phi}{dt} = -\mathcal{E} = v$$

where $\mathcal{E}$ is the Electromotive force (emf) and v is the induced voltage. Note that the emf is opposite to the induced voltage. Thus

$$\frac{di}{dt} = \frac{v}{L}$$

or

$$i(t) = \frac{1}{L}\int_0^t v(\tau)d\tau + i(0)$$

These equations together state that, for a steady applied voltage v, the current changes in a linear manner, at a rate proportional to the applied voltage, but inversely proportional to the inductance. Conversely, if the current through the inductor is changing at a constant rate, the induced voltage is constant.

The effect of inductance can be understood using a single loop of wire as an example. If a voltage is suddenly applied between the ends of the loop of wire, the current must change from zero to non-zero. However, a non-zero current induces a magnetic field by Ampere's law. Any change in the magnetic field induces an emf that is in the opposite direction of the change in current. The strength of this emf is proportional to the change in current and the inductance. When these opposing forces are in balance, the result is a current that increases linearly with time where the rate of this change is determined by the applied voltage and the inductance.

Multiplying the equation for di/dt above with Li yields

$$Li\frac{di}{dt} = \frac{dL}{dt}\frac{i^2}{2} = iv$$

Since iv is the energy transferred to the system per time it follows that $\frac{1}{2}Li^2$ is the energy of the magnetic field generated by the current.

Induced emf

The flux Φ_i through the i-th circuit in a set is given by

$$\Phi_i = \sum_j M_{ij} I_j = L_i I_i + \sum_{j \neq i} M_{ij} I_j$$

so that the induced emf, $\mathcal{E}$, of a specific circuit, i, in any given set can be given directly by

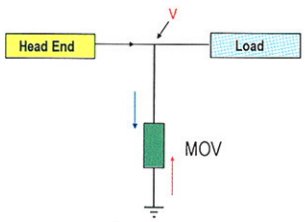
$$\mathcal{E} = -\frac{d\Phi_i}{dt} = -\frac{d}{dt}\left(L_i I_i + \sum_{j \neq i} M_{ij} I_j\right) = -\left(\frac{dL_i}{dt} I_i + \frac{dI_i}{dt} L_i\right) - \sum_{j \neq i}\left(\frac{dM_{ij}}{dt} I_j + \frac{dI_j}{dt} M_{ij}\right)$$

Self-inductance

Formally the self-inductance of a wire loop would be given by the above equation with $i = j$. However, $1/R$ now gets singular and the finite radius a and the distribution of the current in the wire must be taken into account. There remain the contribution from the integral over all points where $|R| \geq a/2$ and a correction term:

$$L_{ij} = L = \left(\frac{\mu_0}{4\pi}\int_{V_i}\int_{V_j}\frac{\mathbf{ds}\cdot\mathbf{ds}'}{|\mathbf{R}|}\right)_{|\mathbf{R}|>a/2} + \frac{\mu_0 l}{2\pi}\beta'$$

Here a and l denote radius and length of the wire, and β' is a constant that depends on the distribution of the current in the wire. $\beta' = 0$ when the current flows in the surface of the wire (skin effect). $\beta' = 1/4$ when the current is homogeneous across the wire.



Typical Metal Oxide Varistor (MOV) Arrangement Illustrating Potential Path of Reverse Current During Low Side Surge

At normal voltage levels, the MOV provides no path to ground.

When a voltage (at V) above rated clamping voltage of the MOV is observed, the device is designed to allow current flow from the head end directly to ground -- provided that the ground represents a lower impedance than the load.

But… MOV's (as well as GDT's) are non-polarized! This means they can pass current in either direction. If the voltage is sourced from the ground side of the device (as seen in GPR) *and* is above clamping voltage rating of the MOV, the device will allow current flow directly to both the head end and load side equipment (Low Side Surge.)

Inductive reactance

Inductive reactance X_L is proportional to the signal frequency f and the inductance L.

$$X_L = \omega L = 2\pi f L.$$

An inductor consists of a coiled conductor. Faraday's law of electromagnetic induction gives the back emf $\mathcal{E}$ (voltage opposing current) due to a rate of change of magnetic flux density B through a current loop.

$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$

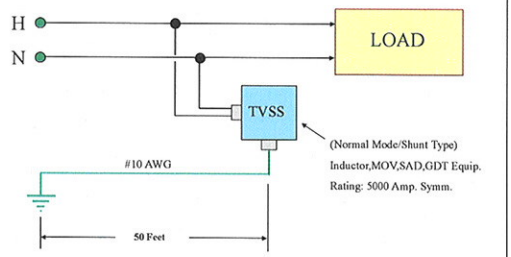
For an inductor consisting of a coil with N loops this gives:

$$\mathcal{E} = -N\frac{d\Phi_B}{dt}$$

The back emf is the source of the opposition to current flow. A constant direct current has a zero rate of change, and sees an inductor as a short circuit (it is typically made from a material with a low resistivity). An alternating current has a time-averaged rate of change that is proportional to frequency, this causes the increase in inductive reactance with frequency.

As will be seen in the following examples, this back-EMF is what causes most of the problems associated with the use of conventional surge suppression technology in lightning protection service.

System Configuration



Example 1 – Common Surge

Scenario:
Current impulse equal to 1% of rated capacity of TVSS
Impulse: 50 Ampere, T_t = 50uS

Calculated Values:

L = 27.64 uH
X_L = 0.01 Ohm
V_G = 0.52 Volt (Measured on Ground Bus)

Result: Satisfactory for a typical surge suppressor.

Example 2 – Lightning Frequency

Scenario:
Same as Example 1 except for increase in frequency (f) to 200KHz
Current impulse equal to 1% of rated capacity of TVSS
Impulse: 50 Ampere, T_t = 50uS

Calculated Values:

$$X_L = \omega L = 2\pi f L$$
$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$

L = 27.64 uH
X_L = 34.73 Ohms
V_G = 1736.5 Volts (Measured on Ground Bus)

Result: Catastrophic damage to Microprocessors and CMOS devices

Example 3 – Ground Conductor Length

Scenario:
Same as Example 2
F = 200KHz
Current impulse equal to 1% of rated capacity of TVSS
Impulse: 50 Ampere, T_t = 50uS

$$X_L = \omega L = 2\pi f L$$
$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$

Question:
How long will a #10 AWG ground conductor need to be in order to safely divert a 50A impulse @ 200kHz?

Answer: 19 millimeters

Example 4 – Actual Near Lightning Strike

Scenario:
Increase in frequency (f) to 500KHz (50% of typical)
Current impulse equal to 1% maximum observed values
Impulse: 3000 Ampere, T_1 = 50uS

Calculated Values:

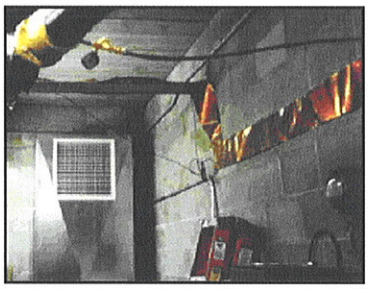
$$X_L = \omega L = 2\pi f L$$

$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$

L = 27.64 uH
X_L = 86.83 Ohms
V_G = 240,485.3 Volts (Measured on Ground)

Result: Call the Scrap Yard!

Low Impedance Ground System Designed For Lightning Protection



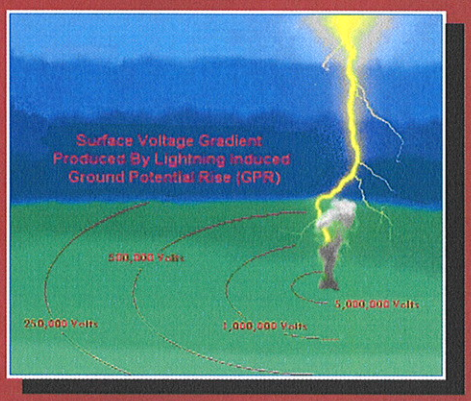
Problem #1 - Summary

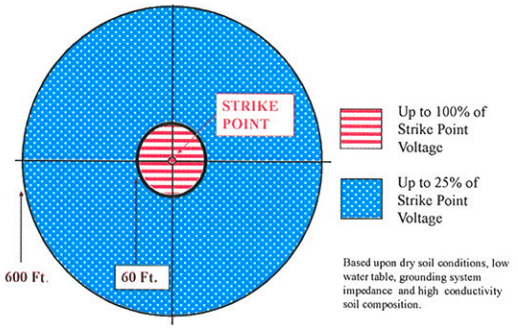
- Conventional TVSS devices provide excellent protection for typical normal mode surges, but are inadequate for high frequency transmission characteristics of lightning.
- Commodity TVSS products do not utilize low impedance pathways required to eliminate the effects of Inductive Reactance (X_L).
- Commodity TVSS products are not rated to handle the current requirements of a near lightning strike.

Problem #2 – Ground Potential Rise

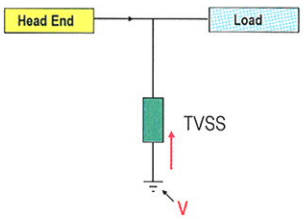
Where does all that energy go when lightning strikes an earthbound object or the ground itself?

What happens when the ground itself is the source of the excess energy?





Lightning Strike Ground Potential Gradient Chart



Typical TVSS Arrangement Illustrating Potential Path of Reverse Current During Ground Potential Rise

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Coils, MOV's, and GDT's are non-polarized! This means they can pass current in either direction. If the voltage is sourced from the ground side of the device (as seen in GPR) *and* is above clamping voltage rating of the unit, the device will allow current flow directly to both the head end and load side equipment (**Low Side Surge**.)

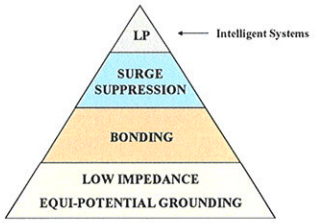
Problem #2 - Summary

- Ground is no longer a safe haven for energy diversion during a GPR event associated with lightning. It becomes the **source** of the excess energy!
- ***GROUND IS NO LONGER GROUND*** IN A LIGHTNING STRIKE EVENT!
- Conventional TVSS devices are not designed to provide protection from reverse currents.
- Low Side Surge resulting from GPR is the most common cause of lightning damage to electronic equipment.

Closing Comments

- TVSS's are a cost effective and practical solution to protecting electronic equipment from common surges, but should never be relied upon for protection from secondary effects of lightning.
- TVSS's are most effective when they are part of a comprehensive equipment protection system design that includes grounding, bonding, and lightning protection.
- Lightning is a comprehensive problem and almost always requires a comprehensive solution.

The ILD Technologies Lightning Protection System Pyramid



An effective Lightning Protection System requires a comprehensive approach that includes Active and Intelligent Systems integrated into well designed Surge Suppression, Bonding and Low Impedance Ground Systems.

The Problem With Grounding Systems

……. The facility grounding system is historically one of the least maintained major subsystems found in private, commercial, and governmental facilities.

Consider the following exert from a 1997 report published by the Electromagnetic Test and Analysis Dept.of Sandia Laboratories:

"After investigation of over 95,000 induced facility lightning strikes, what we found out was that passive lightning protection systems were able to play only a limited role in safely directing current from a strike. As a result of poor system grounding, we routinely observed high electrical currents traveling through structural steel and foundation rebar, concrete, piping systems, vent work, and electrical cable networks."

Shortcomings of Conventional Lightning Protection Systems

- Conventional passive and active protection systems are completely dependent upon a zero voltage reference point/low impedance ground. This is not present during a lightning strike event due to GPR.
- Commodity type devices are not fast enough nor rated to handle the energy levels commonly encountered in a lightning strike.
- Commodity type protective devices offer no protection against the most common effects of lightning: Low Side Surge resulting from GPR and Near Field Coupling associated with EMP.
- Commodity type protective devices do not operate until dangerous energy levels are already present on equipment wiring and may actually provide an uncontrolled pathway for destructive energy.

The Challenge ....

To discover an active lightning protection system that will provide greatest value for the customer's investment and also the highest effective rating against all forms of lightning damage to electronic systems without the shortcomings of commodity products.

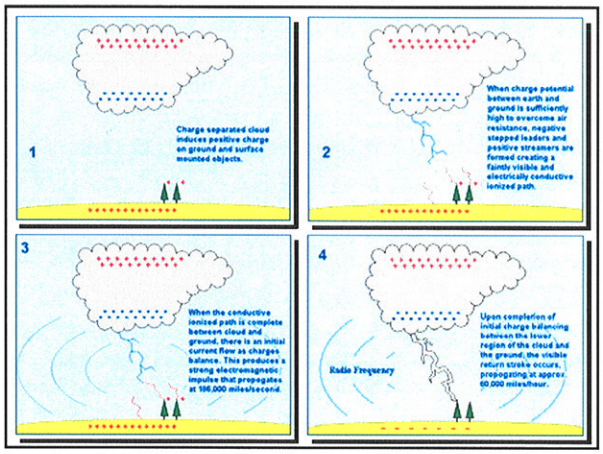
Introducing... **The ILD Technologies Solution**

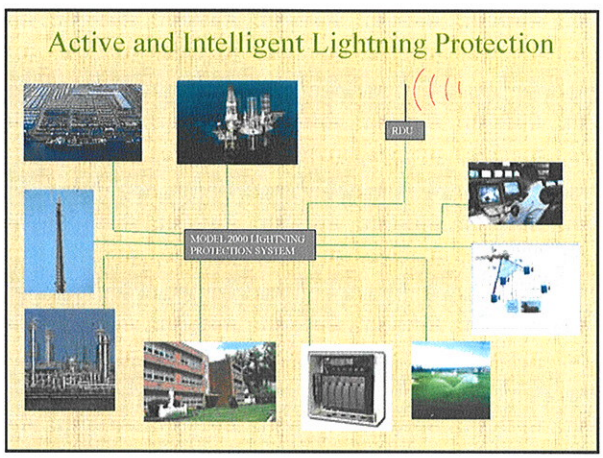
Active and Intelligent Lightning Protection

Model 2000 System Controller



- The ILD Technologies Model 2000 is a microprocessor-based application which functions to integrate real-time data on local atmospheric conditions into existing facility control and IT network systems.
- Triggered by the detection of an actual lightning strike or a change in atmospheric charging
- The Model 2000 provides critical early warning in the form of a high speed serial data transfer or discrete digital outputs.
  - Outputs can easily be configured to place critical facility equipment into safe operating conditionsstart standby power systems,
  - initiate logical control sequences through customer control equipment.
- **Fully automatic and requiring no operator intervention, the system automatically restores normal operation when storm conditions abate.**



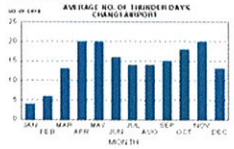


Lightning and People

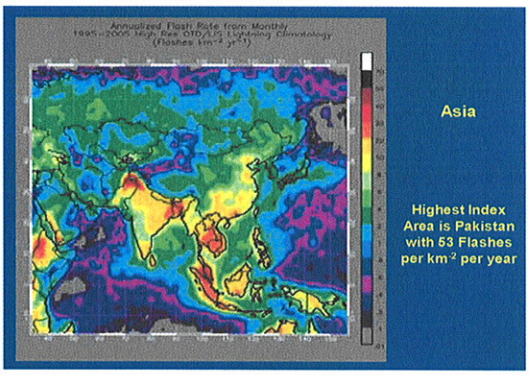




- **Lightning in Singapore**
- **INTRODUCTION** Singapore has one of the highest rate of lightning activity in the world. Lying near the Equator, the weather is hot and humid almost all year round. Conditions are favorable for the development of lightning producing thunderstorm clouds. An average of 171 thunderstorm days (days when thunder is heard) are recorded annually in Singapore.
- The monthly distribution of the number of thunder days (see figure 1) shows a peak in April/May and November, with an average of 20 thunder days and a low of 4 to 6 days in the months of January and February respectively. The preferred time of the day for thunderstorm to occur (see figure 2) is between 2 pm and 6 pm in the afternoon for all months of the year as diurnal heating and convection play an important role in thunderstorm development here.



Lightning in Asia



What We Have Learned

- The Secondary Effects of Lightning are 2000 Times More Likely than a Direct Strike
  1. Direct Energization
  2. Electronic Magnetic Pulse (LEMP)
  3. Ground Potential Rise (GMP)

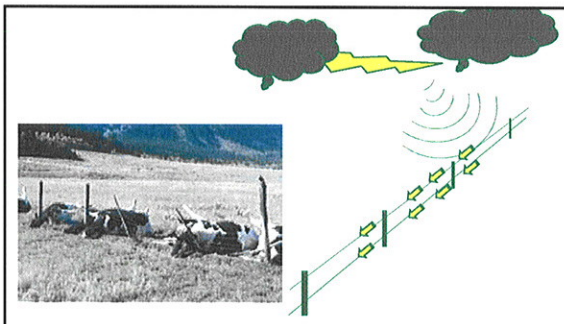
Early Warning Saves Lives



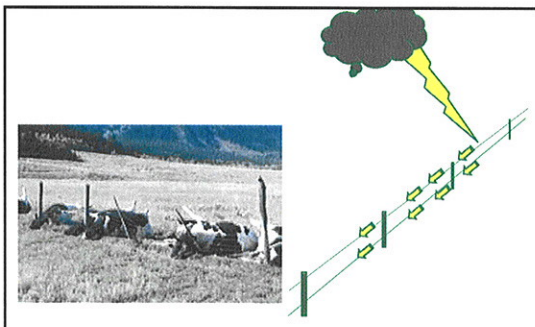




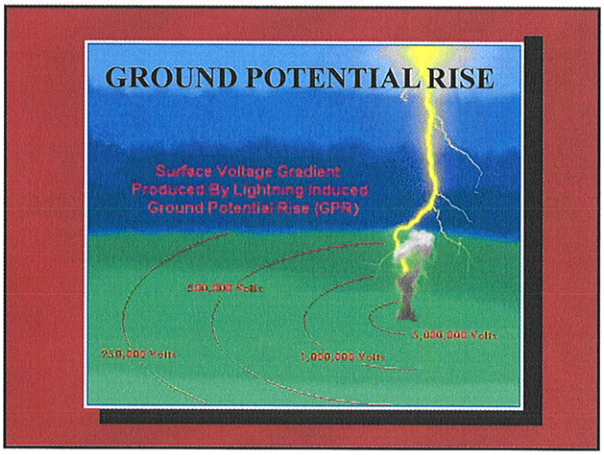




Near Field Coupling EMP



Near Field Coupling EMP


GROUND POTENTIAL RISE
Surface Voltage Gradient
Produced By Lightning Induced
Ground Potential Rise (GPR)
250,000 Volts
1,000,000 Volts
3,000,000 Volts




ANGA

SPORTS FACILITIES

- PICTURE OF SOCCER
- ARTICLE OF MULTIPE INJURIES
- SUPERIMPOSE GRADIANT PICTURE
- SWIMMING POOLS

Early Warning for Lightning



- **Features: EWS -1**
- Requires no Internet or other external data feed - no subscription fees!
- Available options and programming configurations to meet any application.
- Bright flashing strobe and 115dB siren provide instant, positive notification of
- atmospheric conditions likely to produce strikes or actual, strikes in the area.
- Monitors atmosphere in 360 degrees!
- Optional battery backup is available for highest reliability in all weather conditions.

Lightning Protection System Design...A New Concept

By: Keith Brashear - ILD Technologies, LLC

The concept of having low ground resistance in conjunction with Lightning Protection Systems (LPSs) and Surge Protection Devices (SPDs) is a topic that causes spirited debate among experts in the use of these systems. Most designers, manufacturers, and installers promote low ground resistance as being critical to the performance of such systems. But in reality, the problem is more complex than simple reliance on a low DC resistance ground.

Lightning Frequency

Frequency (f) of 200KHz
Current impulse equal to 1% of rated capacity of standard TVSS
Impulse: 50 Ampere, T_1 = 50uS

Calculated Values:

$$X_L = \omega L = 2\pi f L$$

$$\varepsilon = -\frac{d\Phi_B}{dt}$$

L = 27.64 uH
X_L = 34.73 Ohms
V_G = 1736.5 Volts (Measured on Ground Bus)

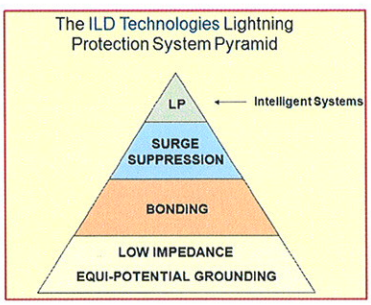
Result: Possible Catastrophic Damage to Microprocessors and CMOS devices

At the frequency of a lightning transient (with a fast rise time of 50 microseconds or less) system impedance (Z) becomes more of a factor than simple DC resistance (R). Soil inductance (L), reactance characteristics (X_L) resulting from the length or geometry of connecting cable systems, and high frequencies can render even the most well optimized LPS or SPD grounding system almost completely ineffective against a lightning impulse.

In fact, many people are surprised to learn that effective protection can be achieved even without the presence of a low impedance ground through proper bonding of the electrical system. The key to understanding this simple but often overlooked concept is voltage equalization as opposed to current diversion. One must consider that there are locations where a true low impedance ground is not practically achievable – for example: in very large/tall buildings where cable lengths are extreme or in dry locations like those in desert environments where soil conductivity is naturally very low. In cases such as these, the "grounding" system of the electrical network is in reality more of a "bonding" system. The key to preventing damage to sensitive electronics, electrical systems or even the structure itself lies in creating a situation where the grounding, bonding and protective systems prevent a difference of potential between points anywhere in the electrical system. Without a difference of potential, no current can flow as dictated by Ohm's law. Another way to state this is that if current flows without the presence of significant impedance, a significant difference of potential cannot be created. And while static grounding may be of primary concern to many, this principle can effectively be applied to any type of electrical network. The concept works equally well for low voltage signal and data pathways as there are now specialized systems (Intelligent LP Systems) available that can temporarily isolate as well as create the equi-potential state for very short durations (<400mS) during a lightning strike to protect critical systems that must remain operational during storm conditions. When combined with a true low impedance ground and proper application of SPDs, equi-potential based systems provide the most effective LPS grounding systems possible by also reducing overall system impulse amplitudes and dissipation periods during strike events.



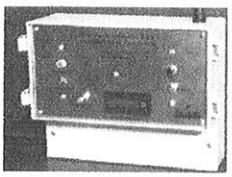
Model 2000 Equipment Protection System
Programmable (Network Compatible) Isolation Controller



Finally, the most critical aspect of this process is often defined in the level of experience that the designer has in combining Active and Intelligent LP Systems, SPDs and low impedance bonded grounding networks into a single integrated system. To learn more, contact:

ILD Technologies, LLC
San Antonio, TX USA
www.ildtechnologies.com

Model 800 Programmable Controller



The ILD Technologies Model 800 works as a programmable stand-alone lightning detector/controller with Remote Detector Unit or as a Modbus™ slave to the Model 2000 System Controller. Designed as a low cost solution for remote or unmanned facilities, the Model 800 functions much like the Model 2000. Factory programmable to meet an endless variety of applications and customer requirements, the unit is available in 120– 240VAC, 24VDC, and Solar Power versions.

Features:

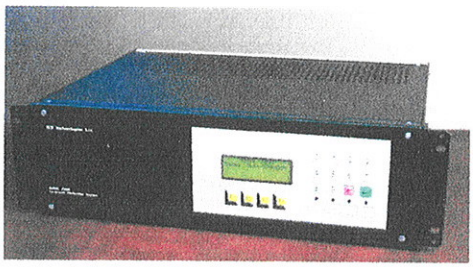
- Built-in resettable Digital Counter stores & reports number of warning events.
- Up To 32 units can be networked via built-in RS-485 for synchronized system control via a single master control station.
- Convenient Barrier Strip Connections
- Push-button test capability for disconnect/protect function
- Auto-manual toggle switch for system bypass during servicing operations
- Full complement of on-board indicators for easy operation
- Optional wireless interface to master control station
- Non-metallic gasketed enclosure allows indoor/outdoor installation
- Input & Output voltages fused internally
- Weight: 3.5 pounds
- Dimensions: 9"x7"x4"
- Gray, non-metallic weatherproof enclosure

Multiple Configurations available.

Learn more by accessing Model 800 Specifications.

Our unique line of products utilizes patented technology, distinguishing it from anything else on the market. Combined with our catalog of Services, our products make ILD Technologies your most cost effective solution for integrating lightning detection into any modern facility design.

Model 2000 System Controller



The ILD Technologies Model 2000 is a microprocessor-based application which functions to integrate real-time data on local atmospheric conditions into existing facility control and IT network systems. Triggered by the detection of an actual lightning strike or a change in atmospheric charging that could indicate approaching storms, the Model 2000 provides critical early warning in the form of a high speed serial data transfer or discrete digital outputs. These user programmable outputs can easily be configured to place critical facility equipment into safe operating conditions, start standby power systems, or initiate logical control sequences through customer control equipment. Fully automatic and requiring no operator intervention, the system automatically restores normal operation when storm conditions abate.

Features:

- Built in LCD display/HMI makes for fast custom configuration, visual monitoring of atmospheric disturbances and provides system status in real time
- Fully network compatible with TCP/IP,Modbus™ and industry standard RS-485 interface.
- Protected AC Power Source 10 Amperes- 1200 Watts Max
- Built-in real time clock and flash memory stores and reports system status, warning events and other user definable data.
- Standard terminal block connectors for phone, intercom, or control/data line equipment protection
- Remote Detector Unit features built-in diagnostics to continuously verify detector operation
- Standard 3-wire female AC terminals for equipment power source connection
- Industrial rated terminal block customer connections.
- Battery back-up for uninterrupted protection, even when power is off
- User programmable signal functions for 8 independent channels (expandable.)
- Available with optional encoded wireless interface to remote devices located as far as 2000 feet away.
- Unique 2-piece case (optional) allows easy removal and replacement of main control module without the need to disconnect field, power or communications wiring.

IPS SECUREX

LIGHTNING WARNING SYSTEM

MODEL EWS-1



Double 115 dB Siren, High Intensity
Strobe Lamp and Eave or Wall Mount Mast

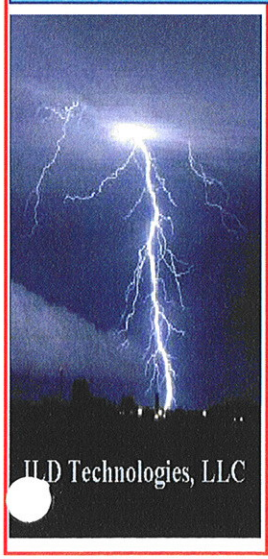


Lightning Warning System

Active Solid-State Lightning Detection and Warning

Detects & Reacts to Threat of Lightning Strike

Programmable Configurations to Meet Any Application



APPLICATIONS

- **Open Public Areas - Golf Courses, Yacht Clubs**
- **School & College Campus**
- **Sports Fields**
- **Weather Reporting Centres**
- **Factories & Warehouses**
- **Airport and Port areas**

Your Total Solution Partner

LIGHTNING WARNING SYSTEM

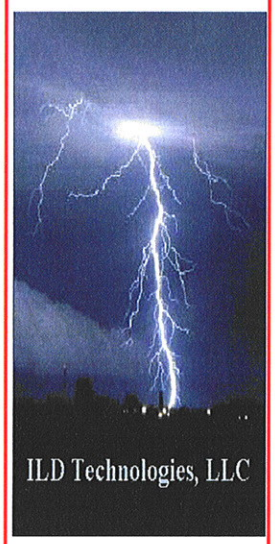
MODEL EWS-1

SPECIFICATIONS & KEY FEATURES

Unit Operation	12 VDC (30 W) with 7.0AH battery backup
Power Options	30-Watt Solar Panel and Charge Controller
Switching Channel	2 Internal (Lamp & Siren Set) 2 External (Common Mode): 1.0Amp. @ 240VAC
Sensitivity Range	Approx. 2km
Controller Size	11.5cm(H) x 21.6cm(W) X 5.8cm(D)
Total Weight	5.6 Kg
Sirens	115dB
Halogen Strobe	6000 Candle Power – Red, Blue, or Amber
Other Features	Alarm Sequence Available as Wall or Ground Mounted

BENEFITS

- ☑ Model EWS-1 monitors atmospheric activity within a pre-defined range to provide an audiovisual warning of a potential lightning strike – it is programmable and fully automatic.
- ☑ Detects imminent 'First Strike' before the actual lightning strike.
- ☑ Equipped with battery backup for high reliability in all weather conditions.
- ☑ Requires no control or other external data feed.
- ☑ Programmable configuration allows flexibility for specific applications.



IPS Securex is a Singapore based integrated security solution provider with offices and engineers throughout Asia. IPS is able to offer an enhanced level of support to all our customers. We hold a comprehensive stock of spare parts in each location. IPS Securex is ISO 9001:2000 certified.

**Our policy is one of continuous improvement. Design and specifications are therefore subject to change without prior notice*

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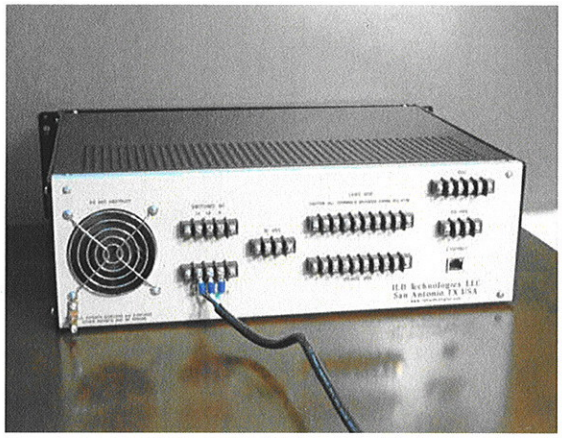
Your Total Solution Partner

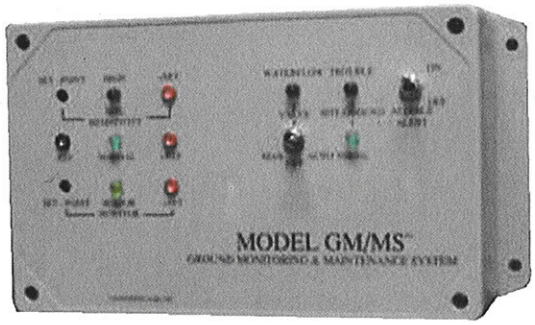
IPS SECUREX

LIGHTNING PROTECTION SYSTEM

MODEL 2000
MODEL GM/MS



MODEL 2000
(Lightning Detection and Equipment Protection Module)

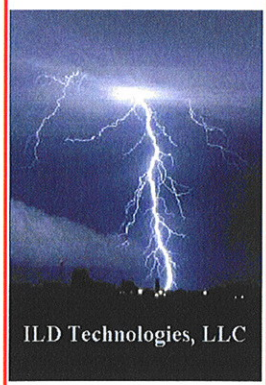


MODEL GM/MS
(Ground Monitoring and Maintenance System)

Active Solid-State Lightning Detection and Protection

Detects and Reacts to the Threat of Equipment Damage from Lightning

Complements Existing Lightning Protection Systems



APPLICATIONS

- **Military Installations**
- **Telecoms Installations**
- **Broadcasting Installations**
- **Computer and Data Processing Centres**
- **All Types of Sensitive Electronic Equipment**

Your Total Solution Partner

IPS SECUREX

LIGHTNING PROTECTION SYSTEM

MODEL 2000
MODEL GM/MS

SPECIFICATIONS & KEY FEATURES

Model 2000

- **120/240 VAC 50/60Hz, 10-amps**
- **Battery backup**
- **Disconnect timer** (0.4secs – 20 mins)
- **Detector Look-up timer** (0.4sec – 3mins)

Key Features

- **Displays atmospheric disturbances in real time**
- **Combats low side surges**
- **Isolates and protect sensitive electronics when lightning is present**

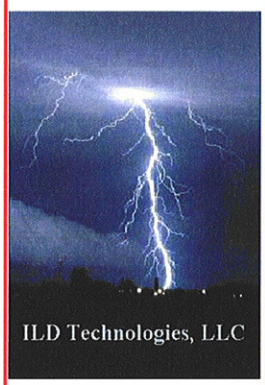
Model GM/MS

- **2 sensing rods to monitor soil resistivity**

Key Features

- **Maintains soil resistivity**
- **Monitors facility grounding integrity**

BENEFITS


ILD Technologies, LLC

☑ Model 2000 detects the lightning strike before it occurs and automatically isolates equipment from A/C power lines. Equipment remains on backup power until the threat passes

☑ The active lightning protection system interfaces directly with all types of equipment and provides the protection required

☑ Model GM/MS continuously monitors the resistivity of the soil around the grounding system and provides controlled application of water to ensure grounding remains within a specified range

☑ Model GM/MS can also detect ground anomalies such as a broken lead or broken connector between the main ground buss and ground rod

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