

Maximizing the Reliability of Communications Systems

A Total Protection Approach

Practical Solutions for
Protecting Communications Systems
From the Effects of Lightning and Other Transients

As presented by David Anderson
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This paper will show you ways to increase your company's profitability, and improve the reliability of your comm/data systems. It will also discuss the appropriate tools for enhancing the overall performance of your voice, data and video equipment.

Introduction

Contamination in communication and power lines is a fact of life. High-voltage transients like lightning can shut down entire systems. High-frequency disturbances caused by utility practices as well as copiers, elevators and other loads on building power lines can be equally devastating. You can't prevent harmful power disturbances from occurring. But by instituting Total Protection, you'll prevent them from undermining the performance of your communications systems.

Telecom systems have changed dramatically over the last several years, evolving into "telecomputers." Compared to past technologies, today's telecom systems are more sensitive to transient influence and more expensive to install, repair and maintain. Thus, the quality of the end user's power and grounding environment are more critical to the system's performance than ever before.

A Total Protection approach meets the demanding protection needs of today's microprocessor-based telecommunications systems. As a solution, it provides for a clean, quiet and stable electrical environment for all power and communications cables. To achieve Total Protection, however, requires that the telecom system is installed according to the manufacturer's recommendations and that the appropriate protection device protects all power and communications paths to the telecom system.

This paper will explain how implementing a Total Protection Solution (TPS) has been proven to:

- Dramatically reduce service calls.
- Improve system performance and reliability.
- Increase customer satisfaction.
- Reduce maintenance, material and labor costs.

It will also show you what to look for when choosing between the different protection technologies available in the marketplace today.

The Fundamentals

A Total Protection Solution (TPS) for telecom systems can be obtained by implementing four fundamental principles.

AC Power Protection - Ensuring that every conductive power path is properly protected with a power conditioner.

Communications Line Protection - Ensuring that every conductive voice, data and video communications path is properly protected with primary and/or secondary protection devices.

Grounding - Ensuring that the entire system (power conditioner, communication line protectors and system ground) is properly grounded using a "single point" grounding principle.

Service - Every site must be regularly maintained to insure the above principles are not violated. Without proper service, the Total Protection can be compromised, allowing the system to be susceptible to downtime.

Determining the Need For Protection

How much is system reliability worth to your company?

To more fully understand the importance of a TPS, it is important to measure the financial value of implementing such a solution. To illustrate this value, we asked people like you. This is one of many surveys used to qualify the financial impact to a company anytime their communications system (voice, data, and or video) is out of service.

Nearly 300 small and large businesses were surveyed and asked what they felt the hourly cost of downtime represented to them. 42% of those surveyed said \$1000 per hour. 35% said \$10,000 and the remaining 23% admitted that they did not know.

It is important to stress that the results of this study are not as important as simply recognizing the potentially high cost of downtime. It is certainly worth any company's time to investigate this further. Implementing a TPS will help control the financial risks associated with downtime.

How do you calculate the cost of system downtime?

To further investigate the harsh realities of downtime, we have identified four areas impacted by downtime. The total cost of implementing a TPS is minor when compared to the total financial risks a company is faced with when a system is down.

- Impact on Personnel Time – When a system is down people are not able to do their jobs. As such, their hourly rate is still being paid even though they are not producing for the company.
- Loss of profit contribution – If a team working on a specific project for the company is delayed due to system downtime, the company's ability to benefit from this project is also delayed. For example, if a new product is delayed to market, the consumer is likely to buy it elsewhere. In this case, the company would effectively lose an

order they might otherwise have secured if the project was not delayed.

- Cost of hardware repair – Blown equipment must be replaced with new, more costly replacement parts.
- Company image – This one is tough to quantify. A customer who cannot access your company or service because of a “down” system will become disgruntled and possibly take their business elsewhere.

Reduced Trouble Calls

We have implemented many field trials to test the effectiveness of a TPS. The chart shows a composite of trials we have conducted in the past 10+ years. Some of the companies involved in these trials include BellSouth, Verizon, SBC, US West, Lucent and many other companies.

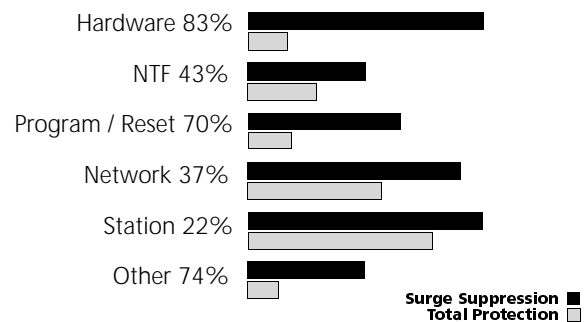


Fig 1: Surge Protection vs. Total Protection

Overall, our studies have shown that a properly implemented TPS and a deliberate effort to enforce the total protection philosophy, will result in a nearly 60% reduction of dispatched service calls when compared to using conventional surge-type protection.

In these studies, TPS was implemented on a mix of sites that included those with “acceptable” trouble levels and those with “extraordinary” troubles.

It is also important to note that a TPS will improve reliability on all sites, good or bad.

The Benefits of Implementing a Total Protection Solution

Up to this point, we have been reinforcing the value of TPS and helping to quantify the “real dollar” benefit realized as a result of implementing this solution. This achieves our first objective, “Ways to Increase Profitability”. Now let's explore ways to improve reliability.

Improving Reliability

In this section, we will show you an example of a communications system and how to address the four principles (power protection, communication line protection, single-point grounding and service/maintenance) of a TPS.

Your Communications System is Vulnerable

Every communication system has peripheral devices that interface with the main system. It is important that we consider these components when applying the total protection philosophy. In each case, these peripheral devices are physically attached to the main system via an RS232 connection or another method that usually involves copper. Copper provides a conductive path into the main system.

The main system and each peripheral require power and are equipped with an electrical cord that also provides a conductive path between the communication system and the building's overall electrical power grid.

In addition to the electrical power grid, most systems are also connected to the outside telephone grid which means you have incoming lines from the Phone Company. Even though fiber-optic cable is becoming more and more common, most every system also has copper pairs that terminate on the system. These provide a conductive path straight into the soft underbelly of the system.

In many cases, the communications system is also connected to other outlying buildings in a "campus-like" environment. In these cases, copper wire is almost always run between buildings to power the station sets or computer terminals thus providing another conductive path into the system.

Creating the "Bubble of Protection"

To properly implement a TPS, it is imperative that a "bubble of protection" surround the entire system — including the peripherals. At any point that the bubble intersects a conductive path, protection must be installed to isolate the system from the harsh electrical environment.

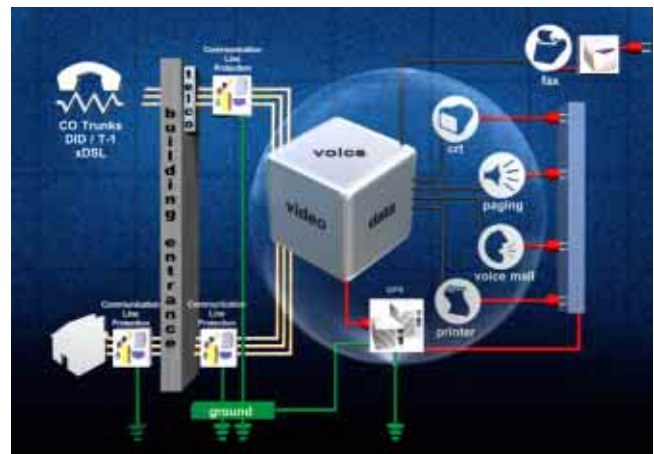


Fig 2: The ONEAC Bubble of Protection

So, how do you begin to protect the system?

Power Protection

First you ensure that all AC power paths are connected to a power conditioner or power conditioned UPS. There are distinct differences in technology when it comes to selecting power protection. Selecting the best technology is just as important as making the decision to protect the power path in the first place. A technology comparison is discussed later in this paper.

Communications Line Protection

The next step in protecting your system is to protect the communications lines. The Telephone Company is required by law to provide protection at the building entrance. This telephone company-supplied protection is meant to protect against fire and human shock hazard and is NOT meant to protect your sensitive electronics. In fact, the let-through voltage of Phone Company protectors exceeds 300 volts and often exceeds 1000 volts if gas-tube or carbon technology protection is used. For this reason it is important to install secondary protection behind the telephone company protectors. And don't forget to protect any copper paths between buildings if you're operating in a "campus-like" environment.

Selecting the right technology is just as critical on the communication line side as it is on the AC power side. A technology comparison is discussed later in this paper.

Grounding

To achieve true total protection, it is very important that all components of the communication system (including the protectors) are properly grounded to a single-point ground reference using appropriate

gauge ground wires. When wiring, it's important to take the shortest and most direct route to ground and use care to avoid sharp turns and kinks in ground wires. Be sure to keep a separation between the ground wire and phone cable bundles. Cable sheaths should also be grounded.

Ongoing Maintenance/Service

Once the protectors are installed and the system is properly bonded and grounded, it is important to check and re-check the installation to make sure ALL conductive paths are being protected because your communications system is only as reliable as it's weakest link.

It is important to manage all add, moves and changes from a communications point of view as well as a power and ground point of view. Allowing someone to add a non-protected terminal can cause as much problem as a direct hit.

It can be difficult to guess when and where someone might install a peripheral device without your knowledge. That's why it's also important to enforce the fourth principle, "Service".

Using the right technology to enhance the overall performance of your voice, data and video communications equipment is critical. Let's compare technologies. We'll begin with a power protection comparison.

Power Protection Technology: A Side-by-Side Comparison

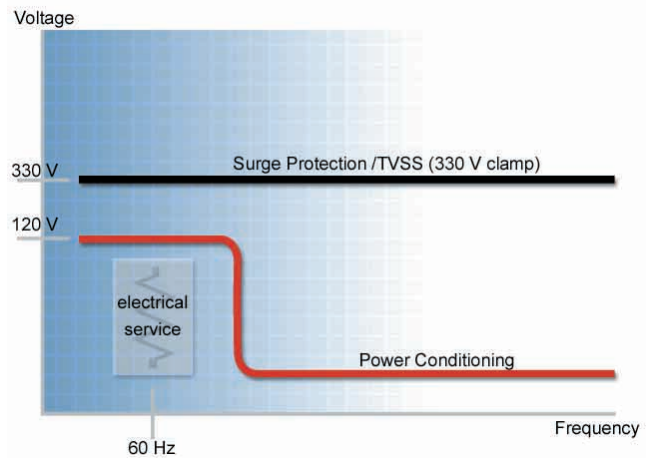


Fig 3: Let-Through Comparison

This graph builds upon the parameters that make up the building's branch power circuit. It graphically depicts the let-through comparison between a power conditioner and a traditional surge protector.

Compare Technologies

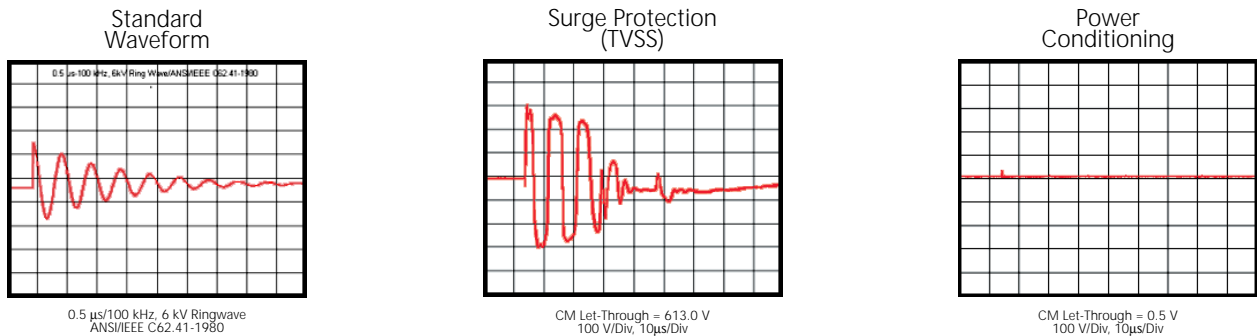


Fig 4: Oscilloscope Comparison

As seen through an oscilloscope, these shots show what the let-through voltages truly look like when subjected to the standard industry ringwave, ANSI-IEEE C62.41-1980. Surge protection technology passes through dangerous fast-edged transients

while power conditioning technology eliminates them entirely. This further illustrates why power conditioning technology is more effective at protecting your communication system from interference on the AC power line.

Power Conditioning Considerations

If your application demands that your communication system remain up and running even during a total power loss, be sure to select a power conditioner with battery backup.

When selecting your power conditioner or power conditioned UPS, be sure that it has the following characteristics:

- Tight-surge let-through
- Virtual Kelvin Ground®
- Low-impedance isolation transformer
- Maintenance-free
- Small footprint
- Quiet operation
- Plug & Play
- 5-year warranty

Communication Line Protection

Technology: A Side-by-Side Comparison

StarBalanced™ Frequency-Dependent filtering vs. Conventional Clamping.

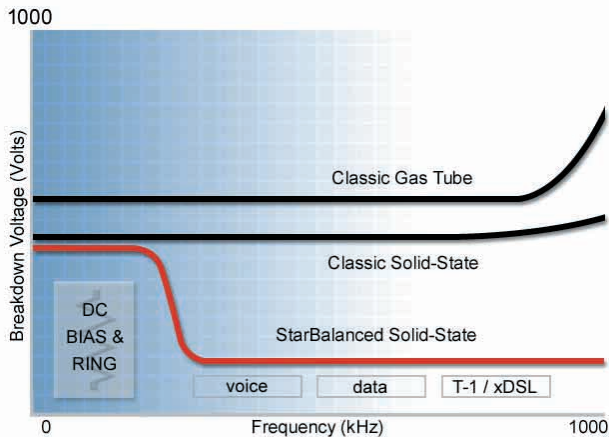


Fig 5: Star-Balanced vs. Conventional Clamping

Using the same format as we did for power conditioning, the graph above depicts the various signals found on the line. Transient voltages lower than the desired signal voltages can be harmful at high frequency. As you can see, classic protection technologies that clamp at a single voltage threshold can't stop them. The StarBalanced protector with patented SwitchedFilter Technology can. This graph clearly shows the value of the frequency sensitive filtering technology used in the StarBalanced protector. It filters out harmful

transient voltages that the others miss and still allows the ring signal to pass through.

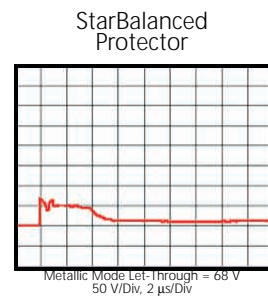
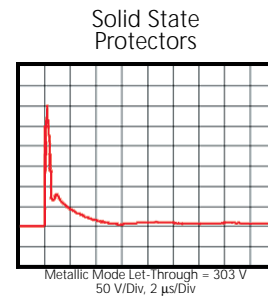
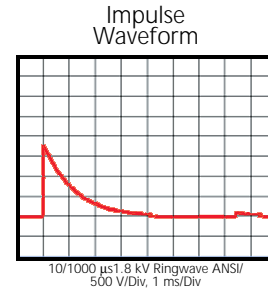


Fig 6: Oscilloscope Comparison

Communications Line Protector Selection Consideration

Use the following criteria when selecting your communication line protection:

- Robust, solid-state overvoltage protection
- Frequency dependent filtering
- Self-resetting sneak current protection
- Convenient test points
- 5-year warranty
- Technology available for analog, digital, data and xDSL
- UL listed (Primary and Secondary)

Conclusion

In conclusion, a TPS implementation will reduce service troubles and dispatched service calls, enhance service profitability and your image with customers, and give you an immediate return on your investment.

Our side-by-side technology comparisons make it clear that power conditioning technology (with or without battery back-up) is the clear choice for power protection. And the clear choice for communication line protection is StarBalanced protection with SwitchedFilter Technology solid-state technology as illustrated in the side-by-side comparison with classic solid-state and gas tube protectors.

Implementing a TPS ensures that power disturbances do not disrupt telecom system performance. Field data confirms it. Leading installers who use the TPS report more reliable voice, data and video communications, fewer damaged components to replace and far fewer service calls. As a result, they are able to assure customer satisfaction while increasing sales revenue and profitability of service contracts. Using the Total Protection approach in your installations will achieve the same advantages.

About the Author

David Anderson, Product Marketing Manager, Telecommunications.

David Anderson is responsible for business development and product marketing for the telecommunications division of ONEAC Corporation. In this position, Anderson is responsible for addressing the protection needs for carrier-type networks, enterprise networks and customer-premise applications involving all types of communication applications.

Throughout his career, David has gained an acute awareness of the needs of the communications industry in the area of power line, communications line and grounding protection. Since joining ONEAC in 2000, Anderson has contributed to the development of several new communications-oriented protection products for ONEAC by working directly with system integrators and end users to ensure their unique and ever changing protection needs are being addressed.

David has local and national sales and marketing experience spanning over 30 years in the telecom industry; holding key positions with Illinois Bell and Ameritech. While with Illinois Bell, he also served as a Lieutenant Colonel in the United States Army Reserve. David has recently been featured in several industry-related articles focusing on system reliability and the importance of protection. Anderson holds a Bachelor of Arts degree in Management from North Central College in Naperville, Illinois.

About ONEAC

ONEAC Corporation, a wholly owned subsidiary of the Chloride Group, PLC was founded in 1979. ONEAC designs and manufactures products that provide the highest level of protection against power and data line disturbances, regardless of conditions. ONEAC's comprehensive product lines include power conditioners, uninterruptible power supplies and voice & data line protection devices. With ISO9001 certified manufacturing plants in the U.S. and U.K., ONEAC is dedicated to demand-flow manufacturing and the highest quality standards.

Organizations whose productivity goals allow no possibility for system downtime use ONEAC. They include many of the world's leading companies, in a wide range of applications including telecommunication systems, information technology, retail information systems, computer-integrated manufacturing systems, semiconductor test equipment and biomedical instrumentation and information systems. Information on ONEAC products and services is available on the Internet at www.oneac.com.



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