

electroindustry

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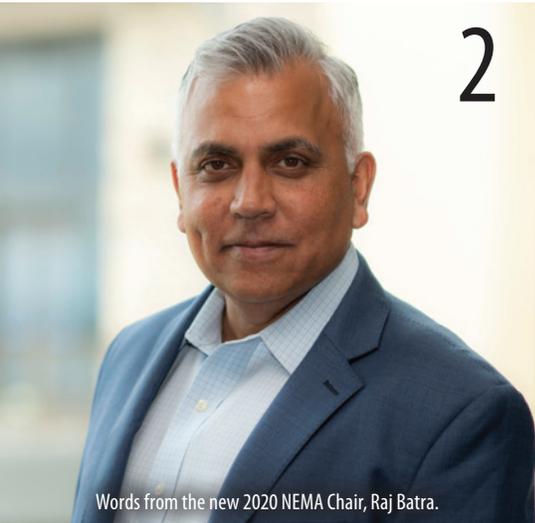
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Unless a washing machine is zapped or an overhead light fizzles out, most people don't notice the electrical infrastructure at home or work that powers and enables their modern lives. Like an audience for a Broadway production, we're dazzled by the actors in front of us, paying little attention to the stage crew that keeps the show moving behind the scenes.

Like Broadway stagehands, most of the electrical infrastructure in a building is hidden from view and working hard to make modern life enjoyable and seamless. The safety of the hidden products is paramount as well. Any glitch can mean the show's over. Not all electrocutions and fires can be prevented, but luckily, they are far rarer than even 10 years ago. The electroindustry works hard to keep those numbers going down.

The increased adoption of ground-fault circuit interrupters in homes has led to a significant decline in electrocutions. Wiring devices of many types have been standardized, making it much easier for companies to develop safer products. Improved building codes ensure the safe installation of electrical products in buildings and homes. NEMA does all this and more—writing Standards, developing and advocating for strong building codes, and promoting safe electrical products—through the work of the NEMA Building Infrastructure Division.

NEMA Standards and technical publications contain stipulations that help building infrastructure manufacturers construct world-class products. The Building Infrastructure Division has a large catalog of Standards and publications that define requirements for materials, construction, dimensions, and product recommendations. Using established Standards ensures that consumers and building developers can obtain quality products that perform as intended.

Modern life functions seamlessly because of NEMA Members' products. They are used to run the data centers that provide connectivity. They protect people and sensitive electronics from being harmed. These technologies and products are in place to make people's lives comfortable, efficient, and safe both at home and at work. Essential building infrastructure products allow that to happen. Ⓜ

Raj Batra

Chair, NEMA Board of Governors

Embrace Technological Change

As Bob Dylan's title track song from his 1964 record says, "The Times They Are a-Changin'."

As a child of the '60s, I loved the show *The Jetsons*. Futuristic items like teleconferencing, robotics, drones, smartwatches, and holograms seemed so farfetched back then. Today, technologies like these can be delivered to our homes in two days or less.

Beyond Hollywood's predictions, we are seeing other wondrous technologies enter our world.

Sensors are going to be the latest infrastructure foundation our future is built upon—just six years ago there were roughly 10 million sensors, and today there are more than 3.5 billion. Some predicted this number to be more than a trillion in less than five years. We should consider their importance to be equal to that of previous infrastructure developments like our electrical grid and highway system.

Due to artificial intelligence, predictive analytics, and quantum physics, the amount of data and new technology that will be incorporated into this infrastructure over the next few years boggles the mind and is limited only by the imagination.

We are already seeing new technologies in the market that allow building owners to reduce energy utilization by quickly documenting the power consumption of every single electrical device within a facility. Soon, these technologies will proactively identify future electrical equipment failures before they even happen.

Connectivity is advancing how we look at not only luxuries but also survivability. For example, beds are already available today that monitor our vitals and transmit them to the cloud via smart thermostats. Eventually, countless lives will be saved with this technology once predictive analytics are incorporated. For heart attack victims, emergency response teams will be notified faster, but the end goal is to use the data to provide early warnings that a heart attack is likely to occur within a few days.

Where will this all lead? What else can we expect to see in tomorrow's building infrastructure?

I think the short and simple answer is the future will look like what we want it to look like. In the end, different people want different things, and I believe our economy has the horsepower to deliver them.

Engineers have been and always will be inventive. Artificial intelligence, predictive analytics, and quantum physics are all in overdrive. It is easy to imagine that moving objects from Seattle to Miami in an hour, replacing crop production in the San Joaquin Valley to just a few miles of vertical farming, and harvesting energy from space-based power stations are all within reach.

This brings us to a position where the eyes begin to glaze over. What will new technology bring us? What will be the new disruptive technologies, and how can one get ahead of the game, whether from a business perspective or an investment perspective? Because technological change tends to happen so quickly, I think the idiom of not seeing the forest for the trees is never more applicable for executives than when considering topics like these. However, if we were to take a long, hard look at the big picture, I believe most would realize that these changes are not something to be feared but, rather, embraced.

The vast majority of new technologies really boil down to two categories ... faster and more accessible. Five-column ledgers became adding machines, which became computers, which became supercomputers we carry around in our pockets. They are faster and more accessible, but they still perform the same function. The future of building infrastructure will be the same way. Just as a kid watching *The Jetsons* in the '60s, the technologies will be amazing to see, but the net gain will simply be something that is faster and more accessible. ☺



Mark W. Wingate is a serial entrepreneur and founder of Maxivolt Corporation. He is involved globally with Standards development and disruptive technology, has trained scores of people and authored numerous technical papers, and serves as an adviser to multiple boards and committees.

Standards Talk



NEMA Industry Director Jonathan Stewart, far right, participated recently on a panel to discuss Standards in the Middle East and North Africa region at the Discover Global Markets in Houston. 

NEMA Goes Back to College

NEMA staffers Danny Abbate, Industry Director for Building Infrastructure, and Muhammad Ali, Program Manager, attended and completed the Robroy Corrosion College in Gilmer, Texas, in August.

Corrosion College provides hands-on experience in understanding the process of corrosion through two days of intensive instruction conducted by professionals in the field of corrosion protection. Instructors enhance learning retention through a comprehensive curriculum, including case studies, laboratory workshops, and interactive presentations detailing the proper installation and use of anti-corrosion products.

Abbate and Ali learned about the theory of corrosion, prevention, applications, and installation practices. In short, working with any metal requires electrical manufacturers and installers to be mindful of any corrosion possibilities. It is important to keep this in mind to maintain the useful life of electrical products and to ensure safety is always upheld, they learned. The staffers will take the lessons learned on corrosion and apply them to the other NEMA products. 

Daniel Abbate, Industry Director, NEMA

I Am NEMA...



Tim McClintock, NEMA Field Rep

Electrical equipment and products play a key role in public safety to ensure the places we live, work and play are free of electrical hazards.

NEMA is committed to safe electrical installations and products wherever electrical power is used, and I am excited to be the association's new Midwest Field Representative supporting those objectives.

My role as a NEMA Field Representative includes providing support for the adoption and proper application of the *National Electrical Code*® (NEC®) and any other matters impacting the electroindustry in my 17-state region.

Before joining NEMA, I worked in NFPA's Regional Operations as a Regional Electrical Code Specialist providing support to state and local jurisdictions with the adoption and use of the NEC and other National Fire Protection Association electrical codes and Standards in a 26-state region that included the Midwest and Western states.

Prior to NFPA, I worked as an electrical inspector for the Building Department in Wayne County, Ohio, for 16 years. For the latter 14 years, I also served as the Chief Building Official, supervising the operations and personnel of the building department.

I began my career in the electrical industry back in 1985 as an electrician, which provided me with a great foundation in the electrical industry and hands-on experience with the installation and maintenance of all phases of electrical systems in commercial, industrial and residential occupancies. 

Book-a-Speaker



Jonathan Stewart, Industry Director, NEMA Utility Systems Division, will participate in a workshop where

he will give an overview of state and local regulatory activity related to sulfur hexafluoride at the DIL0 Gas Management Seminar in Tampa, Fla. on Nov. 13. Check out <https://www.eiseverywhere.com/website/2145/agenda/> for details.

NEMA electroindustry experts are available to speak at your event. Need a speaker? Book a speaker at www.nema.org/book-a-speaker. 

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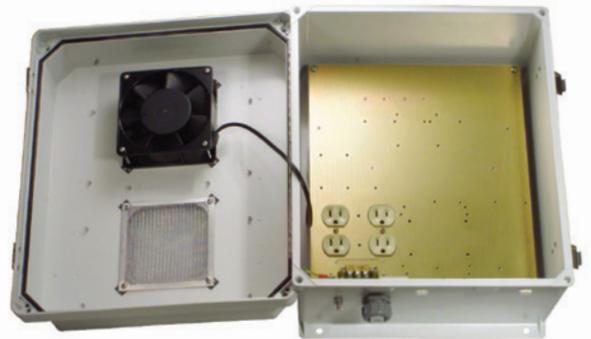
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GFCI Receptacles: Small Installation, Big Protection



Daniel Abbate,
Industry Director,
Building
Infrastructure
Division, NEMA

Recent years have seen a significant increase in the number of do-it-yourself projects that homeowners will undertake. Home products and construction materials are easily accessible, and there are online tutorial videos for every installation imaginable. This includes the ground-fault circuit-interrupter (GFCI), which is designed to protect people from electric shock. It is important for all homeowners to understand that this type of electrical plug, or receptacle, is essential.

GFCIs work by sensing ground faults, which occur when electrical currents leave the standard path and then disconnect the circuit before electrocution occurs. GFCIs are easy to install, and there are now years of evidence showing them to be effective. Data shows that the installation of GFCIs has led to a drastic decrease in the number of electrocutions associated with consumer products.

GFCI receptacles have improved significantly from the first editions that were sold in the late 1960s and early 1970s. Most, if not all, have the self-test option, which allows the home dweller to perform a simple test of the receptacle's operability and protection. Many now also contain a small indicator light that shows the GFCI is still functioning. Recent editions have power denial features that can keep a non-functioning receptacle from being reset and receiving power, offering another level of protection against electric shock and fires.

The modern electrical codes now require GFCIs in many more places, such as near sinks and in laundry rooms. For any homeowner that wants additional protection in areas such as those, GFCIs can easily be installed in place of most any electric plug. The new features of the GFCI make it easy for people to see whether the electric plug is still working as intended. When the decision is made to replace an older version, the homeowner can rest assured that a GFCI will provide robust protection. ©

Top Factors to Consider When Working on a Data Center

Dependence on quality, reliable data is now more business-critical than ever. Businesses rely on data centers for 24/7 connectivity; to uphold federal codes and regulations; and to ensure resiliency, performance, and more—all so a company can stick to meeting the demands of its customers. Data centers should also be highly adaptable. With today's technology changing daily, new business opportunities presenting themselves at every turn, and looming threats from competitors, businesses must have the ability to position resources—servers, applications, storage, and services—seamlessly across enterprise networks swiftly, without any disruption of service.

These growing demands have forced businesses to look in the mirror and assess their infrastructure. Whether it's modernizing an existing data center, scaling up to meet business needs, or building entirely new network architecture, considerations must be made to ensure superior performance of today's mission-critical data centers.

While your data center might be “out of sight, out of mind,” it is the central hub of your business from which to generate information. There are simple ways to increase organization, ease of use, and scalability within your network centers.

What to Do

Opt for Modularity

Choose cable solution products that can be combined to create any number of design configurations to meet your cable management needs and provide the option of scaling as your business grows. Various customizable cabling management systems are designed to meet specific business needs and specifications.

Eric Gertie,
Product Manager,
Cope Cable Tray

Eric Gertie
is a product
manager for
Cope Cable Tray,
a part of Atkore
International.



Wire baskets provide the flexibility to create a grid system out of wire mesh trays. Wire baskets are produced first by welding a net from high-strength steel wires, forming the channel, and then finishing after fabrication. A UV adder can even be used in the powder coating process, if needed, for additional lifetime protection. The 2" x 4" mesh allows for continuous airflow and prevents the buildup of heat, dust, bacterial proliferation, and other contaminants. With increased airflow reaching the cables, your facility will achieve increased energy efficiency, improved cooling capabilities, and reduced risk of interference.

Among complex installation environments, installing a wire basket cabling management system can lead to considerable benefits. Even filled with maximum cables to code, the grid system is naturally stronger and lighter. To this point, it requires less frequent support locations, typically every 9-10 feet. This creates a domino effect of benefits. With fewer support locations needed there is more optimized space in the facility.

Because wire mesh cable trays are lighter in weight, one person can complete the installation, offering cost and time savings.

Choose Accessories That Save Time in Installation

With technology changing at a rapid pace, technicians should use equipment that allows them to pivot quickly in response to shifting technologies. There are small but sizable considerations that can help achieve faster installation.

Wire baskets contribute to open structure efficiency with the option of dropping cables out from any part of cable trays. And the wire mesh structure makes it easier to organize cables by cable ties or a variety of accessories:

- **Clip-on wire basket accessories** can aid in the attachment of conduit to the wire basket and provide two different latching configurations for mounting 1/2" to 1-1/4" EMT connectors. A bottom mount design accommodates all load depths, but can also be side-mounted to 4" and 6" load depth wire baskets.
- Another option to secure cables quickly is choosing a channel tray system that offers pre-punched holes,

saving time and labor by eliminating the need to drill holes and allowing for the easy inspection of cables. This option is more versatile and flexible than enclosed raceways and wireways.

Pre-attached, auto-locking splice plates that connect two or more wire baskets can save time by allowing an installation contractor to run wire baskets the length of the facility with specialty hardware woven on that easily snaps together. These quick latches decrease time and labor when splicing two wire baskets together after field cuts are made that require removal of the factory splice. Pre-attached, auto-locking splice plates also eliminate the need to carry bulky tools and accessories to connect each basket to the next and reduce the amount of scrap on-site and subsequent cleanup time.

This type of systematic, organized cable management setup can help prevent kinks and entanglement, while evenly distributing weight and keeping cables cool—vital elements in improving overall network performance.

Organize for Increased Efficiency

The next important factor in continuous uptime in data centers is organization. There are various ways to increase the organization of your cables.

Colored cable is a time-tested method of quickly and easily identifying different runs of cable at a glance. Wire baskets provide optimized visibility of wire paths, but even more so when color-coding is employed. Although the cabling set of Standards does not specify the color of the cables, there are general guidelines to consider. Group color selections by:

- **Type of Cable:** Having one color for Cat5, one for fiber, and so on, will make it easy to determine the type of cable with just a glance.
- **Cable Purpose:** Standardize a specific color for specific wire purposes. For instance, color-coding by internal wiring, user equipment, or external wiring can be an effective strategy.
- **Cable Destination:** For some larger buildings or wider applications, it could be most effective to color-code based on which floor or building area cables are routed to.

Ensure each color has an intent and be consistent. Use colors that stand out and that are not commonly confused (pink and red, for instance). That will make it easier to avoid confusion, follow cable runs, and troubleshoot any potential issues. Powder coating can be used to color-code different runs in red, blue, yellow, green, black, and white. Colors can be customized using the RAL color scale.

What Not to Do

Overfill

Don't overload your baskets and get outside of code. Avoid using a tray system that is so big that it becomes bulky and hard to move. Instead, plan cabling pathways and proactively take into account parameters that influence cabling pathways, including rack density, type/count/diameter of cables, end equipment cable entry, and room height.

Select basket sizes compatible with the size of your facility. For instance, standard ladder trays can range from 12 to 20 feet long and may be awkward (and even damaging) to maneuver if you have a smaller center. Alternately, seek a wire basket that comes in 10-foot lengths, offering increased movability.

Codes vary based on the type of cables run. For multi-conductor control or signal cables, adhere strictly to NEC 2017 Article 392, Cable Trays, 392.22.2 Ladder or Ventilated Trough Cable Trays Containing Multi-Conductor Control and/or Signal Cables Only, which states that with the use of these cables, a 50 percent fill ratio of the cross-section is permissible. In other words, the total of the cross-sectional wire area will need to be half of the total cross-section of the basket tray itself.

For multi-conductor power cables rated for 2,000 volts or less, follow table 392.22 (A) for proper fill in NEC 2017.

Often, contractors will purchase a larger width than needed in the application to allow for future modification of the electrical cable runs. Think of how often an additional conduit run is needed after a job is completed. With cable trays, if the basket was sized appropriately, the only thing that needs to be pulled is the wire.

Rely on Electrogalvanized Steel

Small but mighty zinc whiskers wreak havoc on sensitive electronic equipment by disrupting day-to-day equipment operations. Failures can include short circuits, voltage variances, signal disturbances, and complete system resets.

Whiskers are caused by tiny "spurs" splintering off of zinc-electroplated steel surfaces. While a thin layer of zinc coating can prevent rust and corrosion, it is under compressive stress and will tend to relieve that stress through the splintering effect—zinc whiskers. Eventually these whiskers break off, and that is when the damage happens. Unattached zinc whiskers now have the capability of circulating through a facility's air system and can settle on sensitive equipment.

So how do you avoid these potentially damaging whiskers? The answer is simple: Reduce or eliminate the amount of whisker-producing electro-galvanized steel used in and under the server room. To do this, choose materials wisely—consider the difference between electroplated zinc and powder coating.

Powder coating, applied explicitly to wire baskets, provides superior protection compared to standard electroplated zinc galvanizing. This application also projects an aesthetically pleasing, sleek, high-tech appearance ideal for a data center. This type of coating is also durable, corrosion-resistant, and resistant to most prevalent chemical substances. By replacing electroplated steel with powder-coated cable trays and wire baskets, you will prolong the life of your products and protect your investment.

Conclusion

Whether your facility needs a complete overhaul or just a few minor upgrades, there is a wealth of cabling and cable management solutions that can make your data center more efficient, safer, and more organized. ©

Structured Cabling for Data Communications



Rick Pimpinella,
Panduit Fellow

Dr. Pimpinella is a Panduit Fellow, is a member of the IEEE, and is actively pursuing his research interests in multimode and single-mode optical fiber.



George Einterz,
Development
Engineer Principle,
Panduit

Mr. Einterz started his own consulting firm advising clients in the design, implementation, and training of telecommunications networks and systems. Today, he is a Development Engineer Principle with Panduit's Enterprise Business Unit.

Whether you're an engineer, installer, consultant, or network designer, you might have multiple questions regarding cabling infrastructure and management: "What type of cable should I be using? Can I run power and data cables in the same pathway? Do I run my data cable in a conduit or cable tray? What cable tie should I be using? How do I ensure proper fill ratio for future expansion?" The answer is typically the same: "Well, that all depends . . ." For the answer to these questions and a host of others, it is necessary to understand why and how a data communications infrastructure is designed and implemented.

Table 1

Standards Body	Abbreviation
Alliance for Telecommunications Industry Solutions	ATIS
American National Standards Institute	ANSI
American Society of Civil Engineers	ASCE
American Society of Heating, Refrigerating, and Air-Conditioning Engineers	ASHRAE
ASTM International	ASTM
Building Industry Consulting Service International	BICSI
Electronic Components Industry Association	ECIA
European Committee for Electrotechnical Standardization	CENELEC
European Telecommunications Standards Institute	ETSI
International Code Council	ICC
Institute of Electrical and Electronics Engineers	IEEE
International Electrotechnical Commission	IEC
International Organization for Standardization	ISO
National Electrical Contractors Association	NECA
National Electrical Manufacturers Association	NEMA
National Fire Protection Association	NFPA
Telcordia Technologies	Telcordia
Telecommunications Industry Association	TIA
Underwriters Laboratories	UL

Structured cabling for data communications is a Standards-based system of cabling, connection methods, and hardware, consisting of distinct and well-defined segments including: entrance facility, equipment room, the work area, a consolidation point, horizontal and backbone cabling, cross-connects, cable management components, and equipment cords. Not all segments must exist to be defined as structured cabling. A single, well-designed structured cabling system can be thought of as a set of well-defined building blocks that reduce moves, adds and changes, installation time, and maintenance costs.

The design and implementation of a structured cabling system is based on industry Standards. In Table 1 the Standards bodies that define methods and best practices are listed. The Standards dictate all aspects of the build: the spaces that house the active and passive equipment, the copper and fiber connectivity, the cables carrying data and power, and delivery system or pathways running overhead or through the floors, ceilings, and walls, as well as cable and patch cord management.

ANSI/TIA 568 and 569 Standards govern the delivery systems for copper and fiber cabling.

The Space

At a minimum, the Standards specify a telecommunications room (TR), sometimes referred to as an equipment room (ER), which is an enclosed architectural space for housing telecommunications equipment, cable terminations, cross-connect cabling, and cable management. There must be a minimum of one TR/ER per floor. Floor space exceeding 10,000 ft² should consider a second TR/ER. Conduit entering the TR must be placed so that terminations are performed from left to right. There may not be any bends 1-2 in. into the room, and they should enter at least 8 ft. above the floor. The minimum ceiling height for each space should be 8 ft. with a recommended height of 10 ft. There must also be clearances of 3.28 ft. of unobstructed space around racks, cabinets,

and enclosures within the TR. Note: attention is to be paid in industrial/manufacturing spaces, as accommodations are necessary to comply with controls system architectures and harsh environments.

Bend radius guidelines must always be adhered to when determining placement of cable trays and conduit. It is recommended to feed a single TR with four 4-trade-size conduit or sleeves for horizontal cross-connect and a single 3-trade-size conduit or sleeve for interconnecting multiple TRs on the same floor. Standards specify that the bend radius shall not exceed the limitations of four times the diameter for solid copper cable (10 times for stranded copper), and a 2 in. minimum bend radius for optical fiber. The 2 in. bend radius for fiber was originally defined for legacy fiber to ensure high reliability. Today, however, both multimode and single-mode fibers are “bend insensitive” and can withstand tight bends (0.5 in. radius) with no impact on performance or reliability. Fiber cable management systems are designed to maintain minimum bend radii.

The Delivery System

The horizontal distribution system consists of trunk cabling, the pathways supporting the cables, and the data communications spaces that support the pathways. A horizontal cabling system may consist of many elements, but cable lengths must comply to application Standards. In Table 2, the maximum cable lengths for common data rates and media types are listed.

The cable types used in a structured cabling system do not dictate the type of pathways. The pathways used for distributing horizontal and backbone cabling from all associated connected hardware consist of two types: continuous and non-continuous. Examples of continuous pathways would be conduit, cable trays, and ladder racks. Non-continuous pathways would consist of J-hooks and cable clamps.

When designing the pathway, plan for changes over the facility lifecycle. Use standard components and cabling systems. The pathway must support multiple technologies and accommodate future moves, adds, and changes.

A conduit delivery system may not exceed continuous runs of 100 feet. Runs greater than 100 feet require pull points. Bends greater than 90° are prohibited. Aggregate bends may not exceed 180° between pull points. Conduit shall be grounded/bonded per Standards. Conduit fill shall not exceed 40 percent.

Cable trays are preferred over many systems due to their greater accessibility and their flexibility in accommodating moves, adds, and changes, and overall building structural changes. Cable trays are supported every 5.ft., with supports placed 2 ft. from each side of system fittings. All metal parts shall be grounded/bonded per Standards. Capacities are based on manufacturer’s guidelines and those of the AHJ. ANSI/TIA-569-E dictates maximum fill is not to exceed 50 percent. Some cable trays also provide the capability of separating telecommunications and power cables. See ANSI/TIA-569-E, Section 9.3 for specific best practices.

Table 2

Media Type	Ethernet Maximum Cable Lengths (meters)						
	100 Mb/s	1 Gb/s	10 Gb/s	25 Gb/s	40 Gb/s	100 Gb/s	
Cat 6	100	100	37	Not specified			
Cat 6A	100	100	100	Not specified			
OM1 ^a	2000	275	Not specified				
OM2 ^b			Not specified				
OM3			400	300	70	100	70
OM4				100	150	100	
OM5				100	150	100	
OS1 ^c			2,000	2,000	Not specified		
OS2	2,000/10,000/30,000/40,000 options						

^a OM1 cabling contains 62.5/125 micron multimode fiber

^b OM2 cabling contains 50/125 micron multimode fiber

^c OS1 cabling contains single-mode optical fiber

An access floor distribution system is a raised floor within the data center and equipment room. This floor is made up of 18-inch or 24-inch modular panels atop a structural floor via 6-inch-high steel footings. A minimum floor height of 12 in. is recommended if serving an ER or plenum. The access floor should not contain connecting hardware.

A ceiling distribution system is used when space between the structural ceiling and a suspended ceiling grid is accessible. The area must allow for 3 in. of clear vertical space above conduits and cables and 12 in. of vertical space above cable trays and raceway systems. Conduits, raceways, trays, and cabling must be attached to structural walls and/or ceilings via hardware specifically designed to support all anticipated weight. All pathways must allow for 3 in. of clear vertical space above the ceiling while cable “sag” must be no closer than 4 in. J-hooks for supporting the cabling infrastructure must be spaced no more than 5 ft. apart. The number of existing cables, weight of existing cables, and anticipated growth must be considered when sizing the support mechanism.

Surface-mount raceway serves the work area where telecommunication devices are accessed via walls and partitions. It is mounted directly to the wall and other surfaces, providing a multichannel medium for routing telecommunications and electrical cabling. When run horizontally, these metal, plastic, and wooden raceways are placed at baseboard and chair-rail levels. They are versatile in that outlets and connectors can be placed and mounted anywhere along the length of the run. Cable fill is based on manufacturer’s guidelines, with recommendations typically 20 to 40 percent.

Cable Types and Management Components

The cable type depends on the functionality and environment. In Table 3 the Standards-specified cable types are listed.

Plenum cable is the most common flame type, and CM is commonly used for patch cables.

Cable management is a major component within the cabling infrastructure system. Vertical and horizontal managers organize, manage, and protect network cabling and patch cords. They ensure bend radius compliance while protecting cabling from inadvertent snagging, abrasion, and other damaging forces.

Cable ties, hook and loop, and cable straps are vital to cable management. They are used to harness, bundle, and secure cables. Since they are of a multitude of materials, it is important to follow manufacturer’s guidelines for best practices.

To avoid issues when designing and deploying a telecommunications infrastructure, it is imperative to use Standard-compliant components, follow Standard guidelines, implement manufacturer’s best practices, and adhere to local codes. Doing so will eliminate costly changes in the future, unpredictable downtime, and negative strain placed on a business’s network. ☞

References:

1. ANSI/TIA-568
 - a) ANSI/TIA-568.0-D “Generic Telecommunications Cabling for Customer Premises”
 - b) ANSI/TIA-568.1-D “Commercial Building Telecommunications Cabling”
 - c) ANSI/TIA-568.2-D “Balanced Twisted-Pair Telecommunication Cabling and Components”
 - d) ANSI/TIA-568.3-D “Optical Fiber Cabling Components”
2. ANSI/TIA-569
 - a) ANSI/TIA 569-E “Telecommunications Pathways and Spaces”
 - b) ANSI/TIA-569
3. IEEE 802.3at “Power Over Ethernet” (PoE)

Table 3

Cable Type	Application
Riser	Used as general-use riser and horizontal cable. Not for plenum spaces.
Plenum	Used as riser and horizontal cable in plenum spaces. Can be used in general areas also.
CM	Used as general-use riser and horizontal cable. Not as high a flame rating as riser.
LSZH	Low smoke zero halogen. Used in plenum spaces when code prohibits plenum rating.



Get Smart About a Better Building Occupant Experience

The relationship between commercial property developers and their tenants is evolving. Across the country, there is a growing trend toward building systems that create more value for real estate developers, building owners, property managers, and occupants alike.

All these people have different, but complementary needs with a common goal of creating an overall better occupant experience. And owners are prioritizing solutions that help attract and retain both top talent and long-term tenants by:

- Enhancing the occupant experience and providing desirable amenities
- Optimizing building operations
- Reducing energy use

- Making that experience seamless across their building portfolio

Lighting controls and window shading solutions already play a major role in a building experience that enhances occupant comfort and saves energy, but moving forward, networked lighting control solutions will have to contribute to additional building occupant and owner goals while enabling an elevated human experience within the built environment.

Let's consider three essential lighting control technologies: daylight sensors, occupancy sensors, and tunable, white-light fixtures. Each of these plays an important role in building systems that enhance building value. To keep up with changing expectations they are going to have to incorporate new features and higher-level functionality.



Pekka Hakkarainen

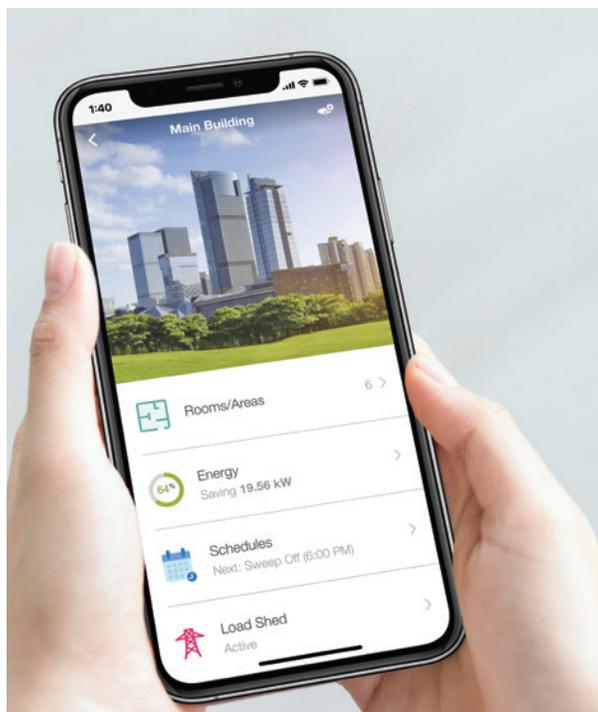
Pekka Hakkarainen is Vice President of Government and Industry Relations at Lutron Electronics Company Inc.

Sensors Offer So Much More Than On and Off Switching

Daylight and occupancy sensors, for example, are already engrained as staples of any code-compliant, lighting-control solution. But that’s just the beginning of the story. Daylight sensors are broadly deployed to help adjust electric light in response to available daylight, but most designs still rely on manual shades or mini blinds as the main mechanism for daylight control. This not only limits the benefit of the daylighting sensors but also, most of the time, these blinds just stay closed.

The future of networked lighting control must incorporate control of both electric light and daylight via a dynamic daylight management system. This holistic approach will increase energy savings, and it also provides greater access to views and “natural” light throughout the space.

Occupancy sensors fall into the same category—essential to any energy-efficient lighting design, but with so much more potential. As sensor capabilities expand to easily share actionable data with other building systems, they become a key tool for space optimization and building management. They have the ability to provide rich data about how individuals use building space and can integrate with specialized occupant apps that are being developed to put control and customization into the hands—or smart phones—of individual employees.



As building owners adopt technologies designed to enhance workforce productivity and engagement, lighting controls will have to integrate seamlessly—plug-and-play integration will be the key to broad adoption of any lighting control platform.

Lighting as a Key to More Comfortable, Flexible Spaces

Tunable white is a big topic of conversation, but it has not yet become a mainstream technology. At this point lighting control manufacturers are paying close attention to ongoing, academic research into the power of tunable white lighting and the potential impact of human-centric and circadian lighting.

Groundbreaking technologies such as natural lighting systems are already delivering the next generation of beautiful, customizable illumination, full-spectrum, saturated color, and advanced control integration that will be easy to deploy—even in retrofit situations. The goal is to provide building owners and occupants with adaptable, flexible control that enables quick, easy adjustments to accommodate changes to space design, furnishings, or other materials integral to the overall comfort of a space.

Smart building solutions are at the edge of a new technology frontier. As building owners refine relationships with their tenants, they’ll count on manufacturers to provide solutions that contribute to higher occupancy rates, greater building value, and long-term tenant relationships.

From simple energy retrofits to full-scale smart building integration, lighting control providers understand the opportunity to enhance value by delivering systems that grow with expanding real estate portfolios and deliver ever-better experiences for both the owner and the occupant. 🌐

Philip Squair

Vice President of Government Relations, NEMA

NEMA Keeps Active on Capitol Hill

It was a consequential summer for NEMA and the electroindustry on Capitol Hill. NEMA has advanced legislative proposals on surface transportation, industrial efficiency, appropriations, carbon monoxide detection, and cyber modernization of the grid.

Most recently, the U.S. Senate Environment and Public Works Committee passed a surface transportation bill that authorizes \$1 billion over five years for a comprehensive build-out of the electric vehicle charging infrastructure along designated corridors. Legislators will now debate how to fund the bill's various provisions.

NEMA also had a significant hand in the drafting of the Energy Savings and Industrial Competitiveness Act, introduced on July 17 by Sens. Rob Portman (R-OH) and Jeanne Shaheen (D-NH). This bill includes two rebate programs for (1) inefficient transformers and (2) certain electric motors and associated automatic controls.

Other positive provisions in the bill would strengthen national model building codes to make

new homes and commercial buildings more energy-efficient and create a new grant program to assist home builders, trades, and contractors to implement cost-effective, updated building-energy codes.

NEMA has lobbied for funding for electroindustry priorities at the Department of Energy. The Senate Energy and Water Appropriations bill for FY2020 bill recommends "\$30,000,000 for research, development, demonstration, field evaluation, and commercial application activities related to advanced solid-state lighting technology development."

Finally, NEMA has been very active in trying to ensure that Congress does not pass legislation incentivizing or otherwise supporting analog grid technologies. A provision has been added in both the House and Senate versions of the Intelligence Authorization Act to establish a two-year pilot program to identify new classes of security vulnerabilities and evaluate technology and Standards to isolate and defend industrial control systems, including analog and nondigital control systems. ☺

Craig Updyke

Director, Trade and Commercial Affairs, NEMA

Section Covers Spectrum

Members of the Transportation Management Systems and Associated Control Devices Section braved Washington, D.C., traffic to visit the U.S. Department of Transportation (DOT), Capitol Hill, and three counterpart organizations on Sept. 25 and 26. Central to each discussion were deployment of connected vehicle systems and the communications backbone represented by a dedicated band of the radio frequency portion of the electromagnetic spectrum.

Diana Furchtgott-Roth, deputy assistant secretary of transportation for research and technology, emphasized the DOT technology-neutral approach to facilitating private-sector-driven solutions. On the Hill, the group strategized on spectrum management with Republican staff for the Committee on Energy and Commerce and on contracting for roadside technology with Rep. Rick Larsen (D-WA), a member of the Transportation & Infrastructure Committee.

In separate meetings with the American Association of State Highway and Transportation Officials (AASHTO) and the Intelligent Transportation Society of America (ITS America), the group identified common ground and potential joint work items. In addition, the Section's meeting featured an interactive presentation by the American Traffic Safety Services Association, which also generated collaboration plans. ☺



Visiting Capitol Hill were (l-r): Timothy McCall (Eberle Design), Jason Morrison (Daktronics), Bryan Mulligan (Applied Information), Steve Griffith (NEMA), Joseph Dudich (Eberle), Steve Bowles (360 Network Solutions).

NEMA 05VS Brings Clarity to a Confusing Market

For many years, surge protective device (SPD) specifications have been a source of confusion in the marketplace. While NEMA wants manufacturers to be competitive and to promote their specifications, some must be standardized, benefitting both the industry and the market.

As such, the NEMA Low Voltage Surge Protective Devices Section (05VS) has developed and published NEMA SPD 1.1-2019 *Surge Protective Device Specification Guide for Low Voltage Power Distribution Systems*, which is available for purchase from the NEMA website.

To quote a portion of the foreword of the publication,

“This guide represents the consensus of the NEMA Low Voltage Surge Protective Device Section 5VS. It is intended to serve primarily as a guide for those who use or specify SPDs and others

affiliated with the Low Voltage SPD marketplace so that uniformity of specifications in terms of valid, understandable parameters, will improve the comprehension, application, and utilization of SPDs ...”

The guide is not intended to introduce new Standards, derive tests, create an evaluation methodology or define extensive vocabulary. Rather, it is intended to provide the reader with information and a specification checklist for ease of use and comparison by the user or specifier of SPDs.

This guide, along with the information found on the 05VS website, www.nemasurge.org, will benefit the industry at large. 🌐

Updated Standard for Electric Lamps Includes Revised Specification Sheets

Ann Brandstadter

Manager, Standards Publications and Marketing, NEMA



American National Standard for Gauges for Electric Lamp Bases and Lampholders is a lighting industry Standard that now includes updated specifications for base gauges (caps) and lampholders for electric lamps, including ANSI and IEC lamp base (cap) and lampholder gauge sheets. **ANSI C81.63-2019** is available for \$500 in hard copy and electronic download.

NEMA 260-1996 (R2004, R2019) *Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas* is available for \$64 in hard copy and for no cost in electronic download.

NEMA ICS 3.1-2019 *Guide for the Application, Handling, Storage, Installation and Maintenance of Medium Voltage AC Contactors, Controllers and Control Centers* is available for \$175 in hard copy and for no cost in electronic download.

NEMA CPSP 3-2019 *Cyber Hygiene Best Practices Part 2* is available for no cost in electronic download.

NEMA RR P1-2019 *Best in Class Roadmap for Resilient Distribution Systems* is available for no cost in electronic download.

NEMA/MITA DD P1-2019 *Understanding the Limited Usefulness of Detector Dose Measurements in Modern Medical X-ray Imaging Equipment* is available for no cost in electronic download.

NEMA/MITA RMD P1-2019 *Considerations for Remanufacturing of Medical Imaging Devices* is available for no cost in electronic download. 🌐

Innovation and Technology Drive Proposed Changes to International Energy Conservation Code

Energy conservation, efficiency, and sustainability have become fundamental considerations in the building environment. The effective use and conservation of energy for a building no longer take a back seat to code requirements related to life and fire safety. This change is due to advancements in technology being incorporated into the development of national energy codes.

Evidence of this can be found in the development of the 2021 *International Energy Conservation Code*, where many proposed changes are driven by innovation and technology. Below are several of the highlighted changes that are currently under consideration:

Residential Occupancies

Residential lighting systems consume a considerable amount of the total energy used in a dwelling. To reduce this consumption, progressive light source efficacy and control requirements are being proposed. The proposals include exterior lighting. Interior lighting controls, electric-ready features, and EV-ready provisions are also under consideration.

Commercial Occupancies

Commercial lighting and lighting controls have been a major focus during this code development cycle. Improvements to the code related to lighting include:

- Reduced lighting power densities (LPDs) permitted for both interior and exterior spaces of a building
- New requirements for lighting dedicated to plant growth and maintenance
- Daylight-responsive control enhancements and clarification
- New requirements for parking garage lighting controls
- Revisions related to occupant sensor control, time-switch control, and light-reduction control

A software platform that converts data provided by sensors and devices to automatically identify faults in building systems and provides a prioritized list of actionable resolutions based on cost, comfort, and maintenance impact—called a “fault detection and diagnostics system”—will be incorporated

into the code. This advanced technology will be mandatory for buildings having a gross conditioned floor area of 100,000 square feet or more or can be installed to achieve additional energy-efficiency credits when the system is not required by the code.

Automatic receptacle control and energy monitoring requirements similar to what is required in ASHRAE Standard 90.1 *Energy Standard for Buildings Except Low-Rise Residential Buildings* will be added to the code as mandatory requirements or possibly as two separate options to achieve additional energy-efficiency credits.

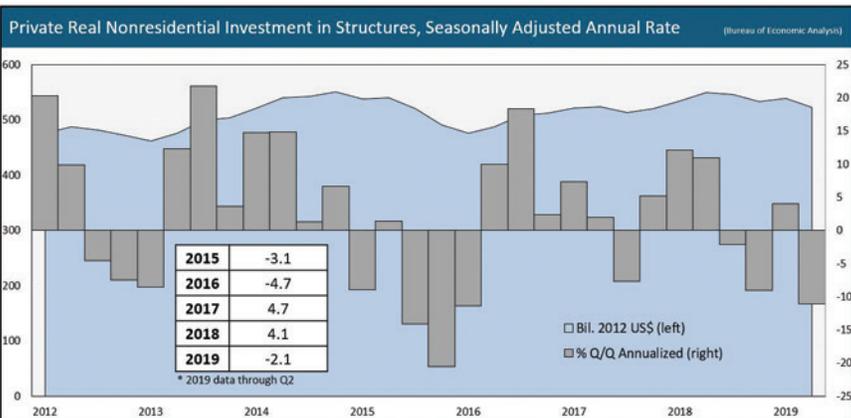
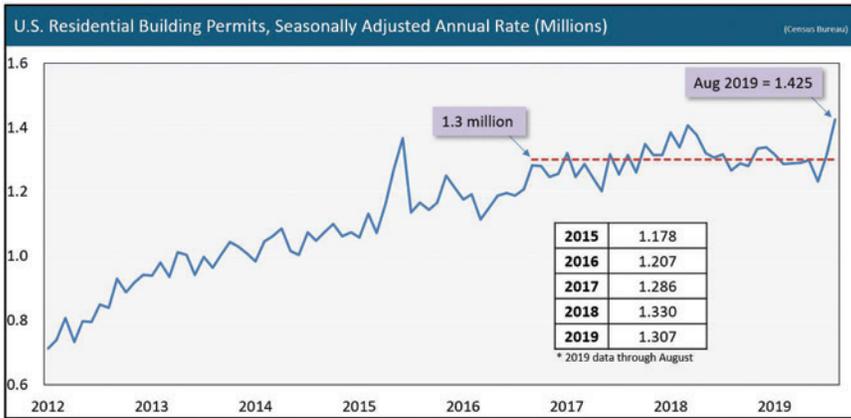
New requirements for “electric vehicle-capable” and “EV-ready” provisions have been proposed for inclusion as a mandatory requirement of the code or as an option to achieve additional energy-efficiency credits. Every qualifying parking lot or parking garage will be required to provide a certain number of EV-capable and EV-ready spaces. An EV-capable space is one that provides electrical panel capacity and space, and includes the installation of raceways to support the electric vehicle supply equipment (EVSE). An EV-ready space is one that is provided with a dedicated branch circuit that terminates at a receptacle, junction box, or the EVSE.

The 2021 *International Energy Conservation Code* will also begin to consider energy production and energy storage systems (ESS) as two methods to properly conserve and effectively use electrical energy. This includes on-site or off-site solar photovoltaic energy and other renewable energy sources and the use of ESS controlled by an energy management system and programmed to shift the load from on-peak to off-peak time schedules based on energy generation demands.

Innovation and technology will be the driving force in real and sustainable energy reduction, conservation, and effective use of electricity in the built environment. Zero-energy, carbon-neutral, and other progressive energy policies will heavily rely on the innovation and technology developed by the electroindustry. NEMA and our Member companies will continue to be a driver of energy-efficiency and conservation solutions. 🌱



Electrical Construction Activity Expected to Wane as Economy Slows



Electrical construction is a primary end market for the electrical manufacturing industry. This market is prone to booms and busts as business cycles wax and wane. The Great Recession, which centered on overleveraged housing investments, ushered in an unprecedented era of stagnant household formation and tepid demand for housing. Households struggled to unwind big bets on home appreciation while the economy tanked.

After more than 10 years of economic expansion, annual housing starts remain nearly one-third below the pre-recession pace. The subdued housing demand is tied to several factors:

- Housing affordability is challenged by rapid home price appreciation, tight credit markets, and high debt loads by prime-age potential homeowners
- Construction costs have soared as construction labor supply diminished during the recession and failed to bound back. The prices for raw materials such as lumber and concrete as well as land close to booming job centers has jumped sharply as well
- Household formation has barely budged as young adults remain at home or room with other young adults struggling to save up for a down payment while paying down student debts. A slowing population growth rate is also weighing on household formation

Housing permit data suggest that demand for housing is recovering with permits averaging just over 1.3 million in 2019 compared to less than 1.2 million in 2015. Wage increases and declining mortgage interest rates will aid in the recovery.

Nonresidential construction is an even larger endmarket for electrical manufacturers. This market rebounded, buoyed by investment tax credits for energy investment and a surge in commercial real estate to satiate the growing appetite for sizable investment returns with low interest rates. Nonresidential investment has since pulled back and is expected to remain flat through 2021 as markets absorb existing inventory. A manufacturing downturn is reducing factory capacity utilization and, therefore, demand for manufacturing structural investment. Hospital construction is one of the few positive markets as the nation's population ages. 🇺🇸

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Some Products Escape China Tariffs

Although the Administration has continued to raise import tariffs on Chinese goods as part of its effort to reach an agreement on changes to a series of policies and practices that disadvantage U.S. companies there, the Office of the U.S. Trade Representative (USTR) has excluded many NEMA scope products in response to requests from importers. Among the products the agency has exempted are: specific types of ac and dc motors, bodies for gas circuit breakers, ground fault circuit interrupters, arc fault circuit interrupters, lighting control switches, and certain types of copper wire. Products may be excluded on the grounds that they are not associated with China's industrial policy, China is the only source, or that

additional U.S. tariffs cause severe economic harm to U.S. importers. Once granted, an exclusion for a specific type of product can be used by any importer, regardless of whether the importer filed the request. However, USTR has rejected many exclusion requests for NEMA scope items, citing alternative sources of supply or links to Chinese industrial planning.

Tariffs on items remaining on USTR's tariff lists rose from 25 to 30 percent on October 15. USTR's fourth target list of products facing 15 percent tariffs was bifurcated; a first tranche saw tariffs take effect on September 1 while tariffs on the second tranche are scheduled for December 15. ☯

Craig Updyke

Director, Trade and
Commercial Affairs, NEMA

Gustavo Domínguez Poo

Director, Latin America, NEMA

Mexico and Brazil Considering Key Reforms

On August 23, the Economy Secretary of Mexico announced an initiative that could result in the replacement of the country's Federal Metrology and Standardization Law with a new Law on Quality Infrastructure (LIQ). In summary, the proposal aims to reduce the time needed to develop new Standards and keep the government at the head of the system of mandatory Standards and conformity assessment. At the same time, the LIQ is intended to provide for greater integration and consistency across the Standards system as well as provide authority to reach conformity equivalence agreements.

Mexico's initiative follows on a recent proposal made by Brazil's National Institute of Metrology Standardization and Industrial Quality (INMETRO) to reform and expand its regulatory reach and power. In short, the government found that current regulations cover only 12 percent of products it is authorized to regulate. To pursue 100 percent coverage, the agency intends to put in place general regulations for safety and performance that are to be supplemented as needed by sector-specific regulations. In the area of conformity assessment, INMETRO aims to make rules "less prescriptive and more flexible," with essential requirements that define the results to be achieved or the risks to be mitigated. ☯



The electricity sector may account for only 2 percent of U.S. GDP, but the other 98 percent of the economy depends on it virtually 100 percent of the time. Behind the electronics and electrical products that power modern life are essential—but largely out-of-sight—building infrastructure technologies. Said differently: “What’s behind your walls?”

The impact these quality products have on modern commerce and society cannot be restated often enough—NEMA Members power our country’s economy all the while doing so safely, reliably, and efficiently.

But there is more to come. The Internet of Things and electrification more broadly are introducing new products, sensors, and connected devices. Increasingly these products include sensitive and expensive onboard computers and digital controls that will need special levels of surety such as from surge protectors. This cost-effective capability can prevent downtime, improve system and data reliability, and all but eliminate equipment damage due to transients and surges for both power and signal lines.

The average home in the U.S. conservatively has \$15,000 worth of equipment that can be damaged by surges, but it is a common misconception that only lightning causes surges. And while surges, from lightning account for some 20 percent of events, many people think it is the leading cause. More than 80 percent of surges originate from internal building sources, such as those caused by starting and stopping any electrical load. And a whopping one billion dollars of insurance claims per year result when these sensitive pieces of equipment are not properly safeguarded.

NEMA successfully advocated for the inclusion of surge protective devices in the *National Electrical Code*®, which has been updated to add requirements for surge mitigation in residential dwellings. Further, NEMA recently published *NEMA SPD 1.1-2019 Surge Protective Device Specification Guide for Low Voltage Power Distribution Systems*, which educates users, provides clear guidance on how to specify these devices, and encourages contractors to purchase the reliably high-quality ones made by NEMA Members.

I urge you to join NEMA in promoting these sorts of products and systems by taking the opportunity to ask audiences of various types, “What’s behind your walls?” For more information about any of these activities, please contact Danny Abbate, NEMA Industry Director for Building Infrastructure (daniel.abbate@nema.org). To join NEMA, contact Vi Lilly, Membership Director (vi.lilly@nema.org). ☎

Kevin J. Cosgriff
NEMA President and CEO

Coming Next Year

March/April

Lighting Systems

Connected lighting

May/June

Transportation Systems

The Internet of transportation

July/August

Building Systems

Energy management

September/October

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18. Signature and title of editor: Jena Passut, Managing Editor. Date, September 30, 2019. I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested in the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

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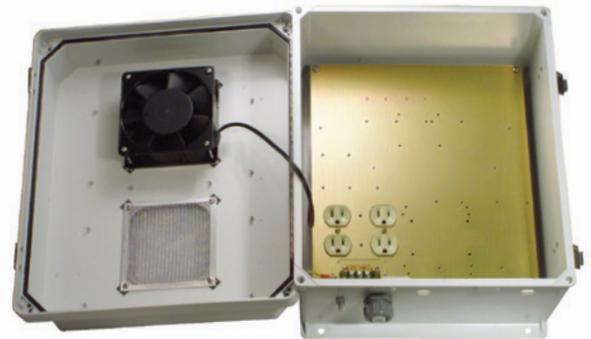


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