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- IPC APEX Expo 2022
- Benefits of Overmolded Assemblies
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- Quicksand! The Danger of Overcommitting
- Tips to Help You Make Your Company Great
- Altering Design Parameters to Strip Fluoropolymer Cable Jackets
- Battery Show and Electric & Hybrid Vehicle Technology Expo

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Company Profile: CVG's Global Wire Harness Group

By Joe Tito
 Wiring Harness News

From its beginnings, CVG (Commercial Vehicle Group, Inc.) was assembled as a company that provides a vast array of products to commercial vehicle OEMs. Headquartered in New Albany, Ohio, CVG is a global provider of components and assemblies into two primary end markets - the global vehicle market and the U.S. technology integrator markets. The company provides components and assemblies to global vehicle companies to build original equipment and provides aftermarket products for fleet owners. They also provide mechanical assemblies to warehouse automation integrators and to U.S. military technology integrators. CVG has built a rather

extensive array of products and systems meeting the worldwide needs for trucking, construction, military, bus, agriculture and other specialty transportation markets. They produce everything from trim components to headliner systems, structural components, mirror and wiper systems and, of course, electrical wiring systems. Wiring Harness News recently spoke with Rich Tajer, Senior Vice President and Managing Director of the Global Wire Harness Group.

"If you look at some of the major commercial truck manufacturers, you will see our seats and many of our cabin assemblies, wipers and structural components," Rich stated. He explained that the Wire Harness Group was created through the acquisition of two specialty harness companies in the early 2000s, Monona Wire and the later acquisition of



Rich Tajer, Senior Vice President and Managing Director of the Global Wire Harness Group.

PEKM in the Czech Republic and the Ukraine. Monona had a North American footprint with the main manufacturing facility in Agua Prieta, Mexico, just over the border from Douglas, AZ. Both companies fit into CVG's growth model as each brought unique strengths to the table.

"For Monona, it was a chance to diversify because they really weren't in the trucking business at all," Rich explained. "We were very strong in the construction and agriculture market, so we were used to even lower volume and higher complexity than commercial trucking." PEKM was already well established in the passen-

ger vehicle industry, with a major European OEM as their main customer. This offered CVG a good blend of manufacturing capabilities to build upon.

Rich actually joined the company in 2019 with a solid understanding of electrical systems and high voltage systems from a global perspective. "I came here from a large electrical system automotive supplier where I lead a \$1B electronics and specialty wiring systems group, with the intent on taking CVG to a new place," he informed. "Our heritage has been

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Partnership Helps Supply Chain Issues With Components

A new partnership is helping solve supply problems for backshells, battery lugs, and related components.

Intercable, a prominent global manufacturer of backshells, bus bars, battery lugs and plastic parts, is partnering with distributor Eurotech Direct to bring a sustainable reliable supply chain for these high-demand components to the domestic automotive market.

Recently a large portion of the backshell/adaptor market became unavailable after Schlemmer, a former

manufacturer of these components, claimed bankruptcy. The partnership between Eurotech and Intercable aims to fill the space left by the Schlemmer departure.

The partnership will offer these components at what the companies believe to be competitive global pricing. Full expert technical support will be available across multiple time zones from Eurotech. The partnership also promises consistency of supply for these components as neither has

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New Technology for Smart Wiring Systems

By Joe Tito
 Wiring Harness News

It's unlikely wiring systems will ever be totally displaced by technology.

Whether it's automotive, specialty transportation, military, or aerospace, innovation tends to enhance the critical nature of wiring systems. But because of weight and cost constraints, there is always a push towards technology to eliminate wire from vehicles and airframes.

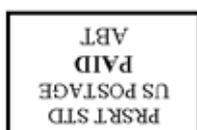
One such technology was revealed to *Wiring Harness News* at The Battery Show in Novi Michigan this past September. Martin Technologies announced their new Electronic Smart Power Distribution Module (eSPDM) earlier that week. WHN had a detailed discussion with Michael Van Steenburg, Global CTO at Martin Technologies, about the company, the product development story, and how the new technology works.

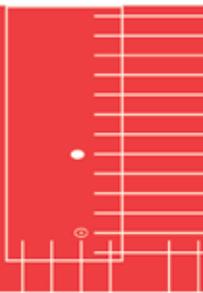
Martin Technologies is deeply involved in the engineering, develop-

ment and manufacturing of components for vehicle electrification in the automotive, aerospace, defense and marine sectors. "Our founder, Harold Martin, began as a GM engineer and helped develop the Cadillac Northstar 32-valve engine along with about 20 other engines from a clean sheet of paper, and has 10 world patents to his credit," Michael revealed. Coming from a successful history in drag racing, they most recently were chosen to build all the harnesses for the Dodge Challenger Mopar Drag Pak.

The company has developed wire harnesses for years in the transportation field, working with other companies like Amphenol in both low and high voltage programs. With all of their varied accomplishments, Martin Technologies was awarded a grant to work with an Israeli defense company to develop an electronic smart power distribution module. The first iteration was proven in various military applications. It's already operat-

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Recent partnership will help solve supply chain issues for backshells and high-voltage components.

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Greetings Readers,

Wiring Harness News was extremely pleased to have exhibited at the recent Battery Show and Electric & Hybrid Vehicle Technology Expo in Novi Michigan this past September. Last year's show was canceled because of...well, you know why it was canceled...I'm tired of mentioning it. This year's show was particularly encouraging for a couple of reasons. First, we didn't really know what to expect. Informa does a great job promoting, but we weren't sure how many folks would turn out to exhibit and attend. I mean, this was our first show since the...well, you know.

I can't begin to tell you how pleased we were to see so many folks in attendance and enthusiastically engaged in commerce. Some folks had masks, some folks didn't have masks, and no one seemed to care one way or the other. People were exchanging ideas, making new contacts, and planning new business. It was a truly refreshing and upbeat atmosphere after the last couple of years.

The second reason we came away so energized, was the number of folks that came up to our booth and asked, "Where can I get harnesses built?" A number of folks saw the words 'Wiring Harness' and ran up and said, "Do you guys build harnesses?" They didn't even see the word 'News,' they were so excited they may have found someone to build their harness!

So, here's my advice (and the reason for my silly graphic in the margin). If you have the capacity, and are at all interested in building harnesses for the EV market, then I recommend attending and networking at next year's event. Heck, you might even consider exhibiting. You wouldn't need much of a message on your booth backdrop other than, 'We Build Harnesses!'

So, we will hopefully see you in 2022 at the WHMA Annual Conference, IPC APEX, The Electrical Wiring Processing Technology EXPO, or The Battery Show. It's time to get back out on the trade show circuit!

Kindest Regards,



PS: You can also tune in to The Battery Show Digital Days in early November. See details on page 52.



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Disruptive Technologies Expert David Pogue to Keynote IPC APEX EXPO 2022

Each year, IPC APEX EXPO features industry's most dynamic, innovative minds to deliver keynote presentations that are both educational and entertain-

ing. IPCAPEX EXPO 2022 will feature New York Times Columnist, Emmy-Winning CBS Sunday Morning Contributor & NOVA Host David Pogue. During his keynote on January 25,

Pogue will present, "Disruptive Tech: How it Will Affect Your Business and What's Coming by 2026."

Drones and robotics, AI, self-driving cars, employee-less stores, flying taxis, wearable medical sensors, software, and components are accelerating the arrival of new consumer technologies—and with them, changes to society and culture. With 30 years of experience reporting technology trends—and the entertaining style that has earned him six Emmys for his "CBS Sunday Morning" stories—Pogue will take keynote attendees on a wild ride through the cutting-edge science and technology that is powering a next wave of technological innovation. His funny, fast-paced snapshot will bring everyone up to date - with a heads-up on how to succeed in a world we've never seen before.

"With broad appeal to general, business, healthcare, and tech audiences alike, David will bring his expansive knowledge, engaging wit, and perhaps a song or two to the APEX EXPO keynote stage," said Alicia Balonek, IPC senior director of trade shows and events. "The audiences will leave as informed as they are entertained, with an enlightened perspective of the state of technology today — and how it's shaping everyone's tomorrow."

Pogue's keynote is free to all IPC APEX EXPO participants. In addition to Pogue's keynote, John Mitchell, IPC president and CEO will deliver a keynote on Wednesday, January 26. Meetings and courses will run January 22-27; the technical conference and exhibition will run January 25-27, 2022. For more information on schedule and registration options, visit www.IPCAPEXEXPO.org.

About IPC

IPC (www.IPC.org) is a global industry association based in Bannockburn, Ill., dedicated to the competitive excellence and financial success of its 3,000+-member company sites which represent all facets of the electronics industry, including design, printed board manufacturing, electronics assembly and test. As a member-driven organization and leading source for industry standards, training, market research and public policy advocacy, IPC supports programs to meet the needs of an estimated \$2 trillion global electronics industry. IPC maintains additional offices in Washington, D.C.; Atlanta, Ga.; Miami, Fla.; Brussels, Belgium; Bangalore and New Delhi, India; Bangkok, Thailand; and Qingdao, Shanghai, Shenzhen, Chengdu, Suzhou and Beijing, China.



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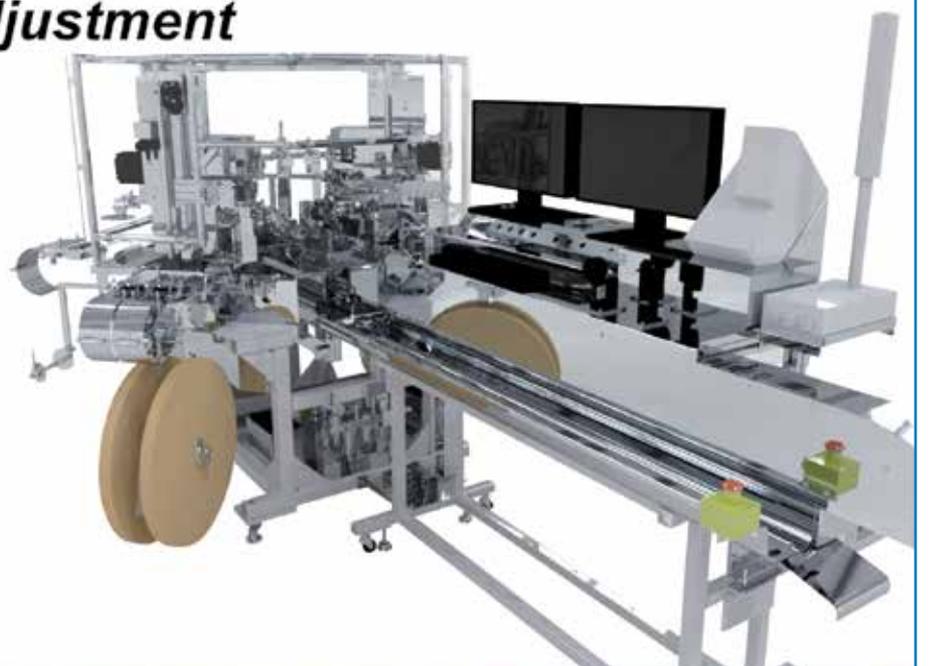


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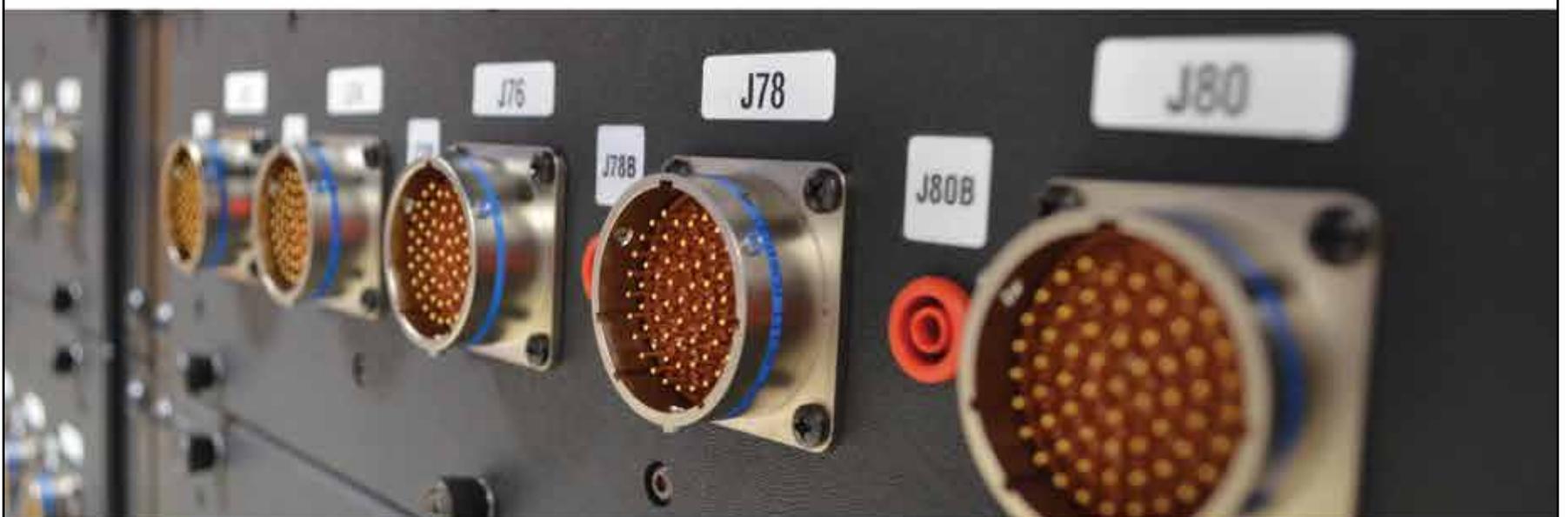
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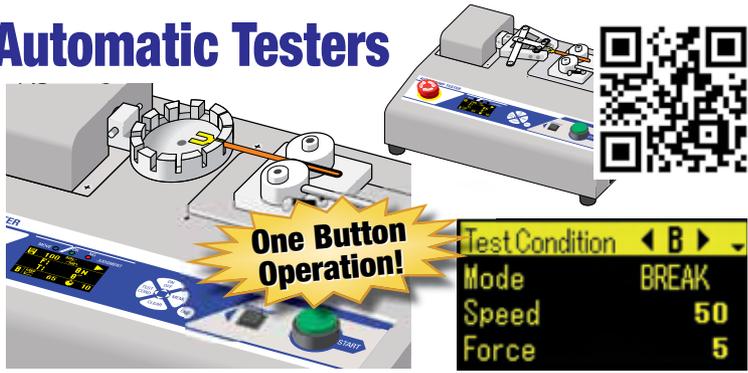


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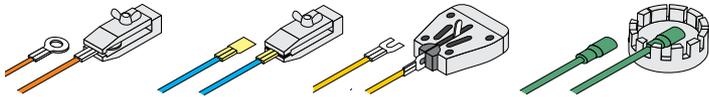
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Correction

On Page 48 of the Sept/Oct issue we incorrectly identified Figure 3 for Linear Welding. Following are the correct figures and labels. See the full version of the corrected article in the archives at www.wiringharnessnews.com

Figure 3. Linear Welding

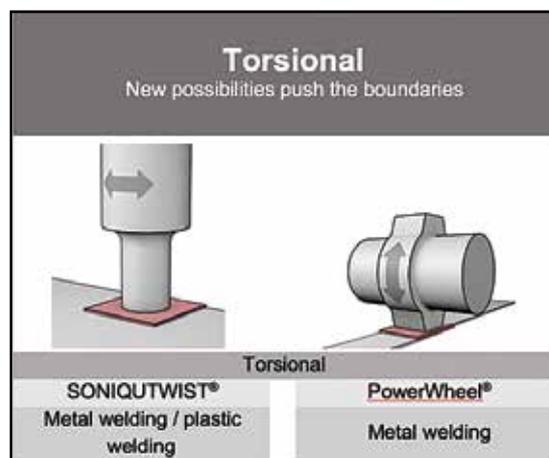
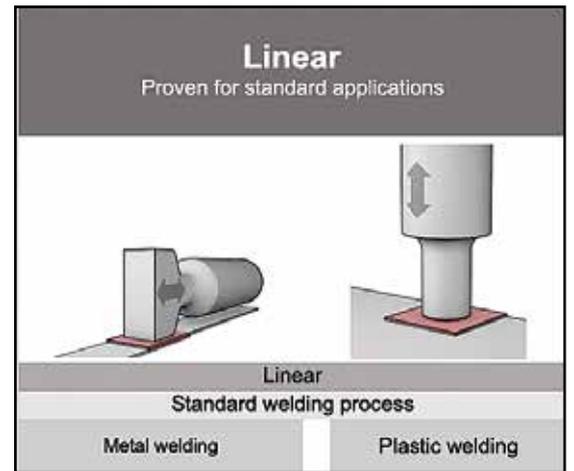


Figure 4. Torsional Welding

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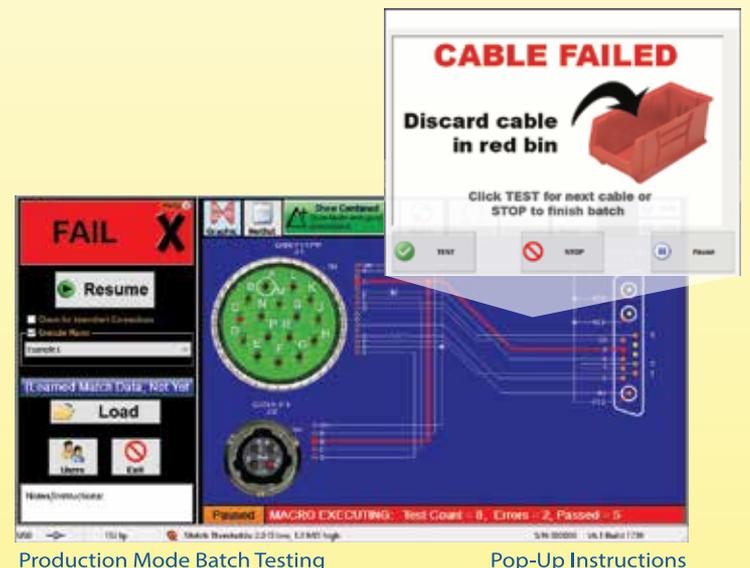
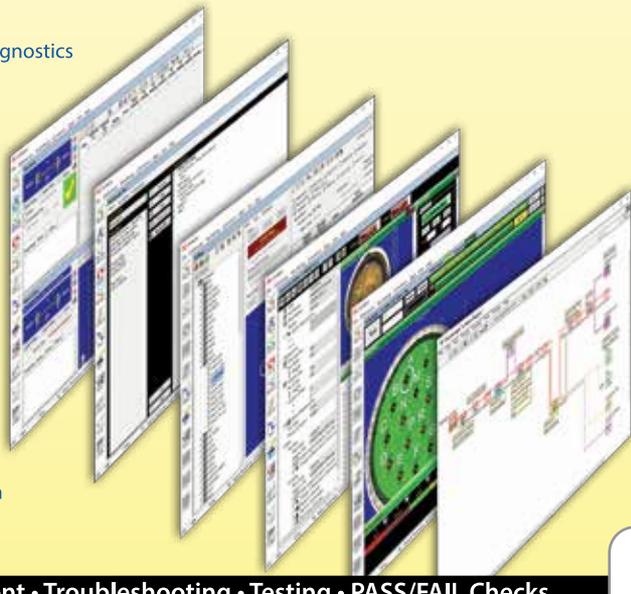
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NEWS PLUGS



IEWC Announces Acquisition of CABLCON

IEWC is excited to announce the acquisition of CABLCON, an industry-leading supplier of custom broadband cabling and fiber and copper connectivity solutions, in a strategic move that continues IEWC's dynamic growth in the North American telecom, central offices and data center markets.

"CABLCON's long history of success in telecommunications makes them a compelling addition to the IEWC team as we

expand our support of telecom in North America," said Mike Veum, Chief Executive Officer of IEWC. "IEWC is a leading global provider of wire and cable materials to manufacturers and sub-assemblers in an array of market verticals and maintains a strong presence in telecom and data centers in the UK and US. This acquisition of CABLCON, in addition to our acquisition of telecom supplier Jupiter Communications last year, reinforces IEWC's commitment to become a leading connectivity solutions provider for telecom companies and data centers throughout the world, with a focus on North America."

Long-time customers of CABLCON, who are primarily wire-

less, wireline, and cable television system integrators and DC power contractors, will benefit from the extensive global supply chain and logistics capabilities of IEWC, along with its domestic and international network of distribution centers. Customers can expect to see increased availability, faster fulfillment, and broader product offerings as the two organizations integrate in the months ahead.

"CABLCON's 35-years of success boils down to consistently providing reliable, custom solutions for our customers and always evolving our product offering to leverage advances in telecom technology," explains Bryan Kadrich, CEO and owner of CABLCON. "We're excited to

join the IEWC family, who shares our passion for customer service excellence, and we're excited to increase our operational footprint in the US, Canada, and Mexico."

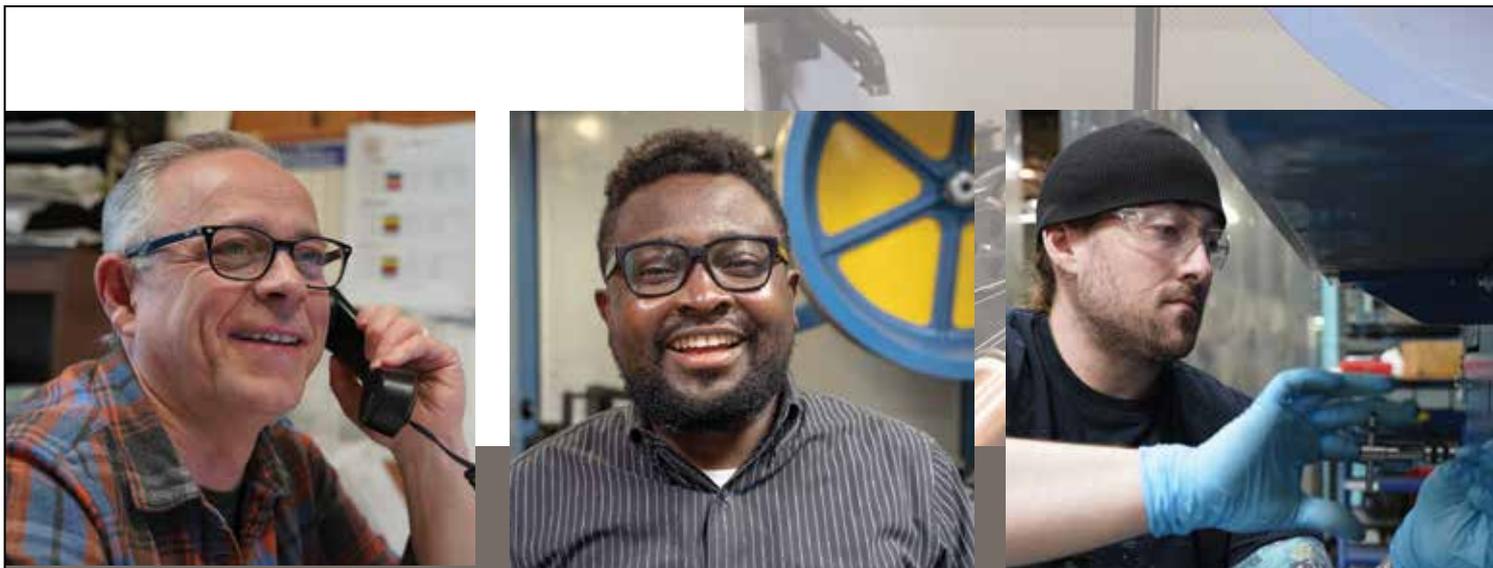
Kadrich will head up this new division for IEWC as President - CABLCON, continuing to lead the CABLCON team and operations based in Detroit, Michigan and Dallas, Texas. CABLCON was represented by Allegiance Capital in this transaction.

About IEWC - (www.iewc.com)

IEWC advances a connected world through comprehensive wire, cable, and wire management solutions. As global supply chain partner to thousands of companies in manufacturing, infrastructure, broadcast, professional audio-visual and telecommunications, IEWC has been an entrusted partner supporting customer supply chain, logistics and product quality initiatives for 59 years.

About CABLCON Communications - (www.cablcon.com)

CABLCON is an ISO 9001 and TL 9000 certified manufacturer of custom broadband cabling solutions. Founded in 1986 as a wire and cable distributor, the company evolved to become a top manufacturer of fiber optic management solutions, passive fiber optic equipment, as well as high-quality copper and fiber assemblies.



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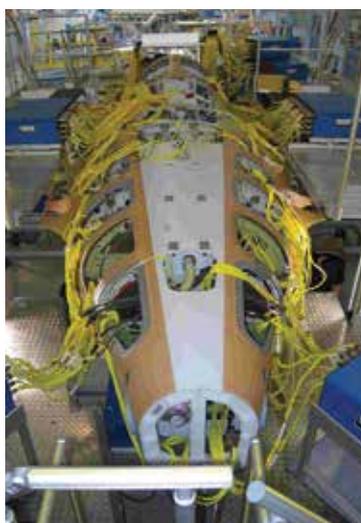


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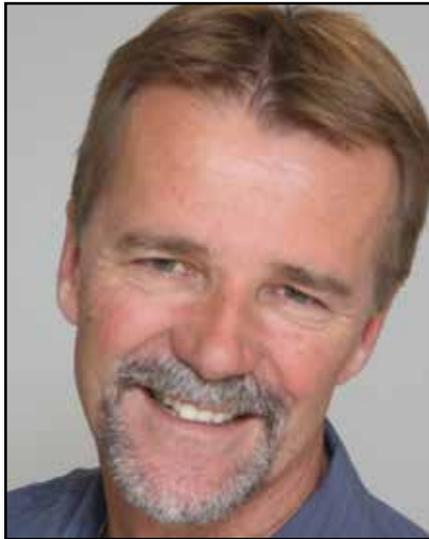
PUTTING INSIGHTS INTO ACTION

Leading for Success: Tips to help make your company great!

By Paul Hogendoorn

I'm continuing the series of sharing tips I've learned from manufacturing companies and leaders that I had the privilege of working with that were doing things well - succeeding and thriving, rather than just surviving. The tips are things I gleaned from people and companies that were doing it better than their peers, but no one company was doing them all. The idea behind this series was if all the top tips were shared and adopted, all of them could do even better than they were already doing.

In the first column, the two tips were: 1) "Don't make a big production of it", and 2) "Your people are the smartest people in the room". The first dealt with introducing new ideas and technology to the floor, and the second was to make sure you listened to the smart people involved in your day-to-day operation before relying on outside advice or influence. (If you missed it, you can



Paul Hogendoorn

find the column in the September/October 2021 edition on wiringharnessnews.com).

Tip #3: "What gets measured gets improved". You might've heard this before, but there's a catch - two actually. The first is "what" you measure is very important. If you measure the wrong thing, the improvements you make won't make much difference -

Continued on page 15

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THE POWERHOUSE OF ULTRASONICS

Leading for Success: Tips to help make your company great!

Continued from page 13

if any at all - to your operation. The best example I saw was a large tool & die company undertaking a major project to measure the OEE of their critical machines with the goal of improving that number. Several years into the project, and their second attempt at doing it, one very astute manager came to the conclusion they were focusing on the wrong thing. He observed that the time “under spindle” was relatively short compared to all the time that the pieces of work sat on skids at the end of aisles waiting for the next process to be run on them, and that minimizing the time between machining processes was a more pertinent objective than minimizing time under the spindle. The net result of measuring and improving that more relevant metric was a near 100% capacity increase in their facility, eliminating all overtime and outsourced operations as well as letting them compete for, win, and take on more work. The second catch is that to engage everyone in the improvement effort, the measurement must be shared in real time and be meaningful for the people actually involved in the work. Sharing reports at the end of a month may be good for plant managers and executives to review in their meetings, but that has little, if any, motivational or behavioural change value.

Tip #4: “You can get a lot more done when you don’t care who gets the credit”. I learned this one early on, from one of my mentors at the London Economic Development Corporation (“LEDC”). Steve (the folks there know who I’m referring to) was a master at this, quarterbacking all sorts of small and large initiatives and differing the credit to others. It was like he was making investments into the people that he knew could leverage the projects’ successes, and if he ended up placing great champions to lead them from that point

on, it would become a recurring win with an exponential result. Plus, he’d be freed to quarterback another project. One of his most successful endeavours was the formation of the “LRMC”, the London Region Manufacturing Council. He initiated it and then placed it in the hands of a series of people (myself included) that received a lot of the credit for what the organization accomplished. Twenty years later, his initiative continues to be a strong advocate for manufacturers in the region.

But there is also a catch to this tip too. Be careful that the right people get the credit. There are ‘credit tak-

ers’ in every organization who will quickly fill every credit void. Even worse, there are ‘dis-creditors’ (credit destroyers), people sensitive to the perception that when someone else looks good, it’s not good for them. To counter this, praise and credit should be shared publicly and evenly sprinkled over a larger group, but the primary praise and credit should be shared more specifically and shared up the ladder a couple rungs so that the individual may receive more opportunities to do even more great things for your company. Giving credit where its due adds to your own personal currency in the organi-

zation as well as puts another potentially impactful contributor on corporate radar. True winning team players are never afraid of having another high performer on the team. ‘Credit’ is an important currency and needs to be invested back into the business wisely. Be mindful of the reality that every organization has its credit takers and people bent on discrediting achievers.

Feel free to send me a note at Hogendoorn.paul@gmail.com if you have comments or if there’s a specific topic or question you’d like me to address in a following column.

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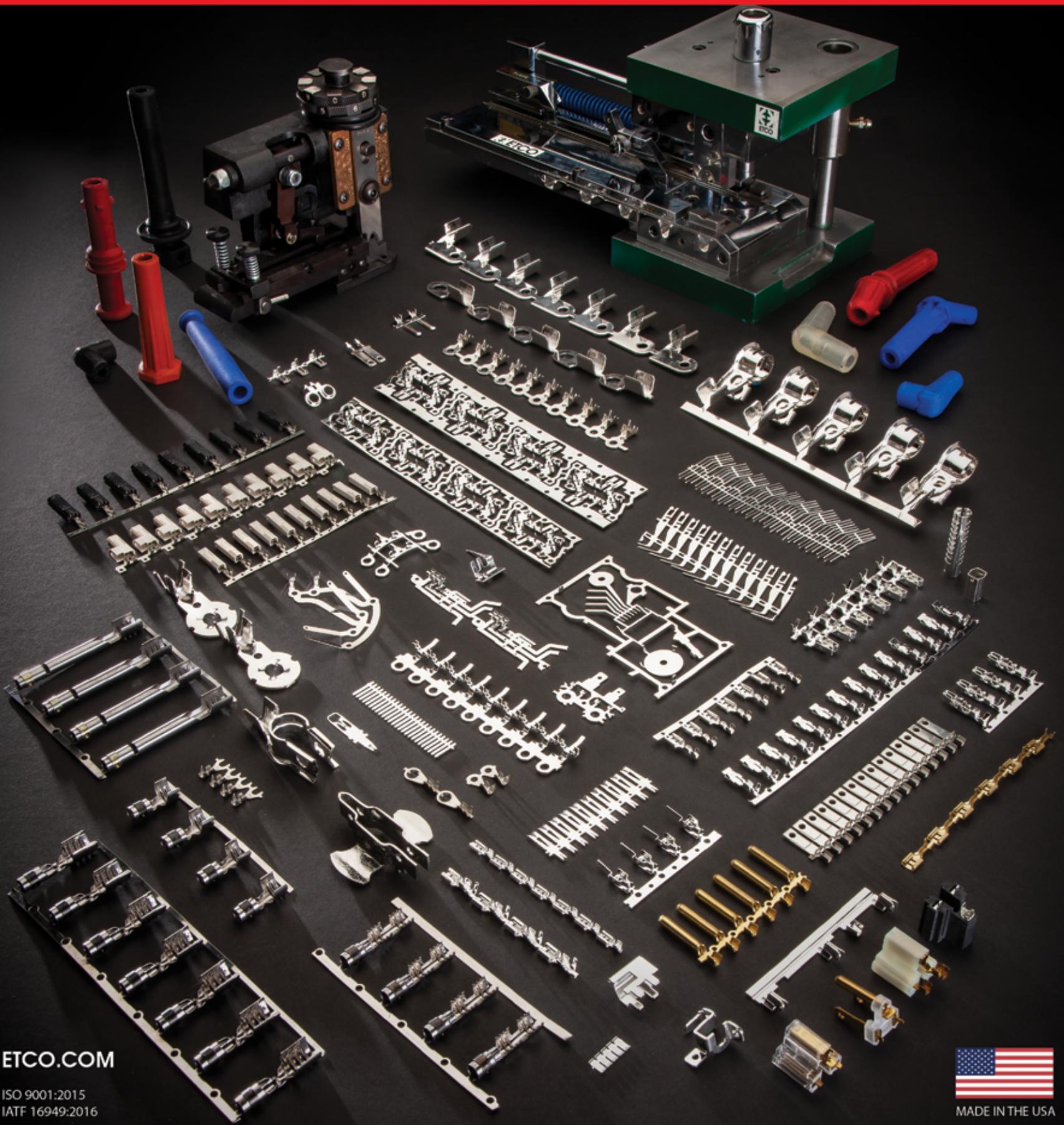
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M & A 101: Lessons learned from decades of deals

Quicksand! The Danger of Overcommitting

By Loren Smith

I recently heard from a harness owner who was scrambling to keep up with demand. Kudos to him for being so busy in the midst of a pandemic, but he anxiously expressed that he was trying to avoid quicksand.

It's a frightening visual, and I looked it up: "A colloid of fine granular material and water, quicksand forms in saturated loose sand when the sand is suddenly agitated. When water in the sand cannot escape, it creates a liquefied soil that loses strength and cannot support weight."

Right. Can't support weight. I've been there. Around the tenth year of my 25-year ownership of Monona Wire, our culture of intensive customer focus was paying off to the extent that we were consistently outperforming our competition. Our customers were honoring us with ever-increasing amounts of business. A nice problem to have perhaps, but I still remember it as the single worst experience in my years of owning a wire harness company.

Overwhelmed with more business than we could handle within the time frame our customers needed, we were forced to siphon customers to our competitors. And rather than regret that desperate move, I felt lucky to survive and vowed to prevent any chance of a recurrence of that predicament.

How did we avoid quicksand in the future? That is reflected in three commonalities I find today whenever I observe successful harness companies:



Loren Smith CEO
Blue Valley Capital

1) They are committed to rigorously monitoring capacity, recognizing the time it will take a new employee to become efficient and limiting the number of new hires coming in the door at any one time.

2) They properly screen potential new hires, such as by testing dexterity and math skills if those are two particular strengths essential to success in the prescribed role.

3) They provide full-time, one-on-one training to new employees so they are fully adept at their jobs before they do an ounce of work. Even smaller companies I am familiar with accomplish this, often by temporarily pulling experienced workers off their jobs to thoroughly train new hires before they hit the production floor.

Without full recognition of the number of new people who can be

brought in within a given period, and without highly effective screening and training, a harness company risks getting submerged in quicksand. And it's not always possible to escape.

Loren Smith can be reached at lms@blvcapital.com or www.bluevalleycapital.com.

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New Partnership Helps Supply Chain Issues for Backshells, Battery Lugs, and Related Components

Continued from page 1 _____

ever been the source for line-down issues across their customer bases.

“When COVID affected global supply chains, we were still able to supply our customers with everything they needed because of our standard and the relationships we have,” Jeff Gross, Vice President of Operations at Eurotech, explained.

Intercable Automotive History

Founded in 1972 with an expertise in the processing of plastics, Intercable has been developing and producing cable protection systems for the automotive industry since the early 1990s. In those early days, the company was a Tier 3 supplier. Through extensive product development and focus on customer support, the company has established itself as a solid Tier 1 supplier. Headquartered in South Tyrol, Italy, Intercable now has plants in Slovakia and China. They are a vital supplier of high-current components for e-mobility.

With many years experience in processing thermoplastics, Intercable’s cable protection systems are found in almost all car brands. They develop and produces components for trucks, agriculture, and special purpose vehicles. The company also produces a vast array of fasteners, clips, connectors, molded parts for cable protection systems, and, cable ducts.

The addition of connection systems, and specifically backshell components, to the product range has proved to be of great value to Intercable’s customers, especially with today’s dire supply chain issues. In addition to backshells, the company

also produces fastening clips, battery clamps, ring terminals and manifolds to provide strain relief for the branching of wires using conduit.

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Partnership Promises Supply Chain Reliability

Eurotech and Intercable firmly believe that this new distributor partnership will bring a sustainable, reliable supply chain for backshells, bus bars, battery lugs and plastic parts to the domestic automotive market. In light of the many companies that have left the market, Eurotech and Intercable are confident that this new relationship fills an essential space, allowing OEMs improved visibility of their supply chains and the elimination of issues related to these products. “Eurotech was built on excellent customer service and the quality of our product portfolio. Eurotech’s team and the organizations we’ve chosen to partner with reflect the same standard we use for customer service and quality,” Gross asserted.

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New Technology for Smart Wiring Systems

Continued from page 1 _____
 ing in Israeli military aircraft and armored land vehicles.

The eSPDM is a smart wiring system technology consisting of electronic power distribution modules

(Fig. 1). It has six channels with up to 13 amps per channel. “You can think of it as kind of a neural network instead of a wire harness,” Michael described. Onboard programming performs the function of switches, relays, actuators, circuit breakers and

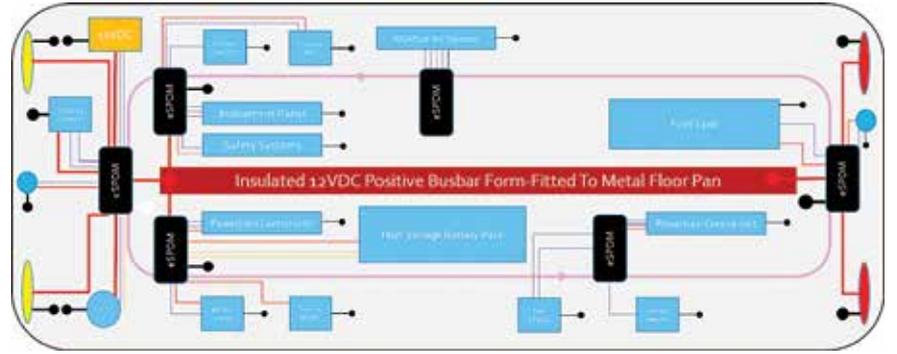


Figure 1. Basic Schematic of eSPDM.


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other legacy system controls. These modules perform all the signal and power functions of a large wire harness. They are connected by a central bus bar for power and typically use a single wire for signal transfer. “Your headlight switch no longer has to go all the way up to the headlights,” Michael said. “Now it goes to a module and then the module communicates to the other module and says, ‘hey turn the headlights on.’”

Instead of having large harnesses throughout the vehicle, you have the eSPDM modules connected by fewer, much smaller, milliamp wires. Martin Technologies also developed an encrypted communication method that can actually send signals over the power cabling (bus bar) at different frequencies and wavelengths to further reduce wiring.

The system is all solid-state and has a wide voltage range of 5V up to 60V DC. Initial applications have

been mostly with low-voltage, but the eSPDM’s is also adding high-voltage power for EV systems. “We have a high voltage daughter board that plugs on top of the eSPDM to control up to 800V power distribution systems for EVs.”

Michael sees the eSPDM as a way to integrate old and new technologies. “You’re still going to have wires; they will just be smaller. And now you can use a ribbon cable and even printed circuits instead of wrapped bundles of wire,” he instructed. This makes it much easier to route wires through the vehicle, airframe or machine apparatus. “It also gives us the opportunity to use composite body panels and use the chassis as a printed circuit board.”

The eSPDM also brings many new safety redundancies to the electrical system. Even if there is a fault in one module, or there is damage from an accident, there is a way for the oth-



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eSPDM Module

er modules to pick up the slack and help control critical systems at minimally functioning levels.

There are actually two additional levels of safety/protection offered by the eSPDM. “We have software that allows us to look at overcurrent, overvoltage or overtemperature type conditions on all circuits that we are powering, both inputs and outputs,” Michael conveyed. This detection happens in less than a microsecond. “So, we can actually detect a short before the wire even heats up,” he informed.

The next level of protection is with a cascade option that is configurable with over 20 flexible parameters for each channel individually. “In addition, it also tracks data, so it measures input voltage output voltage the load current temperature and it’s all communicable over a CAN bus or LIN bus,” he detailed.

Michael described the typical architecture for automotive applications of the eSPDM in more detail. “Basically, you have a flat bus bar that is form-fitted to the floor pan of the vehicle, and that’s where it gets its positive power from. Of course, the negative return is to the vehicle chassis, but we can also run a negative bus bar if the body is fully composite.”

Once installed, the eSPDM can actually configure itself to the entire electrical system. “Basically, you can install it in a vehicle or system, and it says, ‘ok, circuit 13 is the headlight.’ It will recognize the characteristics of the component, adjust the circuits to accommodate it, and repeat that function to map out programing for all the circuits” Michael explained. “We can even gang channels together and put them in parallel to provide more amperage to power a starter, for example.”

It was no surprise we ran into Michael at the Battery Show. With many EV platforms in development, he is hoping to get the technology specified in the development stage. He is confident that as the eSPDM enters service in newly developed EVs, the legacy manufacturers will recognize the viability of the technology and embrace it. He was very excited to mention the eSPDM will be in production on the new EV Volcon ATV vehicles, and they have others lined up as well.

The exciting thing for our industry is that open-source units will be available off-the-shelf for companies. Any one on the ground floor in development of autonomous vehicles, robotic systems, or any complex electrical system can integrate a smart wiring system to improve functionality and reduce costs for their customer. “We tend to think automotive because we are, at our core, an automotive supplier. But really, anything that switches power is an application.”

Martin Technologies sees a clear path for eSPDM, and Michael is excited about its implications for traditional harnesses and electrical wiring systems. “I think that, as an industry, we need to keep evolving with technology, and anywhere we can put advanced technology to work that increases reliability, reduces maintenance, reduces failure and adds to safety, then why not do it.”

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Automated Testing for Harnesses (Part 2)

By Ray Mumma
Cirris Systems

In a previous article on the basics of automated electrical testing we compared manual and automated cable / harness testing. We'll continue that discussion by expanding on one of the topics mentioned, specifically how automated cable / harness testers make measurements. It's a subject that is often overlooked but understanding a few basic concepts can bring more complex issues into better focus.

This is readily accomplished because, while engineers incorporate some amazing tricks under the hood, the fundamental processes are straightforward. These processes can be seen in three basic measurements - continuity, low voltage isolation, and high voltage testing. Let's begin by examining one of the basic formulas in electronics, Ohm's Law, which describes the relationship between voltage (V), current (I), and resistance

(R) in a simple circuit with the equation, $V=IR$.

There are many excellent resources available on the internet describing Ohm's law, so for our purposes, it's adequate to understand the mathematical relationship between the variables. As in all similar equations with three variables, the third can be calculated if the other two are known. Some find the triangle visual helpful as it makes it easy to find the appropriate formula for calculating the unknown by covering its symbol (Figure 1). When doing the math, it's important to remember that the unit of measure for voltage is Volts, for current is Amps, and for resistance is Ohms.

It's also useful to understand that in a simple series DC circuit, the current at any given point is the same as the current at any other point. In the same circuit, the potential difference (voltage drop) across an unknown resistance can be measured. In the case of automated cable / harness testers,

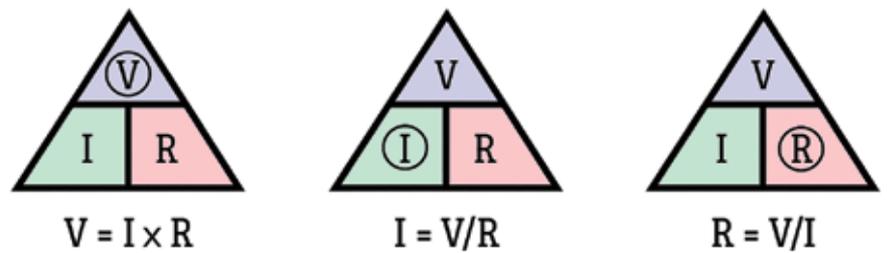


Figure 1. Ohm's Law

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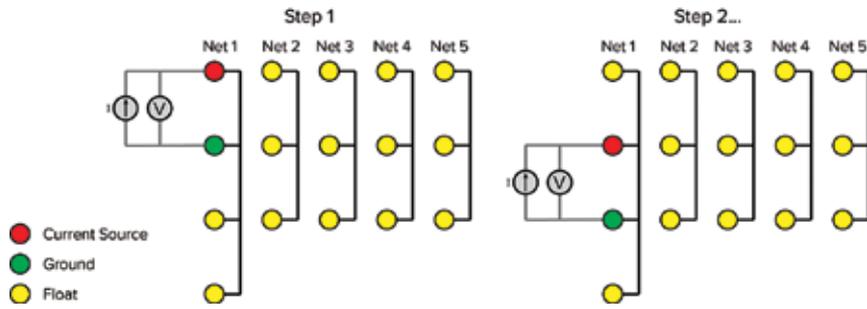


Figure 2. Continuity Testing

the unknown resistance is the device under test (DUT).

When performing a continuity test, the quality of the connection is evaluated by its resistance with the acceptance criteria set in Ohms or fractions of an Ohm. Generally, the lower the resistance of a connection, the better. Therefore, the test passes if the measured value is less than or equal to the specified value. Sometimes, this is referred to as a “pass-if-under” test.

The tester performs continuity tests two points at a time, regardless of the size of the circuit (more commonly called a network, or simply net) by connecting a current source to one point in the net while holding one other point in the net at ground and floating all remaining points by connecting them neither to the current source nor to ground. Some testers use the same source point for each continuity test in a net while others step through the net using the ground point in the original test as the source point for the subsequent test, as shown in the simple example below (Figure 2). Either method is acceptable.

To perform each step, the tester applies a steady, calibrated current to the DUT then measures the voltage drop from the source to ground

through the circuit. The resistance is calculated using Ohm’s law by dividing the measured voltage drop by the known current ($R=V/I$). The result is compared to the specified threshold to determine the pass or fail condition.

When performing low voltage isolation testing to ensure no unintended connections (shorts) exist, the acceptance condition is again set as a resistance value, except the pass/fail threshold is set in kilohms or megohms with the test passing if the measurement exceeds the threshold. The “pass-if-over” test is used as the greater the resistance between isolated nets the better.

To ensure that no shorts exist, all nets must be tested against all others. The exact process can vary, but for simplicity’s sake, we’ll assume that the tester applies the current source to one or more points in each net while it floats others in the net (connects them neither to the current source or ground) and holds all other points in the DUT at ground (Figure 3). The voltage drop from source to ground is measured and Ohm’s law is again used to calculate the resistance. It steps through this process by applying the source to one net at a time. If any isolation tests fail, the tester

Continued on page 25

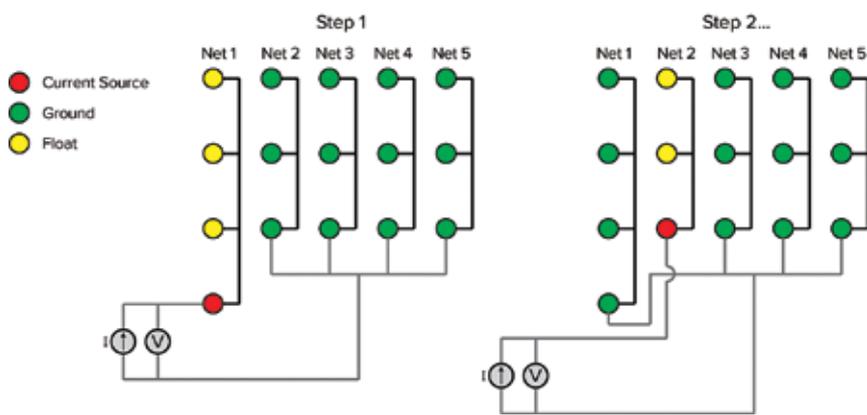


Figure 3. Isolation Testing

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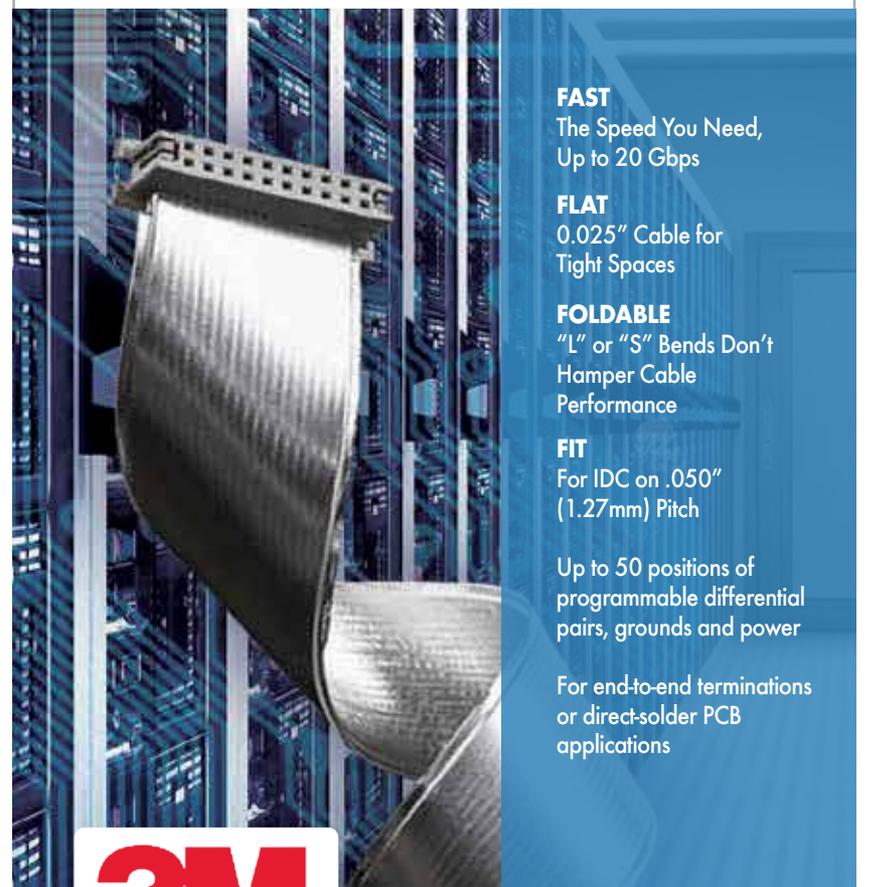
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Automated Testing for Harnesses (Part 2)

Continued from page 23 _____

initially knows only that the failure occurred between the source net and the group of nets held at ground. Therefore, it subsequently executes a search routine to identify the nets that are shorted.

A similar process applies to high voltage testing. However, high voltage testing typically includes two separate tests - Dielectric Withstand (DW or DWV) and Insulation Resistance (IR). Again, we're looking at this briefly to understand the basic processes, so we'll use simple definitions. A DW test ensures that the device under test withstands a specified voltage for a required period of time. The test equipment is designed to identify transient conditions, like an arc, in which the current spikes

rapidly. An IR test ensures that the resistance between circuits meets a required minimum.

A DW test can be performed using AC or DC voltage and the pass/fail threshold is set as a maximum current in microamps or milliamps. DW is a "pass-if-under" test meaning that the test passes if the current measurement remains below the threshold for the duration of the test (lower current flow between isolated nets is better). An IR test is always performed using DC voltage with the pass/fail threshold set as a resistance, typically megohms or gigaohms. IR is a "pass-if-over" test meaning that the test passes if the measurement is greater than the threshold (greater resistance between isolated nets is

Continued on page 27

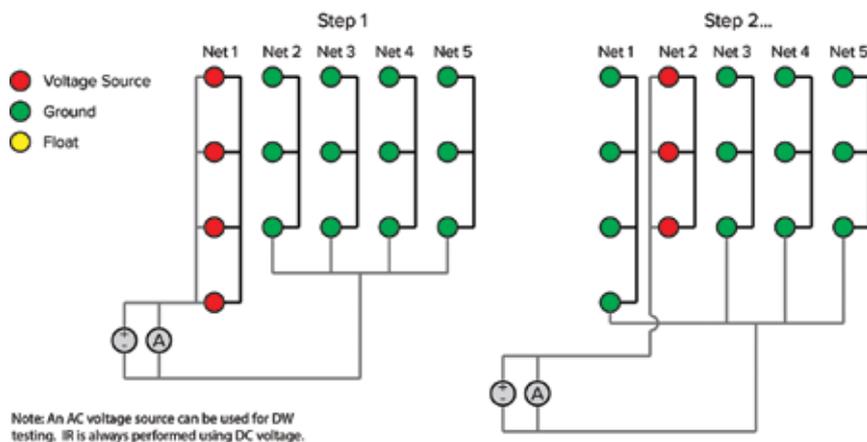
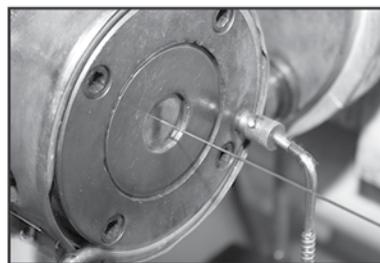


Figure 4. High Voltage Testing

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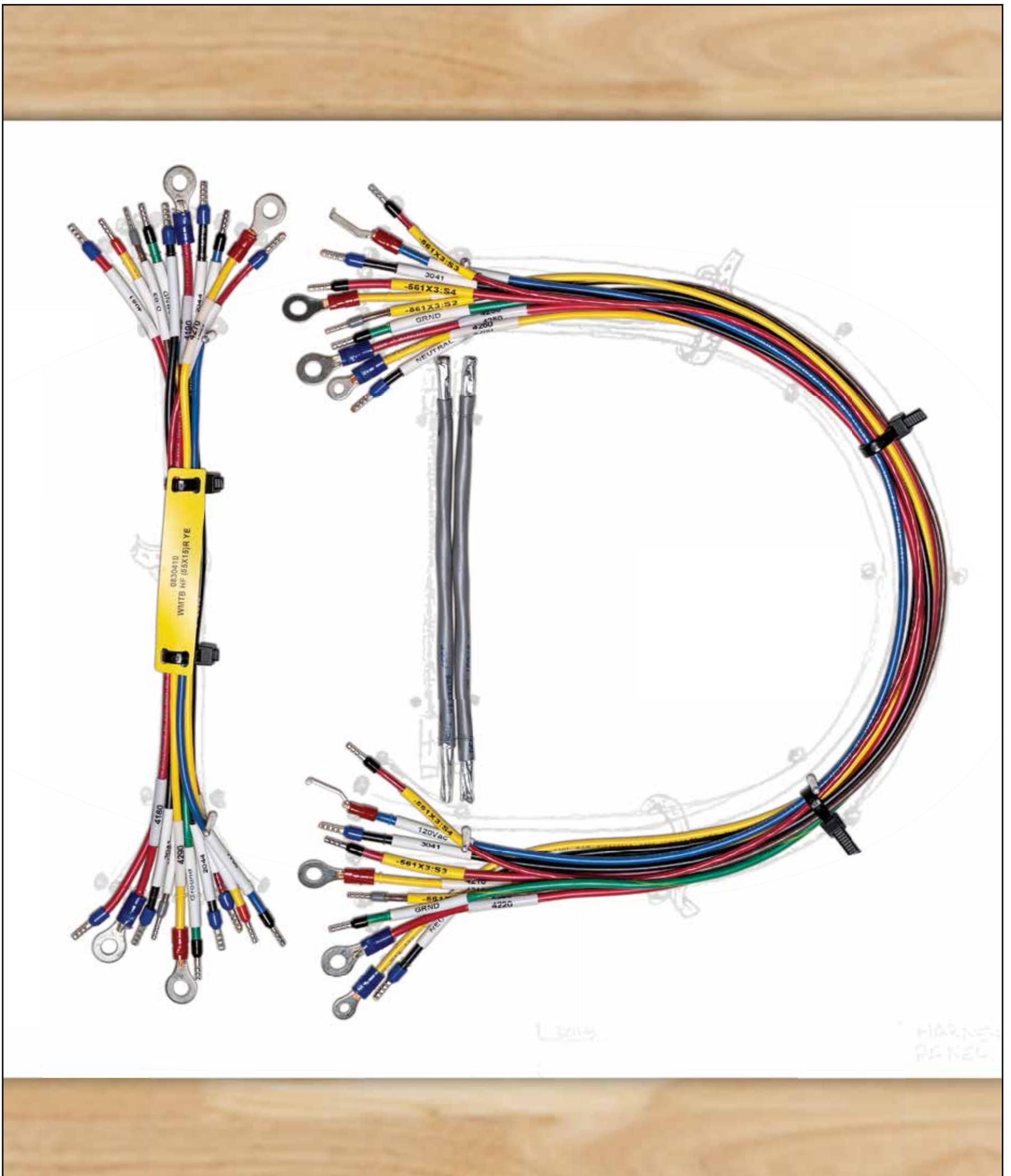
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Automated Testing for Harnesses (Part 2)

Continued from page 25 _____

better). Typically, the DW test and IR tests are performed sequentially with the DW test performed first. In both cases the measurement is made between nets that are expected to be electrically isolated.

There can be variations in the process, but like low voltage isolation testing, each net must be tested against all others. A standard process for doing this is to connect a high voltage source to all points in one net while all other nets are held at ground (Figure 4 page 25). At the same time the current flowing from source to ground is measured. The measured current is used to determine the pass/fail status of the DW test while Ohm's law is used to calculate resistance for the IR test by dividing the voltage by the measured current ($R=V/I$). The calculated resistance is then compared to the IR threshold to determine the pass/fail condition. We'll cover high voltage testing in greater detail in the future, but for now it's enough to say that very little current is expected to flow between nets that are electrically iso-

lated.

As with a low voltage isolation test, if a failure occurs, the tester only knows it occurred between the net at high potential and the group of nets held at ground. In the event of a DW failure, the tester will report the net that was at high potential, but it won't usually execute a search to identify the specific net to which the failure occurred. Primarily, this is because arc events are not reliably reproducible, which often makes the search unproductive. However, IR failures are typically reproducible and testers with search capability can, therefore, identify the net to which the failure is occurring.

Hopefully, this brief summary will remove some of the mystery that can surround automated electrical testing and help build a foundation for better understanding of the testing process in general.

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CVG's Global Wire Harness Group

Continued from page 1

as a build-to-print manufacturer, and we wanted to change that into something that provided more value and fun.”

The ‘new place’ that Rich is referring to is the transformation of CVG’s harness group from a contract manufacturer into a full-service, design-to-build supplier. For the trucking industry, this meant

more than just building a harness. CVG’s vision was to take drawings of the OEM electrical components and design a harness within the physical constricts of the vehicle. “With our new value proposition, we design and can release to the customer’s CAD/engineering systems. This allows us to be a true integrated partner with our



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customers,” he stated.

Although ‘commercial vehicle’ is in their name, the company has also laid out an enhanced path for CVG beyond the trucking industry. Rich explained that the time is right to push even further into other markets.

“There are standards you have to worry about, and some unique speci-

fications, but basically the process is well known to us,” he instructed. “There are many start-ups and other OEMs who haven’t invested in the resources to develop the electrical harnesses. Many have decided not to invest in those tools, and we have the expertise to bring their products to market.”

When Rich came on board, he quickly got to work putting the pieces in place. “We brought in a sales group that had the technical competence, we brought in an engineering team, and also made the investment in equipment that would allow us to move quicker and handle complexity more effectively. Under this structure, as a company, we are much more agile.”

Understanding the need for the company to be quicker to market with a focus on service, CVG streamlined the quoting process and brought in some contemporary production tools. “Another thing we did to increase our speed to market is we set up a prototype center in our Agua Prieta facility where we can do quick turnarounds, usually in 24 to 48 hours.”

One of the most productive investments CVG heralded was the use of digital boards. “These are very large LCD screens with fixtures for routing the wires on suction cups that go right on the screens,” Rich described. The LCD screens replace traditional harness boards, and several can be strung together for larger harnesses. “And the boards are smart in that they actually have videos embedded on the screen that can explain to the operator what goes where, a tutorial on special taping processes, or answers to other questions the operator may have.” The digital



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boards have greatly enhanced CVG's efficiency. "We can go right from our CAD software to the digital boards so it really helps with data migration and the speed in which we can deploy products into the marketplace."

The use of digital boards is not unique to CVG, so Rich was happy to share images of them. The 'secret sauce', as he referred to it, is really the software they developed internally. "We believe it gives us a competitive advantage in the marketplace as it allows for speed, execution and cost reduction (tooling cost and tool changeover)," he detailed. "We are actually converting the entire Mexico facility to digital boards; the return is very favorable."

Rich echoed what we always seem to hear in our industry—that the harness is often the last thing OEMs think about. But he sees this as an opportunity for CVG to jump in when the customer begins to realize the complexities in harness design. "It doesn't sound very complicated from 10 steps back, but the devil is always in the detail as the harness touches everything."

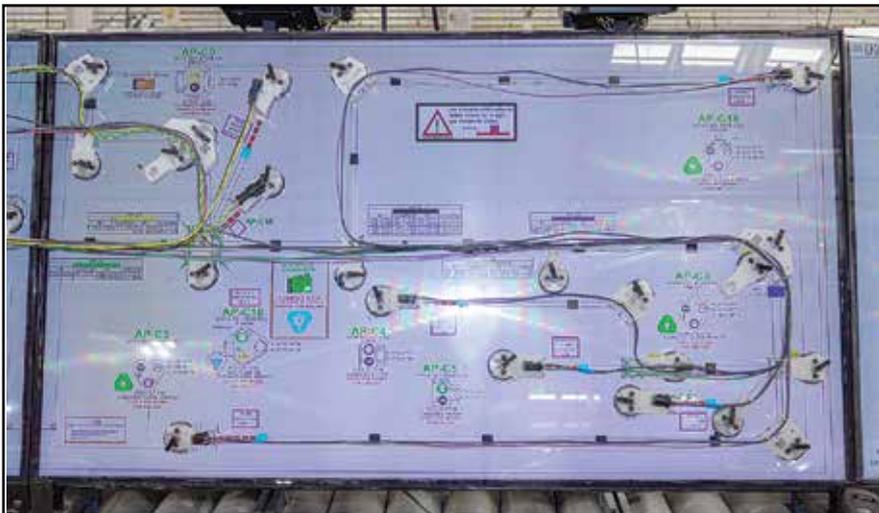
Our interview took place just before Wiring Harness News' participation in The Battery Show, so the EV market was top of mind. "We looked at what's going on in that space, and there are a lot of fantastic opportu-

nities where we are partnering with new customers," Rich stated. CVG is currently working on an EV bus application, as well as EV last-mile delivery and commercial long-haul vehicles.

As some of this business is coming from municipalities funded by taxpayer dollars, CVG is repurposing a facility in the US to handle the domestic requirements. This facility is being set up as a complement to the Agua Prieta plant, with CVG initially using about 15,000 of the 60,000 square feet of available space. "We are bringing in high-voltage processing equipment, some light stamping and forming machines for bus bars and junction boxes, and high-voltage test equipment," he listed. Many other capabilities are coming into that plant to facilitate the vertical and horizontal expansion of the company's vision.

In addition to some specific new aerospace applications, Rich was also excited to talk about recent opportunities they have for autonomous material handling equipment. He mentioned they are also working on some medical applications, but laments that the sales cycle is a bit longer there than in other markets. "We've been prescriptive so far with

Continued on page 30



CVG's Digital Boards



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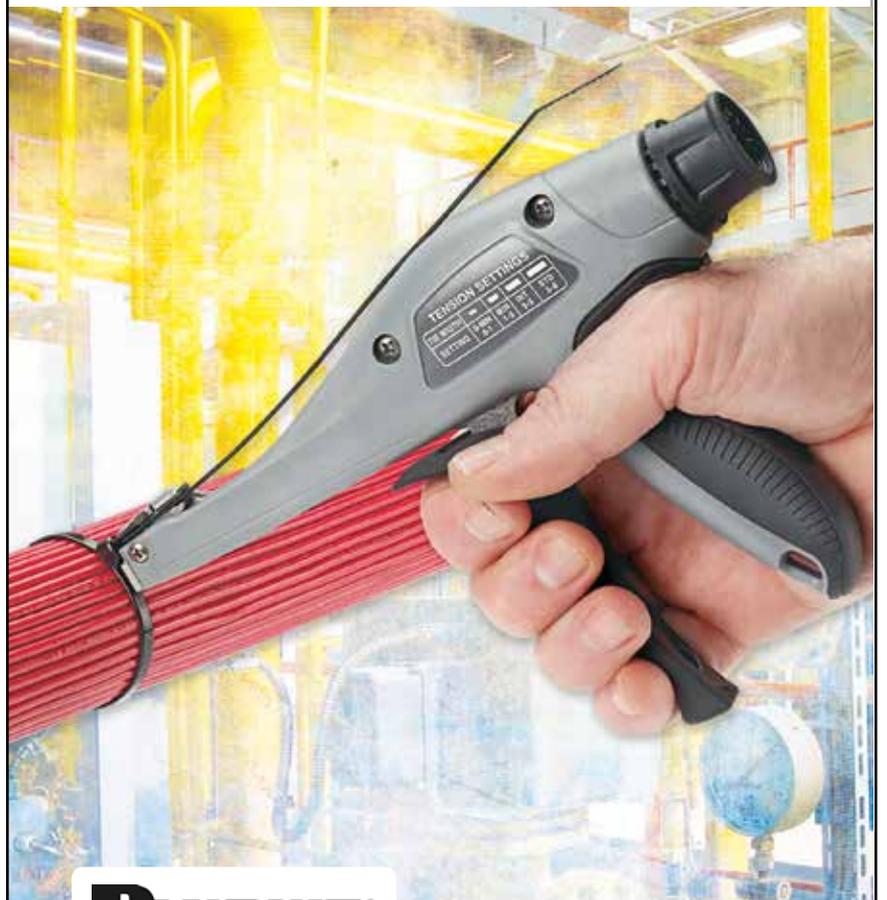
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CVG's Global Wire Harness Group

Continued from page 29

the customers we are targeting but we always have an open pipeline to listen and see if we can help them with a solution. I try to look at the potential business and say, 'how can we solve the problem' instead of 'do they need a harness.'

This strategy also led CVG into junction box builds. "We are moving up the technology spectrum. We started with low-voltage applications, moved into full-service low and high voltage, and then into junction boxes, so you can see we are moving up the

ladder," he stated. The junction boxes CVG had provided thus far had consisted of mostly passive components, but they are working on one now with some active components where they are programming software. This highlights another way the company is growing upward and outward from a technology perspective.

CVG realized they would need a specialized engineering team to meet these aspirations. The company is establishing an engineering or ideation center on the west coast and is staffing it with some of the best creative



Multiple Digital Board Setup

minds in the industry. This will enable CVG to handle a lot of the high-voltage requirements that seem to be centered on the west coast while making sure they can support all of their customers' engineering needs. "I'm pretty excited about that because, right now, the only thing limiting us is our imagination, and the ideation center continues to increase our profile and value to our customers."

The conversation turned to ways CVG is actively marketing their business. "About two years ago, we put together a marketing plan where we determined which segments of the market we anticipated growing. We looked at who the major players were in those spaces, then specifically targeted certain customers," Rich laid out. Then, it was a matter of explaining our value proposition and how we can be a solution provider in the targeted markets.

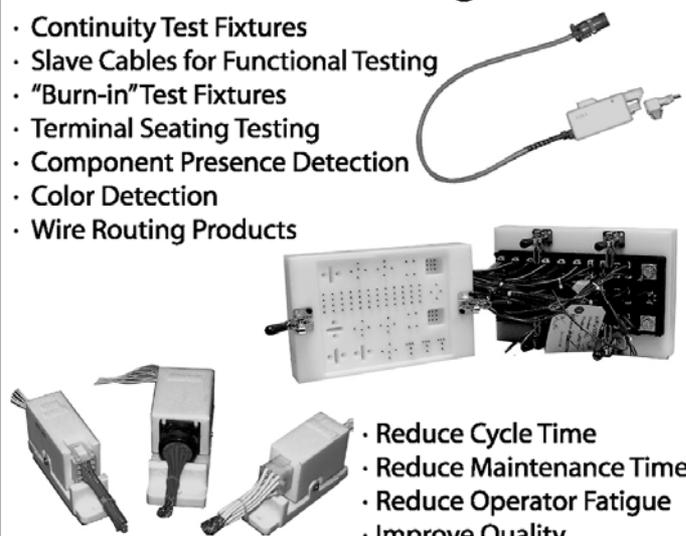
Rich is very excited about CVG's approach to their business. Even previous to joining the company, he recognized that traditional wire and cable and electronic subassembly manufacturers waited until the print was done to get involved. CVG is focused on being at the forefront of this to help its customers. The combination of a multifaceted engineering, global footprint, global procurement and error proof manufacturing process make CVG a company that is situated to make this happen for many industries.

CVG is already well established as a world class supplier. Under the guidance of Rich and other leadership team colleagues, they are staking their claim as an industry problem solver. Recent investments in technology and engineering personnel, coupled with CVG's open approach to customer problems, is giving them the edge among their competitors.

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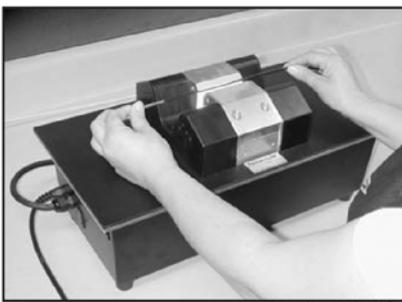
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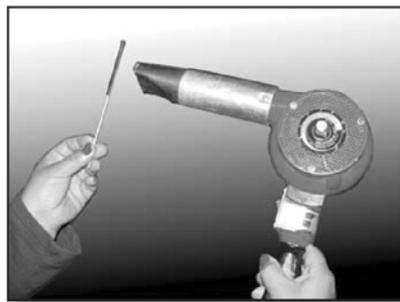
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Altering Design Parameters to Strip Fluoropolymer Cable Jackets

By Dick Chen
Aerospace Wire & Cable

As all we know, it can be quite difficult to strip fluoropolymer cable. It has excellent insulative properties for many applications, but its slippery nature makes it a challenge to process.

Generally speaking, you need to purchase an expensive, specially designed and very expensive piece of equipment to do the job without damaging the insulation (Fig 1). It's an even bigger challenge in long-run and second-end terminations in an aircraft or in the field, such as a fire alarm system. It is time consuming and mistakes will be costly.



Figure 1. Damaged or Nicked Insulation

Most people don't realize that producers of wire and cable can control some of the parameters in the manufacturing process to meet the needs of specific customer applications, thus reducing the effects of these stripping challenges. Sadly, not all manufacturers are willing to work with customers to produce these custom solutions.

As a fluoropolymer cable manufacturer, Aerospace Wire & Cable has long carved out a niche in the industry with their willingness to produce custom extrusion solutions to meet specific industry and customer needs. If, for example, the customer can specify the maximum force re-

quired to pull the jacket off at a certain length (four inches long with maximum one lb. of force), they can do their best to produce a more suitable product.

Here are some of the engineering procedures they can tweak to improve the stripping characteristics of fluoropolymer cable jackets.

1. Design the extrusion die and tip to get Draw Ratio Balance and Draw Down Ratio*. Typical draw ratios for Fluoropolymer are 50-150 with special techniques is >150. Draw Ratio Balance** shall always keep as 1.
2. Set up proper extrusion parameters for process temperature, extrusion speed, cooling distance etc. depending on different Fluoropolymer.
3. Select suitable Fluoropolymer for easy strip. For example, Harlar is easier to strip than FEP.
4. Add high temperature ripcords or tapes to facilitate an easier strip. (Fig 2, 3 page 34)
5. Design the cable configurations to facilitate an easy strip. They do this by offering a different lay for the wire pairs, or by using a different type of cable to enhance roundness.

There are many considerations to design a cable for different purposes. Some end users want the jacket to be loose, others want it to be tight. If a fluoropolymer has been selected for the jacket material, ease of the stripping process will be one of the main parameters for a qualified engineer to consider.

Continued on page 34

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The PowerStrip 9580 automatic cut & strip machine was designed with a focus on high-precision processing, excellent production output and a high degree of production flexibility. It is available in four basic configurations, combining processing with functional modules to cover a wide range of wire processing applications.

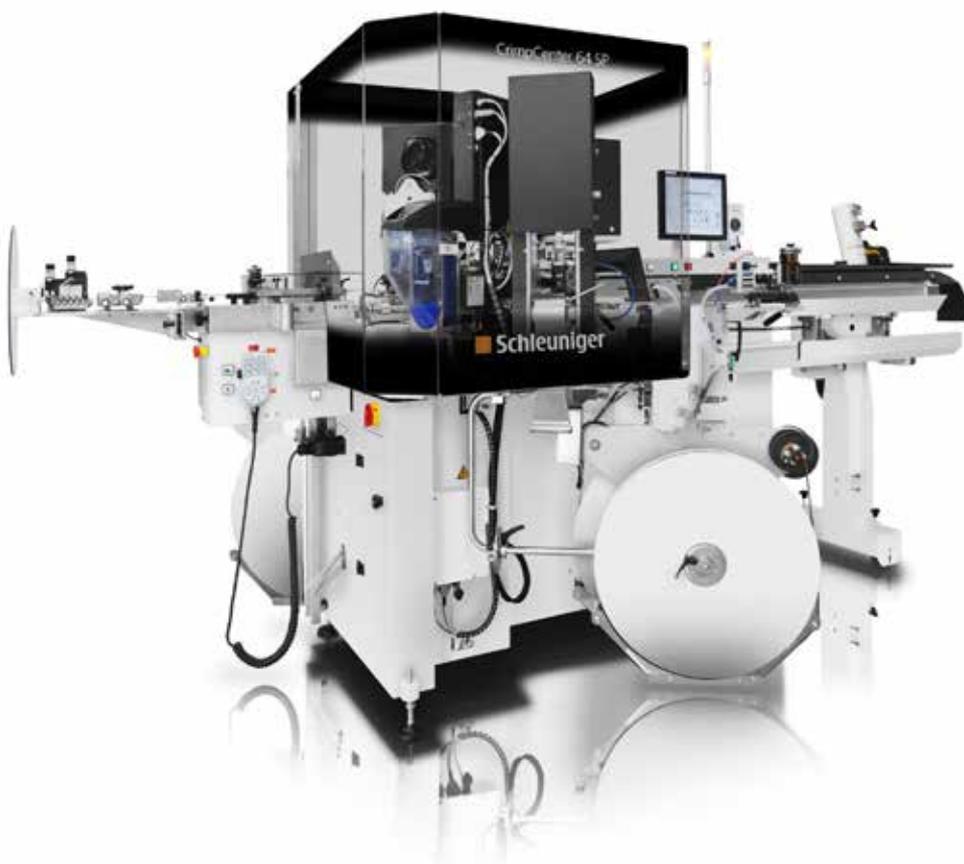
- High-precision processing of discrete wires with cross sections up to 70 mm² (2/0 AWG), shielded cable and complex multiconductor applications
- Modular, flexible and retrofittable machine concept
- Innovative machine control for high productivity and process reliability
- Short changeover times and intuitive machine operation
- State-of-the-art safety concept

Wire Solutions for a Connected World




To Be Strategic

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The CrimpCenter 64 SP processes wires with conductor cross sections from 0.13 to 6 mm² and features the latest quality assurance options, such as SmartDetect, WireCam and Guided Feasibility Study, to ensure transparency and traceability of important production data. These features, along with a number of performance enhancements, qualify the CrimpCenter 64 SP as a first-class machine for complex, high-precision production with high quality requirements.

- Reliable, high precision technology
- Increased effective performance
- Minimized setup times
- Significant cost-per-lead advantage
- Optimized parameter settings
- Enhanced deposit quality

Wire Solutions for a Connected World

Altering Design Parameters to Strip Fluoropolymer Cable Jackets

Continued from page 31



Figure 2. Hi-Temperature Rip Cord

as a wire or cable. It is the extent to which the plastic has been reduced in size to make the part. A larger DDR enables faster production rates, while a lower DDR facilitates more precise control of the product dimensions. A low draw down ratio process is more stable than a high one.

**Draw Ratio Balance describes the balance between the rate the outside of the cone draws down, and the rate the inside of the cone draws down. Most products made by drawing a plastic melt are smaller in cross sectional area than the tooling gap.

About AEROSPACE Wire & Cable

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Figure 3. Hi-Temperature Tape

* Draw Down Ratio in a tubular die is defined as the ratio of the cross-sectional area of the annular die opening to the cross-sectional area of the finished insulation. In the case of wire, it's the ratio of the cross-sectional area of the extruded plastic melt to the cross sectional area of the plastic in its final product form, be it a tube, hose or insulation on a core, such

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Back to Basics

The Benefits of Overmolded Assemblies

Cable assemblies are critical to various applications, covering a wide range of vertical marketing including demanding military applications or offshore harsh environments; however, they have also proven essential to home electronics, medical equipment, instrumentation, audio, and automotive applications. The use of overmolded cable assemblies has been found to provide specific benefits across these various applications.

Overmolded Cable Assemblies

An overmolded cable assembly is typically used to enhance a cable assembly that would otherwise rely solely on a backshell or heat shrink for additional protection, support, and/or strain relief. The process of molding a cable assembly involves molten PVC (polyvinyl chloride) or other high-performance polymers to encapsulate wiring materials. Overmolded cables are available in basically limitless shapes, sizes, materials, and configurations that offer many advantages and the needed flexibility for design engineers.

Benefit #1: Durability & Strength

Overmolded cables are designed to provide additional protection

against harsh environments where exposure to dust, debris, liquids, abrasion, heat, cold, and harsh sterilization are involved. In addition, overmolded cable assemblies add overall strain relief and support continual flexing without damage to the termination point, which can be critical to the reliability of a design.

The choice of material is intrinsically tied to the benefits from implementing a cable overmold. The material choice should be one of the key specifications for a connector. Standard materials include TPE (thermoplastic elastomers), PUR (polyurethane), PVC, and Nylon, while higher-rated materials include polyester resin and silicone.

Benefit #2: Customization Options

Another benefit of using an overmolded cable assembly lies in the plethora of available customization options. The first is size: cable overmolds can be formed to fit inside or around any obstacles or tight spaces for any application. In addition, the size can be easily maintained and is flexible enough to meet an application's specific requirements.

Continued from page 37

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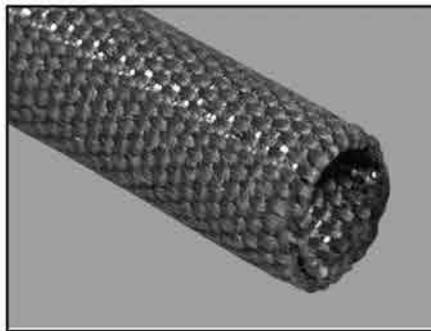
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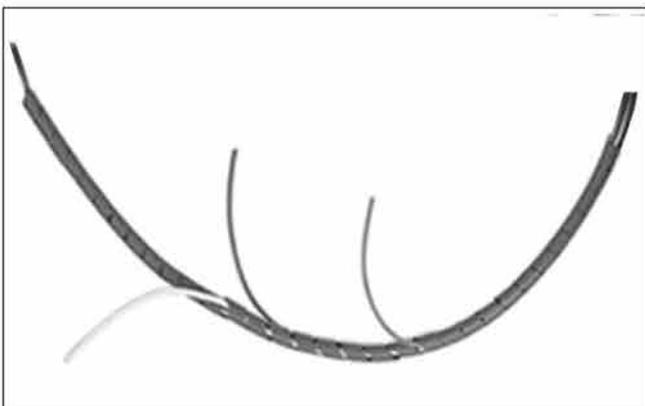
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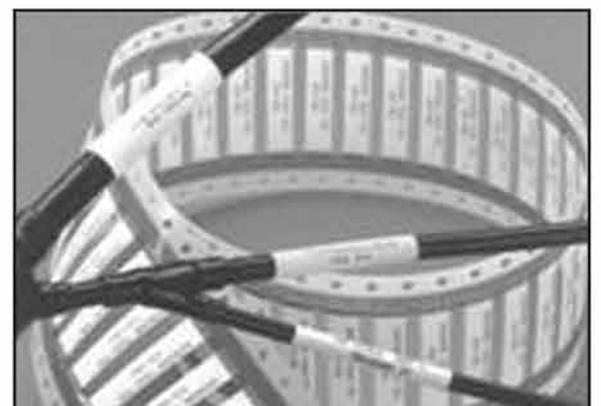
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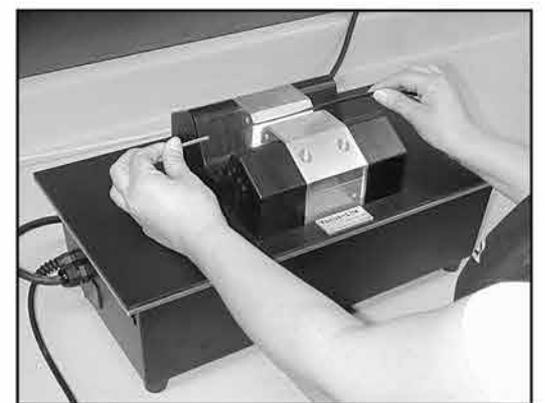
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The Benefits of Overmolded Assemblies

Continued from page 35



Multi-Colored BNC's

Cable overmolds also make it possible to choose color options that can do one of the following:

- Match a company's branding
- Blend the cable into the product
- Provide a more professional finish vs. glanded and/or heat shrink solutions
- Differentiate between cables

Products can be made more aesthetically pleasing by using tooling that includes corporate logos or trade names. Customization also involves the connector style used: an overmolded cable assembly can be specified to match a specific connector shape needed, such as circular, D-Sub, USB, and others.

Benefit #3: Quick Yields

A customized overmolded cable assembly does not mean a long turnaround time, even if a significant quantity is needed. Through 3D printing, prototype models of the mold can be created both quickly and cost-effectively while ensuring that the overmold meets the application requirements prior to hard tooling. Once the overmold has been approved, the manufacturing process can produce large quantities at a rela-

tively low cost. This is due, in part, to the combination of a vertical molding press with a rotary table that allows multiple molds to run on the same machine simultaneously.

Overmolded Cable Assemblies for a Variety of Applications

Understanding the appropriate place and time to use overmolded cable assemblies in your application can make the difference between success and failure. Designers looking to capitalize on the key benefits of overmolded cables will be able to take advantage of these connectors' durability, strength, customizability, and short turnaround times in applications that depend on these features for a successful buildout.

About PEI-Genesis

Whether your application involves harsh environment RJ45 connectors for use in transmitting data for oil field applications or high-performance circular connectors for factory automation, PEI-Genesis can help. From specifying the right connector, choosing the most appropriate contacts, setting up custom packaging or kitting, and selecting the best connection method, our experts are ready to help you bring your designs into the realm of reality.

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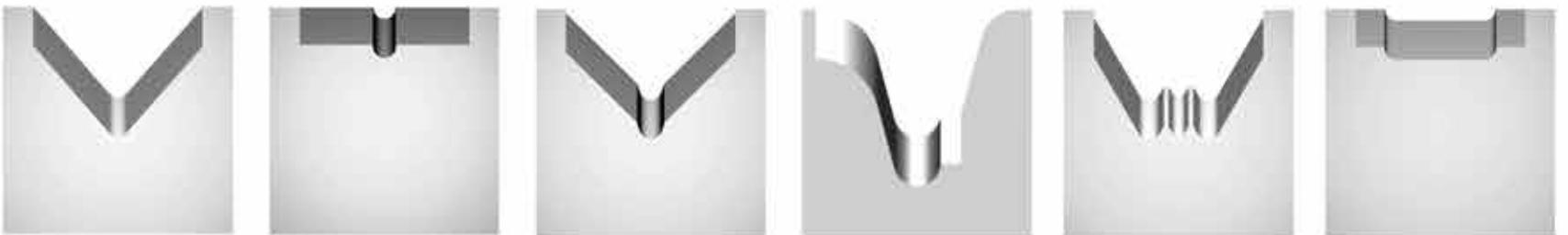
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Braiding: Proper Uses and Materials

Braiding technology has been around for more than 150 years. Originally developed for textiles, it became a great way to encapsulate wire harness, especially in aerospace and other high reliability arenas. More recent developments in braiding materials have expanded its use to other industries. Some more common materials used on harnesses are copper, steel, brass, Nomex, Kevlar, polyester, nylon, fiberglass along with many others. This brief article was developed through a conversation with John Tomaz of Wardwell Braiding. We discussed the various uses of braiding and the ease of bringing this technology in-house.

There are many reasons why one may choose to braid a wire harness. First and foremost is that braiding increases the tensile strength and durability of the harness. If you are building a harness for a bus or an airplane, for example, it would likely be very long and heavy. As the harness is installed, it can be pulled against various bulkheads and cavities and the connectors and wires could become damaged. Braiding mitigates this damage by providing a tight outer barrier that resists damage to wire and connectors. The most common material in this situation would be Nomex, especially in aerospace and military applications. This will also keep the wire harness from expanding.

High vibration during the normal operation of any piece of high-reliability equipment, such as an aircraft, can cause chaffing damage to wire or connectors. Braiding greatly lessens this effect. Some common materials to reduce chafing would be steel or bronze.

Another reason you may choose to braid a harness is to protect it in a high-temperature situation, as heat can damage the various components of the harness. To reduce heat-trans-

fer, a fiberglass braiding material is often used.

Electromagnetic interference (EMI) is a big problem in both data and signal transmission. Manufacturers are constantly seeking ways to minimize it. Braiding provides superior protection from EMI. Typically, copper or tin-plated copper braiding materials would be used in this situation. Further EMI reduction can be achieved by installing the connector over the metal braiding, thus grounding it in order to drain static electricity.

Finally, braiding can be used to create a more aesthetically pleasing final product. Common materials for this would be polyester or nylon.

Braiding can also be used as a product identifier. Many producers include a color strand or strands to identify them as the manufacturer of the cable assembly. In a 24-strand braid, for example, a manufacturer could choose one or more different color spools for contact tracing.

Braiding is an easy process to learn and integrate into an existing operation. The folks at Wardwell Braiding wish to remind people that once they have acquired a machine, they can teach any mechanically inclined person how to set it up, how to operate it, and how to maintain the equipment in two days. They can do this at the customer site or at their facility. They will also provide customers with lists of braiding-specific material suppliers.

About Wardwell Braiding

Wardwell Braiding is a world leading supplier of braiding equipment. Since its founding in 1911 by Simon Wardwell, the Company's engineers have continually introduced advances in braiding technology that have made Wardwell braiders the industry standard for overall value.



Modern Braiding Equipment

(Photo Courtesy of Wardwell Braiding)

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NEWS PLUGS continued



Eurotech Announces New Partnership with Escubedo Group

Eurotech is a proven leader in global business-to-business partnerships, providing unique products, technical sales, engineering, market development, distribution and order fulfillment for engineered products used in the global automotive and commercial vehicle industries.

Eurotech also produces and represents an exclusive group of advanced technology products, with partners headquartered in Europe and Asia, offering only highly engineered products. These products include a full range of adhesive tapes, heat shrink tubing, BluSeal splice sealer, connector systems and PUR foam quality assessment tools.

With over 200 combined years of hands-on wire-harness design and market experience, the Eurotech team of professionals can also provide value-added services and analysis in the areas of VAVE, warranty, and should-cost.

With a strong reputation of success in our markets, we leverage our access by working directly with global industrial manufactures, automotive OEMs and Tier-1 suppliers, to introduce new products, obtain certification to customer requirements, and provide program management all the way to production launch, and beyond. At Eurotech, there is nothing more important than helping our customers, and your customers, be successful.

Founded in 1998, Eurotech is a privately held company with direct sales in excess of \$10 million annually, and supporting an additional \$50 million client sales indirectly. The company is headquartered in Northfield, Ohio, and has additional support locations in the U.S., Mexico, and Europe.

Eurotech is pleased to announce a new partnership with the Escubedo Group, to bring their innovative connection system products to the North American Market.

Starting more than 50 years ago as a private family owned company, Escubedo has developed as a multinational company to supply the best connection system to the white goods and the automotive market. With its headquarters in Girona/Spain, ESCUBEDO and additional manufacturing plants in Istanbul/Turkey, ESCUTURCO, and Queretaro/Mexico, ESCUMEX, Escubedo extends his market services with logistic subsidiaries in Brazil, ESCUBRAS, China, ESCUASIA and Sweden, ESCUNORDIC.

Escubedo operates in 5 continents with its high technology production equipment and it serves more than 50 countries. Escubedo has the opportunity to serve its customers with its personalized designs. Beyond that, Escubedo has Solidworks 3D, CAM-based CAD workstations, electrical discharge machining with the support of automated robots, the best metrology, and a pioneering team in progressive mold manufacturing.

Starting with the design of the most efficient connection systems, Escube-

do capabilities in terms of metal stamping (more than 35 high speed stamping lines), plastic injection (more than 40 injection machines worldwide) and over molding capabilities allow us to create and supply the market with the most efficient products for our customer needs.

The quality control systems applied in Escubedo ensure that everything in the factory allows monitoring. Strict quality control of all production processes pass standards.

Three main drivers are always in Escubedo, reliability, to supply more than 3 billion parts annually according to the most strict specifications, service, to be always side by side with our customers and competitiveness, achieved following a complete commitment to automatization to guarantee the most cost efficient solutions for our customers.

Supplying to the main component manufacturers and wire harness makers our products arrive to almost all car and white good manufacturers.

Our global team of more than 300 people is working to grow and improve our company to serve all of our customers. For more information, contact Eurotech at: EuroSales@eurotech-direct.com or +1-330-467-0205.

New AEC-Q200 Compliant Fuses with High DC Voltage Rating

Bel Fuse-Circuit Protection, a Bel group company, announced the OACH Series of fast-acting, high current SMD brick fuses. The series offers high current ratings and high interrupting ratings within a small package size of 4.5 x 4.5 x 12.3 mm.

The OACH Series is designed for automotive and other applications which require a high current fuse, and where any gain in size, weight and power is beneficial - such as high-power battery systems, routers, and blade servers. The range is supplied as tape & reel for auto-insert SMD processes.

The series delivers current ratings of 60A to 100A, DC voltage of 72Vdc with interrupting ratings up to 1000A, meets AEC-Q200 automotive requirements, and is RoHS compliant, halogen free and complies with UL 248-1 and UL 248-14.



Summary

Series: OACH Series

Applications: Automotive, High Current Rating Requirements

Distribution availability: Digi-Key,

Mouser, Newark, Heilind

Datasheets: OACH

About Bel

Bel Fuse-Circuit Protection is a Bel group company (NASDAQ: BELFA and BELFB). Bel designs, manufactures and markets a broad array of products that include circuit protection, connectors, cable assemblies, discrete components, magnetics and power supplies. The Company serves a global market and operates facilities around the world.



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NEWS PLUGS continued



Zuken Accelerates its Drive to Expand the Model-Based Systems Engineering Business

Zuken Inc. (Yokohama-shi, Japan) announced that it has formed a new R&D unit in Japan. In the United States it has appointed a new COO of Zuken Vitech Inc., with the aim of enhancing support for customers that intend to transform their product development process through the introduction of model-based systems engineering (MBSE).

“As products become increasingly complex, we see our customers and the broader market moving towards Digital Engineering and MBSE-based solutions,” said Jinya Katsube, President and COO of Zuken Inc. “Zuken is committed to delivering forward-looking, innovative solutions. Our newly formed Process Innovation Development Department, in collaboration

with Zuken Vitech, will anticipate customer needs now and well into the future.”

MBSE has proven effective in developing extensive and complicated systems such as aerospace, aircraft, and the automobile industries. The challenge many product development companies face today is not just introducing MBSE but bridging MBSE into a digital engineering-based design process afterward. Zuken is uniquely positioned to offer both MBSE and detailed design solutions for electrical and electronic systems. Combining these disciplines enables customers to produce better product definition and communication, leading to fewer design errors and improved traceability.

Responding to the needs of our customers, Zuken has established the Process Innovation Development Department, a specialized development team

under the Technology Division. This newly formed department will assist the Process Innovation Promotion Department, which has been responsible for business development in the fields of MBSE and systems engineering in Japan. The department will enable Zuken to work closely with Zuken Vitech to expedite efforts to develop application software and utilities linked to the GENESYS modeling tool, and interfaces with existing Zuken products.

At the same time, Zuken appointed Enrique Krajalnik, who joined Zuken USA Inc. from No Magic, Inc. in September 2020, as the Chief Operating Officer (COO) of Zuken Vitech. Together with David Long, President of Zuken Vitech, the new COO will take the lead in business development in the advanced MBSE market that is the U.S., and in bolstering product planning for the global market through development collaboration between Japan and the U.S.

About Zuken

Zuken is a global software company delivering electrical and electronic design solutions. Founded in 1976, Zuken has a consistent track record of technology innovation and financial stability in the electronic and electrical design automation (EDA) industry.

With its CR-8000 and E3.series product families, Zuken provides a robust lineup of system-level 2D/3D electrical and electronic toolsets complemented by comprehensive design data and configuration management capabilities.

Most recently, Zuken has embraced the digital transformation and, more specifically, digital engineering as the way forward with its entry into the Model-Based Systems Engineering (MBSE) industry. Today, Zuken delivers world-class design solutions combining MBSE products and services with a mature, proven electrical and electronic design suite to address the needs of a broad range of industries across the globe.

For more information about the company and its products, visit www.zuken.com, www.zuken.com/blog, or www.linkedin.com/company/zuken

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TEST SYSTEMS



Heyco's Steel Design Edge Clips Now Available at Heilind Electronics

Heyco edge clips' steel design provides high panel retention forces while requiring low insertion force.

Heilind Electronics, a leading global distributor of electronic components and authorized distributor for Heyco, announces the addition of Heyco's steel design edge clips to its full line of molded wire protection products.

Designed for a variety of outdoor/harsh environment applications, Heyco edge clips offer the perfect solution for applications where fastener holes are not available or temperatures are too extreme for adhesive solutions. The products' steel clip design provides high panel retention while requiring low insertion force. Additionally, the plastic housing ensures easy, ergonomic installation and works with a variety of panel thicknesses from 1-3 mm or 3-6 mm.



The edge clips are available in both parallel and perpendicular orientations, with the orientation indicating the positioning of the cable tie to the fixing edge. The clips are constructed from nylon 6/6 UV-stabilized material with a flammability rating of 94V-2 and a temperature range of -40 degrees Fahrenheit (minus 40 degrees Celsius) to 185 degrees Fahrenheit (85 degrees Celsius). Heyco edge clips are ideal for industrial and manufacturing equipment, contract manufacturing, automotive and alternate power, and the fuel and energy industries.

Visit Heilind's website for more information about Heyco's edge clips.

About Heilind

Heilind Electronics, Inc. (<https://www.heilind.com>) is one of the world's leading distributors of connectors, relays, sensors, switches, thermal management and circuit protection products, terminal blocks, wire and cable, wiring accessories and insulation and identification products. Founded in 1974, Heilind has locations throughout the U.S., Canada, Mexico, Brazil, Germany, Singapore, Hong Kong and China.

About Heyco

Heyco Products (<https://www.heyco.com>) designs and manufactures molded wire protection products, plastic fasteners, molded components and stamped electrical components to meet the needs of industrial, medical, appliance, transportation, alternative energy, lighting and aerospace companies. Heyco also brings with it a modern, globally certified, U.S.-based manufacturing facility with vast expertise in injection molding, progressive stamping, over molding and assembly processes and techniques.

OSRAM High-Power Infrared Lasers Available at TTI

TTI, Inc., a leading specialty distributor of electronic components, is now stocking OSRAM's SPL UL90 Series LASERS. These devices are state-of-the-art components designed to meet the stringent requirements of automotive applications and characterized by long life, high performance and first-class reliability.

OSRAM is offering a new single-channel pulsed laser, the SPL UL90, that features improved beam quality and particularly compact dimensions. Thanks to its space-saving footprint of just 0.3 mm x 0.6 mm, system manufacturers can create extremely compact designs. These LASERS address the broad consensus that only a sensor combination of LiDAR, radar and camera systems can provide the necessary security for fully autonomous driving. Each of these technologies has advantages and disadvantages depending on the particular scenarios, but overall, the better they are matched, the safer the vehicle moves through traffic. The SPL UL90 is the latest addition to OSRAM's comprehensive photonics portfolio for LiDAR applications. Long-range LiDAR is used to detect objects up to approximately 250 meters away.

To learn more, visit OSRAM Lasers at TTI.

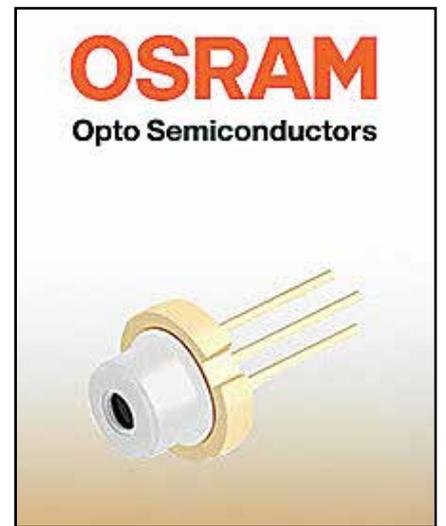
About TTI

TTI, Inc., a Berkshire Hathaway company, is an authorized, specialty distributor of electronic components. Founded in 1971, the emphasis on a broad and deep product portfolio, available-to-sell inventory and sophisticated supply chain programs has established TTI as a distributor of choice to manufacturers in the industrial, defense, aerospace, transportation, medical and communications sectors

worldwide. TTI and its wholly owned subsidiaries, the TTI Family of Specialists, Mouser Electronics, Sager Electronics and TTI Semiconductor Group employ over 7,300 people in more than 136 locations throughout North America, South America, Europe, Asia and Africa. Globally, the company maintains over 3 million square feet of dedicated warehouse space in 30 distribution centers, housing over 850,000 component part numbers. For more information about TTI, visit www.tti.com

About OSRAM

OSRAM Opto Semiconductors offers a spectrum of infinite possibilities of high-quality products in the field of illumination, visualization and sensor technology. Extensive technological know-how and a passion for innova-



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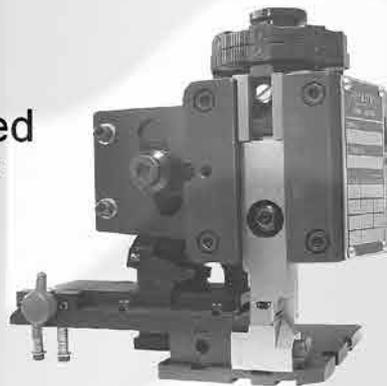


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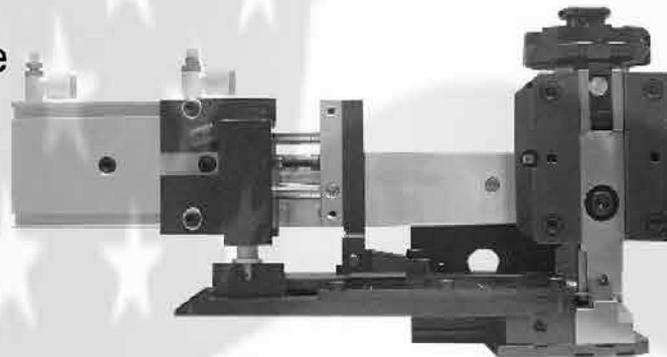


Model 1700

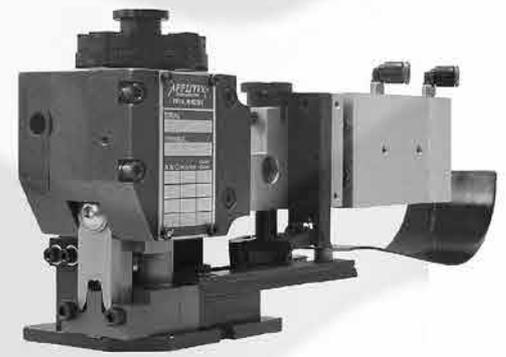


Model 2000

Pneumatic feed mini-style applicators can accommodate terminals with center to center distances up to 2 inches.

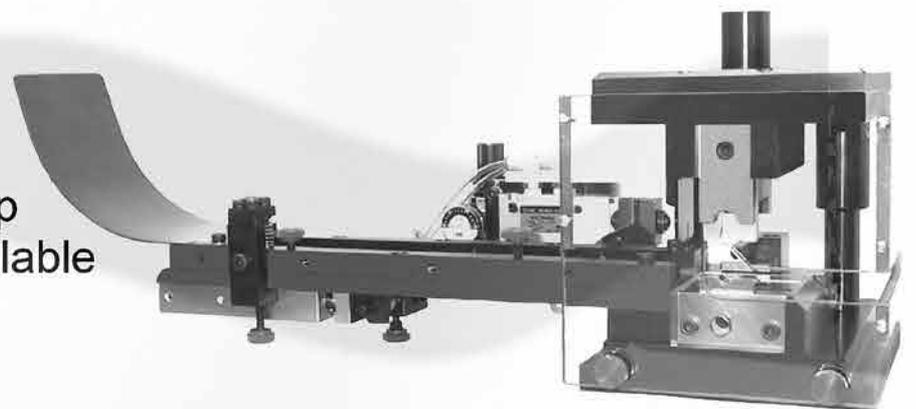


Model 1500



Model 2100

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NEWS PLUGS continued


Waytek, Inc Presents Egis Mobile Electric with Waytek's New Supplier of the Year Award for 2020

Waytek presented the award to Egis Mobile Electric at the Police Fleet Expo in Richmond, Virginia. The award recognizes the new Waytek supplier that has distinguished itself by partnering to deliver innovative vehicle electrical solutions and value to Waytek customers.

Egis Mobile Electric, which signed a distribution agreement for its fuse blocks, time-delay cut-off relays, and bus bars with Waytek in 2019, quickly became an emerging leader among Waytek's product lines.

"Waytek is fortunate to work with a supplier like Egis Mobile Electric who is committed to fostering a strong relationship with us and providing our customers with valuable solutions," said Charlie Kanan, Waytek CEO. "I'd like to thank the entire Egis team for consistently delivering quality and best-in-class service."

"Egis Mobile Electric consistently strives to deliver maximum value to customers," said Eric Graham, Presi-

dent of Egis Mobile Electric. "We are excited that Waytek, known for its high quality and service standards, has honored us with this award."

Egis Mobile Electric was selected for the award by demonstrating stellar performance in the following areas:

- Providing an exceptional customer experience
- Innovation and unique product introductions
- Growing contribution to Waytek's revenue
- Commitment to a long-term relationship
- Support of Waytek's long-term initiatives
- Exceptional product quality
- On-time delivery of products

About Waytek

In 2020, Waytek marked 50 years as a company. Waytek is fiercely dedicated to quickly getting our customers in the specialty vehicle and equipment industries the quality electrical parts they need, when they need them, shipping more than 99 percent of in-stock orders the same day.* Waytek is a family-owned business supplying electrical parts to manufacturers and upfitters specializing in wire harnesses and mobile equipment including trucks, trailers, ag equipment, construction

equipment, emergency vehicles, boats and more. With a mission to provide an exceptional customer experience, Waytek is committed to making it easy for customers to source electrical parts.

About Egis Mobile Electric

Egis Mobile Electric has been dedicated to providing the highest quality motor vehicle electrical products and customer support for over 25 years. Egis develops and manufacture products designed to provide safe, de-

pendable electrical power and battery protection technology for marine applications, emergency and municipality fleet vehicles, and other specialty vehicles. The company's product solutions include low and high amp timer disconnects, fuse and ground distribution blocks with screw and connector output options, and whole vehicle system solutions. Egis also offers custom solutions on a case-by-case basis. For more information, please visit www.egismobile.com.



Waytek presents its New Supplier of the Year Award to Egis Mobile Electric at the Police Fleet Expo. Left: Erin Graham, Director of Operations at Egis. Center: Egis President Eric Graham. Right: Rob Iversrud, Waytek Product and Category Manager.

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NEWS PLUGS continued



TPC Wire & Cable Acquires The First Electronics Corporation (FEC)

Acquisition adds custom interconnect solutions for growing engineered products division
 PC Wire & Cable (TPC), a portfolio

company of Audax Private Equity, announced that it has completed the acquisition of The First Electronics Corporation (FEC), a leading supplier of manufactured custom cable assemblies for Military and Defense applications. Founded in 1955 and based in Boston, Massachusetts, FEC has grown to be the leading supplier of electrical wiring harnesses, specializing in the production of over-molded, extra-flexible, multi-conductor, EMI-shielded cable assemblies and harnesses, and electro-mechanical assemblies custom-built for military applications.

“At TPC, we continue to focus on providing high-performance connectivity solutions for our customers’ high-cost-of-failure applications. We’ve invested in our Engineered Products Division to build on this promise in a growing number of high-reliability end markets and applications. Our investment in FEC will enable the organization to build upon the success that the FEC team has achieved over the years. Our commitment is to provide the FEC organization with the tools and resources to provide the highest quality products and services to their customers.” says Jeff Crane, President and Chief Executive Officer of TPC.

Speaking on the transaction, Will Donnellan, the President of FEC noted, “FEC has enjoyed exponential growth over the last two years. In order to continue that growth and deliver the highest quality product in support of our nation’s defense, we needed to find a strategic partner who had the resourc-

es to help us grow and expand but that also understood the military and aerospace marketplace. We found that in our partnership with TPC. FEC is excited about the synergies and additional capabilities the TPC team will add to our industry-leading product line.”

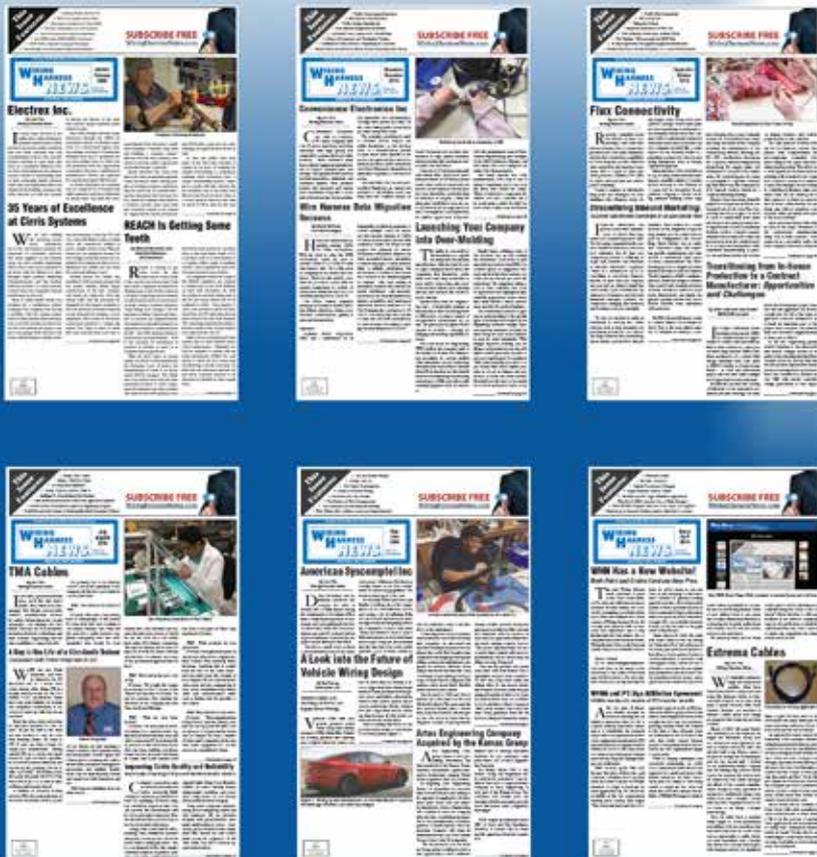
TPC recently formed its Engineered Products Division to expand its coverage of high-reliability end markets like Space, Aerospace & Defense, Semiconductor, Subsea, Renewables, and Medical Devices amongst others. The partnership with FEC enhances TPC’s solutions offering to these end-markets by expanding its portfolio of specialized wire and cable solutions for high-reliability, mission critical applications.

About TPC Wire & Cable:

Founded in 1979, TPC is a leading designer and provider of high-performance wire, cable, connectors, assemblies, and accessories used in harsh, high cost-of-failure environments. TPC’s products are designed to exceed customer performance specifications and withstand abuse from impact, abrasion, flexing, chemicals, extreme temperatures, miniaturization, and other demanding design requirements. TPC’s products are specially constructed for a wide range of design challenges across high-reliability applications in diversified industrial end markets, defense, aerospace, medical and other industries.

For further information, visit tpcwire.com.

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NEWS PLUGS continued



TE Connectivity Introduces New Hybrid and Electric Mobility Products to Meet the Unique Needs of the Commercial Transportation Market

High voltage accessory connectors and charging inlets designed specifically for ultra-rugged applications while addressing safety and reliability requirements

TE Connectivity (TE), a world leader in innovative connectivity solutions for Industrial and Commercial Transportation (ICT), is introducing three new products for the hybrid and electric commercial



transportation market. As the world quickly shifts away from internal combustion engines towards hybrid and electric mobility, the ICT market is key to meeting world-

wide goals of electrified transport, lowered emissions and a cleaner planet. TE is taking major steps in the electrification revolution by offering a new trio of products

squarely aimed at helping ICT customers meet the challenges of tomorrow.

The new IPT-HD power bolt connector performs exceptionally well when exposed to extreme temperatures (-40°C to 125°C) and, thanks to its low contact resistance design, can withstand excessively high engine-level vibrations. The IPT-HD power bolt high-voltage connector features a new shielding design that complies with ISO and LV standards, as well as thicker options for conductor cross-sections used in MCU (Motor Control Unit), E-axle and E-motor applications. To support diverse applications and increased assembly flexibility, the IPT-HD power bolt series can support up to 3 positions, as well as 50 mm² and 70 mm² conductor cross-sections with a 95 mm² option available soon. Further-

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PAGES 59-60



more, the IPT-HD power bolt connector series provides a separate, single wiring harness to help simplify the assembly process.

TE's new ICT charging inlets are designed specifically for the rigorous requirements of industrial and commercial vehicles and are the optimal choice for fast and secure charging. These charging inlets are modular and highly customizable with various design options including cable exits to the left or right side. Capable of 10,000 mating cycles and charging at 250 VAC (at 32 A) and 1000 VDC (at 200 A), these charging inlets feature larger cable sizes than what is used in the Automotive market – DC 70 mm² / PE 25 mm² / AC 6 mm².

Safety features include an integrated actuator for end position sensing, integrated PT1000 temperature sensors for enhanced temperature monitoring and optional protective flaps to help keep out dust and moisture. With an LED charging indicator option available, end users can easily distinguish when the

vehicle is actively charging. Kits and pigtail cable assemblies (in 1.5 m or 3 m lengths) are available to help ease supply chain and manufacturing worries.

The HVA HD400 high voltage accessory connector is TE's new solution for high voltage accessory applications virtually anywhere within the vehicle. This versatile connectivity system is designed for use in applications such as HVAC, heaters, hydraulic pumps and electronic power steering. The compact and adaptable design allows for either 2 or 3 conductors in the same interface, handling 2.5, 4 and 6 mm² LV216 conductor cross-sections single-core cabling (multi-code and ISO cabling are in development). The HVA HD400 connector can perform reliably in extreme environments and can handle up to 1000 VDC and 60 A (at 80°C). Other features include an operating temperature of

-40°C to 140°C, dust and water ingress protection rating of IP68 and IP6K9K, contact position assurance (CPA) and the



ability to withstand transmission-level vibrations.

"The road to electrification is complex and shifting in real time" said Sebastien Dupré, product manager at TE Connectivity's Industrial and Commercial Transportation business unit. "We are prepared to evolve with our customers. To show our commitment, we are excited to introduce these three new products that address safety and reliability, and most importantly, provide the rugged designs needed to enable high performance in the extreme conditions unique to the ICT market."

About TE Connectivity

TE Connectivity is a global industrial technology leader creating a safer, sustainable, productive and connected future. Our broad range of connectivity and sensor solutions, proven in the harshest environments, enable advancements in transportation, industrial applications, medical technology, energy, data communications and the home. With approximately 80,000 employees, including more than 7,500 engineers, working alongside customers in approximately 140 countries, TE ensures that EVERY CONNECTION COUNTS. Learn more at www.te.com and on LinkedIn, Facebook, WeChat and Twitter.

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Why Blogging is Relevant to Wire Harness Companies

By Christine Siebert
Siebert Consulting Group

Think about the different marketing channels for your company. What are your main goals? Retaining new customers and keeping your current customer base? How does each marketing channel acquire new leads for your sales team? Currently, you have a website to showcase your company and products with a few Call To Actions (CTAs) that your prospects can fill out to find out more about your products or get in touch with a salesperson. But how do they find your website?

Nowadays, prospects/customers have come to find information about products, services and challenges they face in the industry by turning to the almighty search engine. They trust the information they find, and your company needs to be the one providing that trust-worthy information. So, you need a strategy that convinces your prospect/customer of your value in the wire harness industry. This is where a blog becomes relevant for your wire harness company.

A blog builds your authority online and is something that is completely under your control. With an influential blog, you will be able to obtain leads, build up email lists and educate your audience. Search engines love content, the more content the better. It makes it easier for your audience to find your company and products. If you show your value through interesting and informative content, then you'll show your audience that you're not only selling products but are involved in the industry. You will develop loyal customers, willing to trust your company and place an order.

The first step in your blogging strategy is to clarify your key messages, the needs of your customers, and your company's priorities. Below are some additional tips for your blog.

1. Become an educational leader: Show your audience that you're involved in the wire harness industry. Share your expertise and position yourself as a trusted resource. Offering insights on trends in the industry prove to your audience that you are integral part to this industry.

2. Provide additional in-links to products and services: The most important pages on your website are your products and services so don't be afraid to link to them. Building links within your blog is vital. The more links to these pages means the more traffic that will be directly driven there, and a major component of

search engine rankings involves in-links from reputable and relevant sources.

3. Updated blog content means returning visitors: Most company's website content is relatively static. New products may be added but no other content, which causes the website to rank lower in the search engines. Every time you add a blog post, you are adding a "page" to your website. Keeping your website fresh and help improve the website's visibility to the search engine.

4. Blog content can be repurposed for other channels: Interesting pieces of blog posts can be used on social media. Images can be optimized for the search engines. Also, marketing assets you may already have, such as, webinars or whitepapers can be repurposed into a blog post.

5. Boost conversion rates: Every blog post written is a chance to create a new lead. At the end of the blog post encourage your audience to react to a call-to-action. This CTA can be to download something, check out your product page, fill out a free trial request, and more. These leads will most likely create profit for your company.

Blogging needs to be part of your overall marketing strategy. First and foremost, you want to create an amaz-

ing blog and that does take work. Some of the things to think about are:

1. What are you going to write about?
2. When will you write the blog posts?
3. Who is your target audience?
4. What optimization have you done to the content?
5. Who is the team that will write the blogs?

The last item is very important. You can assign different team members in different areas of your company to write blog posts. What are their areas of expertise? It is not just the equipment, product, or service, but the application of it. You sell what your customers see in terms of benefits, improvements, savings, quality, avoidance of risk, etc. These are some of the most important items to blog about.

Blogging can be very time consum-

ing so sometimes hiring a professional to assist with writing the blogs is needed. Finding the right writer is important. Someone who understands the wire harness industry.

Siebert Consulting Group provides marketing services to the wire harness industry. If you are interested in learning more, please visit our website www.siebertcg.com or call us at 630-299-9121.

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The Battery Show and Electric Hybrid Vehicle Technology Expo Continues as Vibrant Marketplace

The Battery Show and Electric & Hybrid Vehicle Technology Expo hosted a remarkable conference and exhibition that surpassed expectations reaching 90% of the event's 2019 attendance with conference significantly exceeding 2019 figures, underscoring the critical need for industry connection and education. Organized by Informa Markets - Engineering, the event connected more than 550 suppliers with more than 9,000 attendees that featured a heavily trafficked expo floor and well-attended keynote addresses from The Department of Energy, LG Energy, and Ford Motors.

The show highlights the latest in battery and electric/hybrid vehicle technologies and is North America's premier battery technology conference/event. Wiring Harness News was exhibiting as this proves to be a vibrant marketplace and incredible networking opportunity for wire harness producers. Many OEMs mentioned the need for contract manu-

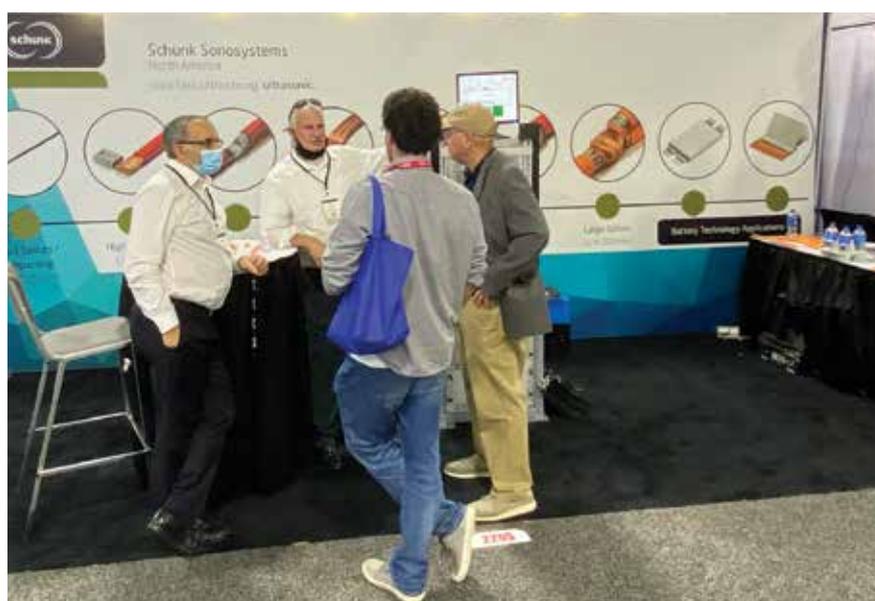
facturers to build their harnesses. A number of WHN advertisers exhibited as well.

Digital Days November 17-18

If you missed the event in Novi, there is still an opportunity to attend the virtual show.

Taking place over two days this November 17-18, The Battery Show & EV Tech Digital Days is the most comprehensive virtual event for the advanced battery manufacturing and EV/HEV technology communities. Digital Days features an enhanced conference program with live and on-demand webinars featuring high quality speakers, exhibitor 'booths' with easy-to-find products and services, and multiple matchmaking and networking offerings.

It will be an opportunity to connect with not only The Battery Show US community, but the global advanced battery and EV/HEV tech community. To register, visit thebatteryshow.com.







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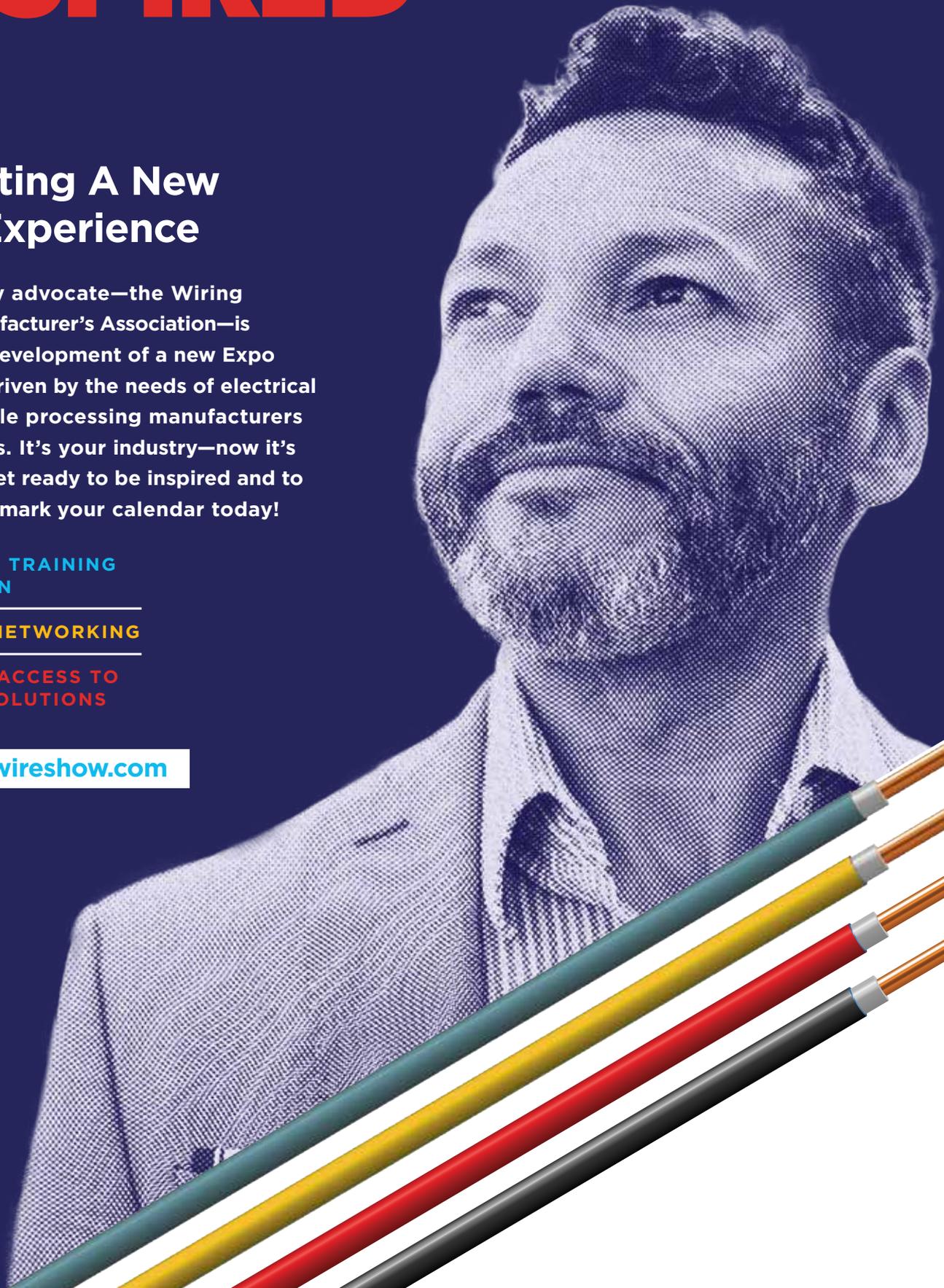
Your industry advocate—the Wiring Harness Manufacturer’s Association—is leading the development of a new Expo experience driven by the needs of electrical wire and cable processing manufacturers and suppliers. It’s your industry—now it’s your show. Get ready to be inspired and to leave wired—mark your calendar today!

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2022 WHMA 29th Annual Wire Harness Conference - Register Now!

By Christine Siebert

Planning for the upcoming 2022 WHMA 29th Annual Wire Harness Conference being held on February 15-17, 2022 in Tucson, Arizona at the Westin La Paloma Resort and Spa is well underway. The WHMA conference has become one of the few investments that gives attendees an opportunity to learn, grow, share and discover new approaches to many aspects of the wire harness industry. The conference is geared towards wire harness manufacturers, suppliers, and OEMs. Attendee and exhibitor registration is now open!

The 2022 WHMA conference has several noted industry experts and thought leaders that will take to the keynote stage to deliver insight on the industry, economy, geopolitical issues, manufacturing technologies and more.

Keynote presenter, John K. Cole, CEO Design Thinking and Olympic Medalist with his presentation “Resiliency 2.0 - Applying Design Thinking to Stress and Resilien-

cy.” Coyle is one of the world’s leading experts in “Design Thinking” and Innovation. He is a world-class athlete in two sports (cycling and speedskating) and an Olympic silver medalist.

As a speaker and writer, John’s special talent is weaving facts, examples, and business principles into engaging, accessible stories that bring his topics and frameworks to life. People leave John’s programs inspired and empowered to make significant, positive changes in their business and personal lives. In this keynote, Coyle discusses how to perform better under greater stress (and enjoy it), instead of trying to manage or reduce stress or get work-life balance back! Explore a new model of resiliency, one where proactive challenges are designed to build capacity for ever greater performance under pressure, while learning the latest neuroscience of recovery. Change your relationship with stress by using the 3R method - Reduce, Recover and Reframe.

Keynote presenter, Cynthia A. Watson, Ph.D., Dean of Faculty and Academic Affairs, National War College, National Defense University

will present “What Keeps China’s Leadership Awake at Night?” Watson writes and speaks widely on the professional military education, China’s modernization challenges, and U.S. military trends.

In this keynote, Watson will discuss why most international focus highlights China’s behavior abroad with an understanding that the intention is on global expansion at all costs. Evidence exists that the fear

of internal threats really motivates the Party’s behaviors in a vast array of areas. This conversation will focus on why that is likely indeed the case. With many issues on its plate, the Party cannot simply commit to international goals without always keeping its eye on how the domestic environment is shifting.

Continued on page 57

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Line	HDR-64 B1	HDR-64 B2	Value	HiPot Results	DC Current	DC Voltage	DC Isolation	AC Current	AC Voltage	AC Isolation
1	28	28	16 mΩ	Pass	< 1 μA	1499 V	> 1 G	0.150 mA	996 V	7 M
2	30	30	32 mΩ	Pass	< 1 μA	1499 V	> 1 G	0.173 mA	996 V	6 M
3	32	32	63 mΩ	Pass	< 1 μA	1499 V	> 1 G	0.189 mA	996 V	5 M
4	34	34	125 mΩ	Pass	< 1 μA	1499 V	> 1 G	0.204 mA	996 V	5 M
5	36	36	249 mΩ	Pass	< 1 μA	1499 V	> 1 G	0.204 mA	996 V	5 M
6	38	38	500 mΩ	Pass	< 1 μA	1499 V	> 1 G	0.200 mA	995 V	5 M

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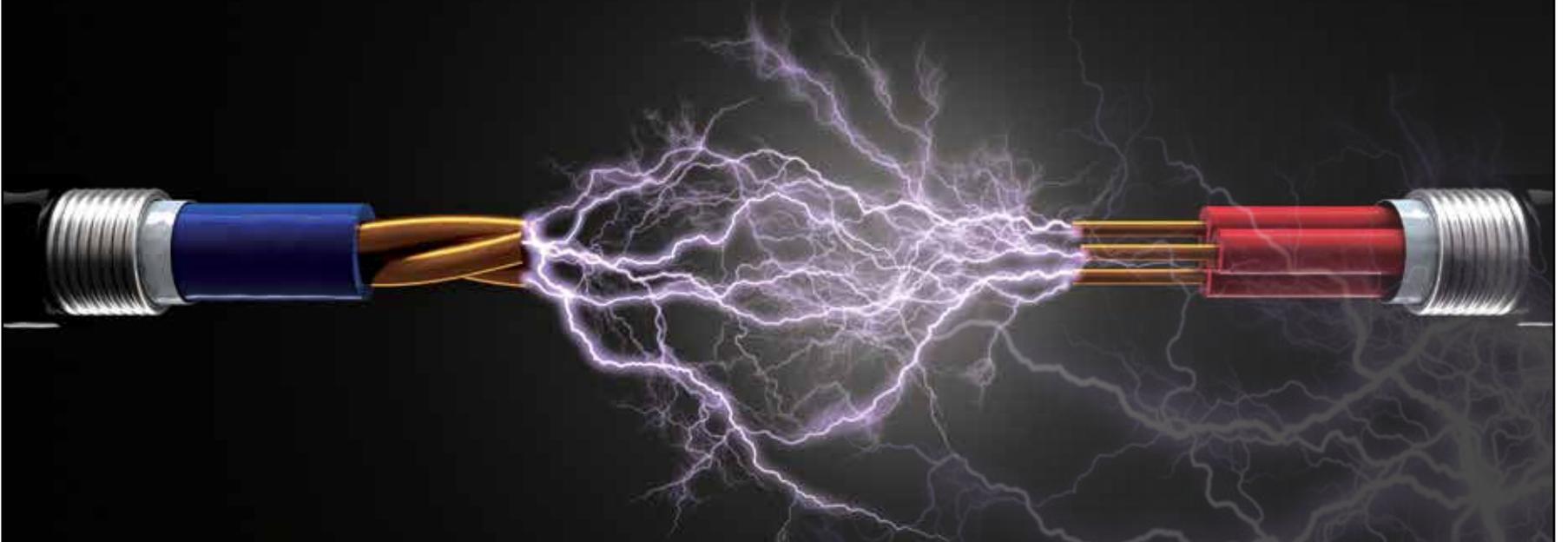
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Continued from page 55

Keynote presenter, Peter Zeihan, Geopolitical Strategist will present “**Manufacturing a New Age.**” Zeihan combines an expert understanding of demography, economics, energy, politics, technology, and security to help clients best prepare for an uncertain future.

In this keynote, Zeihan will discuss the world we have known for decades – insatiable global demand, endlessly complex supply chains, sacrosanct international commerce – isn’t simply in decline. For reasons geopolitical and demographic, it is over. And that is good news. Join Zeihan as he guides us through the de-globalization whirlwind. Learn how changes in consumption and labor will play out, in particular for the industries we depend upon and support, most notably metals processing, automotive, aerospace, semiconductors and electronics.

If this keynote leaves you with concerns, questions and ideas, WHMA has allotted a time for a “**One-on-One with Peter Zeihan: Q&A with a Kick.**” Be ready to discuss the ins-and-outs of massive industrial relocations and retoolings, with an emphasis on labor and all things Mexico. To ensure extra honesty, Peter will have a margarita. Plan accordingly.

Keynote speaker, Shawn Dubravac, Chief Economist, IPC will present “**Economic Report and Future Outlook for WHMA Members.**” Dubravac is a WHMA member favorite with his insight on issues facing the global electronics industry, including supply chain resiliency/uncertainty, trade wars, skilled workforce shortage, and the expanding role of electronics in the global economy.

In this keynote, Dubravac will provide a detailed economic report and outlook for WHMA members.

The keynotes are impressive, but WHMA is also known for its peer-to-peer networking. One of the major highlights of the WHMA conference is the Annual Golf Outing. WHMA 2022 Golf Outing is being held at the illustrious Jack Nicklaus Signature Design Golf at La Paloma Country Club on February 15. Enjoy the beautiful grounds and enjoy some friendly competition with our fun golf contests.

Another fantastic networking event is being held at the Savoy Opera House on Wednesday, February 16. The Old West lives again in the streets of Trail Dust Town; a reconstructed town depicting the late 1880s. Browse in the trading post of galleries, have a tintype souvenir photograph taken, or enjoy the majestic sun setting in the West. Enjoy an unforgettable dinner, listen to a great local band “The Whiskey River Dogs Band” and more importantly have a cold beverage served by a cute and

gentle donkey! We cannot wait for you to experience this unique and memorable networking event.

Don’t forget to stop by and see the latest innovations from the top suppliers in the industry at the exhibit hall and attend our best practice roundtables. The networking, learning, discovering and, of course, the fun never ends at 2022 WHMA Annual Conference.

“From keynotes, technical education workshops and roundtable ses-

sions to an exhibition with industry leading suppliers showcasing their cutting-edge products and services and peer-to-peer networking, the annual WHMA wire harness conference offers leaders in the global cable and wire harness industry opportunities to learn, grow, share and connect,” said Rick Bromm, WHMA Board Chair/ALTEX President. “And, after nearly a two-year hiatus, we’re looking forward to connecting with everyone in person!”

For more information on the conference including schedule, exhibition, speaker profiles, sponsorship opportunities, or to register for event, visit <https://annualconference.whma.org>.



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- Post your company job openings for **FREE** on WHMA’s exclusive **Industry Job Posting Page**
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- Benefit from the advocacy work done by **IPC Global Government Relations** as they proactively engage policymakers in the United States, Europe and Asia to adopt policies that strengthen the talent pool, bolster the value chain, and right-size regulations to spur greater technological innovation and economic growth.

“**WHMA membership has provided our company the opportunity to share ideas, discuss challenges and innovate through networking opportunities. We have built relationships with colleagues, competitors, and industry specialists. Those relationships have been invaluable to our organization.**

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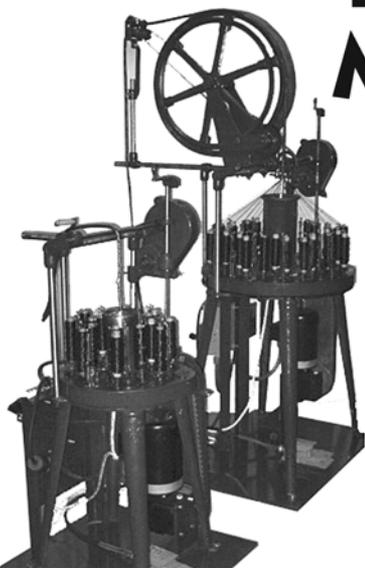
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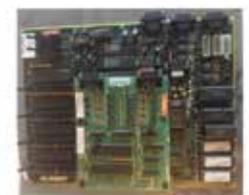
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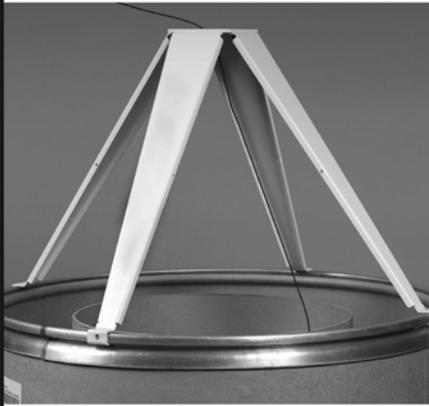
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- Solve problems with customer cable designs.

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Thank you to all who have contributed to creating and supporting an excellent IPC APEX EXPO 2021 experience.

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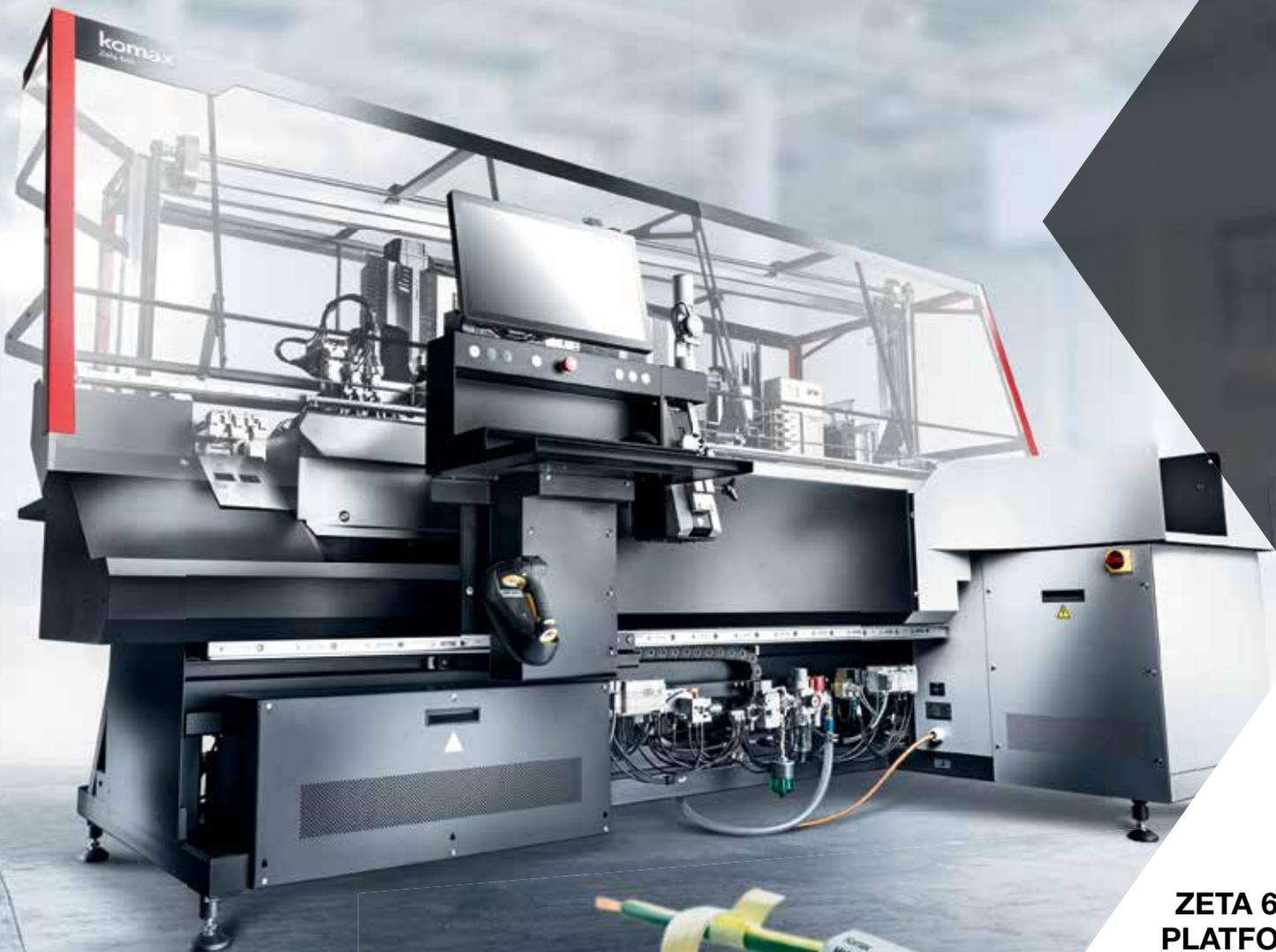
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