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# Company Profile: Fischer-Backus

By Joe Tito  
Wiring Harness News

Over the past decade or so, we’ve seen many wire harness and cable assembly operations change hands. Many who pioneered their businesses in the 1970’s or 80’s have passed them on to a next generation family member. Others that navigated the ups and downs have, through their hard work, been equally fortunate to find an outside buyer for their business. Fischer-Backus is one such business. WHN recently spoke with Tony Carstens, the current owner of Fischer-Backus, about the history of the company, his purchase in 2007, and strategy for growth.

The company was started back in 1980 near Columbus, OH and Tony and his team celebrated their 40th anniversary this past June 23rd. David Backus and Steve Fisher were friends who worked together for an ABB subsidiary, but decided to venture out on their own. They had noticed a void of good harness suppliers and began making assemblies for ABB. In the beginning, that one customer represented a large chunk of their business. After about a year, Steve wanted out, and David bought out his shares. David grew the business to about 30 employees in the early 80’s and brought many new customers on board. As business went overseas in the mid to late 80’s, however, they pivoted to the type of high-mix, low-volume manufacturing that is popu-



Fischer-Backus’ sister company, PCI West.

lar in our industry. In 2007, David decided to retire and was searching for a buyer for his business. The timing was perfect for Tony. “I’d worked for Parker Hannifin as an engineer for a few years, then moved to the Columbus area and worked for Honda for another 11 years. I had gotten my MBA while at Honda, and decided I didn’t want to work for anybody anymore,” he recalled. He looked for the right business opportunity for a couple years, had bid on

a few, but nothing worked out. Finally, in 2007, Fischer-Backus became available, and Tony was able to put a deal together with David Backus to purchase the business. Tony had no experience in the industry, but with his manufacturing experience, was able to quickly come up to speed. Under new management, Fischer-Backus was able to gain a better foothold with existing customers, \_\_\_\_\_ Continued on page 36

# 4 Ways Industrial Manufacturing Companies Can Recover from COVID-19

By Atul Minocha, Dawn Werry,  
and Kimberly Miller

When the pandemic first hit, the industrial manufacturing sector was changing daily. Now, at the start of the recovery phase, the whole industry is adapting. Some companies have had to find completely new markets for their products, while others have started making completely new products. Across the board, supply chains have been disrupted. Buyer behaviors have changed and go-to-market strategies have had to adjust in order to

keep business moving. Here are the 4 ways industrial manufacturing companies can recover from COVID-19:

**1. Respond to Customer Needs**

Even in the face of this disruption, some companies have refocused on what was not impacted and moved in a new direction. Many proactively asked how their customers’ businesses were impacted, what new products or components might be needed, and how they could respond as soon as activity picked up again. In this environment, it’s very \_\_\_\_\_ Continued on page 8

# Schleuniger Group Acquires Cirris Systems

After many years of cooperation, the Schleuniger Group and Cirris Systems Corp. have signed an agreement for Schleuniger to acquire Cirris, based in Salt Lake City, Utah, on the basis of an asset deal. The transaction is expected to be concluded in the third quarter of 2020 and the new company Cirris Inc. will take over most of the assets of Cirris Systems Corp. “With the acquisition of Cirris, Schleuniger is further extending its market lead in testing of cables, harnesses and connectors. Together with adaptronic Prüfsysteme and Schleuniger Test Automation, both located in Germany, we have now fully realized our strategic main direction of “Best in Test” and our ambition to be the global number one in technology, application and industry coverage,” says Christoph Schüpbach, CEO of the Schleuniger Group. The purchase of Cirris represents an important investment in a key growth segment for Schleuniger, further expanding the group’s broad testing portfolio following the January 2018 acquisition of a controlling majority stake in testing equipment manufacturer adaptronic Prüftechnik GmbH of Wertheim, Germany, as well as the May 2015 purchase of test automation solutions provider Cirris So-

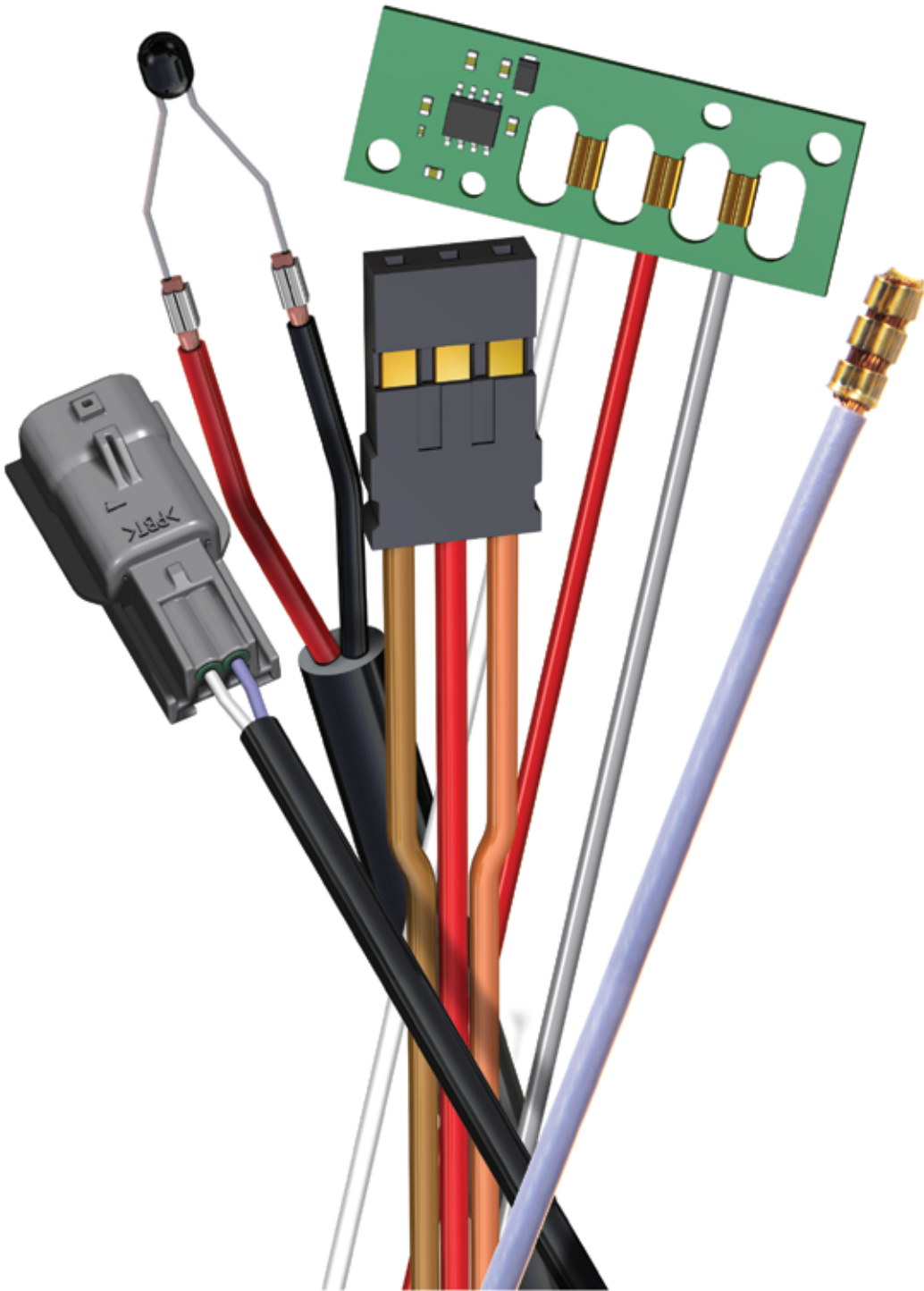
lutions GmbH (now Schleuniger Test Automation GmbH) of Jettingen, Germany. Cirris Systems complements the product portfolios and global market coverage of adaptronic and Schleuniger Test Automation exceptionally well and opens up the North American market for testing and test automation. It also reduces Schleuniger’s dependency on the automotive industry as Cirris generates the vast majority of its sales outside this industry. In only five years, Schleuniger has built its testing business from the ground up to become a single-source supplier for all low- and high-voltage testing needs, from simple-to-use to highly configurable high-end testers and from standalone benchtop testers to partially or fully automated testing systems for virtually all applications in any industry. “We are excited to become a part of the Schleuniger Group after many years of sales and technology cooperation. Our product and service offerings complement the already extensive testing portfolio of the Schleuniger Group, and this acquisition offers us the chance to expand even more rapidly as part of the global Schleuniger organization. And no less important for a successful \_\_\_\_\_ Continued on page 6



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September/October 2020

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## ASK ABOUT OUR NEW DESIGN DRIVE SYSTEM

# M & A 101: Lessons learned from decades of deals

## The Brokerage Scam

By Loren Smith

**H**arness manufacturers often ask me about frequently receiving letters or emails from entities claiming to have a buyer interested in acquiring their company. Are these communications legit, they want to know. In almost every case, the answer is no. Instead, these letters and emails are being sent by disreputable individuals and firms who are simply fishing--with a very wide net.

The senders do not really represent a buyer--and they might not even be knowledgeable about the wire harness industry. They are simply mass producing blind inquiries to

thousands of companies and hoping for a response. Their business model consists of professing to have a buyer, and then, if someone responds favorably, scrambling to send thousands of additional letters or emails to companies that might conceivably consider acquiring a wire harness company. In this second wave of communications, the scammers claim to represent the potential seller who took the bait.

The shakiness of this "enterprise" explains what happened to a harness owner I know. She told me she had received a letter from an individual claiming to have a buyer for her business--a buyer who had targeted her industry ... a buyer who



Loren Smith CEO  
Blue Valley Capital


had selected her company as a perfect fit for its acquisition strategy. But when she contacted the author of the letter asking for a description of the buyer, she never received an answer to her question. Apparently, the scammer was unable to find a potential buyer in a reasonable time. Game over.

It is quite fair to label the folks who engage in these practices as scam artists because they bring nothing to the table and they are misrepresenting or lying to both parties. Without industry knowledge, without buyer relationships, without the ability to put together a CIM (confidential information memorandum), and without any knowledge of the M&A process, in the very unlikely event they do put two parties together, the resulting price will not approach the company's true value.


Although these folks provide no value added and, in some instances, do serious harm, nothing they do is illegal--which is why, unfortunately, this unsavory practice exists in so many business sectors. We are awash in folks trying to make a living in this fashion.

Practically every harness owner I have ever dealt with is barraged with these kinds of letters, and my advice is to put these letters where they belong: in the round file.

Loren Smith can be reached at [lms@blv-capital.com](mailto:lms@blv-capital.com) or [www.bluevalleycapital.com](http://www.bluevalleycapital.com).



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# Schleuniger Group Acquires Cirris Systems

Continued from page 1 \_\_\_\_\_

future together: We also see a great fit between our corporate cultures and values, and we look forward to joining the Schleuniger family”, says Craig Taylor, President & CEO of Cirris Systems, who will remain in his current position at the new Cirris Inc.

- Some specific strategic advantages of the move:
- Acquisition secures complementary testing expertise and improved market access for Schleuniger Group in the important North American market for testing and test automation of cables and harnesses
  - Investment by Schleuniger in key growth segment and in further improved value-chain coverage
  - Another important step in Schleuniger’s strategy to become a strategic system partner for its global customer base
  - Enables more rapid expansion of Cirris as part of the global Schleuniger Group

*About Cirris* - Founded with a single testing product in 1984, Cirris has grown to become a leader in the development and production of wire and harness test equipment, including testers, adapters, software, accessories and custom products. Our reach has extended beyond the headquarters in Salt Lake City, Utah, to representatives and distributors in over 20 countries. We have placed testers in the hands of thousands of customers

on all seven continents. As an ESOP (Employee Stock Ownership Plan) company, employees at Cirris share responsibilities and benefits, thereby increasing workplace efficiency and satisfaction. Every employee owner at Cirris focuses on promoting quality products and providing a gratifying customer experience.

*About Schleuniger* - Founded in 1975 in Thun, Switzerland, the Schleuniger Group is a globally active technology company and a leading supplier to the wire processing and testing industry. With its wholly owned and independently managed company, DiIT, Schleuniger is also a leading player in digitization and industrial IoT. Most of the Schleuniger Group’s customers are suppliers to the automotive, entertainment and information industries, as well as to the communications sector. Schleuniger’s products are used wherever precise connections and highest productivity are required. The company has development and production locations in Switzerland, Germany and China. With a network of sales and service companies in North America, Europe and Asia and more than 40 distribution partners worldwide, Schleuniger is always close to its customers. The Schleuniger Group represents the wire processing business unit of the publicly listed Metall Zug Group and has over 900 employees including 50 apprentices worldwide. For further information visit [www.schleuniger.com](http://www.schleuniger.com).



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## 4 Ways Industrial Manufacturing Companies Can Recover from COVID-19

Continued from page 1 \_\_\_\_\_

important for a company to understand the needs of their customers.

It's equally important for customers to believe that their suppliers care about them and that they are interested in understanding and improv-

ing changing situations. Manufacturers have been forced to move from a position of, "We sell these products" to "What are the needs of my marketplace?"

## 2. Get New Suppliers

Prior to the disruption caused by the pandemic, industrial companies in the U.S. were heavily reliant on overseas suppliers. Many companies had ruled out buying from domestic vendors because they could get products from an overseas supplier at a better price. This is no longer a valid assumption as these supply chains have broken and the overseas reliance has shifted.

This creates an opportunity for U.S.-based component manufacturers that previously were not able to compete. Buyers are now starting to consider domestic suppliers as a back-up, or even a preference, to those overseas.

### 3. Evolve Your Go-to-Market Strategies

As changes unfold in the manufacturing space, go-to-market strategies have to adapt. Some companies have repurposed their salesforce, others are re-tooling their processes to adapt their products for new applications. This is opening up new markets, whether they are complementary, supplemental, or brand new.

Big changes to marketing strategy also necessitate changes to value propositions. If a company starts making new products, supplying different customers with U.S.-built components, or selling into a brand-new market, their messaging and value propositions need to be updated to reflect changes.

Additionally, buyers in the industrial manufacturing sector have changed their behavior. They're not going to trade shows. They're not allowing a salesperson in the door. Without events and sales calls, companies have to consider alternative ways to engage buyers and suppliers.

Many industrial manufacturers have been slow to adopt modern marketing practices and may only have a basic web presence. This current situation has revealed the importance of digital marketing. Websites are now crucial to clearly communicate a company's message and value propositions. The website is a substitute for trade shows, product research, education, video demonstrations. Without the ability to meet face-to-face, customers that respond to outbound messaging, advertising, virtual events, and educational videos are all funneled back to the website. It is a key tool for engaging

*Continued on page 10*

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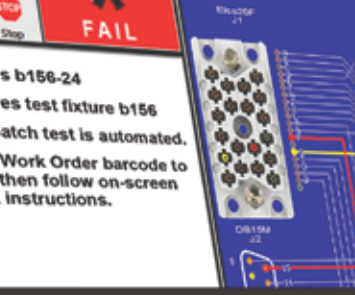
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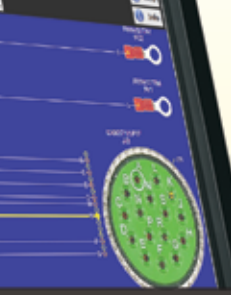
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3	32	32	63 mΩ	Pass	< 1 μA	1499 V	> 1 G	0.189 mA	996 V	5 M
4	34	34	125 mΩ	Pass	< 1 μA	1499 V	> 1 G	0.204 mA	996 V	5 M
5	36	36	249 mΩ	Pass	< 1 μA	1499 V	> 1 G	0.204 mA	996 V	5 M
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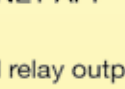
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
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## 4 Ways Industrial Manufacturing Companies Can Recover from COVID-19

Continued from page 8 \_\_\_\_\_

and sharing with customers and prospects. As such, a digitally enabled website should be a priority going forward.

#### 4. Have Agility, Not Prediction

Manufacturing CEOs should steer conversations away from guesses about what will happen or when. Instead they must focus on preparing the organization to flex and switch quickly. Windows of opportunity could be missed if CEOs waste time and money trying to predict

what's coming. The future is unknowable. Success in this climate is more about agility and less about prediction.

Now is the time for manufacturers to become receptive to new ideas. This is the moment to pull teams together and say, “All right, let’s look at this business differently. Let’s build a plan. Let’s figure out what levers to pull, when to pull them, and how hard to pull.”

If manufacturers build agility into their organizations going forward, they'll have a better

chance of flexing new strategies into action quickly. What was done in the past may not be adaptable to the new way of doing business, but positive steps taken today will equip businesses to meet tomorrow's challenges.

Atul Minocha (Partner), Dawn Werry (Partner), and Kimberly Miller are CMOs with Chief Outsiders, the nation's leading fractional CMO firm focused on mid-size company growth. They work with global industrial goods companies to

solve seemingly inextricable growth challenges. More information at [www.chiefoutsiders.com](http://www.chiefoutsiders.com)

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Technology Adoption Has to Start  
at the Top - Addressing the  
Technology Adoption Gap

By Paul Hogendoorn

I t's been an interesting summer, to say the least. The challenges, solutions and new outcomes brought about by the sudden change in our world are wide ranging, and what 'normal' is in the future will be different than what normal was in the past.

There is one 'non-change', or slow change, that continues to surprise me, and that is slow rate of adoption of digital technology on the plant floor. My assumption was 'social distancing', working from home, and the focus on the elimination of unnecessary contact points (i.e. paperwork) would have accelerated the adoption of technologies that have found their place into the rest of our lives - our homes, schools, banks and institutions, and much of our recreational and social activities too - but that hasn't happened. Not yet, anyway.

Prior to Covid, most small and medium manufacturers were contemplating what Industry 4.0 could mean to their company or industry, but few were taking concrete first steps. It was still an investigation for many, and although it was believed to be important, it didn't seem to be urgent. Then came Covid, and the ability to work from home and monitor machines, production and processes remotely, became increasingly advantageous, stimulating a lot of additional urgent discussions, but still little actual 'first step' action from many. There are certainly exceptions to this, but by and large, the adoption of Industry 4.0 technologies by small and medium manufacturers is still



Paul Hogendoorn

surprisingly slow.

The reason for this, in my opinion, is the vision gap between the CEO and the people that any information technology related objectives get delegated to. Most manufacturing company leaders graduated through the ranks of production, or engineering, or perhaps even accounting. Over the course of their careers, they have developed a familiarity and understanding with all of those facets of the operation. The folks immediately below them on the organizational chart share the same basic understanding of those primary elements of the business, although they may specialize in one particular area or another. "IT" however is often considered a 'service' to the business, and the people deeply involved in information technology, or considering advanced technologies, are usually far more technology focused than they are day-to-day manufacturing

Continued on page 14

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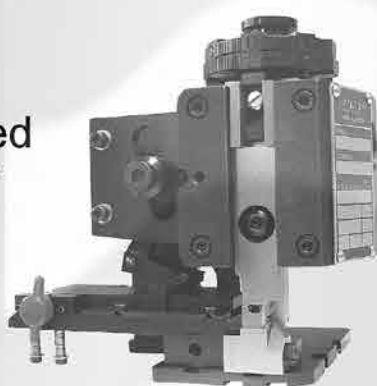


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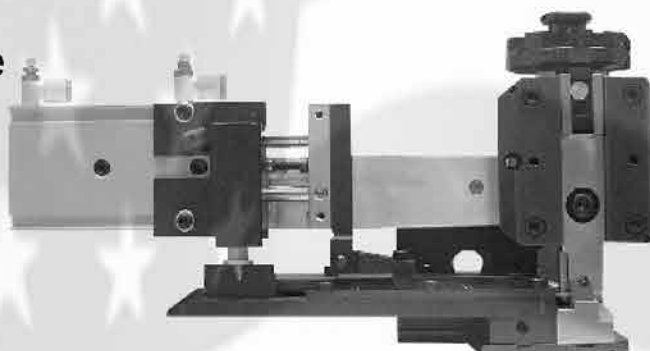


Model 1700

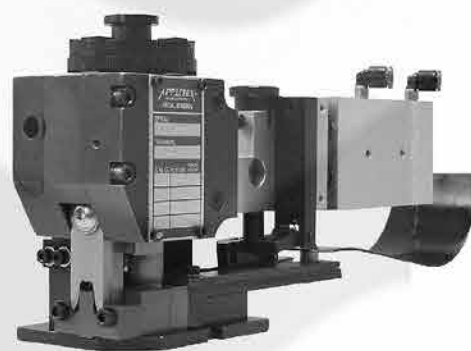


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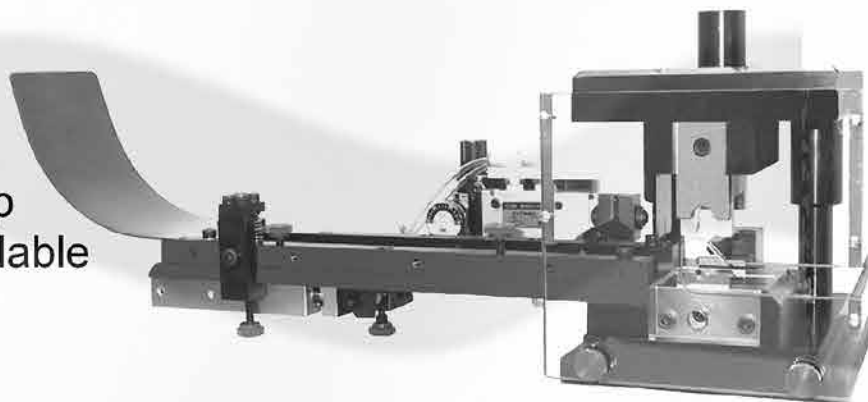


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# Technology Adoption Has to Start at the Top

Continued from page 12

focused. Whenever a new technology conversation comes about, it quickly gets delegated to them, because in the eyes of the executive management team, they are the most technically knowledgeable people. The problem is, most of these technically smart people are several levels away from the CEO, and none of their responsibilities and objectives tie directly to the company's vision or its overall performance. The CEO, and the people that report directly to the CEO, don't have an instinctive understanding and familiarity with technology, and the people the technology objectives have been delegated to don't speak the same language as the executive does, nor are they accountable for the same objectives. The finance, engineering, administration and production departments are all accountable for a common set of interdependent goals, but the IT and advanced technology groups typically have their own specific goals completely apart from the

other departments.

Earlier this year, I was asked to weigh in on the topic of technology adoption by small and medium size manufacturing companies by the Excellence in Manufacturing Consortium ("EMC"). After a lot of research and contemplation, my conclusion was that the CEOs are usually well intended in regards to adopting Industry 4.0 technologies, but they are not comfortable with the whole technology conversation, so they delegate it to someone they think is. If a CEO delegated a financial objective to the CFO, the CEO would still have some basic financial aptitude to be able to stay up to date with the CFO, and keep the CFO's efforts connected with the company's vision and obligations to its stakeholders. The same is true if it was a production objective, an engineering objective, a new product objective, or even an administrative or a sales objective. With advanced technology or Industry 4.0 objectives, the problem is often that the CEO believed they had to delegate the project to someone

he or she is unable to communicate with, and that person is not part of the executive team that shares all the interrelated responsibilities to the company's stakeholders, (i.e. its customers, suppliers, staff and investors).

As part of that research, FreePoint developed a "value-to-vision persona chart". Roles on the left are very tactile, and in the present. On the far right, the C-suite scope of view is far longer term, and the metrics are financially, and sustainability focused. In the middle, you have department and plant management roles. The two positions missing on the value-to-vision connecting line are the IT manager and CTO. Although very important positions, they are often not directly connected in the line connecting the value adding activities of the plant floor with the vision, and accountability, to the stakeholders.

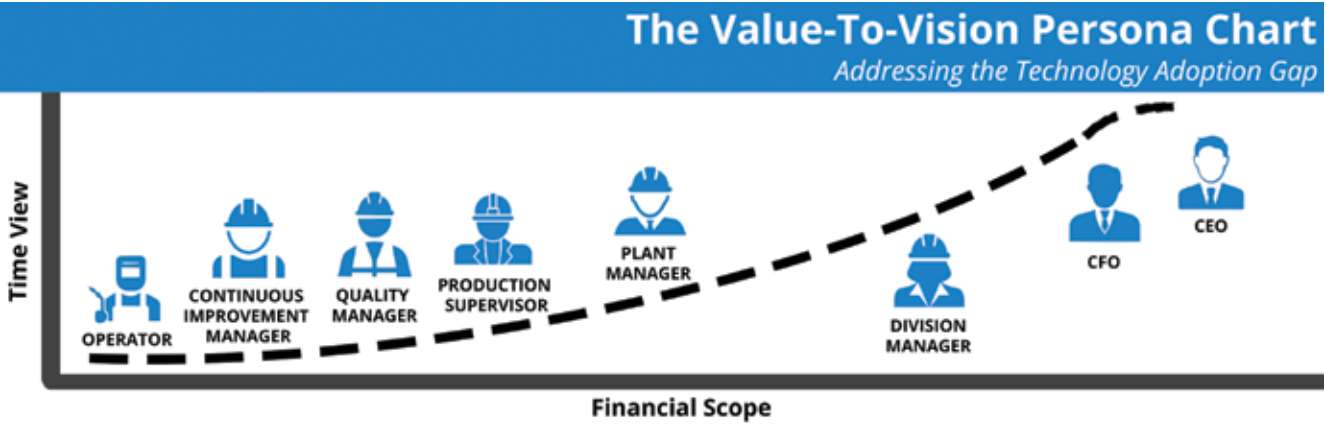
This, in my opinion, is why many manufacturing companies remain slow to adopt new technologies. There are exceptions, but in most of those cases, the exceptions are the ones where the CEO has a strong per-

sonal interest and inclination towards technology.

There are several ways to close this gap. One way is to make sure IT is not considered a 'service' and run as an independent, stand alone department, or 'advanced manufacturing' not simply considered a research or development project. They need to be connected to the company's vision directly, and to the accountability to the stakeholders. Another way is to be aware of potential candidates within your organization that have a good sense for your company's business and a strong personal inclination towards technology, and then encourage and support them to develop and advance their technology skills. And another is to investigate association or government sponsored programs to help you get started. There are many such funding opportunities now available.

Technology adoption needs to start at the top. It can be delegated to a champion, but to make sure the right goals get accomplished for the company, the CEO needs to stay involved. Effective delegation requires communication, goals, checks and balances. Anything less is abdication, not delegation.

Paul Hogendoorn is cofounder of FreePoint Technologies. For further information on this topic, he can be reached at paul.hogendoorn@getfreepoint.com or visit www.getfreepoint.com



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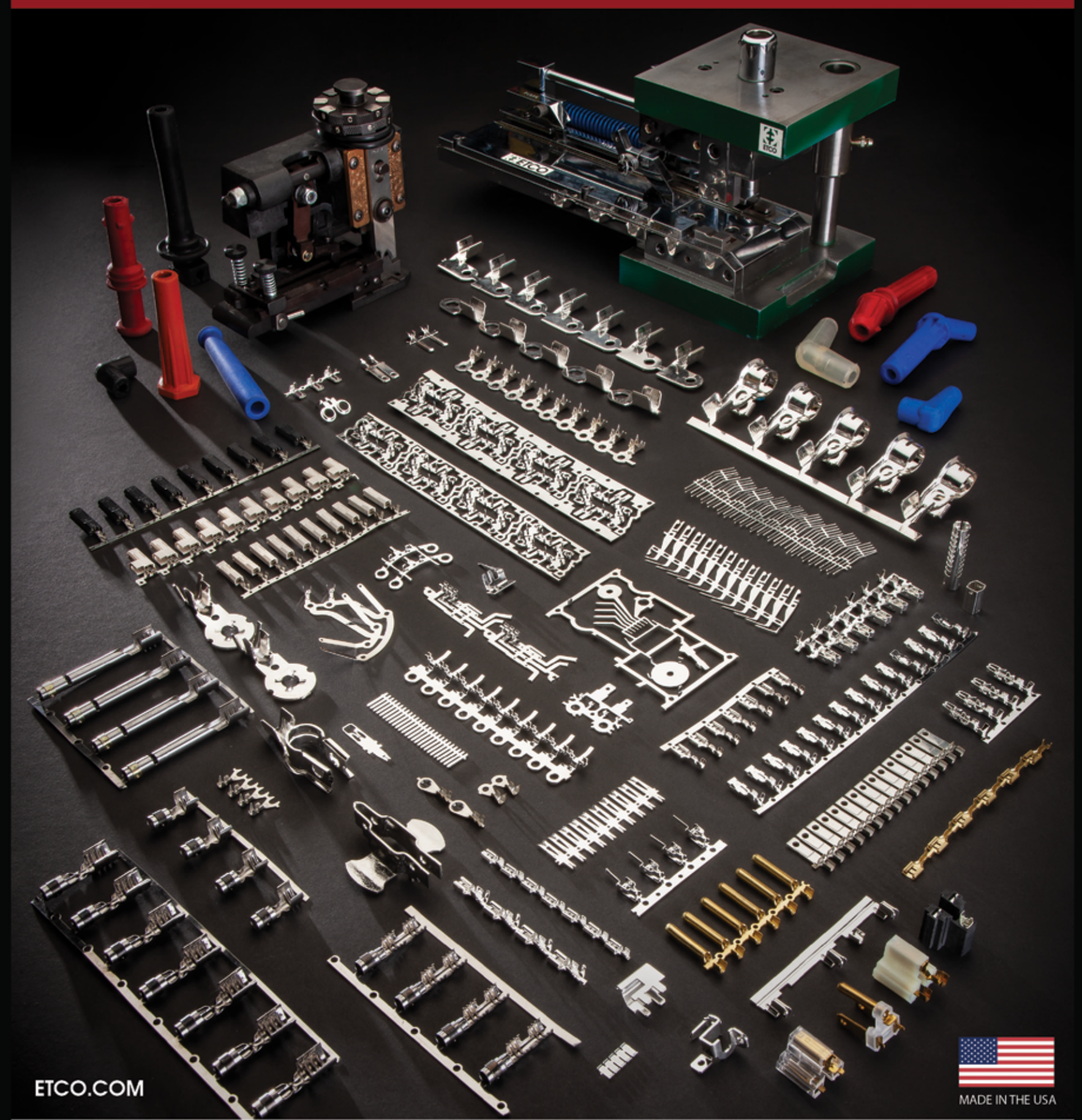
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# EEVision Provides Simple Visualization of CAD Data

By Joe Tito  
Wiring Harness News

I recently ran across a Facebook post from Sanjay Patel, CEO at EDA Direct promoting a webinar entitled, “Smart, Interactive Cable and Wiring Harness Documentation for Fast Issue Resolution.” I was obviously intrigued and contacted Sanjay. I invited him for an interview to dis-

cuss their software solution tool they call EEVision.

He sent some preliminary information prior to our interview. In a nutshell, EEVision is a visualization platform that OEM’s can use to share harness schematic and design data from their CAD systems (Siemens Capital, Zuken E3, etc.) downstream to harness manufacturers, field service technicians, etc. In essence, they

can share that data with anybody who might need it, but does not have the expensive CAD software license. They partner with a company called Concept Engineering in Germany to bring their visualization technology to the cable and wire harness industry.

Following are some of the salient points from our conversation:

**WHN:** Tell us a little about your company.

**Sanjay:** Our company’s name is EDA Direct and we’ve been in business since 1997. We are a Solutions partner for electronic automation design (EDA) companies, as well as systems companies. There’s a company called Concept Engineering in Freiburg, Germany who are leaders in Visualization technology, and we have been their partner in US and Canada since 1997. Their technology is all about visualization and schematic generation on the fly. Their previous product, before EEVision, was called StarVision PRO, which was primarily used by circuit and chip designers. They took their expertise and said, ‘ok, how can we help cable and wire harness engineers.’

**WHN:** What’s the fundamental problem your product seeks to address?

**Sanjay:** One of the fundamental problems we recognized in the industry was that publishing the cable and wire harness electrical data to supply chain, manufacturing and service groups was difficult. Modern automotive and aeronautical electronic system complexity has exploded, creating a major problem for development teams and service operations. Engineers and technicians waste hours trying to find critical information on unfamiliar systems, using incomprehensible static documentation or CAD displays. This has a significant impact on product quality, maintenance and schedules.


EEvision is an online visualization and debugging solution that easily renders schematics of circuits, wiring harnesses and component attributes specific to individual development and maintenance situations. Taking original CAD data or proprietary data as input, schematics are automatically rendered and explored on-the-fly, allowing complex systems to be easily and quickly understood. Google-style live search features allow for precise information to be extracted from huge data files and displayed in an easy-to-understand fashion.

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Continued on page 19

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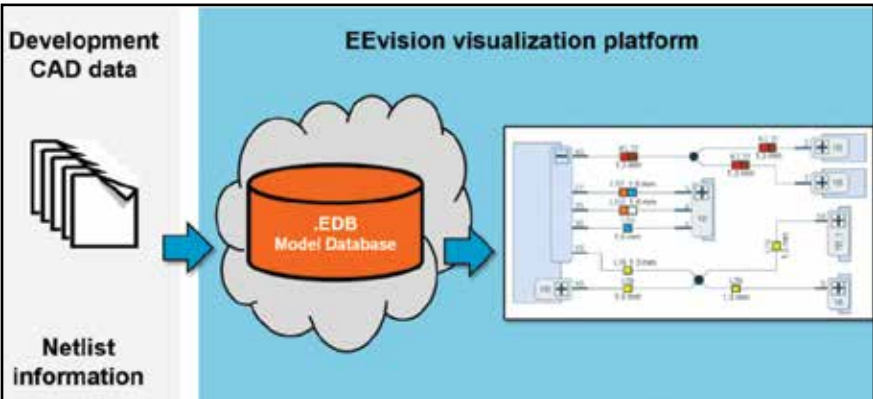




Figure 1. On-the-fly Schematic Display

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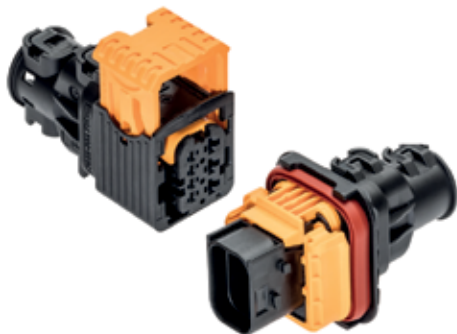
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# EEVision Provides Simple Visualization of CAD Data

Continued from page 16

highlighting key data to significantly accelerate development and debug. The views can be modified and transformed as the engineer moves around the system, with important information actually displayed on the schematic, for example, power distribution, component detail, and other nomenclature. The EEVision online live search capability can extract all components from a model database (EDB) associated with specific vehicle function, (e.g. interior lighting) to create and display a complete schematic diagram on-the-fly (Fig. 1).

**WHN:** It sounds like it would be a more reliable way to share information and take the guesswork out of quoting a harness.

**Sanjay:** Yes, engineers can then do Google like searches looking for certain connectors or modules from page 1, for example. On the fly, [EEVision] will show you everything that's connected to that particular splicer or connector and it's dynamic. The schematic will only show the module that you are interested in, but when you double click on it, the engine grabs adjacent data as needed. So, you're not looking at pages and pages of PDF data sheets. You are zooming in to the area you want to analyze.

**WHN:** How did this all come about?

**Sanjay:** To give you a bit of a history of how this technology came about, we were approached by NASA and JPL. They had a problem where they were using Mentor Capital (now Siemens Capital) on the Mars Rover project. The lab technicians wanted to look at schematics, and share them with manufacturing, but they had no consistent way of having all these people look at the same data. Design changes had to be shared with manufacturing and the data translation was literally taking months. So, Concept Engineering partnered with JPL/ NASA to develop the EEVision platform.

Now, with EEVision, they can do all this instantaneous in real time, and any changes that are made by the

designer is reflected in EEVision. Manufacturing (or supplier) is then flagged when there is a change in the design. They can stop the manufacturing process to make the new change. It's been a huge productivity game changer for NASA and JPL. They continue to use Capital for design, but when it comes to publishing the data, they have deployed EEVision. Actually, your readers can check out the whole story at, <https://bit.ly/3gwxqlZ>.

**WHN:** Are there any other ways it can condense the time to market?

**Sanjay:** Suppliers have asked for plug-ins to do verification checks for manufacturability. Let's say, for example, they want to calculate, the weight of the cable. Our system knows the length of the wire and the component parameters, so we can give them the total weight of the whole harness. In fact, you can generate a bill of materials from EEVision.

**WHN:** Thanks, Sanjay. Where can I direct readers and what type of information will they find there?

**Sanjay:** Our website (edirect.com) has plenty of information. They can see industry specific videos demonstrations on the Video tab, and white papers under Documents.

Under the Events tab, they will find many webinars we have coming up. There's just a plethora of information there, and I would invite them to spend some time touring the website. And, of course, they can always contact our team directly at [sales@edirect.com](mailto:sales@edirect.com).

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# Improving Outcomes for Our Clients in Electronic Harness/Interconnect Manufacturing

By Arik Vrobel  
El-Com Systems

**Introduction**

The electronics OEM industry can hugely benefit from the option of having a comprehensive solution to improve the effectiveness and accuracy of interconnect design. This is even more important for high-reliability industries where interconnections tend to be highly complex, highly sensitive (in terms of performance) and face rapid change due to evolving application parameters/constraints all within a very high-risk, late-cycle project timeline environment which these industries often face.

**A Growing Problem**

The Interconnect industry is ripe with challenges and hurdles partially because of the significant variability in component design, requirements, processes, applications, manufacturing practices, differences in design software capability and large variability of suppliers, their documentation and their qualifications. What compounds the challenges of the interconnect industry is that customers/OEMs, whose focus is on their main product development efforts, are often not deeply skilled in or adequately focused on the technical design details of these late-in-the-cycle interconnect systems. Thus, they may over-design, under-design, or more of-



Arik Vrobel, El-Com Systems

ten improperly design these critical components

**Why are Critical Interconnects Designed Late in the Product Design Cycle?**

Interconnects (more precisely: harnesses, cables with connectors that are interconnecting between sub-systems or components) are technical components of a system and are usually designed last in the overall product design cycle. Typically, major systems’ mechanical, and electrical designs of core products “*have to be well developed before their interconnections are fully defined*”. Interconnections today are growing in sophistication but still are consistently an afterthought in the



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design process. Yet they play a hugely critical role in the success of the product both in terms of its technical performance to target requirements, its development roadmap/timeline, the product's overall cost and impact on production schedules.

Late Design Lends Itself to Costly Mistakes and Delays

Because the interconnections are typically designed at a later product development stage and are often considered an afterthought, mistakes are often very costly and risky. As a result, they can cause delays that span many weeks or months and also result in sub-optimal long-term designs in terms of performance, cost and risk of failure.

This article will attempt to provide greater insight to a major challenge we see impacting the quality of harness/interconnect design and manufacturing:

CAD Packages Not Well Suited for Interconnect Market

MCAD (Mechanical Computer-Aided Design) Software has become very sophisticated over the past 20 years, given the extensive investment of large industry players such as Siemens, Autodesk, CREO, and Solidworks amongst others. It is extensively used for geometric designs mostly related to mechanical components and has significantly developed in capacity for simulations and error validation. However, the typical me-

chanical CAD packages that many OEM's use are not well suited for the electrical interconnect realm and therefore provide a very limited view of the interconnect as a subsystem of its own.

Integrated Error-Checking/Design Validation Tools Miss the Mark

In fact, when evaluating typical MCAD software we note that its integrated error-checking/design validation tools only provide feedback on the below parameters, but really there is so much more that is required:

- 1. Wire ends not connected to anything
- 2. Missing or duplicated wire numbers
- 3. Duplicated components, terminals, pin values, cables, and cable wire colors
- 4. Components with wire connection attributes but no wire connected
- 5. Components without a catalog Value
- 6. Child contacts not related to a parent
- 7. Components in the same wire network from different categories. For example, a one-line symbol connected to a schematic symbol.


Continued on page 23

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# Improving Outcomes for Our Clients in Electronic Harness/Interconnect Manufacturing

Continued from page 21

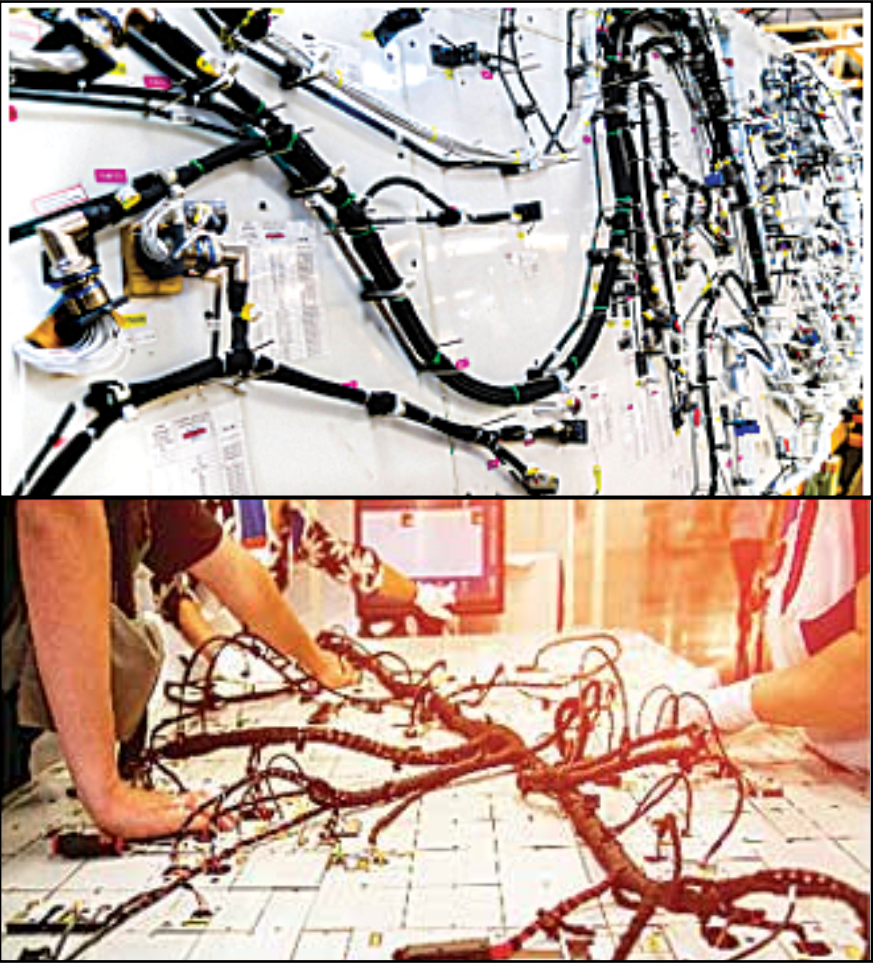
## Interconnect CAD Software Packages Must Address These Issues

When we look at the traditional Electronic ECAD and Mechanical MCAD software tools we see that they usually provide very comprehensive design validation and simulation capabilities. These tools are highly efficient and effective for the electronic and mechanical systems that they are being used for. How-

ever, the same cannot be said for the interconnect CAD software packages. For example, some of the unvalidated or not well-validated characteristics that we usually find in interconnect designs include:

- 1. Mateability or fit of components for one another, for example are wire gauge sizes meeting the requirement in the respective content

Continued on page 25



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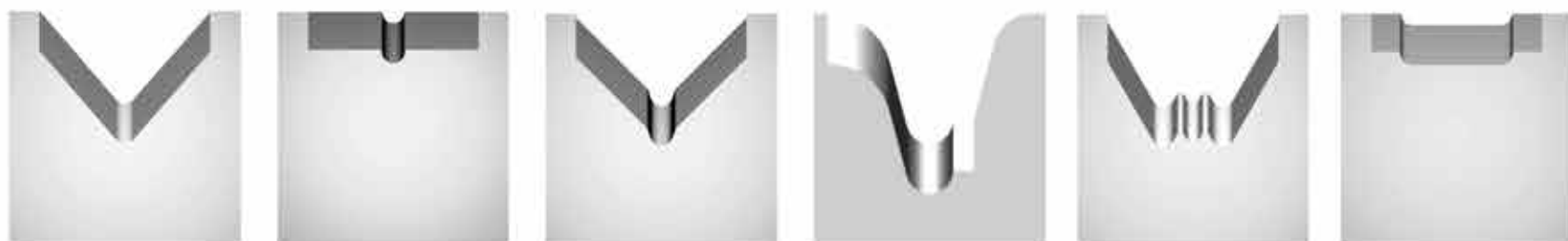
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# Improving Outcomes for Our Clients in Electronic Harness/Interconnect Manufacturing

Continued from page 23

- 2. Sizing of consumables such as sleeving to the bundle size. In fact, many software products tools don't effectively predict the bundle sizes thus the definition of important consumables such as braiding, sleeving or boots is arbitrary (with a high potential for error) and often forcing the correct choice to be made as part of the production process
- 3. Existence and location of splices in the harness and their impact on the bundle size
- 4. Is the correct material properly defined and cataloged or are there mistakes in the parts-lists?
- 5. Does the schematic match the BOM or are there key omissions?
- 6. Are the parts called out meeting the application for environmental requirements such as ROHS, temperature, voltage?
- 7. Is the BOM accurate (correct quantity of contacts, solder devices identified, right length of wires and consumables, etc.)?

## As a Result, "Trial-and-Error", On-The-Fly Changes More the Rule than Exception

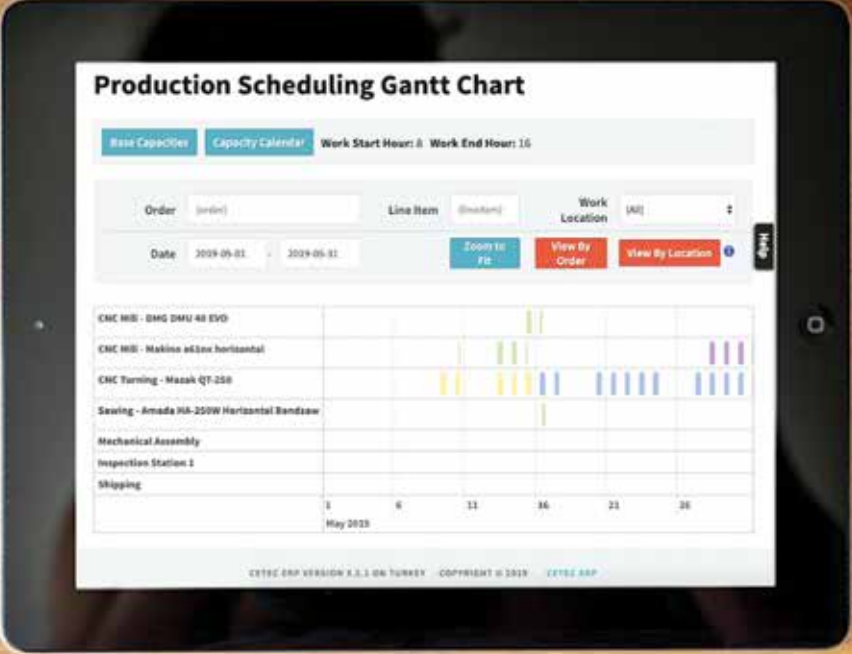

At El-Com Systems we have spent countless hours supporting the design output of many of our custom-

ers. Given the volume of incoming requirements, and the experience required of our engineers to properly evaluate the design and estimate scheduling and costing of new requirements, we have always found it very challenging to identify (discover) many customer mistakes until we reach product realization phase, when the impact is already too great. El-Com has polled many peers and customers and it seems to be a common theme in this field that we accept a "trial-and-error" approach to building harnesses at an NPI level and we accept some sort of "on-the-fly" changes when we find mistakes, which is quite often and as previously stated can be quite costly and negatively impactful (cost and schedule).

## El-Com Teaming with Key Players to Provide Design Validation

Given that El-Com has seen the negative impact of design errors, not just on our customer performance, but on our own operational execution as well, we have decided to invest our time and resources to provide OEMs with a more comprehensive design validation output. We have teamed with key customers, industry peers, and technical experts to improve our approach for design val-

Continued on page 27




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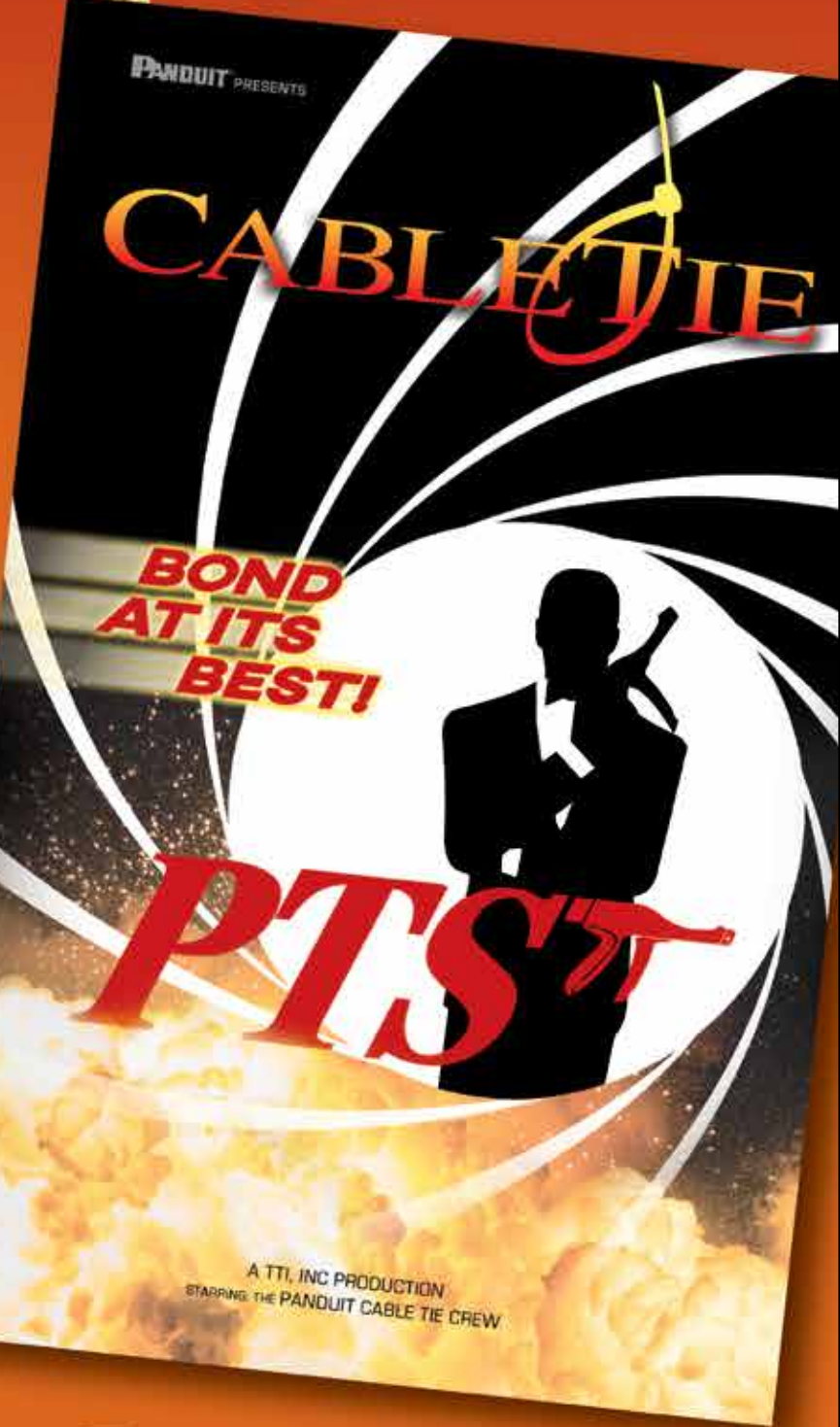
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# Improving Outcomes for Our Clients in Electronic Harness/Interconnect Manufacturing

Continued from page 25 \_\_\_\_\_  
idation and provide Customers with feedback prior to the NPI release.

## Solution –Develop the Tools and Processes to Perform Design Validation

To accomplish this, El-Com is shifting the mindset of our engineers and technical team to not only provide a cost-estimate on a prospective interconnect, but to also perform a design validation concurrently. We have found this approach to be immensely valuable and appreciated by our customers and we hope to continue to impact the industry in a positive way. As a result, our customers’ interconnect designers can better focus on the purpose of the interconnect, which is to effectively connect a multitude of sub-systems in a system, rather than waste their time troubleshooting and upgrading existing designs as a result of mistakes that could have been identified earlier in the design cycle.

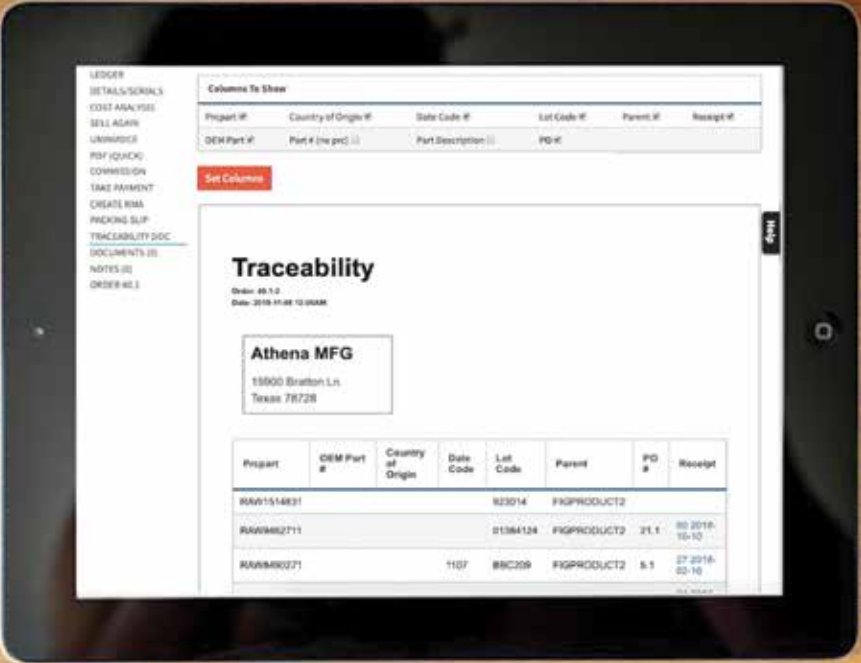

This is how El-Com envisions the future of Interconnects. Contact us if you agree and want to consider participating in designing and creating this enhanced future of the electronic interconnect industry.

### About the Author:

Arik Vrobel is a seasoned executive

with extensive background in operations and strategic business development. Arik currently owns and oversees several operational companies (www.el-comsystems.com & www.ystechusa.com, amongst others) with an emphasis in the areas of design & manufacturing, of high-reliability electronics and electro-mechanical products to OEMs (Original Equipment Manufacturers) in a variety of industries including defense, space, aerospace, medical, and industrial markets. Over his career, Arik’s companies have successfully executed and delivered on over \$1Billion of specialty contracts and products for a variety of customers.

Arik is passionate visionary focused on streamlining and simplifying complex products and processes both for customers as well as internal applications. During Arik’s time overseeing the El-Com Systems’ Business, the Company has transformed itself into being a global leader of electronic interconnects for sophisticated, high-reliability applications and products. With multiple geographic manufacturing locations across the Americas, El-Com Systems supports many of the industry leaders in space, aerospace, military/defense, commercial avionics and medical applications.




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# Back to Basics

## Strain-Relief: Design Tips for Durability and Aesthetic Appeal

By Christian Brown  
fictiv

You reach over to plug in your phone, and you feel that spark – and not in a good “I love this product!” kind of way. The wire is broken, and yet another charging cable is about to make its way to a landfill, while you have to make a midnight run to the store to be ready for your 6 a.m. Skype conference with Japan.

For such a simple idea, strain relief designs have a huge impact on users, right or wrong. And it’s not only in consumer products where we can blame gorilla-like users; even NASA has these issues. When you need your cables to last a long time, how can you create a reliable connector? Can you do this without demolishing that beautiful aesthetic your team has worked so hard on? The following tips will get you the answers you need, and still have you out the door in time for happy hour.

**Why Do Good Cables Go Bad?**  
Tight bends in the cable near the connector cause high stress, fatigue,

and failure. The stiff connector interfaces with a very flexible cable, and the point of contact ends up taking the brunt of the movement. Every tug is concentrated on a single point.

Strain is inversely proportionate to the radius of curvature – a fancy way of saying the tighter the bend, the more risk of failure. An easy way to visualize this is to take two paper clips out of your desk drawer and straighten them (for those who want a more detailed, scientific approach, check out the work done by The Royal Institute of Technology in Sweden). With the first paperclip, try bending the wire around a pencil, straightening it, and repeating this several times. The paperclip will bend easily, and is unlikely to break. With the second paper clip, make tight bends, back and forth, and see how many times it can be bent without breaking – my personal best is five repetitions. The lesson is clear: repeated tight bends = failure.

**The Solution? Strain Relief**  
Strain-relief on cables offers mechanical support to the cable, pro-

Continued on page 31

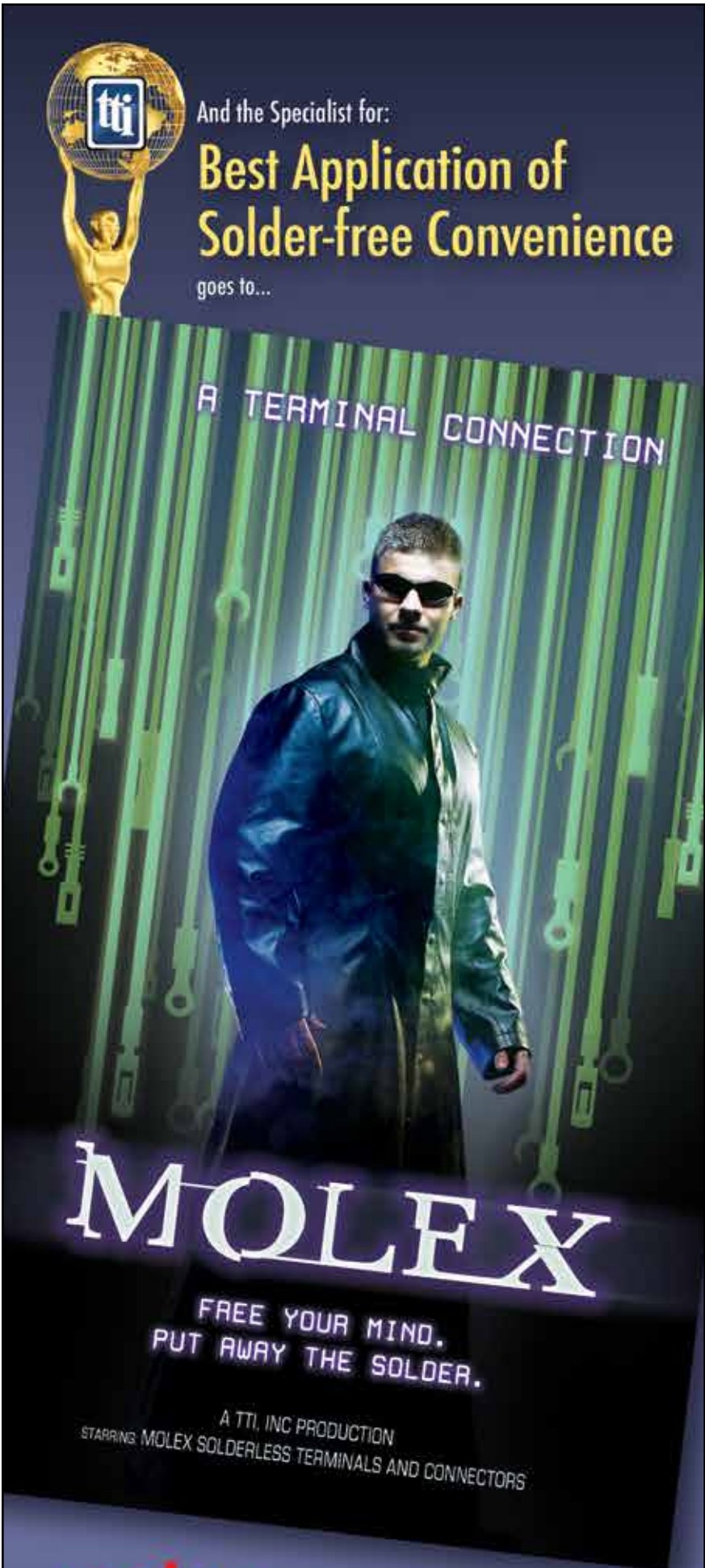


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# Strain-Relief: Design Tips for Durability and Aesthetic Appeal

Continued from page 29

tecting it from tight bends and fatigue loading. But how much is enough?

Of course, you can take the strain equations from bend radii, correlate the strain with stress using the modulus of elasticity of the particular cable material, look up values for maximum stress, figure in a safety factor for material variation, and arrive at a number predicting safe bending allowance for your particular cable. But unless you gain masochistic pleasure from second-order differential equations, I recommend something simpler: the 8X rule.

For any electrical cable, multiply the overall diameter of the cable by eight, and use that as your minimum bend radius. Of course, there are exceptions for shielded cables and multi-core shields, but this basic rule is accepted by the National Electric Code, and will get you the relief you need, without adding the cable's stress to your own.

Okay, so now we know why we need strain relief, what strain relief is, and even how tight to make the bends. Can we simplify incorporating it into the design and get a shaken-not-stirred order on the way? Yes!

## COMMON STRAIN RELIEF DESIGNS

Strain on electrical cables has been around as long as humans have been channeling electricity for our own devious uses, and electrical strain relief designs have been around nearly as long. Today there are several common designs, each with some pros and cons.

### Metal Strain Relief

Older designs involved the use of a metal spring surrounding the cable at the cable-connector junction. Simple and effective, just make certain when incorporating the springs into your design that the bend radius will be large enough when the cable

is subject to common pulling forces. One of the great things about this design is its classic look, so this makes it a great option for cables in high-end consumer designs (Fig. 1).



Figure 1. Metal strain relief - simple and beautiful

### Plastic Designs

Much more common these days are strain relief designs made of flexible plastic. While there are theoretically an infinite number of designs, most designs fall into one of three categories: one-direction, multi-direction and solid.

#### 1. One-Direction Strain Relief

No, we are not talking about using upbeat music to relax. But properly designed, this design is something to sing about. (Almost. Well, not really. Who sings about electrical designs.



Figure 2. One-direction strain relief is great for relatively predictable applications

Uni-directional designs give bend relief in one direction while remaining stiff in the other (Fig. 2). A series

Continued on page 40

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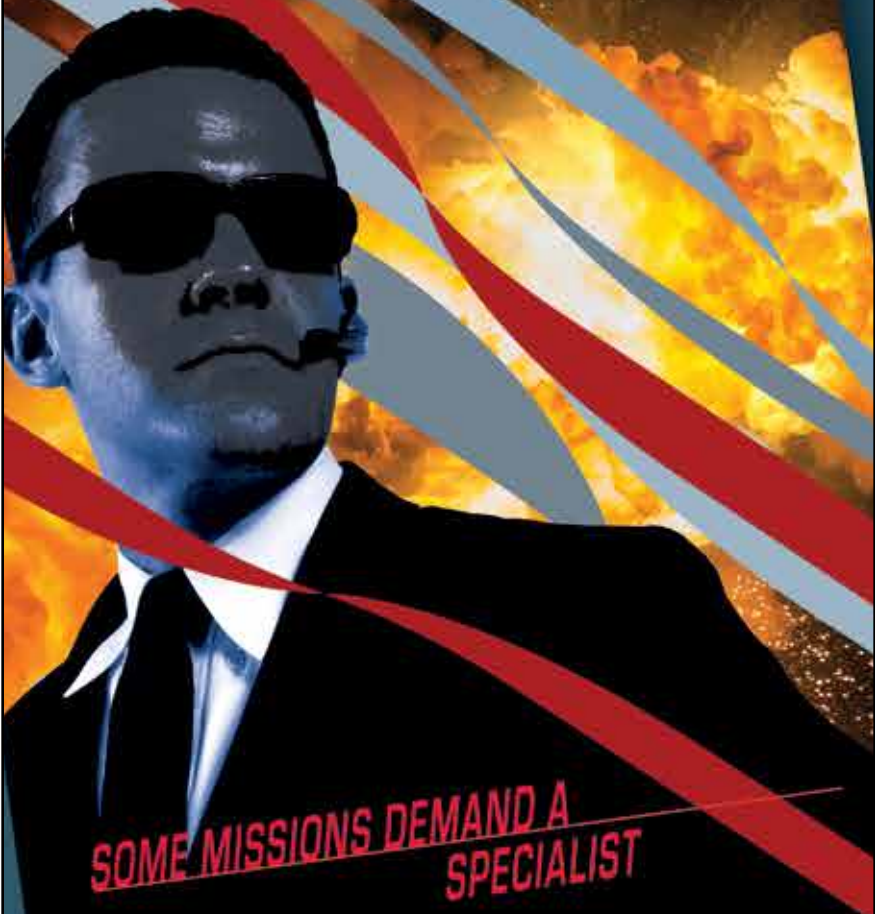
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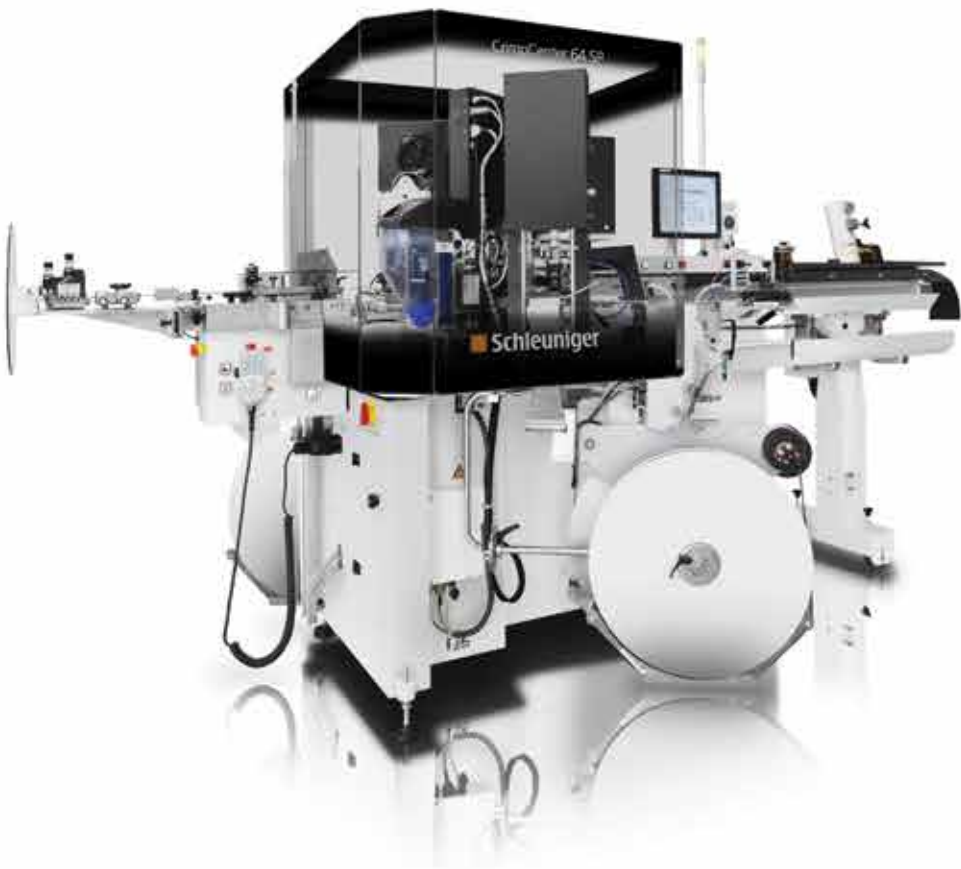
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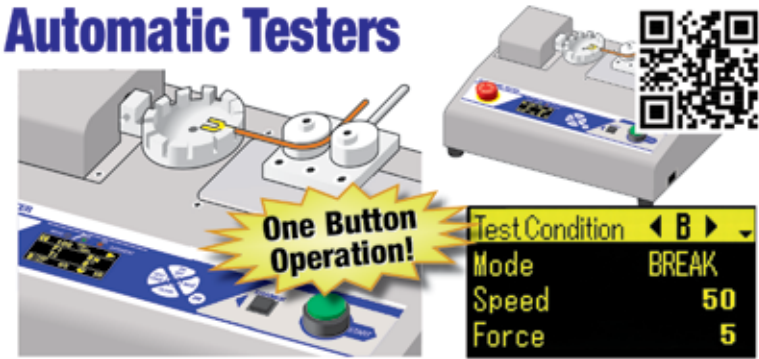
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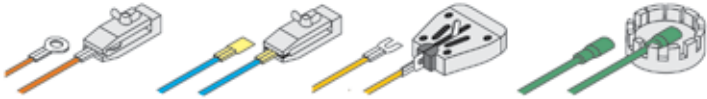
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## How Flame-Retardant Cable Insulations Work

Choosing the correct flame-retardant insulation for your application depends on the electrical and physical requirements of the application. It's important to evaluate these requirements carefully since flame-retardant compounds can affect critical properties, such as flexibility, abrasion resistance, installation, temperature requirements, electrical properties, life expectancy, pulling lubes to be used and more.

### Components of Fire

To better understand flame retardants, it helps to know what causes fire. There are three main elements necessary to create fire: oxygen, fuel and ignition. A fourth factor that can cause fire is heat, such as when overheated wires from a short circuit degrade insulation to the point that it creates combustible materials in both gas and liquid form. These materials combine with oxygen and provide ignition, which releases more heat and creates more combustible material to ignite. This cycle will continue until at least one of the three elements is eliminated.

### How Flame Retardants Work

Flame retardants work by interfering with one or more of these three fire essentials by:

1. Eliminating the fuel
2. Cutting out the availability of oxygen by chemically reacting with the fuel
3. Reducing the amount of heat available to degrade the insulation

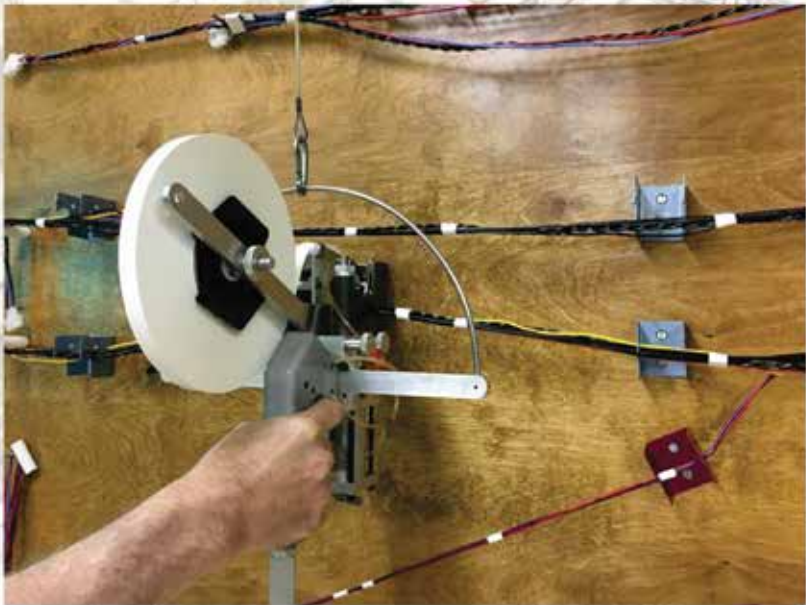
### Halogenated Flame Retardants

Flame retardants used in wire and cable insulations are either halogenated or non-halogenated. Halogens are elements from group 17 of the periodic table and reduce flammability by free-radical reduction. A free radical is an atom or group of atoms with a single unpaired electron, usually produced by breaking a covalent bond.

Halogenated compounds, especially bromine-based types, are the most commonly used flame retardants. They act to halt exothermic processes—how much heat is released by the cable—by trapping high-energy free radicals after they form. This cools the system by greatly reducing or limiting the supply of flammable gases. Brominated flame retardants

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either prevent a fire from starting in the first place or significantly slow a fire down. They are a popular choice because they do not significantly affect the extrusion process and are inexpensive. Other examples of halogens used in flame retardants include fluorine, chlorine and iodine.

**Non-Halogenated Flame Retardants**

Unlike halogenated flame retardants, which limit exothermic processes, non-halogenated flame retardants work by limiting endothermic processes, or how much heat is absorbed by the cable. Metal hydroxides are the most commonly used halogen-free flame retardants and work by employing three methods of flame retardancy: forming water vapor during combustion, reducing available organic fuel load or forming a protective layer of char.

The advantage of non-halogenated cable constructions is that they generally emit less smoke and acidic gas than their halogenated counterparts, improving visibility and breathability during a fire and making it easier for people to find their way out to safety.

For this reason, non-halogenated insulated cable should be used in enclosed areas where human life is at risk. They also have low levels of hydrogen chloride, a compound which is damaging to electronic circuits, making them the preferred cable construction in expensive electronic equipment rooms, such as telecommunications rooms and shipboard applications.

The disadvantage of non-halogenated insulations is the considerable loadings of inorganics required. Loadings can be as high as 65 percent in the final product, which will affect the mechanical properties of the polymer. They also tend to be more expensive and may have inferior physical property performance compared to their halogen-based counterparts.

As you can see, there are a few things that must be taken into consideration when selecting the correct insulation system for an application. Need help deciding which type of flame-retardant cable insulation is best for your application? Visit [anixter.com/contact](http://anixter.com/contact) to get advice from one of our experts.

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# Fischer-Backus

Continued from page 29

and the business grew slowly but steadily for about six years. Tony then began to seek growth through acquisition. In 2013, he found a small harness company in Reno Nevada called CST that was on the verge of bankruptcy. They did have two or three solid legacy customers so Tony purchased the company, and moved production to the Ohio facility.

The following year, Tony was approached by one of his local competitors who was looking to sell his business. "He was a friend of mine, and decided he was ready to retire.

We talked over the years, and I had always told him when he was ready to retire to let me know, and that I might be interested in buying it," Tony informed. Since they were both in the Columbus area, it worked out well. "We basically just shut his plant down and everybody moved over to my facility where we were able to consolidate things and service all of his customers."

Having built a solid platform, Tony returned to growing the business organically for the next few years. All the while, he kept his eyes open

for a business in a warmer climate, specifically Florida. "I wanted to have something for when the kids were eventually gone, and thought if I had a business down there, it would make things convenient," he explained. Rejecting several opportunities, he settled on Paradise Cable located in Venice, Florida in early 2019. A few months later, he purchased Paramount Electronics Manufacturing in Pompano Beach, Florida. Tony's recent efforts have been defining the company as two separate corporations: the Ohio operation and the Florida operation. "We've spent a lot of time transitioning these past months, but that has started to settle down now."

### Ohio Operation

The Ohio operation works under the name Fischer-Backus. There are 15 full-time employees with one part-time, and they specialize in cable assemblies and wire harnesses. They supply harness for military, medical, industrial and specialty commercial applications. Some specific applications are for power generation/distribution, oil refineries, and airport lighting systems. "Some orders are for one piece and others are for up to 500 per week and they can be a single wire or up to hundreds to make up a harness," he described. Products range in size from 1.0-gauge battery cables all the way up to 32-gauge wires that they solder on to PCBs. Some larger harnesses might span three 4x8 ft. formboards. "When you're in the low-volume, high-mix arena, you have to have that wide range because you never know what is going to come your way."

### Florida Operation

The Florida locations operate under Paradise Cable Incorporated (PCI West for the Venice facility and PCI East for the Pompano facility). The Venice facility has 10 full-time employees and one part time. Among their customers are OEMs

Continued on page 38

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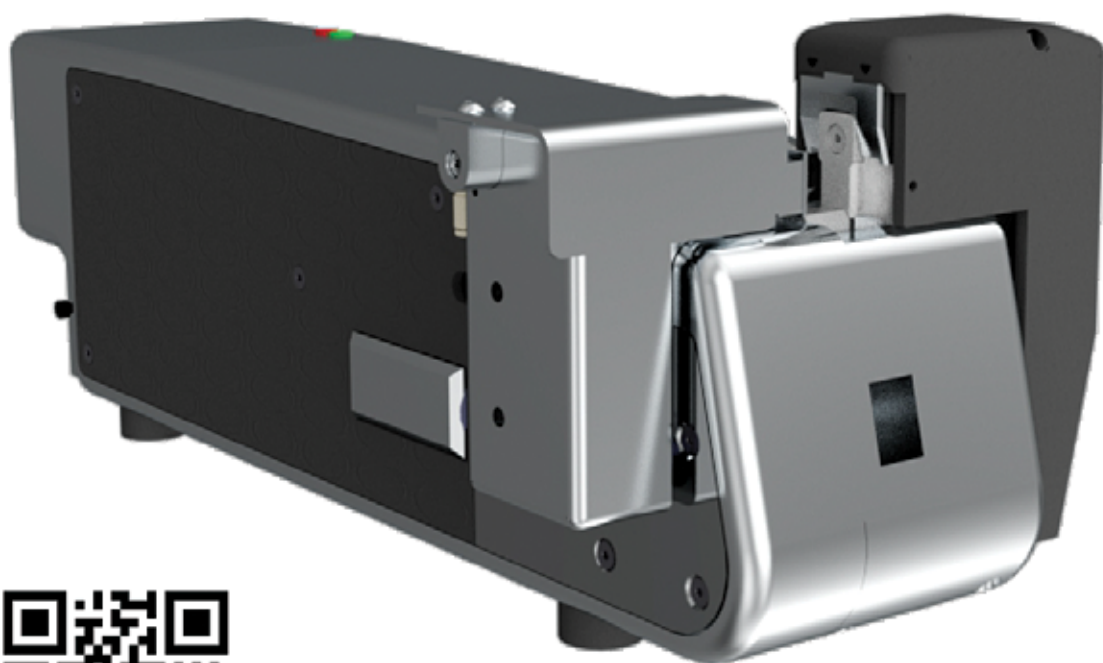
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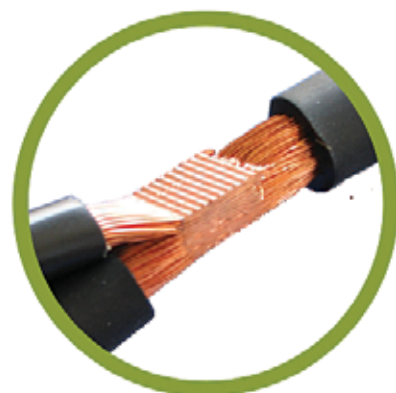
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# Fischer-Backus

Continued from page 36

in the server room and industrial lighting sectors. They do overmoulding at this facility, and that's a big part of what attracted Tony to the business. It's a great asset to add that capability to his overall repertoire, but he admits it's a little bigger challenge to bring on new customers for overmoulded assemblies. "Customers are hesitant to spend 20,000 - 30,000 on molds to switch suppliers," he lamented. But he has been able to make pretty good inroads lately, especially with customers who own their molds.

The Pompano Beach facility has 15 full-time employees with one part-time. They do some cable assemblies, but the main attraction for Tony was their PCB capability. One of their big OEM customers produces galley equipment for the airline industry. Another produces specialty equipment for K-9 patrol cars and PCI East makes many of their PCBs. Yet another company produces restraint harnesses for the military that have specialty embedded electronics. Well before Tony's time, PCI East was a major supplier to

IBM for their computer cables. That business has long since gone overseas, but the company still produces some specialty overmoulded computer cables. Tony operates the locations fairly autonomously, but likes the flexibility he now has. "I've been able to cross-sell with some of the customers in Ohio now that we've got overmolding capability at PCP. Being able to support differing capabilities has open some doors at all the facilities," he explained. "With COVID-19 going on, the Venice facility has slowed. So,

if we've got extra work going on in Ohio or Pompano Beach, we're sending it there so we don't have to lay anybody off." All facilities are registered to ISO 9001:2015 and are UL certified.

Asked what makes his enterprise stand out among competitors, Tony said, "I think it's that willingness to do whatever it takes to get the job done. We've got people who have worked there 30 - 35 years so there's a lot of experience when customers are looking for input or feedback on design."

He also credits their ability to move very quickly. "If we get drawings in the morning, we can get it quoted and, if we have the material, build and ship it that same day." Tony learned the importance of supplier development at his previous employers, and has honed the ability to obtain many parts overnight. He feels strongly that quality is a given, but credits their willingness to go above and beyond. "I think sometimes our price is probably higher and we lose out on some business but, in the end, I think you get what you pay for." He indicated many of those customers he lost to cheaper suppliers overseas have come back when there is a design change, when deliveries are delayed, or when the quality just isn't there.

*Future*  
Tony is quite happy with the way he has

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positioned his company with locations and capabilities and intends to spend the next few years growing organically. “I think the main thing I need in order to grow is a new MRP system that would work between all three plants to track inventories, workloads and job scheduling,” he informed. The facility in Pompano Beach was doing everything by hand. They weren’t even using rudimentary spreadsheets, and at least that part has changed. The Venice facility uses a combination of QuickBooks along with a home-brew order entry that actually works pretty well for them. In Ohio, they are using a legacy system from the 1980’s. It also works well, but prohibits Tony from having a dashboard look at all three facilities.

“For the company to run more efficiently and cost-effectively, we really need to upgrade the MRP system.”

Tony rounded out the conversation crediting the experience and dedication of his employees for the company’s continued success. To show his appreciation, he hosts a company trip every five years. In 2010, 2015 and just this past February, he took his employees on a cruise. “I pay for the cruise and the airfare and they can take somebody along with them, they just pay for alcohol and any additional expeditions,” he informed.

After the interview, Tony made a casual request to his employees asking what they like about working for Fischer/Backus/PCI and he got almost 30 responses that he shared with WHN. It seemed a great capstone to this article to include a few:

- Transparency. Communication of things coming up, good or bad.
- Perks, Bonus lunches, holiday bonuses, random days off and the five-year trip.
- Not a lot of micromanaging. Just get your things done efficiently and on time.
- I like being able to ask for help when it’s needed.
- Small group of people who work well together.
- Flexibility is a major factor, Especially with kids in sports.
- Faith in people to perform their duties.
- The respect that is given between everyone – from ownership all the way to employee.

- I feel blessed to have worked at the same place for 30 years – it’s like my second home. Now with the change [of ownership] I’m happy because I have the opportunity to show how capable I am to do any job and be a good leader. I want to thank Tony for believing in me and giving me the chance to help make the company successful.
- I’m happy to work in a place where I can help with my experience in the field of electronics. I drive 50 miles to and from work every day, but the effort is worth the prize. Thank you, Tony!
- It’s nice to work somewhere where you feel appreciated. The boss is cool too!



Fischer-Backus’ sister company, PCI East.

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# Strain-Relief: Design Tips for Durability and Aesthetic Appeal

Continued from page 31

of plastic segments which come in contact with one another create a minimum bend radius, and are very effective in that direction. Because this design allows for strain reduction in only one axis, the applications are specific: this design is very useful in applications like mechatronics or robotics where the cable will be bending the same direction every time.

## 2. Multi-Direction Strain Relief

As with the design above, multi-direction strain relief relies on plastic segments limiting the bend radius, protecting the vulnerable connection (Fig. 3). This design, though, allows for movement in two or more directions, alternating the connection points between segments. Because of the flexibility of the design, this is the best option for most consumer products, and is widely available.



Figure 3. Multi-direction strain relief is the most versatile

## 3. Solid Strain Relief

Increasingly popular for mostly aesthetic reasons, solid strain relief can be seen on everything from lightning cables to vacuum cleaner cords (Fig. 4). While it looks great, this design requires extra caution, as often the strain relief area is too stiff, and the strain is concentrated at the junction between the strain relief and the cable. The key here is to make sure that the strain relief is flexible enough to allow the cable to bend inside the strain relief area, not at the junction. Even great designers can get this wrong.



Figure 4. Solid strain relief gone bad! This method requires extra attention to work correctly

As an additional consideration, cleaning is simplest with solid designs, and so it becomes the only option for food, beverage and medical industries. Just remember to approach the design carefully.

Continued on page 42

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# Strain-Relief: Design Tips for Durability and Aesthetic Appeal

Continued from page 40

## Aesthetic Considerations

With every great design, form follows function, but follows so closely the two are nearly inseparable. Think beyond minimum bend radius and strength of materials to how this will look and feel to the person using this cable every day.

Some designs need classic industrial chic, and metal springs become an obvious choice. For others, sleek minimalism is the order, and solid strain relief wins. The multi-directional segmentation can fit with a playful, funky look (Fig. 5). Don't be afraid to get more creative, experimenting with different sizes or even totally out-of-box designs, like the designer of the Snakables cables (full disclosure: I worked on the design of Snakables). For consumer products, this can be a chance to really stand out.



Figure 5. Snakable cables are a playful, but very effective solution

## Manufacturing Considerations

Your design is almost complete. But before you put down your pencil and get ready for a chorus of “It’s Five O’clock Somewhere,” think about how your beautiful new design will be made. The options are simple: molded or slide-on.

Molded designs incorporate the strain relief directly into plug design, creating a robust unit. While this is attractive and can be very effective, it might require expensive 2-shot molding, and so is best for designs which will be produced in high quantities.



Figure 6. Slide-on designs, as seen in the Logitech mouse, are a low-cost alternative

Slide-on designs are simpler, and can interface with existing plug designs (Fig. 6). Many designs are available as off the shelf parts, and so are a great option for new products where your company is not ready to commit to custom tooling.

Continued on page 44



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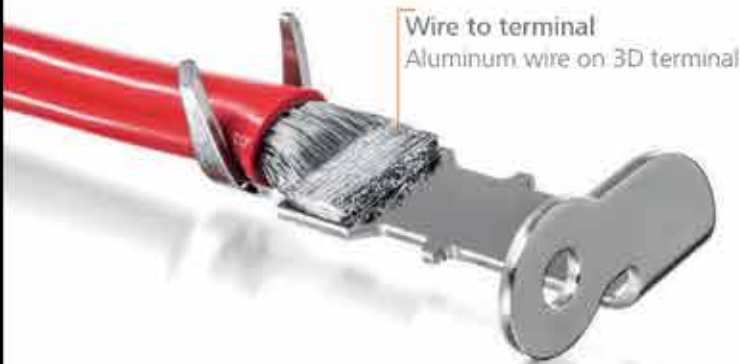
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Strain-Relief: Design Tips for Durability and Aesthetic Appeal

Continued from page 42

Additional Design Considerations

There are a few areas where you should pay more attention. Both the medical and food industries have special requirements for cleanability and materials. If your cables will go into harsh environments, you may need to use special materials, and also consider using much larger bends for extreme heat (where electrical resistance increases) or extreme cold (where brittleness increases). Each application has its own demands.

Prototyping Your New Design

All products go through iterations of design-build-test, and strain relief is no exception. Happily, most designs can easily be tested using 3D printing. For designs intended to be manufac-

tured from an elastomer, try printing in a rubber-like material for testing. If your design is destined to be made of a rigid yet flexible plastic, you can print in a strong and flexible nylon material. Designs which will be molded can be printed in halves and glued together, while slip-on designs can be tested in nearly their final form. If you need more details, check out more articles on hardware design, as well as Fictiv's [www.fictiv.com](http://www.fictiv.com).

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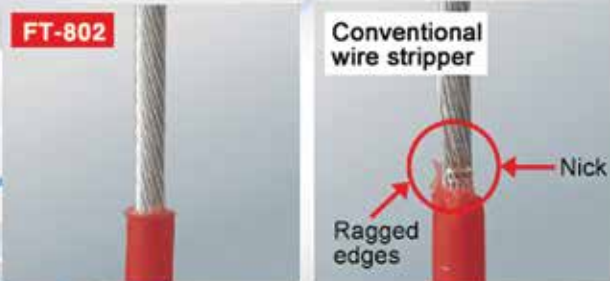
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NEWS PLUGS



RESCO Electronics Announces Acquisition of Convenience Electronics

RESCO Electronics, LLC “RESCO” ([www.rescoelectronics.com](http://www.rescoelectronics.com)) announced that it has acquired the assets and operations of Convenience Electronics, Inc. “CEI” ([www.convenienceelectronics.com](http://www.convenienceelectronics.com)).

CEI is one of the premier manufacturers of custom cables, harnesses, and electronic assemblies in the Midwest. Based in Madison, Wisconsin, CEI has built a reputation for quality products and timely deliveries to its customers. RESCO is a cable harness and electromechanical assembly manufacturer with operations in Baltimore, Maryland and Acuna, Mexico. RESCO’s customers are spread throughout North America and Europe. Through this acquisition CEI will gain access to RESCO’s substantial resources while RESCO will welcome many new customers, expand its capabilities, and obtain production capacity at CEI’s Wisconsin facility.

The operations in Wisconsin will continue under the “Convenience Electronics” name and the CEI staff will remain in place although Harry Lum, founder and president of CEI, will transition into a consulting role.

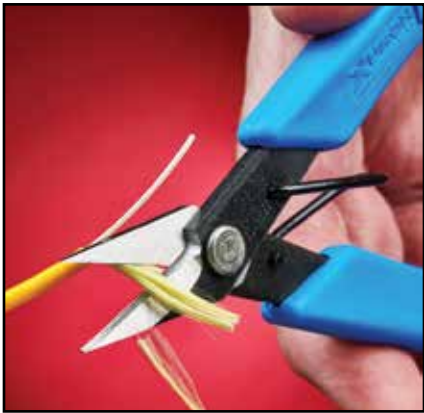
At both RESCO and CEI we have built our businesses by focusing on and striving to meet the needs of our customers, resulting in strong partnerships with customers, suppliers and other stakeholders. We see this merger as an expansion of our ability to serve our customers and look forward to finding new ways to expand on these partnerships.

Serrated Edge Scissors Cuts Kevlar® Aramid Fiber Insulation

An ergonomic scissor that is especially designed for cutting Kevlar® insulation fibers that typically slip out of the grasp of conventional scissor blades has been introduced by Xuron Corp. of Saco, Maine.

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cutting blades that have one serrated edge for gripping slippery aramid fibers and a proprietary sharp edge for cutting them. Ideal for cutting Kevlar® cable insulation, these scissors are comfortable to hold in either hand, have soft rubber hand grips, a return spring, and no cumbersome finger loops. Fast and easy to use in assembly and field service operations, Xuron® Model 9180 Kevlar® Shears’ tapered cutting blades can be used to cut small fiber optic



cable jacketing as well as the aramid fiber insulation. Manufactured from tough alloyed steel, the cutting blades are heat treated to Rc 58-60 to provide exceptional cutting and a long service life. The Xuron® Model 9180 Kevlar® Shears are manufactured in the U.S.A. A complete catalog of precision shears, pliers, and assembly tools is available upon request.

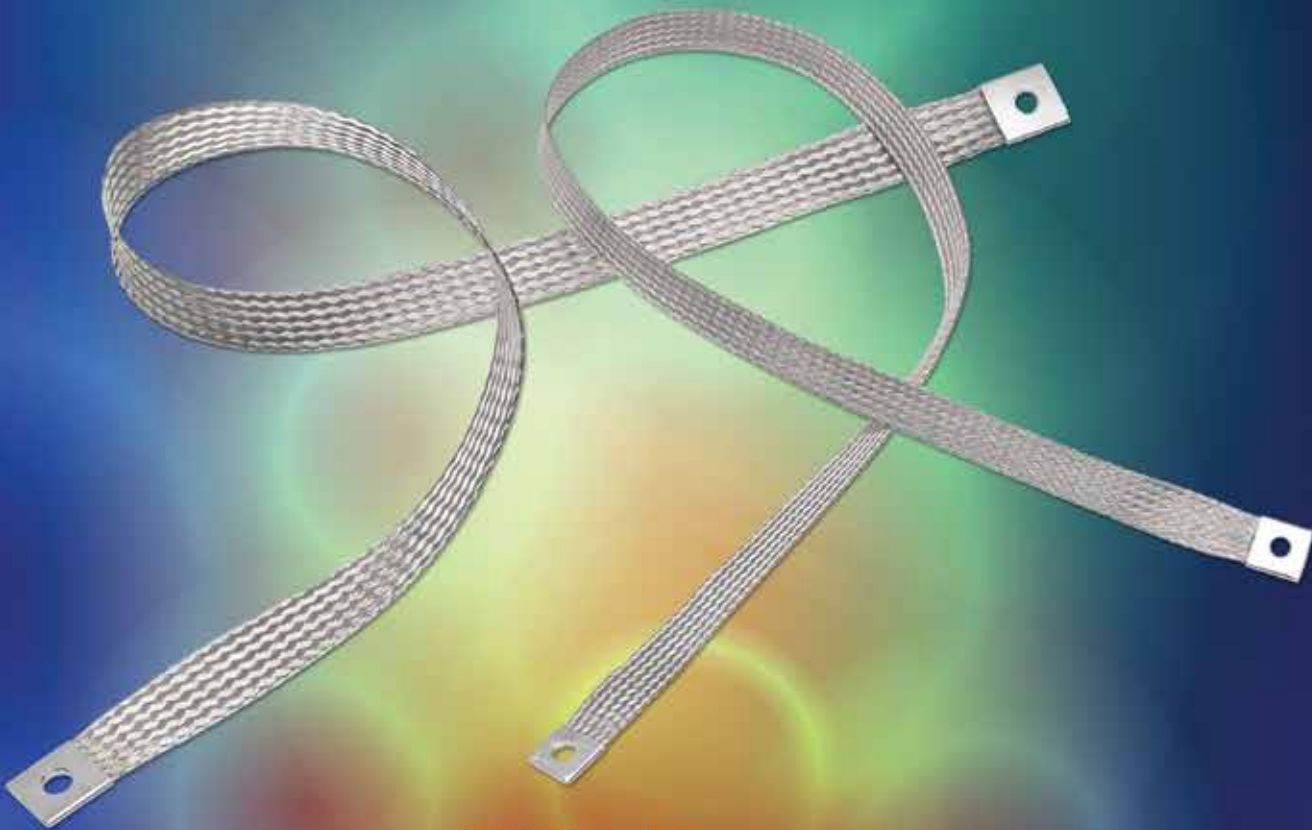
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# Light Weight and Normal Weight Wire Construction in Aerospace Wiring

By Michael Traskos  
Lectrome

Saving weight is a large part of any aircraft design. Naturally, the electrical system is not exempt from the goal of shaving off a couple of pounds. This of-

ten comes in the form of looking for lighter connectors, lighter clamps, and also lighter wire constructions. Those that have done this have undoubtedly come across two classifications of wire construction: “Normal weight” and “light weight”. Of course, if the EWIS has to go on a diet, then

the “light weight” construction looks like a good substitute for the “normal weight” ... after all, why would the wire be called “light weight” if not for satisfying weight requirements.

As with all parts of the EWIS, going to the light weight construction is not a simple swap. There are performance changes and requirements that must be addressed with making the change.

remain the same, but the insulation thickness will not. In light weight constructions, to reduce the weight, the insulation thickness is decreased. In many cases, the light weight construction will have a wall thickness of 5 - 7 mils with the normal weight construction having a construction greater than 7 mils.

Save weight, lose what?


As with everything in engineering, there is a tradeoff for everything done. The use of the light weight wire construction is not without costs. For this example, we shall compare the performance requirements of AS22759/193 and /195. These are the light weight and normal weight

High Level

The difference between light weight and normal constructions is narrowed down to the insulation thickness. Comparing a 20AWG normal weight wire to a 20AWG light weight wire, the conductor size may

Test	Requirement
Impulse Test Voltage	Same
High Frequency Test Voltage	Same
Insulation State Of Sinter	Same
Lamination Sealing	Same
Insulation Blocking	Same
Shrinkage	Same
Insulation Resistances	Same
Wet Dielectric Voltage	Same
Insulation Strip Force	Same
Uv Laser Contrast	Same
Finished Wire Identification	Same
Thermal Shock	Same
Thermal Mechanical Resistance (Life Cycle)	Same
Humidity Resistance	Same
Fluid Resistance	Same
Smoke Resistance	Same
Flame Resistance	Same
Wet Arc Resistance	Same
Dry Arc Resistance	Same
Dynamic Cut Through	Lower requirements on light weight construction
Force Hydrolysis	Same
Longevity Resistance (Thermal Index)	Same
Abrasion Resistance	Lower requirements on light weight construction

Table 1. Test requirements for both construction types.



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variants (respectively) of the smooth surface PTFE-Polyimide construction with silver-plated extra high strength copper alloy conductor.

Table 1 shows the list of tests that are required for both construction types and have the same requirements.

With the exception of two tests (dynamic cut through and abrasion resistance), both the light weight wire and normal weight wire share a common test basis. This makes sense that the chemical and thermal testing requirements are the same for both of the two wire constructions; the insulating materials are the same and so is the conductor. However, it is important to note that while the performance requirements are the same, this does not mean that they are the same.

For example, 5 mils of insulation will have lower dielectric strength than the same insulation if the thickness is doubled to 10 mils. Slowly increasing the voltage until the insulation is breached would undoubtedly find a lower threshold voltage for the 5mil wall thickness.

This also gives an insight into the performance of normal weight constructions. Even with a reduction of 20 - 30% of insulation thickness due to a physical trauma like abrasion, notch, or crushing, a normal weight construction would still be able to meet or exceed the performance requirements (given that a light weight construction is already thinner, made of the same materials, and has the same performance level).

**What about Other Tests?**

Other tests listed in the AS4373 but are not included in the qualification for the AS22759/193 and /195 constructions would similarly show performance differences between the wires. These include:

- Dielectric Constant
- Corona Inception and Extinction Voltages (Also Know As Partial Discharge)

- Flex Life
- Insulation Tensile Strength
- Notch Propagation
- Stiffness and Springback
- Circumferential Insulation Elongation

This is not to say that the performance differences are significant in every application, but there are applications where these factors should be addressed before selecting a light or normal weight wire construction.

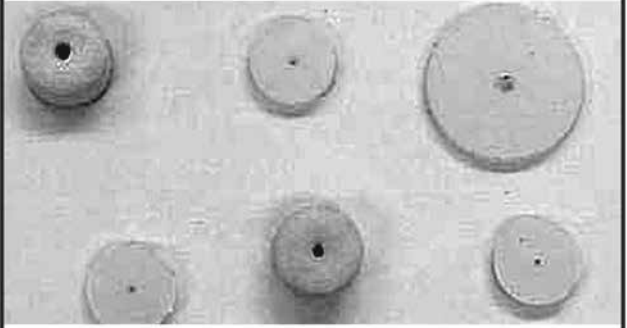
**Restriction of Light Weight**

With the differences identified, next comes the application differences. The wiring bible of AS50881 is a starting

point for this review. A casual reader of the AS50881 does not point to a limitation on the use of light weight wire constructions; there is no explicit limitation except that in section 3.8 “Wiring Selection” it states that, “the wire shall be selected in accordance with Appendix A of this specification”. Digging into the AS50881 Appendix A finds that there are two groups of wires, those that are permitted for use in open harness construction (with no additional sleeving protection) and protected harnesses (additional harness protection).

*Continued on page 48*

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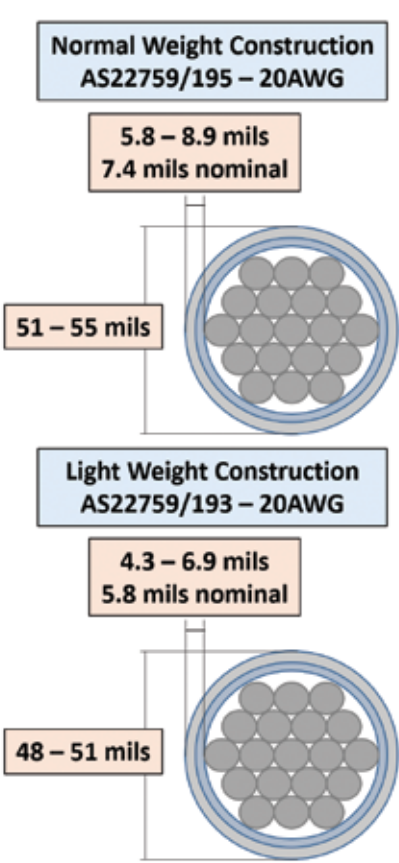


# Light Weight and Normal Weight Wire Construction in Aerospace Wiring

Continued from page 47

Those wires that are permitted for open wire harness construction are exclusively normal weight constructions while the protected harnesses may use either normal weight or light weight constructions. The light weight constructions may also be used in cables so long as the cables have an additional jacket.

And thus, determining the weight benefit of light weight constructions becomes more complicated. Before harness assembly, the clear winner for weight is the wire harness using light weight wire constructions, but after a secondary sleeving is added, the performance is not as clear. Since secondary harness protection comes in many shapes, sizes, and weights, not to mention the potential need to change clamp sizes, additional cost-benefit calculations are needed.



For those seeking to quantify the performance difference and get data applicable to their application, contact Lectromec. Our ISO 17025:2017 accredited lab can perform nearly all of the testing needed for comparative performance evaluations. We are here to help.

### About Lectromec

Whether it is a wire, cable, harness, system, or new/old aircraft, if it is in aerospace, it needs to be certified. But without the knowledge and data, certification cannot happen. Lectromec has been a leader in wires and wire interconnect systems since 1984 and has provided expertise to the aerospace industry, both military and commercial.

Helping our clients advance and achieve their wire system and component goals is what Lectromec has been doing for 34 years. We have the tools, knowledge, and credentials necessary to certify components and systems through the entire lifecycle.

### Wrap Up

Light weight wire constructions are a suitable alternative for those seeking to reduce wire weight, but their application requires calculating the additional factors of harness protection and/or using light weight wires in cables.



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## NEWS PLUGS continued



### Electrical Components International Appoints Chief Executive Officer

Electrical Components International, Inc. ("ECI"), a leading global supplier of wire harnesses, electrical components, and sub-assemblies for the diversified industrial markets, today announced that Michael A. Balsei has been appointed as Chief Executive Officer, effective immediately. He succeeds Douglas J. Grimm, Chairman of the Board, who had been serving as Interim Chief Executive Officer.

Mr. Balsei has an extensive track record of leading global businesses in the electrical distribution systems, automotive, and advanced materials sectors. He most recently led the Electrical Business Unit of Lear Corporation, a manufacturer of automotive seating and electrical systems. He led all aspects of the segment, which spanned 53 manufacturing plants across 25 countries with more than 65,000 employees. Previously, Mr. Balsei was at Delphi Automotive PLC, now trading as Aptiv PLC, for over 17 years, most recently as President of the Electrical & Electronic Distribution Systems division where he was responsible for a team of 110,000 employees in 30 countries. He started his career at General Motors in 1989 and served in various engineering and managerial roles for over 10 years.

"We are delighted to welcome Mike to ECI and look forward to the company's next chapter of growth under his leadership," said Mr. Grimm. "Mike has an outstanding combination of critical sector experience and expertise. The Board is confident that he is the ideal candidate to continue growing ECI while delivering on its high-quality customer service promise."

Commenting on his appointment, Mr. Balsei said, "I am thrilled to be joining ECI at this pivotal time and look forward to working with my new colleagues as we continue providing our customers with world-class products. ECI is a strong business that is well-positioned to continue identifying and capturing opportunities to expand its market leadership, and I am confident we will sustain the momentum built over the last several years. I thank the Board for its confidence in me as I assume this new role."

Founded in 1953, Electrical Components International, Inc. (ECI) is a leading wire harness, electrical components, and sub-assembly supplier for the diversified industrial markets. For more information about ECI, visit [www.ecintl.com](http://www.ecintl.com).

### LAPP North America Appoints New Chief Executive Officer

LAPP North America has announced the appointment of Jay Lahman as the organization's new Chief Executive Officer. Lahman will be responsible for the North American region and will report directly to Georg Stawowy, LAPP's Chairman of the Board of Directors, Lapp Holding, N.A. Inc.

Lahman has 25 years of experience in the cable industry including electrical, industrial, utility, OEM, data communication and specialty markets. Prior to joining LAPP, he served as Senior



**Jay Lahman**  
CEO LAPP North America

Vice President of Electrical Raceway Sales at Atkore International and spent 14 years at General Cable U.S., including a role as Vice President and General Manager for General Cable in Barcelona, Spain, where he led a multinational team of 2,800 employees across seven sites. Lahman began his career with positions at Belden Wire and Cable, Thomas & Betts and ADC Telecommunications.

"The talented team at LAPP is devoted to helping our customers meet the challenges of increasingly automated and networked manufacturing environments. I'm excited to be part of that team as we join our customers in building the factories of the future."

LAPP North America expertly manufactures robust industrial cables, connectors, glands, custom cable assemblies, and industrial communication solutions to help

manufacturers automate and future-proof their factory floors. LAPP's U.S. headquarters is located in Florham Park, NJ with a 130,000 square foot state-of-the-art manufacturing plant, including an in-house UL (CTDP) and CSA (SMTC) certified laboratory to ensure the highest quality industrial cables available in the market today.

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# Wire Harness Testing Evolution and the Advent of Test Fixtures

By Mark Molnar  
Electrical Continuity &  
Components (ECC)

Increasing demand for accelerated error free production of wire harness has impacted every area of the process. Testing is no exception. Once a slow and simplistic manual point to point operation, testing has now become a sophisticated, computerized and efficiency

focused process that is expected by the end customer. Harness manufactures traditionally have used mating connectors to facilitate testing. Locking tabs would be removed where possible to speed engagement and disengagement. The fact that some connectors do not have mates presented special challenges as some are designed to mate into an ECU or other electrical devices which are of no help when performing a continuity test. The re-

petitive engagement of housings and terminals would quickly cause wear and require frequent replacement. Generally speaking, terminals are designed for very few engagements and may only be engaged once or twice throughout their lives in the field. The mating of the terminals in some instance would impact their integrity and lead to failures in the field. Visual inspection was required for critical items such as secondary locks, clips and seating of terminals.

style for the individual application. The mechanical life of spring probes is typically 1,000,000 to 2,000,000 cycles. Spring probes are usually designed to be used in conjunction with a receptacle (sleeve). Lead wires are attached to the sleeve and are interfaced back to test equipment. Probes can be friction fit into sleeves or threaded into sleeves. Both sleeve options allow for quick changeability.

These test probes are incorporated into a designed housing structure that acts as the mating connector and will be keyed to only accept the connector in the proper mating orientation (Fig. 2).

**Spring Probe Technology and the Emergence of Test Fixtures**  
In the effort to speed processing and improve quality, test fixturing has taken hold across the wire harness industry. The benefits are two-fold: ease of use for the operator; less of a maintenance headache for the personnel that support the testing function. The introduction of spring probe (pogo pin) technology has driven this movement (Fig. 1).



Figure 2. Basic Continuity Test Fixtures



Figure 1. Spring Probe

The spring probe allows the light engagement of the terminal to perform the continuity test without violating the integrity of the terminal and introduces very little resistance into the electrical test. Basic continuity testing is typically done with probes that exhibit only a few ounces of spring force. Test probes are manufactured in many different standard diameters with a wide range of tip options that are effective for engaging the varied sizes and shapes of connector terminals. Some tip styles are designed to cut through dirt or oil to ensure consistent, solid contact. The fixture manufacture should select the most appropriate size and tip

The housing will also incorporate a retention mechanism that makes it very easy for the operator to insert and remove the connector. The material that is used in the test fixture housing is generally some type of non-conductive plastic. Delrin is a widely used material across wire harness production testing and automotive functional testing, but some cast plastic materials are also found to be both cost effective, durable and less moisture absorbent. The durability of the selected material should always be considered in respect to volume of testing.

Fixtures can also be designed to test for the presence of other connector and wire harness components such as secondary locks and clips. These features can be incorporated cost effectively through the use of

Continued on page 52

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# Wire Harness Testing Evolution and the Advent of Test Fixtures

Continued from page 50



Figure 3. Switch Pin

switch pins that engage the components to verify their presence (Fig. 3). Switch pins look similar to spring probes. The difference is that current passes immediately through a spring probe upon contact, whereas the current only passes through the switch pin when it compresses and reaches its switch point. A wire is attached to the barrel of the switch pin and another is attached to the stem coming out of the back end. The stem is insulated from the barrel. The two come into contact when the switch pin compresses to the switch point. The circuit closes between these two points if the lock or clip is present. It remains open if they are missing. The switch is wired and programmed into the test sequence like any other circuit.

### Don't Sweat the Small Stuff

Ring terminals, spade terminals, insulated and uninsulated male and female fast-ons and flag terminals, blunt cut wires, stripped, partial stripped, and terminated wires are all common on harnesses. Test fixtures of differing varieties have been developed for all of them.

A ring terminal fixture can consist of a simple plastic base with a metal stud machined to the inside diameter of the ring terminal. If both the ID and OD need to be verified, a plastic stud can verify the ID and a plastic shroud can surround the OD while spring probes contact the underside of the ring terminal (Fig. 4).



Figure 4. Ring Terminals

Insulation piercing clips can be used to test wires, or fixtures with properly positioned contacts can test blunt cuts or stripped wires of different sorts without impacting the insulation.

Spring probe constructed fixtures will effectively contact straight fast-on terminals and flag terminals without violation and simple clips can be used to secure and test spade terminals (Fig. 5).



Figure 5. Spade Terminal Test Clip (2)

### The Unseated Terminal

Issues with unseated terminals have plagued the industry for years. Most connectors are push to seat and operators are trained to push-click-pull. But the repetitive nature of the process and the quest for speed can lead to errors. While some connector designs lend to easy seating, others can be more challenging and error prone. During the testing process, terminals that are barely not engaged can make contact and pass the continuity test. The challenge for manufacturers is to catch these instances.

The most simplistic and least costly approach as it relates to test fixtures is to set the depth of the probes in the fixture to allow minimal engagement with terminals that are fully seated. Typically probe manufacturers will recommend travel/engagement of 2/3rds of the probes full travel. By limiting the engagement, most cases of unseated terminals may be detected as open circuits.

In the testing of connectors with female terminals, a type of probe



Figure 6. Hat Pin

called a “Hat Pin”, “Shoulder Pin” or “Step Pin” (Fig. 6) can be used in many instances to limit engagement with a fully seated terminal. These spring probes have a shoulder that stops on the face of the connector housing (with Deutsch DT04 and DT06 series connectors and their Amphe-nol and Molex crosses, the shoulder stops on the wedge). The dimension of the probe from its shoulder to the tip of the probe controls how much engagement is made with the terminal. These types of probes are slightly more expensive than standard spring probes and are a cost-effective approach to controlling the amount of engagement.



Figure 7. Push Test Fixture

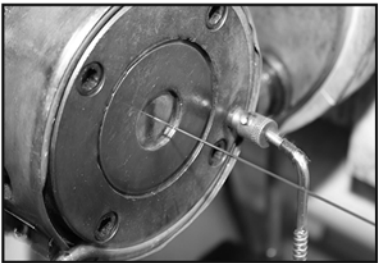
A third and more costly approach would be to test using heavy pressure switch pins rather than a spring probe (Fig. 7). The heavy pressure switch pin can push the unseated terminal back, and though making contact will not pass the current because it has not compressed to its switch point. Conversely, if the terminal is seated the switch pin engages, compresses to its switch point and passes the current. It allows the for a concurrent continuity test and terminal seating test. This can also be done as a stand-alone terminal seating test which would require a continuity test later in the process. The number

Continued on page 54

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# Wire Harness Testing Evolution and the Advent of Test Fixtures

Continued from page 52

of positions and the spring pressure involved will usually necessitate the incorporation of a clamp and a mechanical slide to assist the operator with engagement.

While no approach may catch every instance of an unseated terminal these will work toward the mitigation of these errors.

### Connector Housings that Accept Male and Female Terminals

Some connector housings are designed to accept both male and female terminals. This can present special challenges for the manufacturer in insuring that the proper sexed terminal is delivered to the customer. In some cases, special probes that have an insulator set either in the center or around the outside can be used to read a male terminal only or to read a female terminal only.

### Locking and Marking

In order to prevent bad harnesses from being passed on to the customers, manufacturers may choose to add a locking feature to one of the fixtures used to test the harness. Once engaged and locked in place, the operator is unable to remove the wire harness (Fig. 8). When the testing process is complete and the unit has passed, an accept signal is sent from the circuit analyzer to a solenoid or to an air cylinder to trigger the release of the connector. Circuit analyzers typically have ports or are used in conjunction with relay modules to



Figure 8. Locking & Marking Fixture

control such devices. A supervisor typically has control to release a bad harness from the fixture.

Additionally, marking devices can be incorporated into the test fixture to apply a mark upon successful completion of a test. This is typically done using an electric scribe that etches a mark in the connector housing, or a solenoid or air cylinder that punches a mark. Some ink marking mechanisms are also designed for such applications. These provide another layer of certainty that the product was tested and that it passed. Many circuit analyzer systems will print a label for application to the product for this same purpose.

### Test Station vs Build & Test

There are generally two schools of thought when it comes to production and testing of wire harness. One is to build the harness off line and then bring completed wire harnesses to a test station. The other is to test concurrently while building.

Those that choose to build off line will frequently use fixtures without spring probes to hold connectors in place while they are plugged. Completed harnesses are then taken to a test station where fixtures are either mounted or hang as pigtails and moved to engage the connector on the harness.

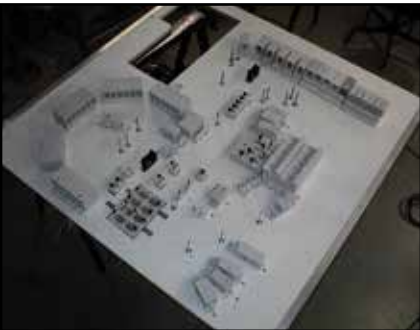


Figure 9. Build-Test Boards

Fixtures that are used on build/test boards are constructed in such a way as to hold empty connector housings in the fixture to allow them to be plugged with terminated wires (Fig. 9). Connectors with front locks may need to be removed to allow the lock to be closed. Depending upon the fixture design, connectors may be plugged while in hand and then engaged into the test fixture which will force the secondary locks closed. Circuit analyzers may signal proper connections during this process or stop the process to allow trouble shooting if an error occurs.

### Hipot Testing and 4 Wire Kelvin Testing

Delrin and polyurethane offer good dielectric qualities for the construction of Hipot and Kelvin test fixtures. These tests are often run at high voltage levels and require special attention to insulation between spring probes to prevent arcing and false failures. This is done by burying the probe/sleeve assemblies in the material or insulating with heat shrink. It is also important to keep the fixtures debris free as this can lead to false failures as well. Special precautions should always be taken to shield operators from electrical shock.

A basic continuity test fixture can easily be modified to perform a 4 wire Kelvin test by simply attaching a second wire lead as near the spring probe sleeve assembly as possible.

### Functional Testing

Spring probe style test fixtures are used heavily across automotive and other applications because durability and serviceability is a necessity when thousands of tests are involved. These fixtures will typically be designed to be hand held and incorporate robust strain reliefs and jacketed cable to endure continuous movement. In many instances these fixtures may be suspended from tool balancers, positioned to allow operators to quickly grab and engage into connectors on seat assemblies, dash assemblies, door panels, sun roofs or front and rear end assemblies. Cameras have become prevalent in vehicles and special coax probes have been developed to carry images across these connections as part of testing (Fig. 10). Similar fixtures will be used in automated assembly and test applications where the device is attached to an actuator and moved in and out of the connector without operator intervention. These fixtures will frequently incorporate quick discon-



Figure 10. Functional Test Applications 2

nect interface connectors to expedite change out for servicing. Spring probes with high current ratings will be incorporated if power will be applied as part of the test process.



Figure 11. Control Module Test Fixture

Spring probe style fixtures are increasingly used for burn-in testing, and programming of ECUs, and testing of circuit boards because of their durability and serviceability (Fig. 11).

### The Future of Testing

Increasing quality and speed demands will lead to continuous innovation on the testing front. Look for incorporation of proximity switches for additional checks and increasing demand for pressure/vacuum testing to catch damaged seals and other leaks in sealed harness systems. The development of smaller connection systems with smaller terminals will likely drive greater demand for spring probe testing style as mating terminals may not offer needed durability and present greater risk of damage.

### About ECC

Electrical Continuity & Components (ECC) has been assisting the global wire harness manufacturing base with testing issues for over thirty years including basic continuity, terminal seating, functional and burn-in test applications. ECC's focus has been to save their customers time and money while improving the quality of wire harnesses and cable assemblies worldwide. For more information, contact ECC at 614-409-9104, find them online at [www.eccco.com](http://www.eccco.com); and visit them at the Wire Processing Expo or the Assembly Show in Rosemont. You can email Mark directly at [mdmolnar@eccco.com](mailto:mdmolnar@eccco.com)

Many Thanks to Mark Molnar for his diligent work on this article!

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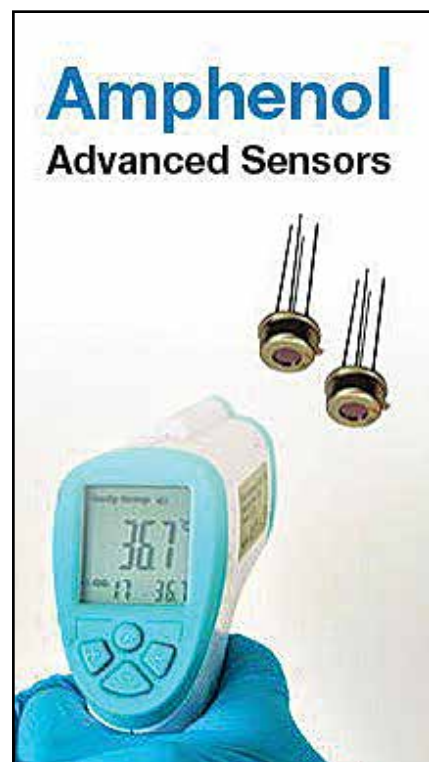


### Molex's iGrid 2.00mm Dual-Row Wire-to-Board Connectors with Positive Lock, Right-Angle Headers and Gold Terminals, In Stock at TTI

TTI, Inc., a leading specialty distributor of electronic components, announces the availability of Molex iGrid 2.00mm Dual-Row Wire-to-Board Connectors with Positive Lock, Right-Angle Headers and Gold Terminals from stock at TTI. Molex iGrid Wire-to-Board Dual-Row Connectors offer a compact design and anti-tangle internal lock for applications requiring good mating retention. The unique inner lock of iGrid prevents wire from getting tangled in the latch, compared to outer lock types where such damage can easily occur. The inner lock also provides space savings, an audible click and a robust design to withstand rugged handling. iGrid connectors are available in AWG #22 to 28 in both straight and right angle designs, from 10- to 40-circuits. Applications include consumer, medical, automotive/transportation and networking, to name a few.

### Amphenol's IR Thermopile Temperature Sensors, In Stock at TTI

TTI, Inc., a leading specialty distributor of electronic components, now has available inventory for Amphenol Advanced Sensors Infrared (IR) Thermopile Temperature Sensors for non-contact temperature sensing. These sensors can be used for temperature scanners, kiosks, or thermometers and are used for initial screening of individuals before gaining access to specific areas.



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Amphenol Advanced Sensors has manufactured non-contact infrared (IR) temperature sensors for more than 30

years and have multiple versions available to address accuracy, sensitivity, field of view and package size.

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### ETCO Begins Manufacturing of Pancon Electrical Terminals

The ETCO Corporation, recently announced that it will begin manufacturing Pancon's electric terminal product line. Pancon has phased out production in its two manufacturing facilities in Massachusetts and California.

ETCO has purchased many of Pancon's dies which allows ETCO to serve the production needs of former Pancon customers and help minimize any disruption to manufacturing facilities.

Sean Dunn, Vice President of Marketing, said "We appreciate the co-operation of the team at Pancon during the transition of the tooling and documentation to the ETCO facility so that we can help their customers achieve continuity of production. Pancon's products are largely complimentary to ETCO's 1,800 standard products but there are some differences in the end product depending on the product line. In addition, our ability to engineer custom products means that we can meet almost any product need."

Interested parties should contact Sean Dunn, Vice President of Marketing at 1-941-756-8426 or [sdunn@ETCO.com](mailto:sdunn@ETCO.com).

Founded in 1947, ETCO is a privately-owned company. The Company manufactures precision stampings and rubber and plastic molded products used principally by major automotive and appliance manufacturers. ETCO also manufactures supporting automated application equipment and has major customers in a variety of other industries in the USA and over 30 countries throughout the world. ETCO has factories and a research complex in Bradenton, Florida and a factory and engineering center in Warwick, Rhode Island.



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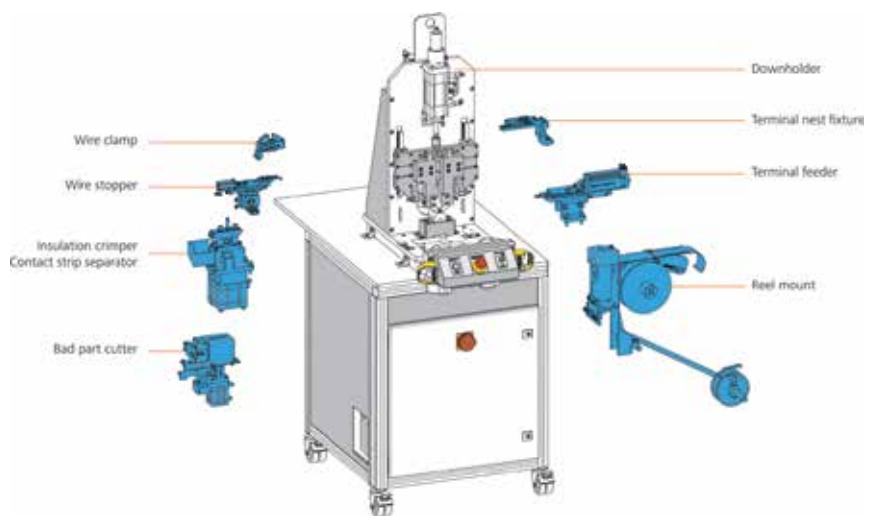


Figure 1. MPX welder modules

The ultrasonic metal welding process is being used for cable terminations/assembly more than ever. New terminals in all different shape and forms are being designed and utilized for automotive applications. The new and most common applications are for high voltage cable terminations and battery cable assembly. Such variety in the automotive terminal designs will require a Universal welding machine that can be adopted to most, if not all, terminals.

To address these developing requirements, Telsonic has introduced the MPX terminal welding machine. The MPX is a universal welder with standardized modular options (Figure 1). Manufacturers can adapt the MPX to their wire to terminal attaching requirements to cover a wide spectrum of differences in both design and manufacturing process.



MPX TC

In its simplest form, the MPX is a benchtop welding machine for spot welding of battery applications. But by adding standardized modules for specific requirements, the MPX can perform more complex processing tasks, such as semi-automatic termination. Once the terminal designs are defined, the MPX can be configured with all standardized and optional modules.

The MPX universal welding machine advantages are:

- Minimizing the changeover for similar terminals or perhaps different size cable for the same terminal
- Easy integration of modular subassemblies when terminals require additional steps such as insula-

tion crimping or automatic feeding of the terminals



Figure 2. Flat terminal

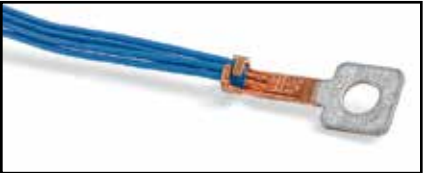


Figure 3. Flat terminal with insulation crimp



Figure 4. MAK terminal, automatic feeding

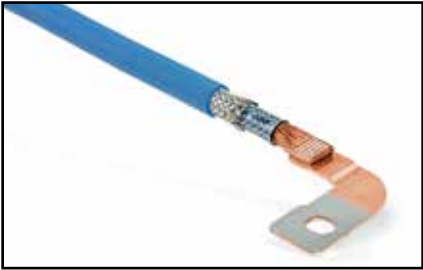


Figure 5. 3D terminal with insulation crimp

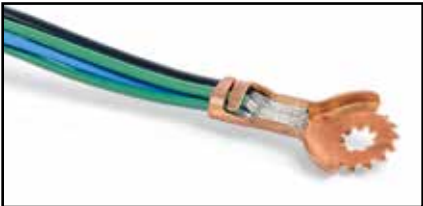


Figure 6. Wall terminal with insulation crimp



Figure 7. Contact terminal

The flexibility of the MPX allows the manufacturer to utilize the same machine for many different terminals (Figures 2-7). For high volume production, the main platform of the machine is common for all application and allow the customers to be trained easily for operation, quality control and maintenance of the equipment on the manufacturing



MPX at welding process



Telso@Flex, with intuitive HMI Touch Screen

floor. This machine is also ideal for application development and feasibility at customers' site or at Telsonic application laboratory. Furthermore, Telsonic will have the advantage of building and making faster delivery as well. Specific configurations of the MPX are defined by the terminal design (Flat, 3D, with side walls) and process requirements, e.g.:

- Terminals with insulation crimp
- Terminals require automatic feeding
- Bad weld cutting device

In any of above conditions, for a different terminal or cable size, the setup or changeover will simply require a different sonotrode and nest that can be set up within minutes. By using the software Telso@Flex, the intuitive HMI Touch Screen (Figure 8) makes the changeover and operation easy and reliable. The Telso@Flex con-

trol unit allows live monitoring of the process, high level quality and machine troubleshooting, and networking from remote location.

The universal and modular features of the MPX with a power range of 2.4 kW to 7.2 kW allows the capability of a wider range of applications with the same machine.

For additional information and evaluation of your applications, please visit us at [www.telsonic.com](http://www.telsonic.com) or contact our USA branch in Massachusetts -617 244 0400

The Swiss Telsonic Group has been offering its industrial ultrasonic solutions through representation in Europe, America and Asia since 1966. Constant innovations help to ensure that, in many applications, Telsonic has established a lead over competitors that offers added value to customers. With over 250 highly qualified staff, the owner-managed company specializes in plastic and metal welding as well as ultrasonic cleaning and screening. All over the world, customers in fields such as automotive, packaging and medical technology value the company's comprehensive services and broad range of ultrasonic components for system construction as well as its complete welding systems.

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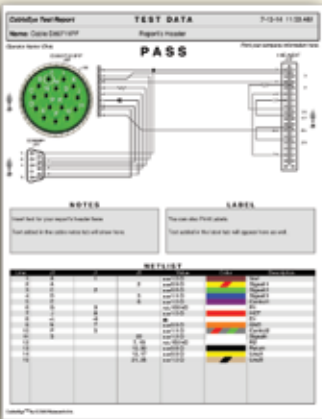
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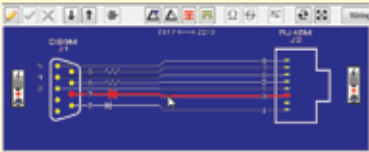
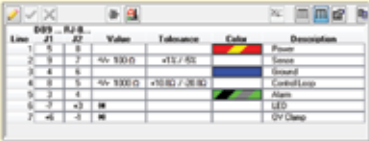
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By Christine Siebert

We are all busy professionals and as busy professionals; we know that it is hard to take time to attend off-site classes/trainings. I mean who can take 3-4 days to attend a training or send our team off-site to attend. The hard part is that most of the time, we really want to send or attend these trainings but just don't have the manpower or are in the middle of an important project. Aren't we always in the middle of an important project? We'll catch that training the next time it's available, right?

Of course, right now, there's this pandemic called COVID-19 and who can go anywhere! Luckily WHMA/IPC has thought of the solution even before COVID, it's called a Video Training Library, also heavily known as "remote learning" in today's world. But honestly, it's been going on for a long time and really saves a lot of companies' time and money.

Let me introduce you to the "Introduction to Wiring Assembly". It's a mini-library of 6 trainings that teach cable / wire assembly manufacturing to your current and new employees in a class room setting for wire / cable assembly, stripping, crimping, preparation, connectors, terminals & coaxial cable assembly. It's incredible! Perfect for training during this time and in the future. The course titles are listed below.

- 1. Wire Harness Assembly Methods (56C)
- 2. Intro to Wire Crimping (58C)
- 3. Wire Preparation (59C)
- 4. Electronic Connector Assembly (62C)
- 5. Terminology Training for Wire Assembly (152C)
- 6. Coaxial Cable Assembly (167C)

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new member before September 30, 2020, you will receive 50% off your first year's membership AND receive a copy of IPC/WHMA-A-620 Revision D Standard. Which literally pays for the membership itself, along with all the great benefits of the WHMA membership and the IPC membership. For more information, please go to [www.whma.org/ipcwhma-a-620/video-training-library/](http://www.whma.org/ipcwhma-a-620/video-training-library/) or contact [sales@ipc.org](mailto:sales@ipc.org).



Screenshot from WHMA's Wiring Assembly video platform.



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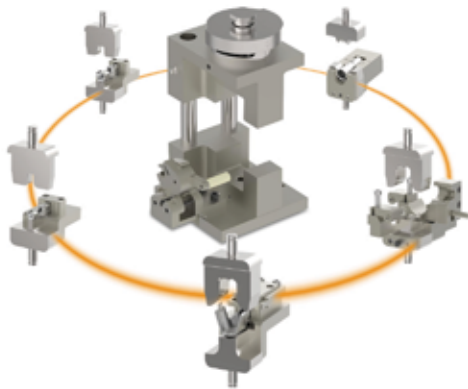


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