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- Getting Deals Done Remotely
- Improving Quality of Testing
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- The Rule of 3's: Insights for Recovery or Re-invention
- Trackwise Champions Improved Harness Technology
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- Model Based Engineering for Wire Harness Manufacturing
- 5 Quick Tips for Better Wire Management in Small Box Builds

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Company Profile: Qualastat Electronics, Inc

By Joe Tito
Wiring Harness News

I remember Vernon Judy Sr. from the early days of WHMA. He was instrumental in the creation of the of the A-620 standard. He was at the very first meeting and was later asked to co-chair a committee for a number of years. He also acted as technical advisor for instructional materials on crimping that are still in use today. When it was recently suggested by Brent Stringham of DITMCO that I do a profile on Vernon's company, Qualastat Electronics, I thought, surely we must have profiled them at some point. But a lengthy check through the archives revealed that we never had. How did that happen? It's been long overdue,

but I had a great conversation with Vernon Sr. and Vernon Jr. to see what they are up to these days.

We began our discussion where we usually do in our profiles - the humble beginning. "I used to work for another company where I ran the shop, and really ran the whole company," Vernon recalled. He was working too many hours and decided he needed a different vocation. The thought of opening his own business seemed daunting, but he felt it would ultimately give him more control of his time. Vernon's boss told him he'd never replace his current income, and for many years, that was indeed the case. But it wasn't about money for Vernon. He truly wanted to spend more time being a husband and father.

Solutions in Cable Labeling at Dasco

Dasco Label was founded in 1954 by Donovan A. Schultz, and was known as the D.A Schultz Company. Don was an electrical engineer who previously worked at 3M and wanted to start his own distribution business. In the beginning, the company handled a wide variety of electrical supply products including silicone adhesives, tubing, sleeving, tapes, varnishes, and insulation materials as they supplied the manufacturing industry. Don had started other companies and included his family in his entrepreneurial pursuits. When he passed away in 1978, his wife Dorothy took over the business adding

on new product lines, including W.H. Brady. That move brought them into the identification and labeling industry.

The company progressed to the second generation of ownership when Don's oldest son Ken and his wife Holly purchased the company in 1987. Ken had worked in the company as a kid, maintaining the yard, cleaning the facility, etc. He systematically held positions in the warehouse, customer service, sales and eventually, management.

Growing up in an entrepreneurial family really had its ups and downs for

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Testing Military Harness at Qualastat

Vernon's experience with his previous company, General Reliance, set the scene for his new venture's specialization. "My background was with military stuff, and the company I worked for was making electro-mechanical products with direct contracts with the government," he said.

Around this time, Vernon had at-

tended a soldering workmanship training class. A fellow student was a quality engineer at a similar company. He and Vernon hit it off and became friends. Sometime in the second week, Vernon's new friend began to tell him about concerns with some

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Automated Wire Processing for Panel Builds

Komax Automated Wire Processing Enables Competitive Advantage at Connexa

It is very time-consuming to design and build industrial control panels manually and is historically dependent on specialists. Estimates vary, but it can take a specialist approximately 105 seconds to process one wire manually. For example, if there are 500 wires inside the control panel, this adds up to 15 hours. With semi-automated production, you can cut the amount of time

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Such is the recent experience at Connexa, an end-to-end integrator of power systems, automation and control systems, and connectivity systems for field applications. Head-

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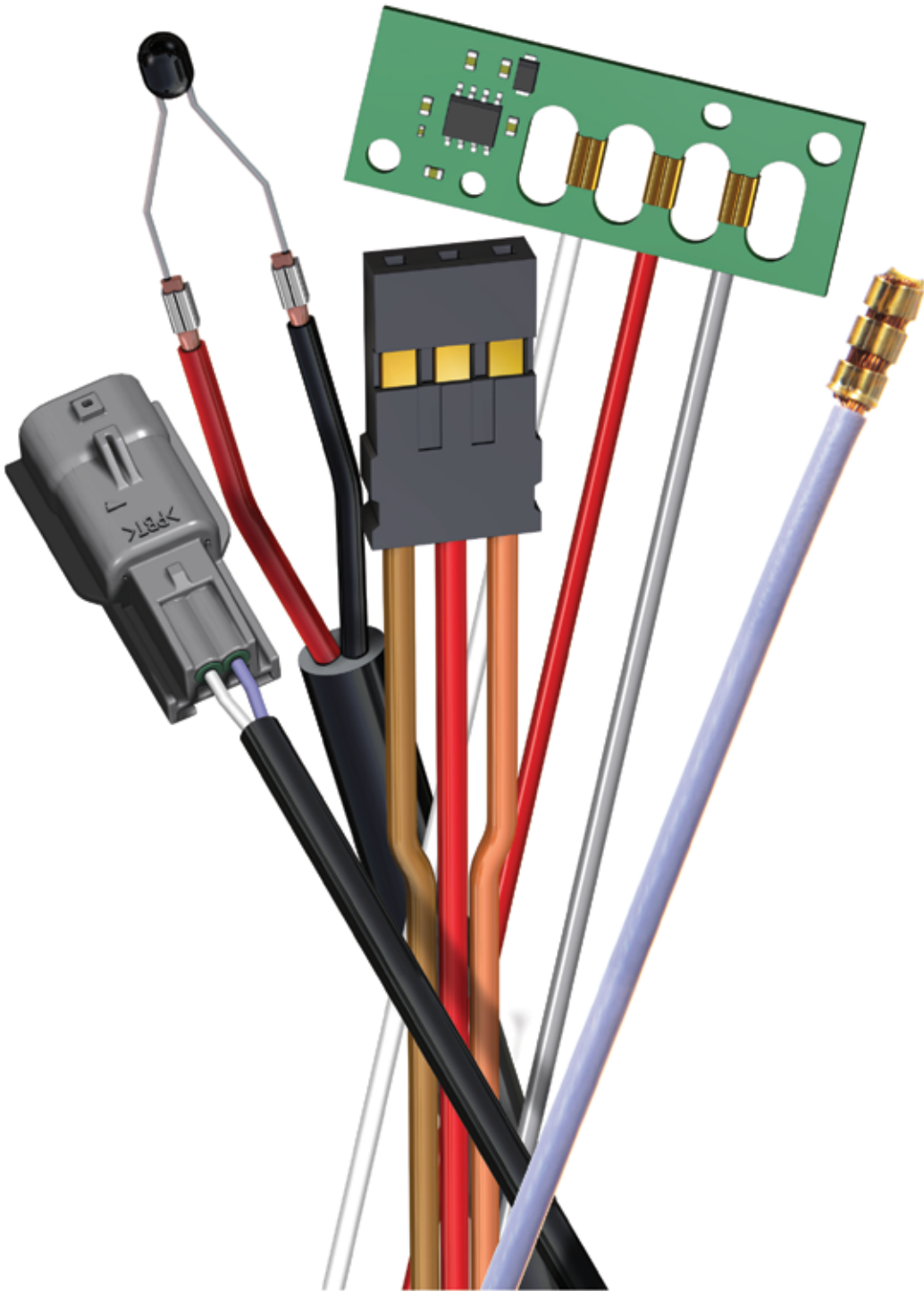
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PUTTING INSIGHTS INTO ACTION

The Rule of 3's: Insights for Recovery or Re-invention

By Paul Hogendoorn

There's a time to brainstorm, a time to gain buy in from your leading group, and a time to act.

There are some people you can brainstorm with, some you can plan with, and some you can work with.

Facing or recovering from a crisis makes this "rule of 3's" more real. If you only needed to make small changes, or if your goal is only incremental improvement, then perhaps you can affect the actions you are looking for with meetings, consensus building, followed up by summaries of the meeting, perhaps with some intended points of action, and then more meetings.

But, you are facing a cliff, and there is no ready-made route to follow, or if you need or want to 'pivot', or do something more than maintaining or improving status quo, you need to know who you can brainstorm with, and who you bring into the conversation later, and who to leave out until it's all figured out.

A colleague forwarded a copy of a study done in 2003, titled "Piloting

the Rocket of Radical Innovation" (Greg A. Stevens and James Burley). Its subtitle stated that selecting the right people for the right roles dramatically improves the effectiveness of new business development ("NBD") and goes on to suggest that most early stage NBD projects fail because the individuals typically selected to lead are risk adverse, patient and persistent, where they should be done by people with high risk tolerance, creativity and openness to the "irrational" process of NBD. The study uses the Meyers Briggs Type Indicator ("MTBI") to identify the type of individual that suits these roles the best, coming to the clear conclusion that there is indeed a specific type of person that excels in these roles, but that they are a very small minority - only about 12% of people.

Over the years, I have written several columns thanking or praising my "all stars" (mentioning them only by their initials). These are the people that throughout my career as an entrepreneur and business founder were the difference between the business or product's success and failure. I did not specifically seek

them out because I didn't have the benefit of the type of knowledge and insight shared in the referenced study. In some cases, these "all stars" sought me out, being drawn by what we were attempting to do, but in most cases, it was a simply a filtering process. Over time, I came to realize who I should draw into a conversation at the brainstorming stage, who I should draw in to develop a plan and strategy, and who I should only draw in to the conversation after the plans and strategies were well thought out and documented. It's a form of "triage".

Triage was a term first used in WWI. It meant assessing the incoming wounded and determining who was seriously wounded and could be saved, who could wait, and who couldn't be saved. It sounds cruel as our tendency would be to want to save everyone, but without triage - breaking it into 3's - many more would've died. We make the same mistake in business when we think we should get everyone on the same page at the same time. This is a point well illustrated throughout a recent book by Ben Horowitz, "The Hard



Paul Hogendoorn

Thing About Hard Things", in which the author filtered out a select few people over the course of his career that he could approach whenever his company faced significant challenges or paradigm altering opportunities. He knew who to brainstorm with, and then which group it was to gain buy-in from, and then which group to execute a plan with.

In my previous column ("Pushing the Rest Button"), I surmised that one

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The Rule of 3's: Insights for Recovery or Re-invention

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of the two benefits of a crisis was that it helped you figure out who would go into a tough battle alongside of you, and who won't. In my December 2019 column "Zero to One" (a pre-Covid column), I surmised that "the few who believe and are willing to take the first step have to contend with the many that only see the roadblocks or don't think it's worth it." This lines up pretty well with the aforementioned study on Radical Innovation.

I've always been a big fan of Jim Collins and often reflect on his landmark book "From Good to Great". It teaches the importance of having the right people on the bus, and in the right seats. These are incredibly valuable insights at a time like these, when companies are seeking to return to "normal", except that perhaps "normal" has now changed. A crisis is a good time to evaluate whether or not you have all the right people on the bus and in the

right seats, but before you even get to that, you need to know which people you can go to, to help find the right destination, and to help you as you pilot the rocket to get there.

Paul Hogendoorn is co-founder of FreePoint Technologies. For more information on gamification or "reconnecting meaning with work", contact Paul at paul.hogendoorn@get-freepoint.com

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Solutions in Cable Labeling at Dasco

Continued from page 1

Ken and his family. “There were both good and bad times, and I remember seeing my parents go through some tough times. Still, it didn’t stop my de-

sire to get involved in the business," he noted.

During his early years with the company, Ken's parents taught him the importance of providing high-end

service to their customers; and he appreciates the lessons. "There are plenty of options for the customers to choose from and I learned that in order to really make a difference, you have to bring unparalleled service and support to the customer. My parents taught me that you need to bring solutions that are going to make a difference in the customers' businesses," he explained.

Ken's goal is to help customers meet their goals and objectives, improve their processes and impact their bottom line. "I have brought this notion forward throughout the years. When making suggestions to customers, we suggest the products and configurations we would choose if it were our business."

Dasco's business is in the wire harness, control panel and circuit board manufacturing industries. That market has grown for them over the years. "We continue to focus on bringing new solutions and technology to automate processes."

Wire identification is one area where we have brought options to customers that have increased their flexibility and significantly reduced their costs," Ken proclaimed. Their continuous shrink sleeve printing solution is something he is most proud of. "It allows you to print on continuous heat shrink material on one or both sides, then cut or perforate

them to the proper length and batch them as required.”

Dasco's unique solution has saved customers 70-80% as they move away from the traditional ladder style sleeves. The system also allows the flexibility to print a wide variety of labels for wire identification, rating plates, raised panel labeling and more. "The majority of manufacturing expense is labor," Ken contended, "and Dasco focuses on bringing automation to the production floor with the objective of reducing labor costs." It's a creative method the company has devised to help customers become more competitive through material cost savings and labor reduction.

Dasco partners with companies like Brady to bring these quality solutions to meet customer needs, but they take the use of these products to the next level. "We are not tied to representing just one manufacturer, so we take products from several manufacturers and bring them together to provide one complete suite of solutions," Ken revealed. "Dealing with manufacturers directly limits you to purchasing only their products, while missing other options that may perform better." The 'secret sauce' at Dasco is that they know the identification market. They've put in the years researching products and have become quite adept at bringing

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Solutions in Cable Labeling at Dasco

Continued from page 8

customers the product mix that will best suit their needs.

“One of the big frustrations I see in the market now,” Ken lamented, “is when our customers get locked into using one vendor who has been called out on a specification. They have no flexibility to select another source if their current source is not meeting their needs.” Under Ken’s management, Dasco is currently working on bringing flexibility to these customers to give them control. “We have become a UL/CSA repackager, which allows us to carry the material manufacturers certification and bring it forward to sell to

our customers. That way if we do not perform, the customer can bring this to any other repackager and bring them in as a supplier.” This has increased Dasco business significantly in the manufacturing sector.

While most businesses are trying to lock customers into proprietary products, Dasco is trying to move the control back to the end user. “If we do our job then you will want to stay with us,” Ken affirmed, “and if not, you can easily move to another supplier that will better meet your needs.” But that just doesn’t happen at Dasco. They stay on top of their game, and Ken and his team are constantly looking for new solutions that provide

value while reducing customer’s costs.

Ken detailed his history with the company in his own words:

I left college in 1982 to join the business full time, and was immediately drawn to the labeling and identification portion of the business. Working with customers to solve their issues and automate their processes provided great satisfaction. The mid 80’s and early 90’s is when computerization was being introduced to label printing, allowing users on-demand printing with desktop solutions, thermal printing, etc. You could really make an impact on the manufacturing floor by providing solutions that would make an immediate impact. During this time, our customers also began asking about bar coding, and it didn’t take long for us to get into the barcode printing and data collection business. This brought our customers new technologies that would totally change their businesses.

I began to enjoy educating them on barcodes and how they could track their processes, and implement scanning to improve productivity. Barcodes became widely accepted and the advent of new technology like 2D barcodes and RFID technology brought new opportunities.

In the mid 90’s we started a label converting business that expanded

our market to include prime labeling. This allowed us to develop new production techniques and bring unique products to market.


Around that time, a customer approached us with an unusual opportunity. They had a company supplying them with promotional magnets who went out of business. We analyzed the business opportunity and within 60 days, we were up and running within the promotional magnet business. This business expanded as we began to provide major league sports teams with calendar magnets.

After running this business unit for about 10 years, I realized that we had lost focus on our core business of bringing labeling solutions to our customers in the manufacturing arena. We sold the promotional magnet businesses and brought the focus back to Dasco’s traditional goals of developing solutions and providing industrial labels.

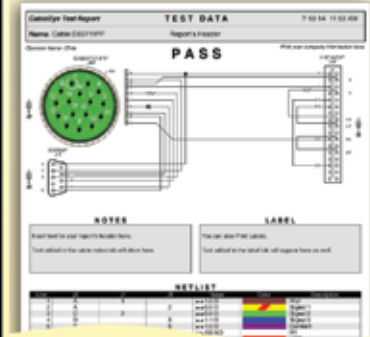

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M & A 101: *Lessons learned from decades of deals*

Getting Deals Done Remotely

By Loren Smith

Although the pandemic has accelerated a dramatic change in the way we communicate and learn, one might assume that a process as complex and delicate as the sale of a wire harness company still demands extensive face-to-face contact. Not necessarily, as I'll illustrate.

First, however, I want to emphasize why I used "accelerate" in my opening sentence. Surely you agree that for years the digital age has been altering how we communicate. Instead of phoning, we often email or text. People of all ages take courses online, whether they are doing so for enrichment or to earn a degree. And many of us have participated in webinars. So the advance was already here, but now we are taking much fuller advantage of our technology.

For me, the power and convenience of applying our technological tools to deal making was vividly revealed in a recent transaction. Formerly, from the time I received a call from an owner looking to sell his or her business to the closing, I was hopping onto airplanes and sitting in conference rooms to meet with all the parties to a transaction. But when I received a call from a harness company owner in the Pacific Northwest

who was considering selling her company, geography and COVID-19 intervened. Flying from the Midwest to spend an hour or two with the owner at her plant was not a pleasant prospect. Enter Zoom.

Setting up a Zoom conference call was simple, and in short order she and I were sitting on our computers having a conversation that was nearly as complete as one we might have had in person. In about an hour I was able to answer most of her questions about the sale process, and she was able to answer most of my questions about her company. Then, in a second Zoom call, I shared documents satisfying her concerns about confidentiality and showed her examples of the kind of confidential information memorandum (CIM) that would be generated if she decided to retain us.

I do not want to sugarcoat this, however. There is much to be said about the opportunity to shake someone's hand (remember when we used to do that freely?) and take in someone's full presence, but the Zoom calls came mighty close to providing that level of interaction. So in this expeditious manner I was able to obtain enough information about the company to feel confident that I could find the right buyer and put together a deal that met her objectives, and she gained the comfort

level to retain our services.

From that point, we continued to handle all of the intermediate phases of the sale process remotely. Past custom would have required a number of face-to-face meetings with prospective buyers at the seller's plant, but once I narrowed the list of buyers to a handful, that step was accomplished through Zoom conference calls that obviated the need for a number of long flights for the buyer candidates and for me. Remotely, we were even able to select the most suitable buyer and achieve acceptance of a letter of intent (LOI).

Only after all those steps did the buyer arrange a flight to see the plant firsthand and confirm chemistry and trust with the seller. The deal was consummated.

We often say, "Necessity is the mother of invention." Were it not for the pandemic, these remote interactions would not have been suggested as a substitution for face-to-face meetings, but in the end they more than sufficed.

So where do we go from here? While I still consider in-person meetings as the gold standard, I am also positing that adjustments we are making because of the pandemic verify that we can avoid extensive air travel and other inconveniences once the COVID-19 threat has subsided. Just



Loren Smith CEO
Blue Valley Capital

as many colleges will likely be offering more remote learning options in the near future, many businesses are likely to cut down on travel when remote meetings are a smart alternative.

The streamlined sale process I was recently part of confirms my view that virtual meetings are a highly effective way to cut expenses and inconvenience—even, in many cases, for something as intricate as getting a deal done.

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

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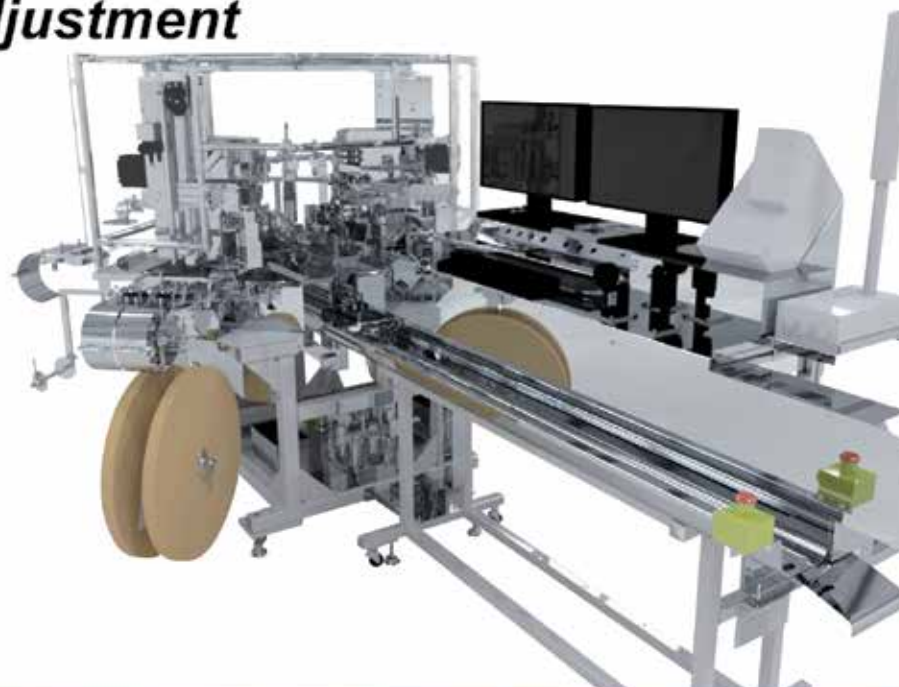
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THE POWER WOMEN OF THE WIRE HARNESS INDUSTRY

By Melissa Femia

This edition of the Power Women series features Christina Trussell, an aeronautical engineer from the Seattle, Washington area. As a child from a military family, Christina was exposed to the Navy; her father, grandfather, and generations prior were in the military. As a result, she joined the Navy right out of high school. She had no engineering influences or aspirations during secondary education. One of her fondest memories was watching the Blue Angels with her father and telling him that she wanted to do ‘that’ when she was a big girl.

Because Christina joined without a predetermined job, which constituted admission in the Undesignated Program, a job was assigned to her. She was placed on an aircraft carrier, the USS Ronald Reagan, based in San Diego, CA. She spent more time on the sea than on land. During that time period, she visited a career counselor to determine her next steps. Since she had a high aptitude per her test score on the ASVAB (the Armed Services Vocational Aptitude Battery), she was advised that she



Melissa Femia

could pursue any job in the Navy. She decided to become an Aviation Electronics Technician. She was placed in the role and received on-the-job training. She was also provided assessment training, which she learned individually. Although the standard training session comprised 51 days in Pensacola, Florida, she studied on her own and was able to take the assessment per the next exam cycle. She advanced to the next rate shortly after passing her first exam—about a

Continued on page 16



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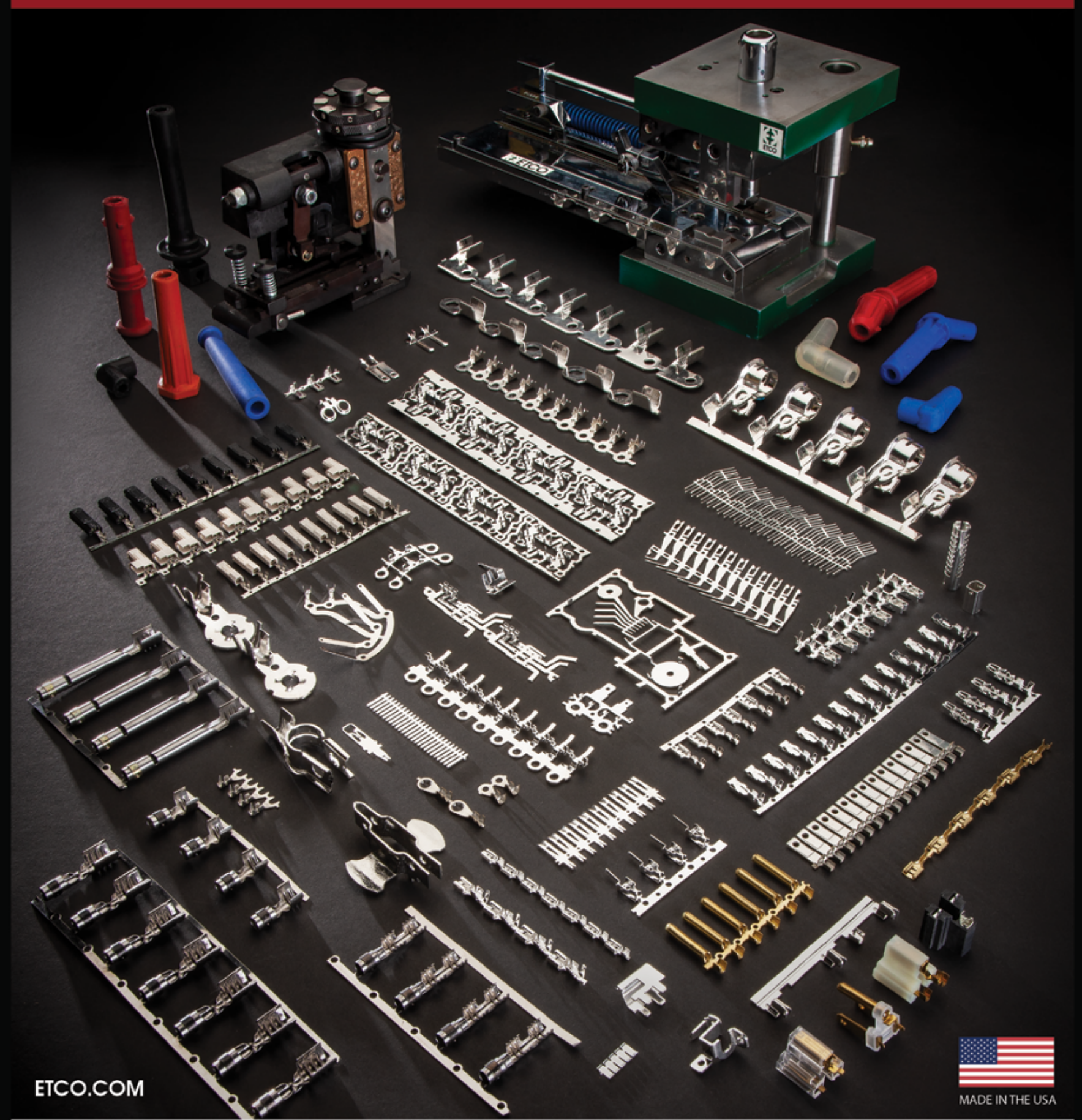
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The Power Women of the Wire Harness Industry

Continued from page 14
month or two into her training. Also, during her naval days, she was in a squadron that worked on a helicopter program, MH 60 Romeos.

Christina was accepted at Embry-Riddle Aeronautical University after being exposed to it in high school. She started attending college while she was still in the Navy. She completed an integrated online program which consisted of class room courses and structured online classes. As Christina wanted to move back to Washington, she was able to attend primarily via the 4 campuses in her state. The teachers often instructed her classes via live screen though sometimes, the teachers were physically present to teach the classes. While still attaining her degree, and completing her Navy time, she worked for ATS (Aviation Technical Services). She mainly worked on Southwest Airline aircrafts converting them to a new standard. She was very involved in trouble-shooting, point to point testing, and reworking of wiring.

Although she received a job offer from one company while attending a career fair held by Embry Riddle in Seattle, she was targeting Blue Origin for work because of the positive feedback she received from her mentors. Blue Origin was also present at the career fair, and Christina was selected to endure an arduous 3-round interview session. Christina's first round interview consisted of a meet and greet with a manager followed by a second interview series with a 6-person panel and subsequently, thirty-minute one-on-one interview sessions. She was hired almost immediately as an integration engineer in the harness lab where harnesses were inspected, reworked, and built. Within a month, she was promoted to the leader of the harness lab. She then became a project manager and just recently moved to wire harness production engineering. She is currently the element between design and production; if there is a defect, she is the person to authorize correction of the problem.

Not only is Christina's path less traditional because of the early military involvement, she also experienced additional challenges because she gave birth to and cared for children while attending college. While she may have had less time for study-



Christina Trussell

ing and assignment completion, she certainly learned to manage her time effectively.

When asked about her experiences in a male-dominated field, Christina advised that about 20% of personnel on the aircraft carriers were female so she was already familiar with the lower female ratios prior to college. In terms of her college experience, she attended about 90% of her classes at one of the Washington State campuses and did not really notice an uneven male to female student ratio. At ATS, there were about 20 males to every female. As a progressive company founded in 2000, Blue Origin has several female engineers and has grown from less than 1400 employees upon her hire to over 3000 people now.

When asked about her recommendations for other females considering their futures, Christina strongly recommends engineering even more so than the military; she believes that she has many options as a result of her aeronautical degree. Her career is very rewarding and she advises that students persevere through the program despite the challenges.

Thank you, Christina, for sharing your story.

If you are interested in sharing the stories but missed the original WHN distribution, the articles are available on the Jana Diversity Solutions website at www.janadiversity.com, or at wiringharnessnews.com.

If you know a female engineer who would make a great candidate to feature in the PowerWomen series, please direct them to me at melissa.femia@janadiversity.com

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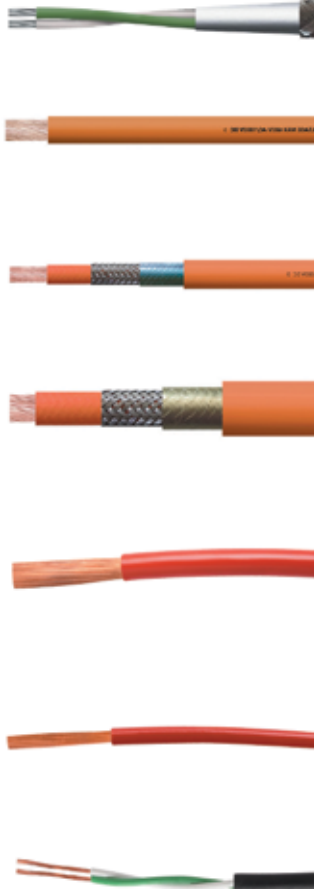
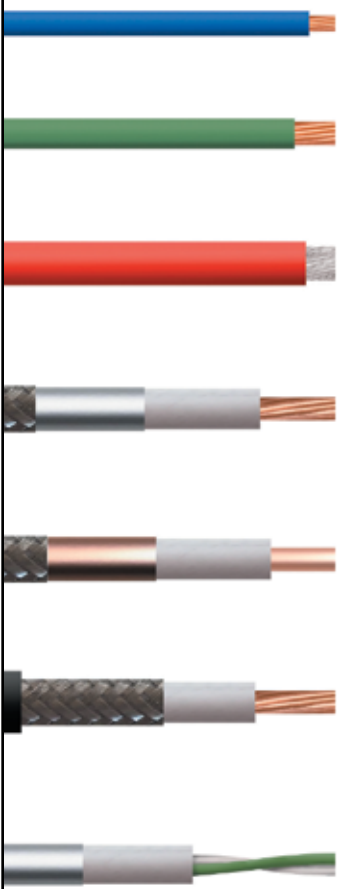


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Flux Continues Amazonification of Harness Manufacturing

By Joe Tito
Wiring Harness News

About a year ago, I profiled Flux Connectivity and got a lot of comments about their unique manufacturing model and innovative views. Interested in their progress to date, I've kept in touch with the team and have learned about some exciting milestones that warrant follow-up, which include the appointment of their Chief Innovation Officer, Jonathan Regidor. I decided to catch up with both Jonathan and Adam Amos, CEO, to see what kind of traction they've gained and see how their unique format is working with the pandemic state and decline in markets.

As mentioned in their profile, to really understand this team and their vision, you need to unpack your conventional thinking of how a typical contract manufacturer works. For starters, Flux believes in a scalable, low-cost operating model, where any cost that doesn't benefit the customer is removed from the business. This doesn't mean cutting profits though. "Our ability to reduce costs for customers while achieving higher than industry average margins has been the biggest sign that our model works", says Adam. In fact, Flux is able to consistently deliver EBITDA performance of 16.5%, double the industry standard due to this low over-head model. "Everyone that can, works from home. If anyone wants to meet face-to-face, they do so freely at one of our collaborative office spaces" says Adam. "In order to maximize our efficiency, we need to ensure that manufacturing takes place in every single inch of our facilities. Even inventory is staged at the lowest cost part of the value chain so it doesn't take up any space".

Since our profile, Flux has quadrupled its size, expanded into verticals such as marine and automotive, and strengthened its executive leadership with the addition of a Chief Innovation Officer. "Innovation needs to be a culture, not a process", says Jonathan, "Our mission is to become the most innovative and customer centric contract manufacturer. We can't just say we are the best though; we need to back that


up with an unparalleled ability to execute." A key to this execution has been Flux's On-Time Delivery Guarantee™. "There is no better way to prove how confident you are in your operational excellence than to pay customers when you're late, that is the premise behind our guarantee" says Jonathan.

One thing that has been evident in my many conversations with these guys is their unparalleled energy and laser focus. Adam and Jonathan are relentless in their mission. "While everyone sleeps, we strategize and execute" says Adam, "If we work not only smarter, but harder, we know we will get ahead". When asked how the pandemic has impacted their business "We are laser focused on ensuring the safety of our people and continuity for our customers. It is becoming apparent though, that our model is built to withstand the most challenging of times, even ones we did not foresee".


Jonathan ended off with the following quote:

"We are passionate about business; this just happens to be the industry that we are experienced in and have come to love. I want to be part of something big, and I want to enable other people to deploy their creativity faster. Since our industry is one that has not changed in over 50 years, I sometimes wonder if such advancements are warranted or even necessary. I then quickly realize that we are undergoing the Amazonification of nearly every other industry on earth. My personal satisfaction stems from knowing that we are breaking the mold and challenging the status quo. We will continue to execute day in and

day out to scale and convince people of our vision. Given that our global addressable market is \$150B, we have a lot of work ahead of us. I encourage other business leaders to be bold, we can't do this alone."



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Automated Wire Processing for Panel Builds

Continued from page 1

quartered in Comfort, Texas, they provide value to their customers by building integrated, turnkey systems, ready to deploy to the field, which reduces field installation costs, provides in house quality control, and systems testing. Connexa specializes in Industrial Internet of Things (IIOT) services, remote solar power, UPS power backup, and industrial control panel applications with internal design and engineering, custom assemblies, and its own line of industrial power products. As one of the fastest growing companies in the United States, Connexa has been included in the Inc 5000 in 2018 and 2019.

Developed to meet the highest demands of the industry for flexibility in automated wire assembly, Komax launched the Zeta 640 and Zeta 650 fully automated wire processing platforms in 2018. The Zeta 640 and Zeta 650 have the unique ability to process many different cables and terminals without changeovers, just-in-time, for batches of any size. Automated processes reduce manufacturing time by up to 50 percent.

These fully automatic wire processing machines provide maximum flexibility across a wide range of applications. The Zeta 640 is equipped with five process modules in the standard configuration, opening up many new possibilities for small batches or

sequences. The Zeta 650 is designed for eight modules, reducing changeovers and minimizing interruptions. Both machines can be extended by five additional modules as required. EtherCAT improves the overall system performance and significantly increases throughput. Continuous data flow to the machine from any system can be easily converted into readable data and sent directly to the machine making entry error-free and highly efficient.

This new generation of Zeta platforms automates all processes such as cutting to length, stripping, labeling, and sleeve insertion, simultaneously and on both wire ends. Three pairs of blades cover the entire cross-section range of 0.22 - 6mm² (AWG24 - AWG10), enabling production without the need for changeovers. The automatic wire changer provides up to 36 different wires over the entire cross-section range. Up to two automated inkjet printers mark the wires in black and one additional color within the same sequence.

Connexa purchased a Zeta 640 wire processing machine from Komax in 2019 and it was in production by the summer of 2019. As one of the few control panel shops in the U.S. with a Zeta machine in operation, they have realized a significant competitive advantage while using the machine. The machine has dra-



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matically improved lead times and enhanced the quality of Connexa's control panel production. They also recognize the great support and training provided by Komax. Connexa's customers appreciate the extra value, and the Zeta machine is the centerpiece of each customer tour of their facility. "Customers are amazed at the speed and technology of the machine, and it has turned into a great marketing tool," states, Mike Postel, Connexa Founder and President.

As a leading integrator of new technologies such as IIOT, edge computing, solar power, and new telecommunication connectivity, Connexa sees these new innovations as the future of its business. Building more complex field systems require the latest in manufacturing technology and the Komax Zeta fills that role when it comes to wire processing. Mike continues: "These capabilities have opened new markets for Connexa and has allowed us to expand and diversify our product offerings outside of our traditional markets. With the Zeta machine and the implementation of other digital technologies, Connexa continues to improve our operations."

To slash throughput time and make production processes of industrial control panels more flexible and ideal, Komax offers a range of optimum automation solutions. These are designed to improve the processes, increase efficiencies, and reduce the technical demands associated with assembly. As a result, they generate major time and cost savings while simultaneously boosting quality and economic return. These perfectly coordinated solutions cover all needs from entry-level automation right through to fully automated wire assembly – whether producing a single control panel or manufacturing a series.

In short, the Komax wire processing portfolio provides industrial control panel manufacturers the ability to:

Save With Automation

- Reduce your production costs
- Cut your production times by up to 50%
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Flexibly Increase Efficiency

- Wide processing range for wire ends
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Achieve Top Quality

- Less personnel training required
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Many thanks to Patrick Moroney, Marketing Manager at Komax for composing this article.



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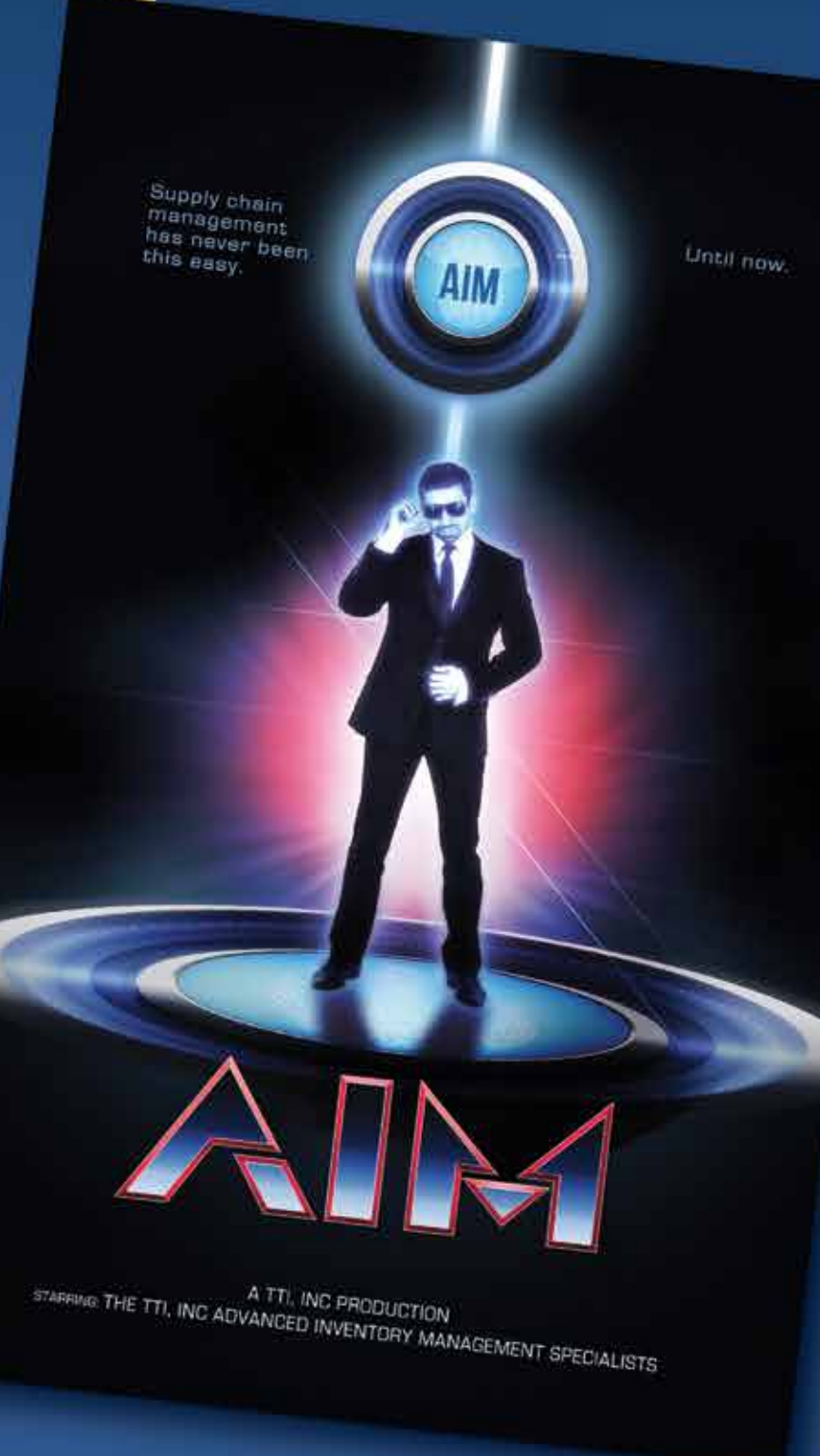
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Back to Basics

The Basics of Mechanical Wire Stripping Part 2 of Soldered Wire Termination Series

By Ray Cirimele
STI Electronics Inc.

This is the second in a series of articles that will continue to review soldered wire terminations. Last issue wire preparation specifically thermal wire stripping was covered. The focus of this article will be mechanical stripping of wires. The use of high quality mechanical strippers that are used for precision stripping will be discussed. Make sure and stay away from the common wire strippers found at the big box stores that are used for stripping electrical wiring used in your house (Fig 1).



Figure 1. Avoid stripping tools typically best suited for home electrical wiring applications.

Select a set of strippers that have precision blades such as this pair of mechanical strippers which has a flat sandpaper like area that grips the insulation instead of sharp metal ridges that will damage the insulation (Fig 2).



Figure 2. Proper Mechanical Stripping Tool.

Make sure to look at the blades to verify that they align correctly in order to make sure that the conductor will not be damaged by the blades (Fig 3).

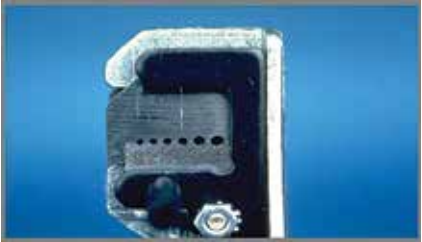


Figure 3. Check Blade Alignment.

The blades should also be matched to the type of insulation that will be stripped. If a set of blades that is designed for PVC insulation is used on PTFE insulation the results will be less than ideal at best. The last article (March/April 2020) discussed that using mechanical strippers on smaller than 20AWG wire might damage the wire such as stretch the conductor and lower the current handling capability of the conductor. On 22AWG and smaller conductors it would be recommended to use high strength copper alloy wire to help mitigate that issue.

Next we'll discuss the steps involved with mechanical stripping.

Step 1: Place the wire into the jaws of the stripper perpendicular to the blades (Fig 4).



Figure 4. Place wire into jaws.


If the wire is not straight the blades can nick some of the conductor strands. In the photo this stripper has the optional wire stop that can be used to achieve identical strip length on multiple wires.

Step 2: Squeeze the handles together with consistent pressure until the blades cut the insulation (Fig 5).



Figure 5. Squeeze handles.

Continued on page 25



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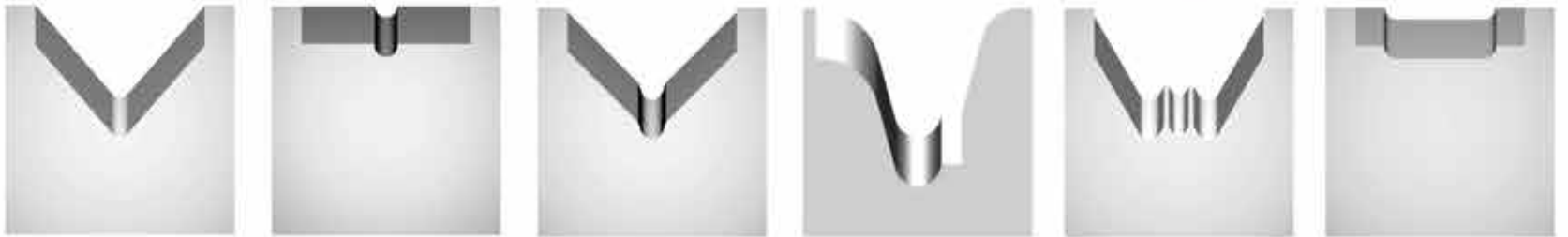




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The Basics of Mechanical Wire Stripping Part 2 of Soldered Wire Termination Series

Continued from page 23

Step 3: Release the handles and remove the wire (Fig 6).



Figure 6. Release handles.

The insulation slug may also be left in place if just kitting the wires for later use to protect the wire from damage until ready for use (Fig 7).



Figure 7. Slug may be left on.

Step 4: Remove the insulation slug from the wire (Fig 8).



Figure 8. Remove slug.

The best way to maintain the natural lay of the strands is to slowly twist the insulation slug in the direction of the strand twist as you are pulling the insulation slug from the wire.

Step 5: Final product. Inspect stripped wires to make sure that they meet your quality requirements (Fig 9 & 10).



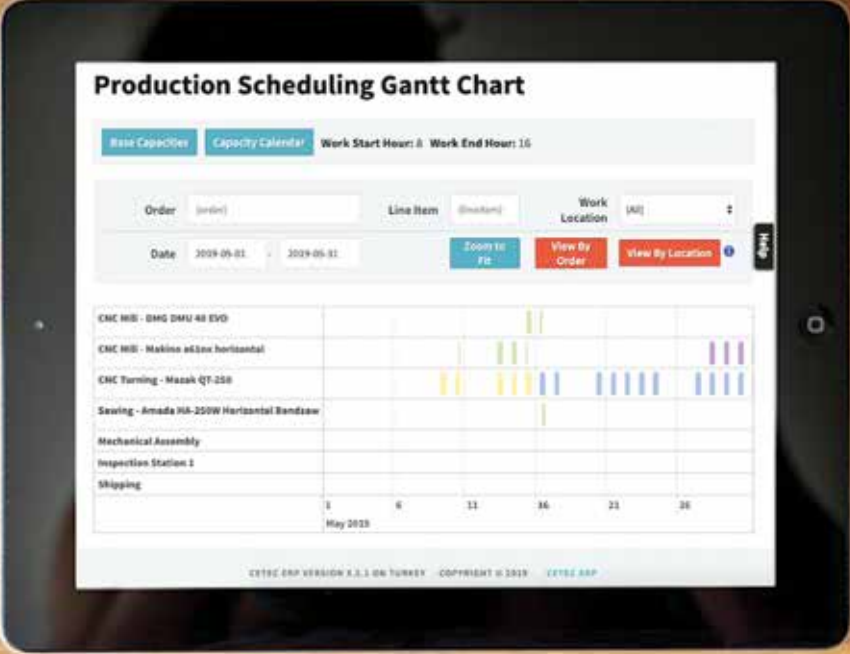

Figure 9. Inspect final product.



Figure 10. Inspect final product.

Now that the process of wire stripping has been covered in detail the next issue will address tinning of wires for use on soldered terminals and crimping of wires onto contacts.

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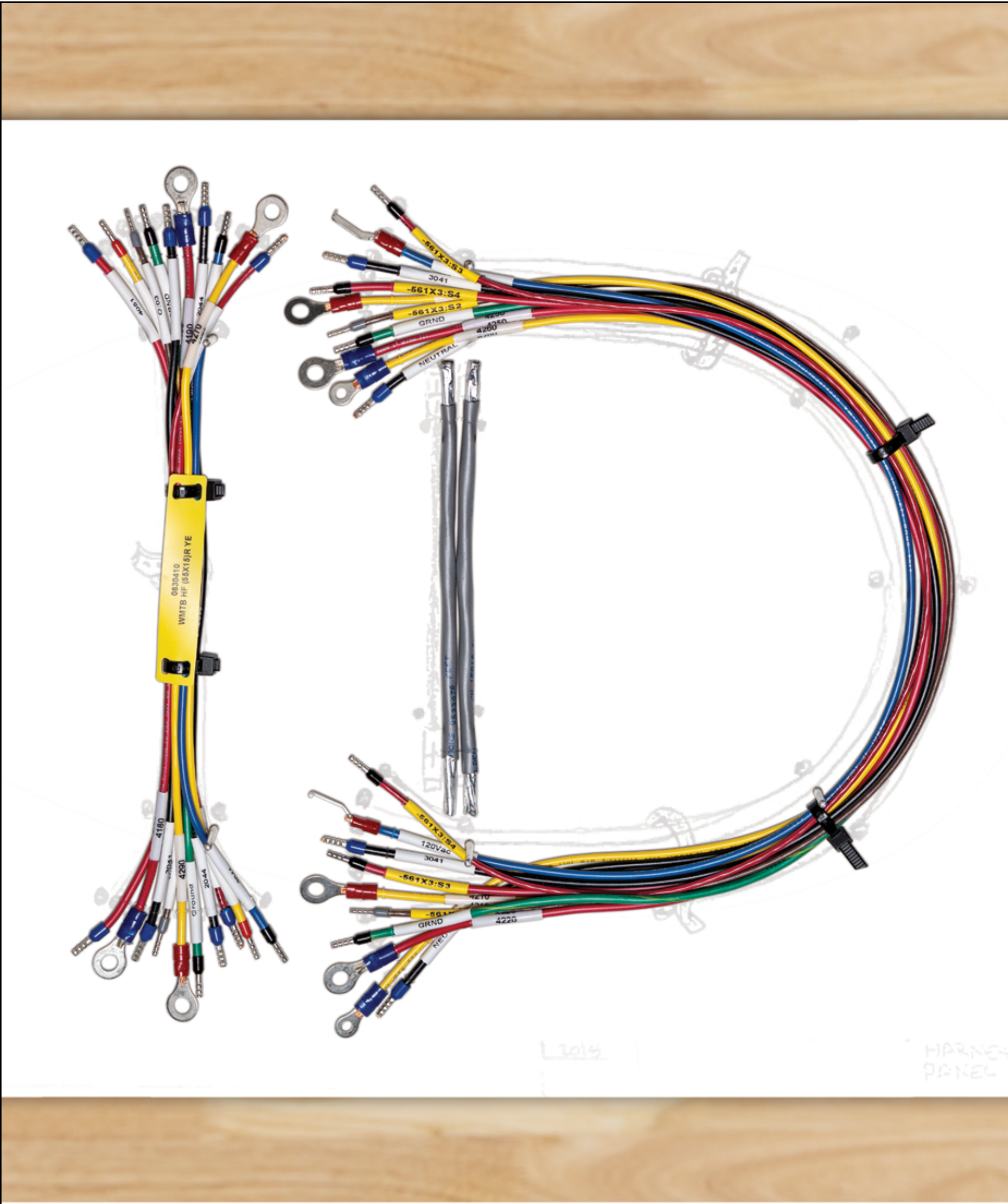
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Qualastat

parts he was making. They were stainless steel sleeves through which he had to solder feedthrough terminals, and his company was really struggling with them. “Well, I knew how to do it and I was going to start a business anyway,” recalled Vernon, “so I asked how much he would pay for somebody to do it, and he said 100 bucks!” Vernon offered to do it for \$70, but there was a catch. His new friend had suggested the name Qualastat for the new venture. “So, to get the business, I named the company Qualastat.”

Continued from page 1

Vernon had a great relationship with his boss at General Reliance prior to starting his company. That relationship proved most helpful in making the new venture work. “I’d done sales for him and I needed income while I was out looking for business for Qualastat, so I told him I would rep him. Our agreement was anything he didn’t want, I could take if I wanted it,” Vernon recalled. He stressed his venture would have nev-

Continued on page 29



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Qualastat

Continued from page 27



Product inspection at Qualastat.

er made it without that arrangement. Qualastat even did some offload work with them when they got busy. This symbiotic relationship remained for about a year and a half while Vernon spooled up the efforts of Qualastat.

Characteristic of many of the humble beginnings of the businesses we profile, the initial setting for the business was in the family home in New Jersey. “We started in my family room with a table set up in the corner where we did assembly, but I did my soldering out in the garage,” Vernon detailed.

Soon they were in a small facility with about six employees. That’s

about the time Northrop Systems approached him with a request for quote on some assemblies. “I said I couldn’t look at it until General Reliance did.” But the buyer informed Vernon that General Reliance had already no-quoted the project, so the business went to him. That order was pivotal for Qualastat. “I mainly got started on opportunities somebody else passed on,” he remembered.

Vernon and his wife wanted a more fitting home for their family and business. They had visited Gettysburg, PA on their way home from a family

Continued on page 30

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Ship Date: Month	Resale (\$)	Cost (\$)
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Prior Year & YTD Shipments

Ship Date: Year	Resale (\$)	Cost (\$)
2019	\$12,178,444.47	\$1,876,948.40

Current Invent...

\$1,605,818.58

Prior YTD Breakout (Cumulative)

Resale (\$), Cost (\$), Gross Profit (\$)

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Resale (\$), Cost (\$), Gross Profit (\$)

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Qualastat

Continued from page 29

vacation years earlier, and used a four-day weekend for a more thorough exploration of the area. That trip sealed the deal, and in 1988 they moved the family and business to Gettysburg.

At that point, Qualastat began to transition from electro-mechanical assemblies into flexible silicon cable assemblies along with some flexible circuit assemblies. The product mix, however, was clearly starting to migrate towards cable assemblies as they established competence there. “After you are in business for

a while, and you begin to do a good job, people start coming to you,” Vernon advised. Their biggest customers became Lockheed Martin and Northrop Grumman. “We supported engineering with them, delivered on time, and our quality has always been good. Those three things have allowed us to get really deep into different programs there.”

Phoenix Operation

Back in 2008, Lockheed Martin approached Qualastat about a new program to replace the Patriot Missile. It was called

MEADS (Medium Extended Air Defense System) and would encompass the efforts of multiple countries. Qualastat was poised to get a large chunk of business from the program, but there was one big concern with Lockheed. “They came down and said, ‘you guys have a lot of business in this program and if something happens to you, you don’t have a catastrophic backup plan.’” After a lot of research, they felt the Phoenix area offered them the engineering and technical labor supply they needed, and settled on Chandler. Not long after they opened the facility, however, the program was canceled. “We really took a big hit there because we had a lot of expense with the facility being opened, and then we lost all that work.”

Facility Specialization

Qualastat championed on however, and today both facilities are busier than ever. They have many overlapping capabilities with the Phoenix location specializing in fiber optic and semi rigid RF. “Anything that requires braiding is done in Gettysburg, and that’s where we actually lay up our own cable and blow on jacket,” he instructed. They also share capabilities in EMI shielding, flex circuits and environmental protection including molding. Both facilities are IPC J-STD-001 and IPC/WHMA-A-620 certified and both are registered to AS9100.

New Business

I asked how Qualastat acquires new business and Vernon reiterated their ability to penetrate further into the programs of existing customers. Performance and execution seems to be the main driver for new opportunities. Vernon, Jr. runs the day to day business operations as CEO, but Vernon Sr. still does sales and production planning. “I can tell you I’m the worst salesman in the world. We get opportunities because our competitors fail in one way or another, and those lead from

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one to another as people move from one program or company to another, and we just follow them.”

Personnel

Qualastat currently employs about 26 people total in both facilities. “We have low turnover,” Vernon informed. “We’re very careful about who we hire and what people can work on,” he explained. If they don’t think someone is going to be an excellent fit, they simply don’t bring them on board. “Most of our stuff is ship-based, ground-based or airborne radar. A lot of manufacturing has left the country, and it’s hard to find good people, so if we get real busy, we have a tendency to work overtime instead of hiring people.” At the moment, however, they are hiring competent engineers

and technical assembly people as their sales have grown over 50% from the previous year.

In his concluding remarks, Vernon had this to say:

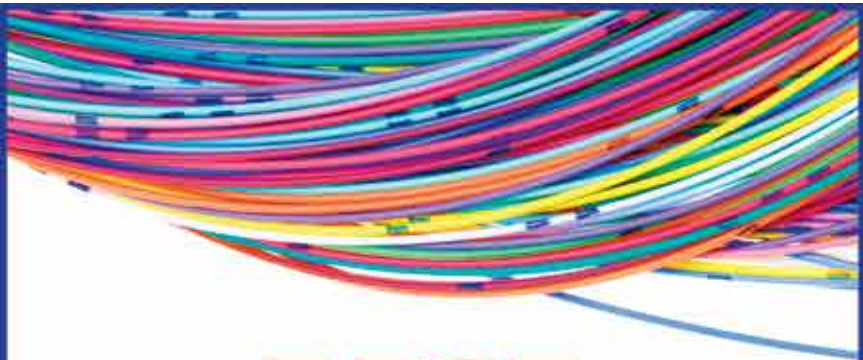
“We never chase after money, if that makes any sense. Don’t get me wrong, we do well as a company, but we’re just real people and we want to build relationships. We just don’t stick it to people and we genuinely like our customers. Vernon, Jr. is constantly chasing details and when you have somebody like that at the top who really lets everybody know how critical things are, well, that just makes a huge difference. We are all busy, but we are enjoying life.”

*** FOR SALE ***

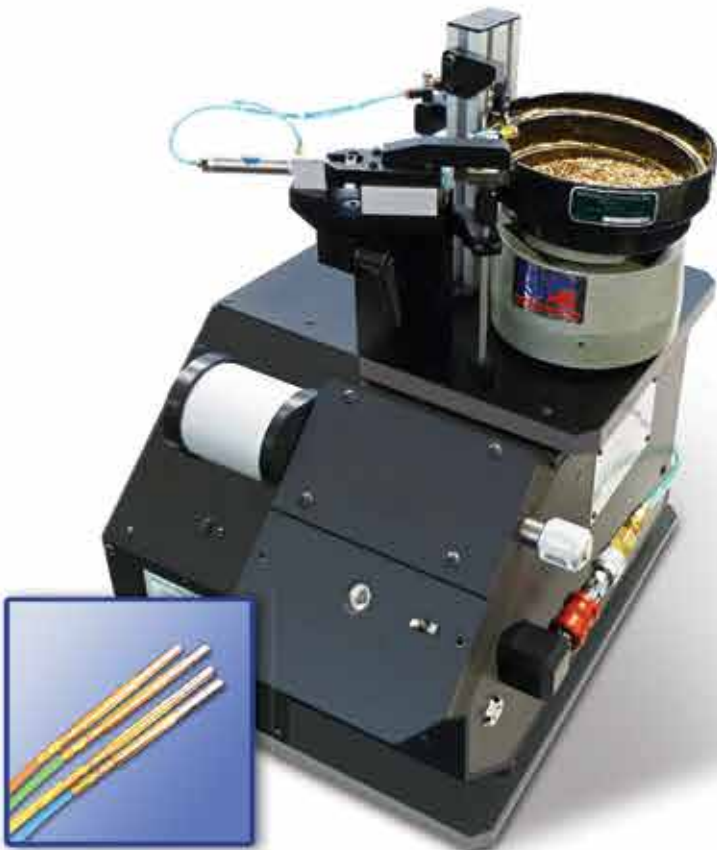
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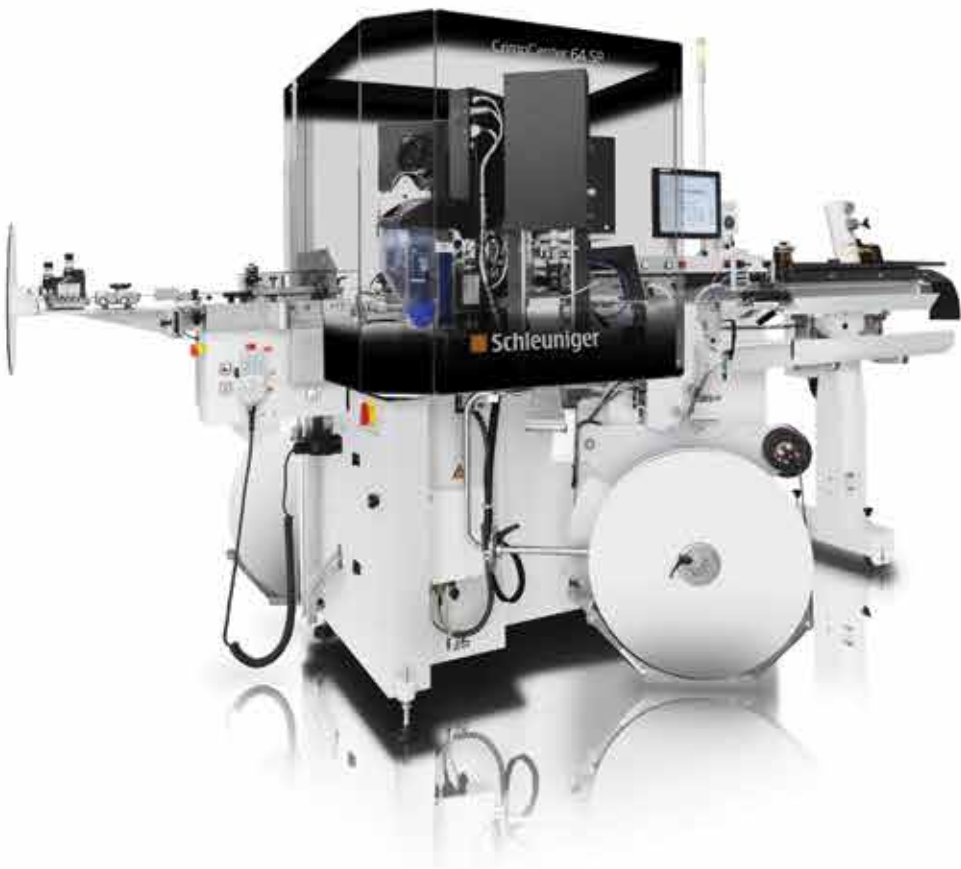
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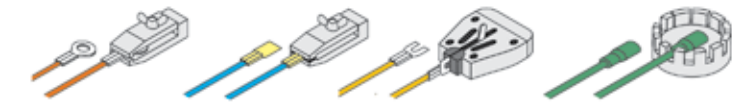
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AN OVERVIEW OF HARMONICS IN ELECTRICAL SYSTEMS

What are harmonics?

In an electric power system, a harmonic is a voltage or current at a multiple of the fundamental frequency of the system. Harmonics can best be described as the shape or characteristics of a voltage or current waveform relative to its fundamental frequency. When waveforms deviate from a sine-wave shape, they contain harmonics.

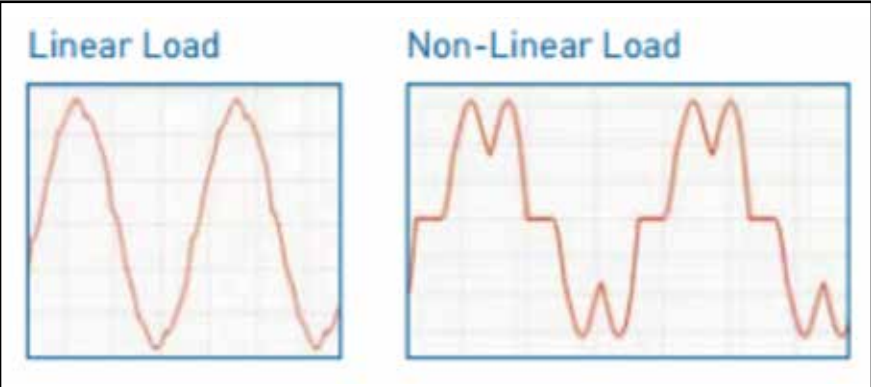
Harmonic frequencies in the power grid are a frequent cause of power quality problems, resulting in increased heating in the equipment and conductors, misfiring in variable speed drives and torque pulsations in motors.

What causes harmonics?

AC electrical loads are referred

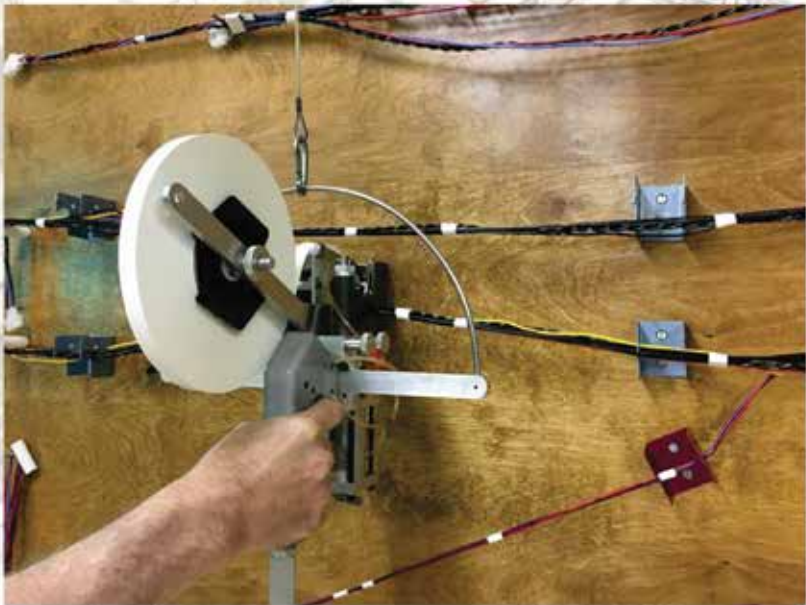
to as either linear or non-linear, depending on how they draw current from the mains power supply waveform. With a linear load, the relationship between the voltage and current waveforms are sinusoidal and the current at any time is proportional to the voltage; this is known as Ohm's law. Examples of linear loads include transformers, motors and capacitors.

With a non-linear load, the current is not proportional to the voltage and fluctuates based on alternating load impedance, meaning the current it draws does not have the same waveform as the supply voltage. Non-linear loads draw currents in abrupt short pulses. These pulses distort the current waveforms, which in turn generates harmonics that can lead to power problems affecting both the distribution system equipment and the loads connected to it. Examples of non-linear loads include rectifi-



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What are the consequences of harmonics?

A power system’s ability to perform at optimal levels is compromised when harmonic distortion enters the system. Harmonics create inefficiencies in equipment operations due to the increased need for power consumption. The increase of overall current required creates higher installation and utility costs, overheating and decreased profitability.

How can you reduce harmonics?

A few of the most popular ways to control harmonics include:

1. Trying to reduce the harmonic currents produced by the load. Adding a line reactor or transformer in series will significantly reduce harmonics, as well as provide transient protection benefits.

2. Adding filters to either siphon the harmonic currents off the system,

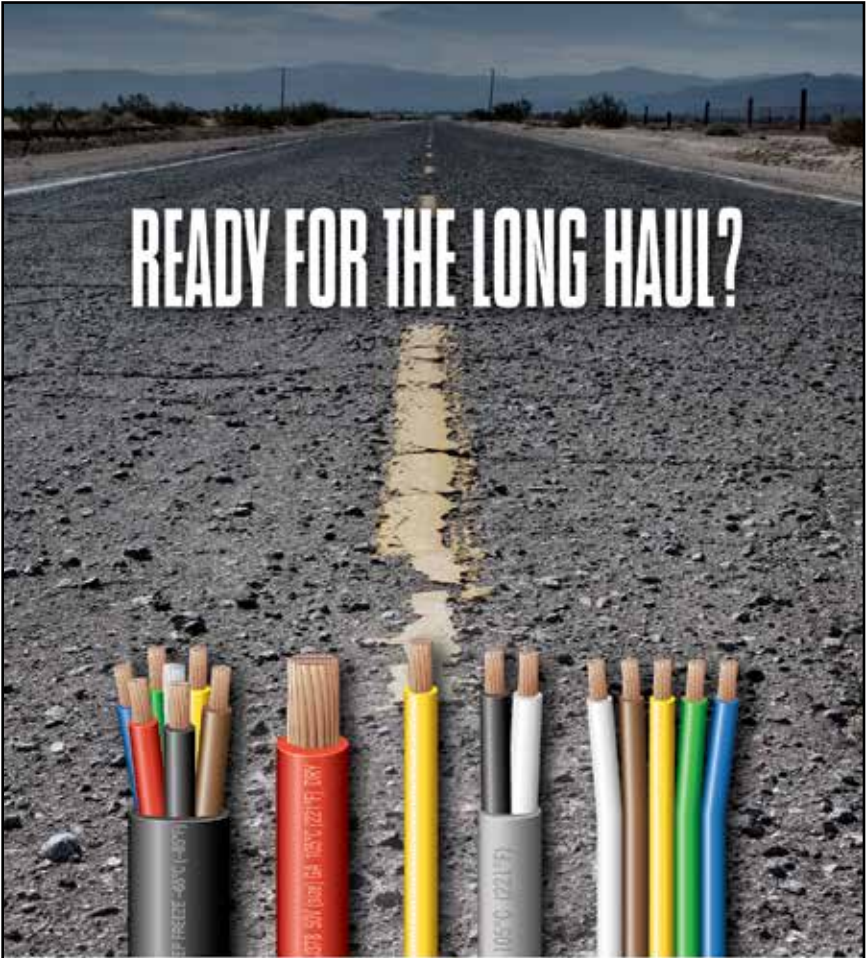
thereby blocking the currents from entering the system in the first place, or supply the harmonic currents locally. For example, adding a shunt filter short-circuits harmonic currents as close to the source of distortion as practical. This keeps the currents out of the supply system. The shunt filter is a popular filter choice because it is cost-effective and can correct the load power factor while also removing the harmonic current.

3. Modifying the frequency response of the system with filters, inductors or capacitors. Active filters work by electronically supplying the harmonic component of the current into a non-linear load.

4. Providing transformer connections, which can reduce harmonic currents in three-phase systems.

5. Changing the capacitor size. This is often one of the least expensive options for both utilities and industrial customers.

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Wired in WHMA UPDATE

Wiring Harness Manufacturer's Association

By Christine Siebert

WHMA and IPC have launched a webinar series to discuss the widespread concern about the COVID-19 crisis. Wire harness professionals join these webinars, COVID-19: Wire Harness Leadership Forum that were held on May 7th and June 4th, to exchange valuable information with their industry peers. The topics that were discussed on these calls were detailed updates on U.S. economic conditions, health and safety precautions companies in the industry are taking, how suppliers are handling demand, employment decisions and issues, and how our industry companies are getting back to business. These webinars are led by David Bergman, WHMA/IPC WHMA Executive Director, Rick Bromm President of Altex and Board Chairman of WHMA, and Norm Sagon WHMA/IPC Sales Associate. The purpose of this webinar is to be an open forum for industry professionals to openly discuss and exchange information during this uncertain time.

The webinar begins with an enlightening update on the U.S. Economic Outlook presented by Shawn DuBravac, IPC Chief Economist. He prepared a few slides to give an overview of where we are today and where we are going. A few key stats that he provided were that lost jobs were down from April at 20 million to 2.76 million in May. The numbers were much better than the expected 8.75 million. Manufacturing down 719, 196. Manufacturing is roughly 10% of the ADP report but was 26% of the decline. An area we are seeing improving is vehicle sales which impacts a lot of the manufacturing markets. In April, vehicle sales had been the worst it has ever been at 47%. In May, vehicle sales are down 30% which is up 17% from April. Electronics and computers are relatively flat which is good. Lastly for an overall look at the GDP which had a historic decline in Q1 of -4.9%, anticipated annualized decline in Q2 of -35%, we have never seen a decline like this before. We do think coming off this steep downturn you will see some recovery in the back half of the year. We probably will not gain the size of the current economy until late 2021 - 2022. The webinars continued with audience participation and polling topics. Discussions on how companies are handling COVID-19 requirements and what type of changes they had to make, i.e., safety rules, reduced staffing, essential workers, providing safety equipment, closing facilities, etc. were some of the main topics. Our audience felt overall somewhat positive on the overall economic conditions for the wire harness. WHMA and IPC will continue to hold these webinars for our industry professionals. Please check your email and the website for details at www.whma.org. If you are a WHMA member, you can view the past webinars in the Members Only area and if you're not a member go to www.whma.org/join to sign up today.

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Model Based Engineering for Wire Harness Manufacturing

Today’s passenger, recreational, and commercial vehicles are no longer just electro-mechanical products. Modern vehicles come equipped with an almost dizzying array of electronic features and components. These include everything from standard comfort and quality-of-life features like heated seats, air conditioning, and in-vehicle infotainment systems (IVI), to limited automation and advanced driver assistance systems (ADAS) (Figure 1). In addition, a network of electronic control units (ECUs) now assist essential vehicle functions, such as braking, steering, and throttle control. In today’s automotive market, the electronics are coming to represent most of the value of a vehicle.

The increase in electrical and electronic features in modern vehicles places more emphasis on the wiring harness, which transmits power and signals between actuators, sensors and ECUs. ADAS and automated driving systems are particularly demanding due to the external sensors that the systems need to perceive the vehicle’s environment, such as

approaching objects or speed limit signs. Furthermore, increasing demand for highly automated and electrically propelled cars directly translates to a growing wire harness manufacturing industry. Currently, the industry generates sales of over 150 billion dollars every year. Almost 30%, 50 billion dollars in 2018, of those sales come from the automotive industry, and automotive wire harness sales are growing. Analysts predict that by 2023 the automotive wiring harness industry will grow to over 70 billion dollars in yearly revenue and more than 91 billion dollars by 2025 (Future Market Insights, 2016).

With growth comes fresh challenges and new pressures on the industry. To support the greater number of electrical and electronic systems, some of which are very sophisticated, wiring harnesses are becoming intensely complex. Manufacturers must also accommodate all of the possible configurations of a vehicle, a number that frequently rockets into the tens of millions. While manufacturing these complex systems, companies



Figure 1: Cars feature a range of sophisticated electrical and electronic features.

have to meet very tight timelines, exacting quality requirements, and minimize the cost and weight of the harness.

Current Challenges

Engineering and manufacturing methods common across the industry have been in use for decades, and are showing their limitations in a new era. Wire harness manufacturing continues to be an extremely labor-intensive process (Figure 2). Today, approximately 85% of all wire harness manufacturing operations are carried out manually.

Even more troublesome is the fragmentation between the harness design and manufacturing departments and systems. Design and manufac-

turing engineers often transfer data manually between their respective domains, recreating and reentering the transferred design data into each of their systems, such as CAD, production, assembly board design, or costing system, and many more.

Conventional wire harness manufacturing methods are starting to creak under the weight of these new challenges. First, fragmented design and manufacturing processes lead to manual data transfer and reentry between domains. This is slow, error-prone, and an inefficient use of engineers’ time and attention. As manufacturing engineers make changes to improve the manufacturability

Continued on page 40



Figure 2: Wire harness manufacturing is still a labor-intensive process relying on manual assembly.



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The accelerating pace of program milestones also means that manufacturing engineers have little time to optimize the manufacturing process, leading to a sub-optimal process from the beginning. One task that can be particularly challenging is the creation of work instructions. With current methods,

Another significant challenge is managing what is called tribal knowledge. Tribal knowledge

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Figure 3: Current methods rely on manual data entry and re-creation at each stage of the flow.

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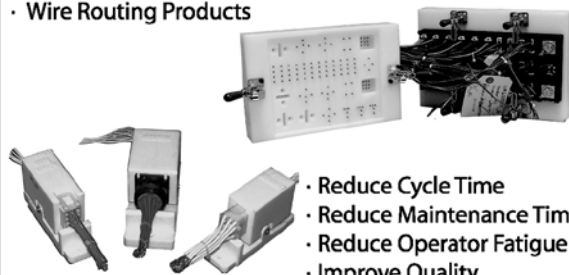
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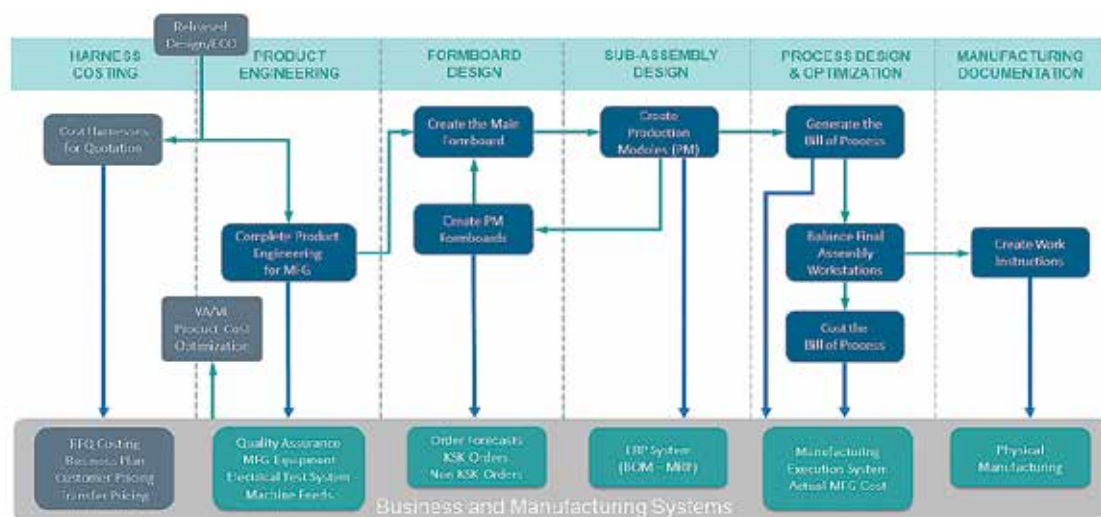


Figure 4: The high-level manufacturing engineering flow in the wire harness industry

is information about processes, methodologies, and more that is stored only in employees' memories. Tribal knowledge is unwritten, but is often critical to successfully implementing a process, creating a product, or maintaining quality levels. Employees that change roles or leave the company will take this information with them, undermining the process or product they once oversaw.

Tribal knowledge presents a very real risk for many companies, harness manufacturers included. Ten thousand baby boomers retire every day in the US. In Canada, from 2011 to 2016, there was a 20% increase in the number of Canadians who reached retiring age or older. And in the UK, it's predicted that between 2016 and 2020 the number of people between 16 and 49 is going to reduce by 700,000. The workforce is shrinking, and this will have significant repercussions if not addressed. How can managers maintain productivity with a younger, less-experienced, and smaller workforce? In particular, how can they capture the vital information and expertise held by their current employees to prevent a catastrophic loss of tribal knowledge?

Figure 4 shows a typical, high-level manufacturing engineering flow in the wire harness industry. First, design engineering releases initial designs or engineering changes for costing and provid-

Continued on page 44

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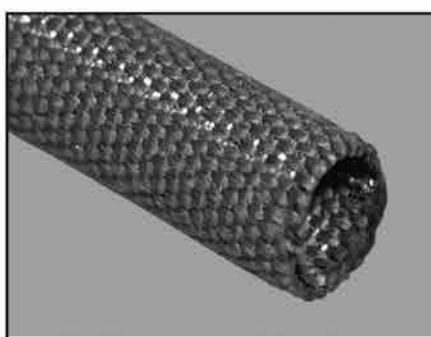
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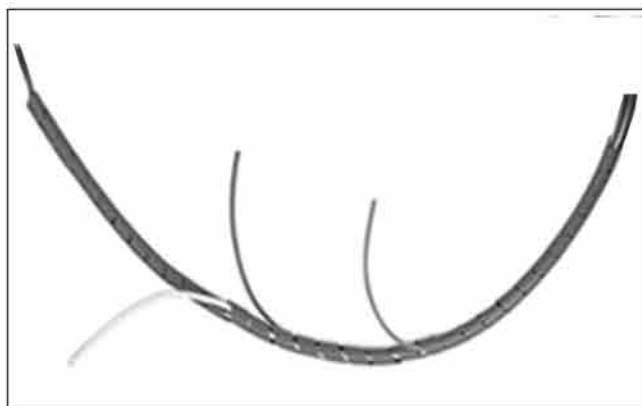
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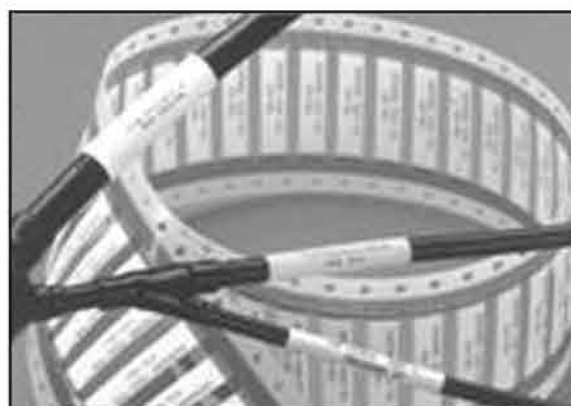
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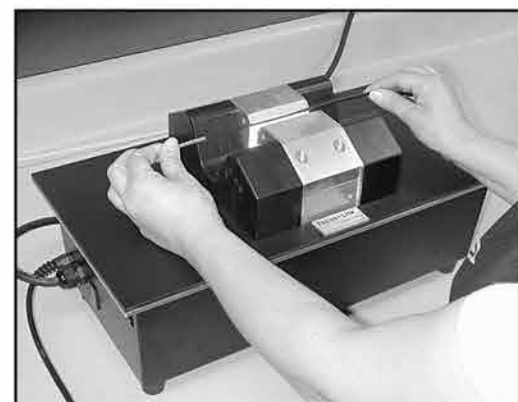
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ing quotes to the customer. Next, the main formboard is designed, followed by production modules and sub-assemblies, which sometimes require their own assembly board. Next, the engineers will design a bill of process (BOP) for the entire harness, allocating wires, splices, twisted wires, and all remaining material to its design-

nated equipment or work station. The BOP is then released into the enterprise resource planning (ERP) system. This is followed by balancing and optimization of the final assembly carousel and then creation of the work instructions.

Today, errors from data reentry can occur at any of these stages, each of which requires great skill experience. Adjustments and corrections

made downstream in the flow must be fed upstream manually in order to achieve data coherency. The conventional wire harness manufacturing methodology is vulnerable to errors from fragmented processes, and the loss of tribal knowledge as engineers retire or leave their jobs. Other key issues include inconsistent or inaccurate costings, sub-optimal formboard design or manufacturing process design, and misplacing key information on the shop floor. These can lead directly to inefficiency during production. As a result, manufacturing and overall costs can overshoot the quotation made to the customer, and production quality can suffer.

A model-based flow unifies the previously fragmented domains of design and manufacturing by automating data exchange and providing engineers with access to cross-

domain decisions. Tribal knowledge, previously held by experienced engineers, is captured through integrated design rules that support automation, guide all engineers consistently and check designs for issues.

There are three key aspects to digitalization and the model-based enterprise in the wire harness industry (Figure 5). First are digital models of the wire harness product and the manufacturing process. The digital models of the harness and production process together constitute the digital twin. Automation is the second pillar. Modern harness design and manufacturing solutions can consume design rules created by veteran engineers and use them to automate the transformation of the digital harness and process models into bills-of-process, work instructions, and other output formats. This simultane-

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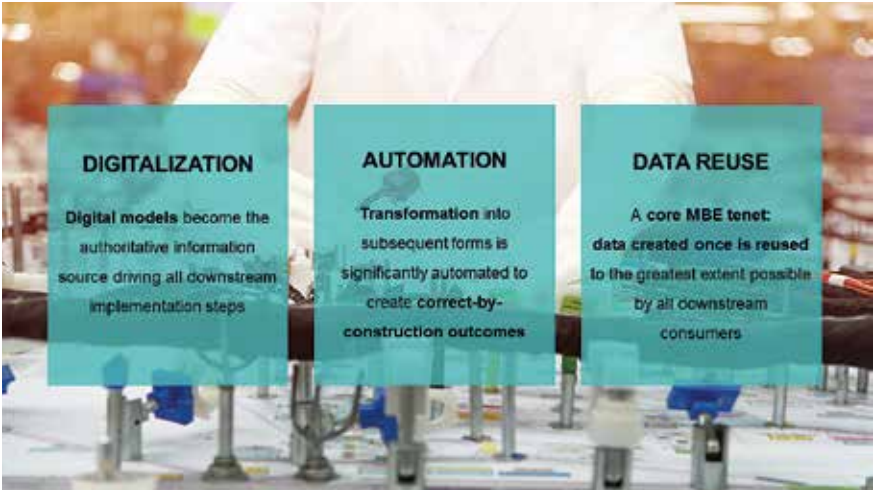


Figure 5: The three key tenets of a model-based enterprise: digitalization, automation, and data reuse.

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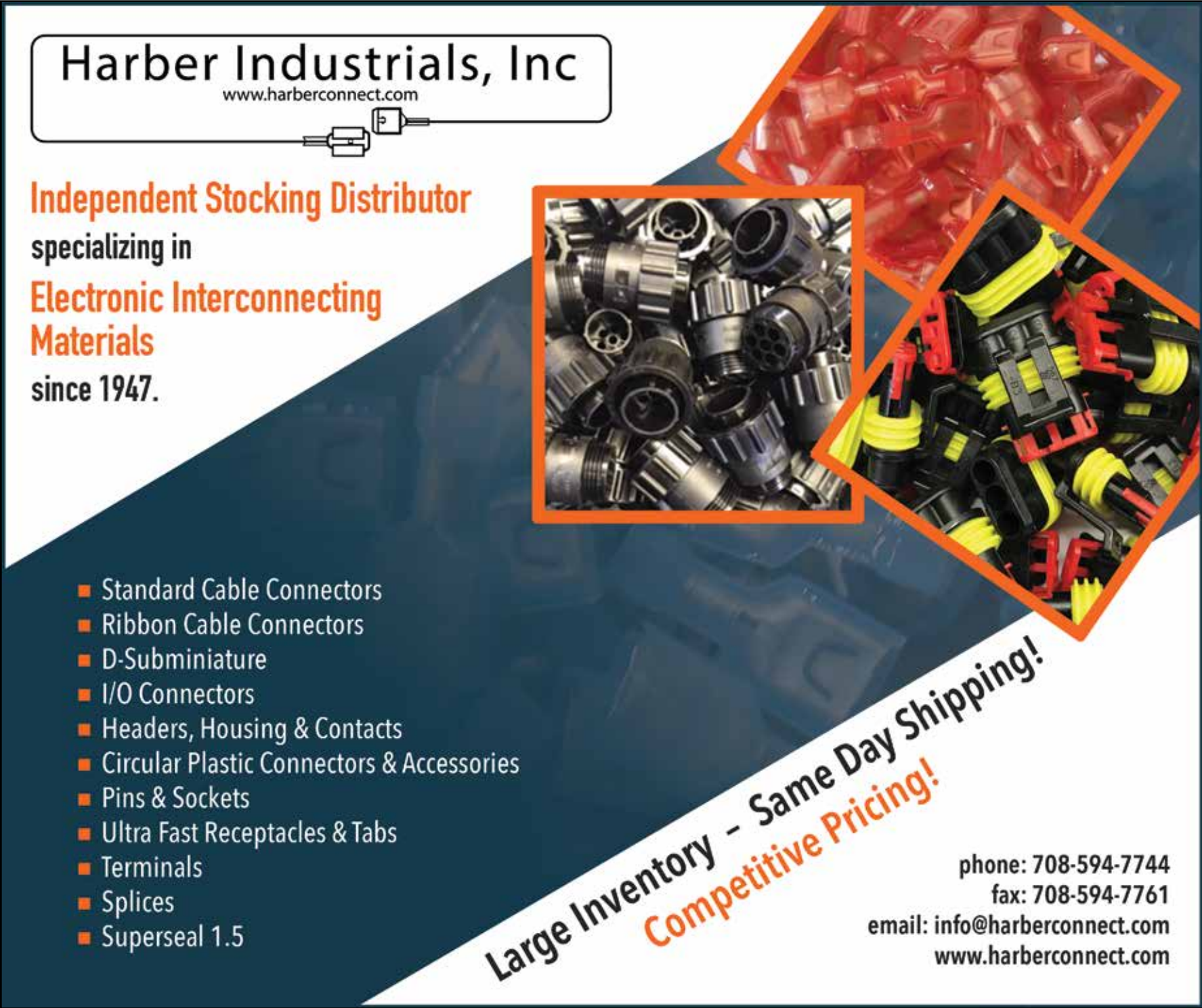
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ously embeds tribal knowledge into the company’s production flow, safeguarding it from employee turnover. The third pillar is data reuse. Instead of recreating or reentering data, in a model-based engineering flow, data is created once and reused to the greatest extent possible by all upstream and downstream consumers.

In a digital world, companies create a digital thread in which all of the functions, from architectural and functional design through to physical design, manufacturing engineering and after-sales service, can all use the same data. At each stage of the harness lifecycle, each stakeholder can use the same data models and have access to decisions that are made in other domains. Using a digital thread, design cycles are faster and issues can be caught and resolved earlier in the process when they are much less expensive. By also reducing design rework, data reuse minimizes costs and enables superior manufacturing efficiency.

Bringing Harness Manufacturing into the Digital Age

Harness manufacturers are concerned with designing sub-assemblies, engineering formboards, line balancing, and generating the bill of process and workbooks. Manufacturers also operate within the context of a larger ecosystem. They typically must interact with an enterprise resource planning (ERP) system, manufacturing execution systems (MES), as well as systems on the shop floor that need to be connected, such as wire preparation and automatic test equipment.

Digitalization can streamline the passing of data from each of these systems and processes to each of the others. Automation further improves the effectiveness of harness manufacturing enterprises. Engineers specify design rules to guide the automation, embedding tribal knowledge into the process. Then, the automation leverages the product and process digital models to complete a variety of tasks including generating process designs, calculating costs, and producing documentation for assemblers on the shop floor. The digital twin provides the model, and the automation generates the information needed downstream.

For example, over time a harness manufacturer will have identified an optimal procedure for designing connector sub-assemblies. Senior engineers

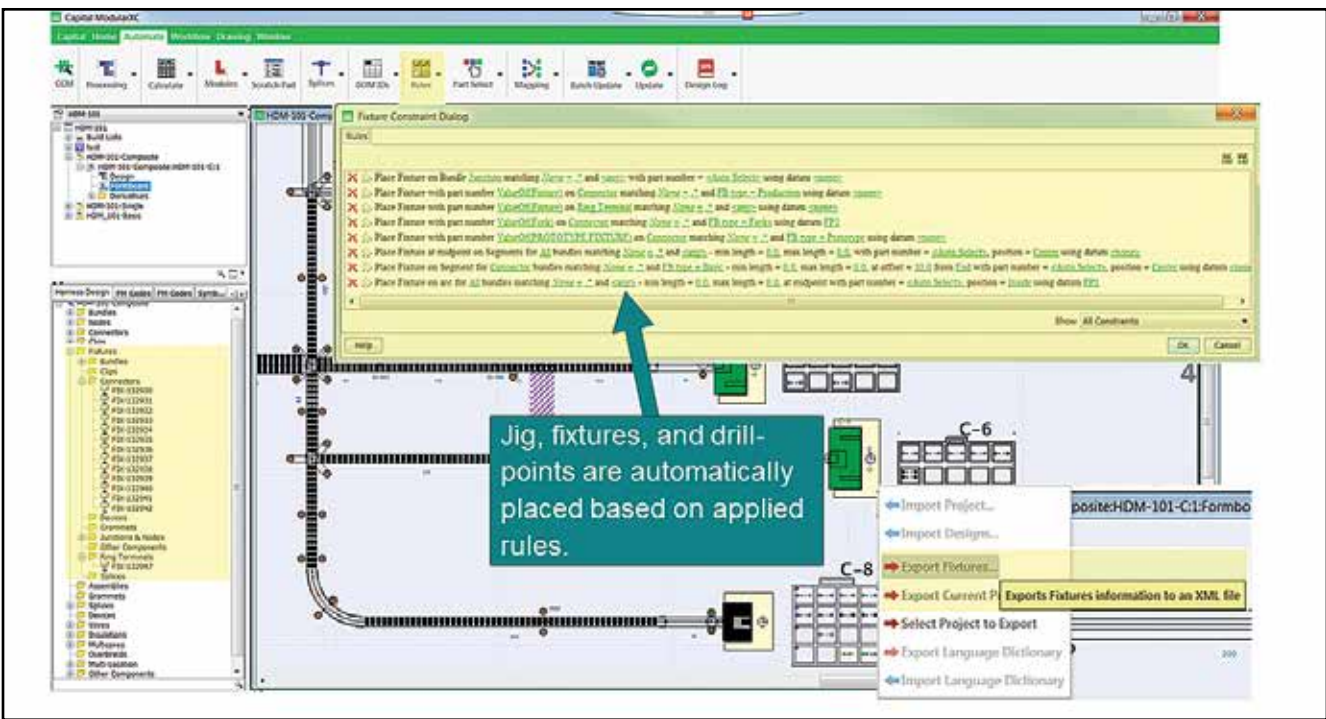


Figure 6: Design rules can help automate the placement and selection of formboard fixtures.

can input the steps of this procedure as standard, reusable rules and constraints for automation. As a first step, these rules may dictate that modules should be created for various groups of spliced connectivity, turning them into sub-assemblies. The next step may be to create modules for connectors with wires that all belong to the same vehicle options, followed

by creating modules for connectors with the lowest number of remaining wires. Finally, if a module contains all of the wires in the relevant bundles, then include insulations & fixings on those bundles. With a digital twin of the harness, advanced harness engineering software, such as Capital, can automatically apply these rules to complete this task in seconds or

minutes, depending on the size of the harness.


In another example, design rules can automate formboard fixture selection, placement, and other factors (Figure 6). Senior engineers with years of experience selecting and placing these fixtures can describe

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guidelines for the best fixture type, placement, and quantity given the junction, connector, and bundle size and length. The software can use these rules to automate the placement of fixtures, drill points, and jigs, greatly accelerating formboard design speed and accuracy.

Furthermore, upstream project delays can reduce the time available

for the manufacturing engineers to generate work instructions. If the instructions arrive late or with inadequate detail, then the assemblers on the shop floor must seek out additional guidance. Furthermore, inadequate instructions can degrade the quality of the finished harnesses, causing them to fail post-production testing. Suddenly, key program delivery milestones are missed, and unexpected late freight costs are incurred

to make up for lost time and yield.

With a digital model of the harness and production process, engineers can automatically generate work instructions. Engineers can incorporate workbook templates, libraries, and style sets to ensure the instructions are accurate and comply with company industrialization and quality standards. It starts with the digital model of the harness. Initially, this looks like a “dumb” drawing of the harness layout, but the engineers have enriched this design with specific component, material, and other data, making it a digital model of the physical harness. The digital harness model is the foundation of a model-based approach for harness engineering.

From this model, the harness engineering software can generate extremely rich work instructions that include data charts for wire cutting, and such data can be fed directly into wire cutting machinery. The generated work instructions also include diagrams for twisted wires, jacketed multi-cores, spliced daisy chains, as well as detailed instructions for pre-populating connectors with wires or cavity plugs. Engineers can also generate various formboard diagrams

showing shop-floor operators how to lay-up sub-assemblies onto the board. Using a digital thread to make this a continuous process, fed from the same data from start to finish, can greatly improve the efficiency and accuracy of the final assembly process.

Harness Manufacturing in the Future

In the future, digitalization and the digital thread will enable companies to accomplish much more. A traditional shop floor begins with preparing materials for assembly through wire cutting, wire preparation, splicing, and connector pre-load. Then, the harness is assembled on the formboards, and technicians perform post-assembly tasks. Already, advanced solutions can automate the design and optimization of the bill of process, production of the necessary workbooks, and the production of the formboards.

Moving forward, these solutions will integrate with a network of other systems (Figure 7). ERP systems will help manage the material stores for harness manufacturing, while a manufacturing execution system (MES) can supply workbooks around the shop floor, gather and supply real-



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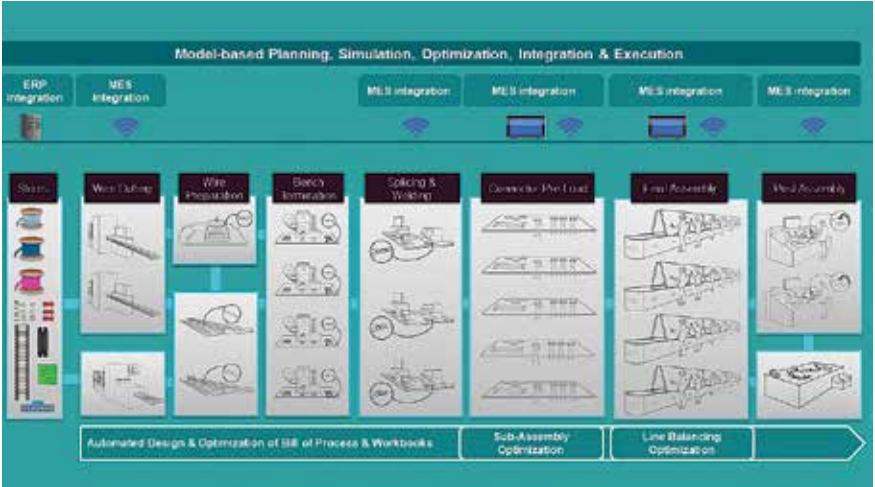


Figure 7: In the future, each system on the shop floor will connect digitally.



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time data from the shop floor, and generate feedback based on that data to help improve the processes and designs. With an entirely digitalized process, from model-based planning and simulation to integrated manufacturing systems, harness manufacturers can realize significant improvements in efficiency and productivity. A model-based engineering approach, with a continuous digital thread, can help harness manufacturers reduce design errors by 50%, quote-to-production cycle time by 30%, and formboard design time by up to 85%.

Thriving in a Changing Industry

The fabric of the harness manufacturing industry is changing as new automotive technologies accelerate the already growing harness complexity across the industry. The increasing electrical and electronic content of today's vehicles shifts the responsibility for critical vehicle functions to the wiring harness. This shift from mechanical to electronic enablement, coupled with more and more sophisticated electronic systems, means that harnesses are more complex than ever. Demands for speedy and efficient production of harnesses are also ramping up as automotive companies vie to beat their competition to market.

The threat of losing valuable on-the-job experience and knowledge from an aging workforce also looms large for harness manufacturers. As engineers reach retirement, or find new roles, they take important but unwritten information about company processes and design practices. It is vital that harness manufacturers capture this information digitally to inform and guide the incoming workforce and to automate complex processes.

In order to survive and grow in this challenging environment, harness manufacturers must significantly change their methods. Digitalization is a key adaptation for harness makers, offering the tools needed to survive in an extremely dynamic industry. A digital model-based flow unifies the previously fragmented domains of design and manufacturing and captures

tribal knowledge held by experienced engineers through integrated design rules. To meet the demands of an evolving industry, it is time for wire harness makers to become digital enterprises.

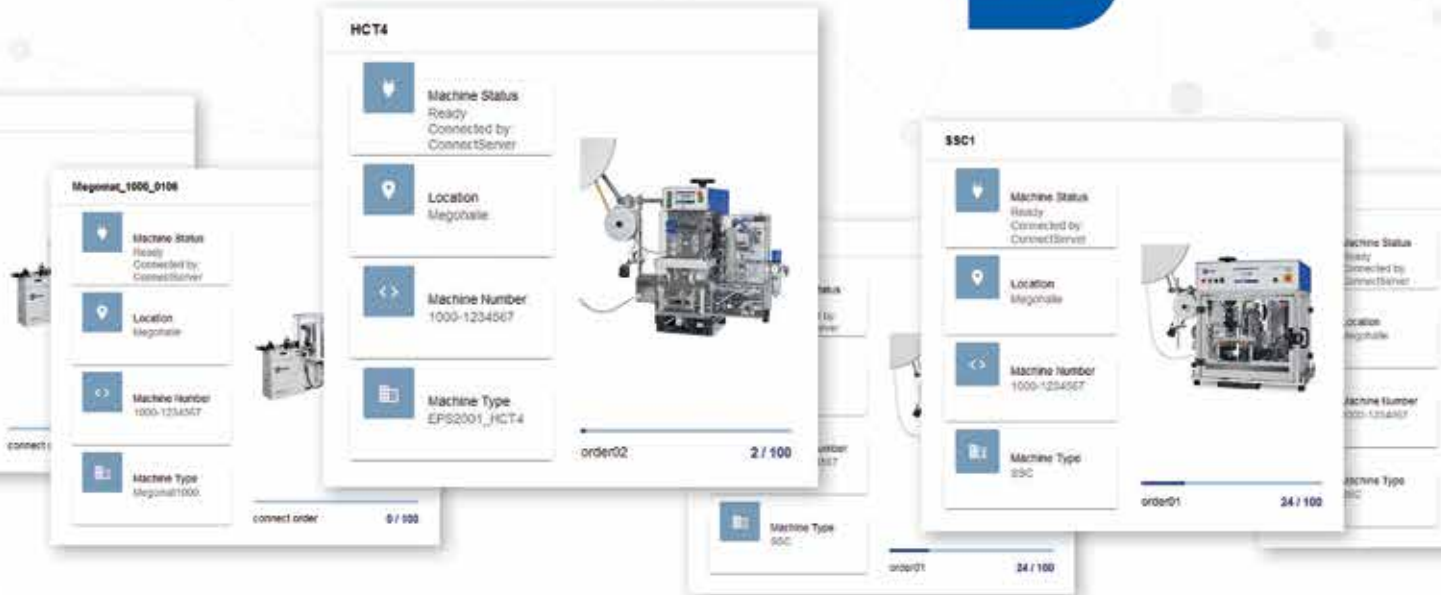

Author/Bio: John Judkins, Integrated Electrical Systems, Mentor, a Siemens Business

John Judkins leads the Harness Design & Manufacturing product line team for the Integrated Electrical Systems business group at Mentor, a Siemens business, which focuses on so-


lutions for wire harness engineering and manufacturing. His career spans over 30 years in the electrical wiring systems domain, which started in the software development department of an automotive wire harness Tier 1. After co-founding the technology company, Harness Software Limited (HSL), John developed the original blueprint for the data-centric, Capital H software which was acquired by Mentor Graphics in 2000. John is a key contributor to Capital's vision and architecture.



John Judkins
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5 Quick Tips for Better Wire Management in Small Box Builds

One of the most apparent effects of COVID-19 is the increased financial burdens being dealt to people and businesses.

This financial strain has people looking to learn new skills that can generate additional lines of revenue by adding products and services offerings to clients.

For companies and professionals in the wire harness industry who typically build larger, cabinet-type enclosures, adding smaller sub-assembly box builds to their sell sheet is becoming a popular way to subsidize income.

Working within smaller enclosures amplifies the importance of

wire management, as space is at a premium and maximizing efficiency is critical to success.

The benefits of proper wire management are foundational for:

- Ensuring consistent connectivity
- Minimizing mistakes
- Efficient troubleshooting and maintenance
- Establishing/bolstering credibility with customers

Of course, each project can vary in its respective requirements and complexity but applying these general principles and tactics can streamline the process and help to ensure a quality final product.

1. ABC. Always Be Consistent

When wiring any project, the best results are always rooted in consistent approach and techniques.

Everything from how the wires are run, to where wires are positioned within a bundle, to label positioning should be the consistent throughout the build.

Establishing this consistency will simplify the initial install and any subsequent maintenance or adjustments that need to be made throughout the process.

The idea of consistency also applies to the wires used to complete the project, where applicable. Utilizing wires with uniform length and bend radius will allow you to maxi-

mize efficiency and prevent potential connectivity issues.

2. Use Cable Ties

Organization is key to making the best of the limited space within a small enclosure. Eliminating the possibility of any hanging or loose wires with cable ties will lead to an easier to maintain, clutter-free result.

Be sure to use the same size and color for ties and anchors and space them evenly throughout the build for a high-quality look and feel.

3. Know If, When, And Where To Bundle

When planning wire routes, always consider any mutual connection points to identify all the possible locations where loose wires can be bundled and space can be saved.

4. Be Prepared And Communicate Clearly With New Clients

You never know when mistakes can occur or if adjustments may need to be made on the fly. Having a surplus of items from the project's bill of materials on hand can save time, money and headaches.

It also helps to regularly communicate with the client to ensure that they've provided all available information that will influence the build - like product dimensions, 3D CAD Models and/or prototypes.

It's impossible to know the extent of your new client's knowledge base without taking the time to discuss the project and they may not otherwise know what information you may consider to be valuable.

5. Keep Workspaces Clean And Organized

This may be obvious, but it needs to be mentioned because the importance of an organized workspace can't be overstated.

Whether time is saved by not having to look around for tools or materials, or speed is increased by having ample space to work without interference, efficiency is a function of organization... period.

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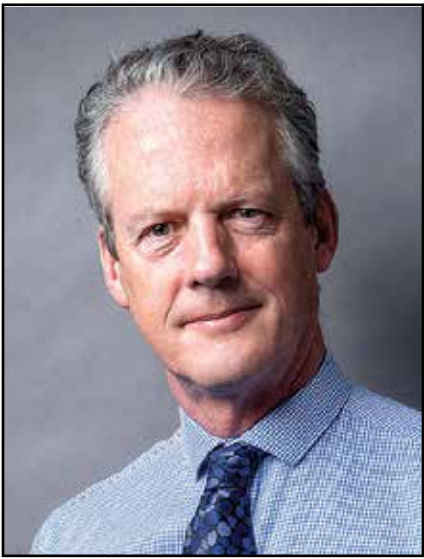
By Joe Tito
Wiring Harness News

WHN has published several press releases covering flexible printed circuits (FPCs). The rationale has been to make the industry aware of this technology as a possible replacement of traditional wire and cable harness assemblies for some traditionally wired applications. As we often see in technologies used by large OEMs, there is a trickle down into low-volume/high-mix applications. As such, this article may serve as an inspiration for many traditional harness manufacturers looking to bring new technologies on board. It is also hopeful it will highlight the rationale of involving interconnect suppliers in the design stage of product development.

Trackwise is very much at the forefront of FPC technology at the OEM level in the automotive, aerospace and medical arenas. It seemed logical to delve into their history and learn about the development and future of FPCs that Trackwise calls Improved Harness Technology™ (IHT). The company's Founder and CEO, Philip Johnston, took the time to sit down with WHN for a fascinating interview.

Located in Tewkesbury, UK, Trackwise has been producing FPCs since 1989. Their penchant for large format circuits came with a specific customer request just a few short years into their existence. "In the mid 1990s we were asked to make a nine-foot long flexible circuit for one of the early cellular base station antennas," Philip recalled. As the frequency of mobile telephony went up, the size of the circuits came down. Nonetheless, Trackwise continued to further develop their large format capability.

Eventually, a large UK aerospace OEM approached Trackwise seeking to replace a harness assembly inside their aircraft engines. They'd seen FPC technology and were looking to reduce overall weight and size. "One requirement was to replace an eight-meter run of harnesses around the engine to be made as a single piece,



Philip Johnston, CEO Trackwise

rather than a daisy chain of interconnected sections," Philip explained. "Everybody else said it couldn't be done, but we thought about it and came up with a means of making length-unlimited multilayer printed circuit boards."

FPC technology has been around since the 1950's, but it's this proprietary manufacturing process that puts Trackwise in an exclusive club among FPC suppliers. "Instead of using the technology only within a box, you can now go box to box inside a wing or within a vehicle," Philip said.

Trackwise has poured a great deal of research into the further development of its Improved Harness Technology™. Philip mentioned the headline benefit being the space and weight savings of up to 70%. Whereas traditional harness manufacturing involves heavy human intervention, FPCs are machine made, offering increased repeatability and dependability. He added that because FPCs are a planar technology, they can be formed under, or even into a composite structure.

Philip doesn't think traditional wire and cable assemblies are going away anytime soon, and sees traditional wire harnesses, FPC's and fiber optics working in concert as a combined offering. "At the moment, vehicles, and in particular airplanes, are wired in fundamentally the same way they have been for 100 years. So, I think there is an opportunity for a de-

signer to use different technologies in the right location and correct format to allow greater functionality as we move into smaller form factors."

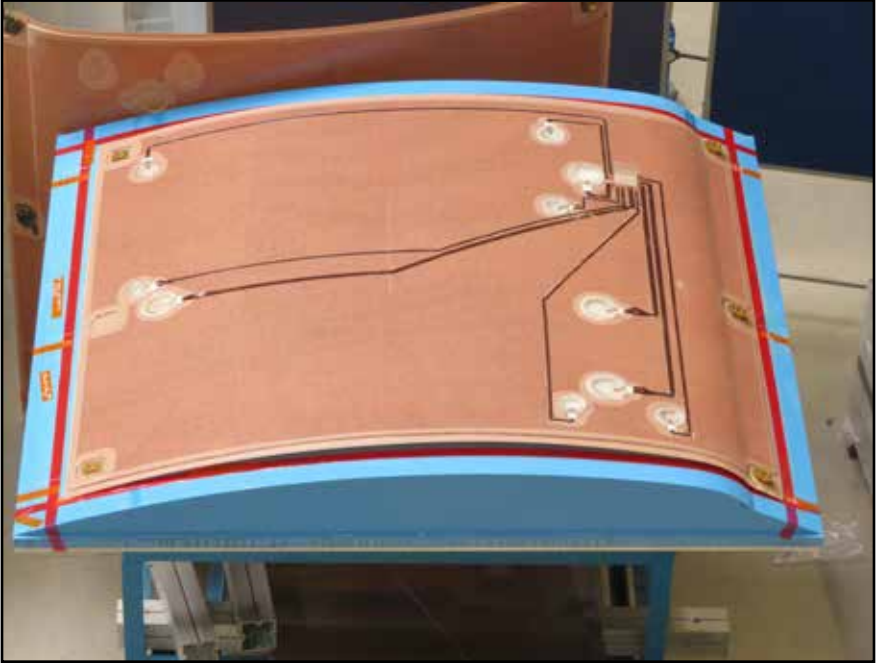
The most significant contribution of FPCs, as Philip sees it, is their design flexibility as an active component. "A conventional wire harness is a passive component, but with FPCs, you can add surface-mount or through-hole components allowing the distribution of control, and giving the assembly local intelligence," he outlined. Instead of feeding signals back to a box, then doing the controls, the controls can be done locally, thus drastically reducing system complexity.

The opportunity window for FPCs greatly increases if the technology is thought of in the beginning and as part of the system, according to Philip. One area he thinks offers great adoption of FPCs is with electric vehicles, especially in the battery management systems (BMS). "The ability to make the interconnect part of the active control of the system must be thought of at the onset. And that's why I see great opportunities in electric vehicles, particularly start-up OEMs as opposed to companies who are just replacing an internal

combustion engine with an electric drivetrain," he explained. Trackwise is always keen to work with OEMs who are starting with a blank canvas, and are thinking system down, rather than box in.

Like traditional wire and cable harness producers, printed circuit board manufacturers are typically build to print. "We've had to change our aerospace accreditation to include both design and manufacture because we are having to offer the design expertise to supplement the skills that aren't always present with our customers," Philip revealed. He described a typical first meeting with an OEM. One of the first things that happens is the customer shows them a traditional harness and asks what it would look like in flex. "My heart both sinks and soars," he detailed. "It soars because it's great they are interested, but it sinks because I know if it were designed with flex in mind, it wouldn't look like this bundle they've just handed me." A journey has started with a single conversation, but Philip is keen to stress that the OEMs who are thinking of FPCs

Continued on page 50



Trackwise FPC embedded into active lining of rotor.

Image courtesy of INVENT GmbH & ACASIAS.

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- The FPC is a flexible laminate, formed from four layers of materials, as shown in Figure 1.
- The base substrate is a dielectric film, which gives the FPC its mechanical properties and also insulates the conductive tracks from one another.
 - The electrical conductors provide the connectivity and electrical characteristics required by the application.
 - The adhesives are used to either bind the conductive layer to the substrate to create a laminate or to bind layers of laminate together to form a multilayer FPC.
 - The cover coat or cover lay is a protective finish applied to the surface of the FPC to protect it against moisture, contamination and abrasion as well as to reduce stress during bending.

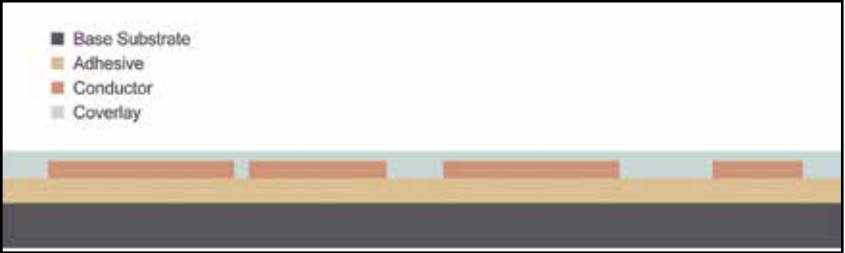


Figure 1: Basic FPC construction

Trackwise Champions Improved Harness Technology™

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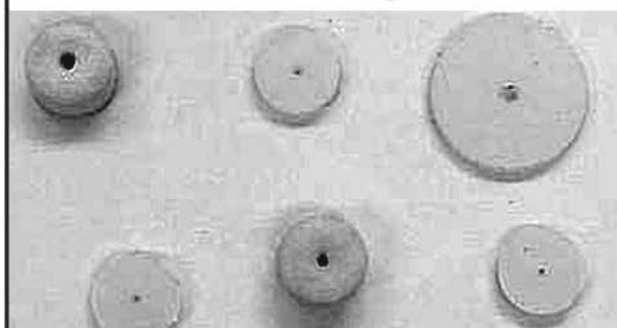
at the beginning of system design are the ones who derive the most benefits from them.

There's a wide range of materials available for the manufacture of FPCs. When they engage a new opportunity, the first thing the Trackwise team seeks to know is where the assembly will be used. "The environment it's operating in absolutely key to both the design and material selection," Philip advised. "We've developed some harnesses going into 200° C plus environment, and in high vibration zones inside engines, so clearly this can be a very robust technology."



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Other Opportunities for FPCs

It seems obvious that FPC technology is a key enabler for many industries. When asked about more recent opportunities, Philip quickly responded that medical devices are an excellent application for FPCs. "One macro trend in all industries is that designers are wanting to get greater functionality into smaller form factors. We are seeing this in medical catheters where you

have tiny traces of maybe two-mil, where the very precise nature of printed circuit technology is allowing us to get greater functionality in these devices," he outlined.

Philip circled back to the aerospace industry as he expanded on new opportunities for FPCs by discussing multifunctional structures. "With the right material selection, we are actually able to embed the wiring into a structural composite. Again, it's a planar item, so it can actually go inside the composite structure, which is something that can't be done with a traditional wire harness." He pointed out that in this configuration, there is just one structural part with an embedded circuit, versus the structure along with a separate wiring component. He noted innovative OEMs in the automotive industry are also beginning to

use multifunctional structures.

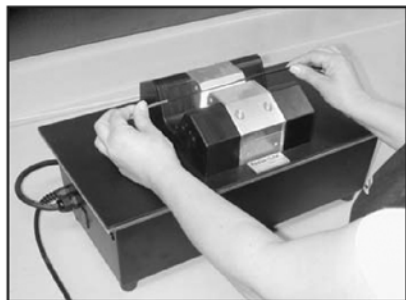
In order to meet the demand challenges, Trackwise has raised capital, enlarged facilities, and made strategic acquisitions quite recently. "We actually landed on the London Stock Exchange last July and raised quite a bit of money to invest in our manufacturing capability," Philip mentioned. A further round of fund raising on the Exchange raised enough capital to allow them to purchase another circuit company in the UK in order to increase capacity. "We were a small company with ambitions to change the way airplanes and automobiles are wired, so having access to public markets gave us the capital to grow with the success of our clients."

You can learn more about Trackwise and review white papers on FPC technology by visiting www.trackwise.co.uk.

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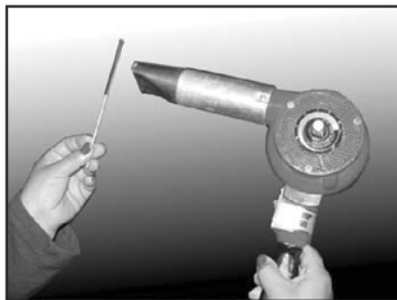
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NEWS PLUGS

Tri-Star Releases Higher Resolution Econolase Portable Laser Wire Marker

Tri-Star Technologies, a leader in laser wire marking and printing technologies, recently unveiled its third-generation ECONOLASE UV portable Laser Wire Marker. First introduced as the world's lowest priced UV laser wire and cable marking system, Econolase now has improved laser delivery that enables 10 times greater resolution over previous models. Additionally, Tri-Star has introduced a new upgrade program which gives customers a path to the larger, automatic laser marking systems. This offering provides for investment protection as customer needs grow and change.

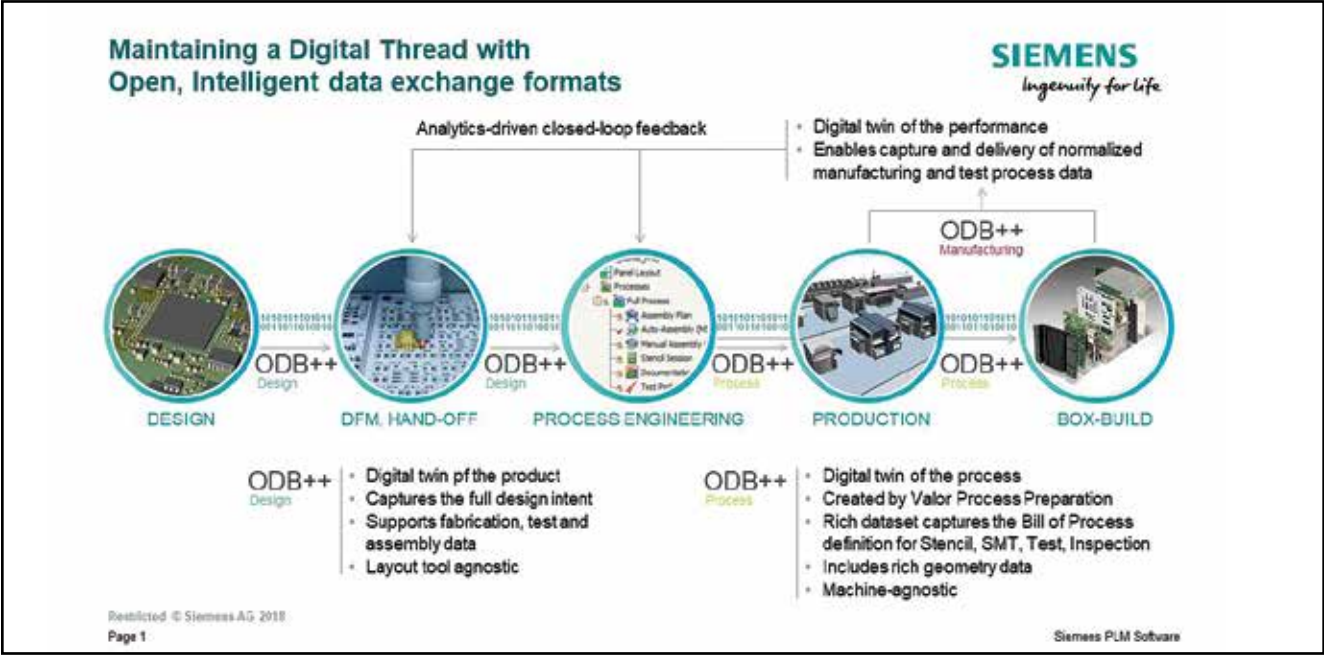
The Econolase allows for manual feed of wire and cable, making it ideally suited for low/medium print jobs and marking of already terminated cable assemblies, a first for the industry. The UV laser system is fully compliant with both common military and commercial specifications, making it a perfect tool for the aerospace, automotive and electronics industries. It has full graphics capabilities that can print any alphanumeric character in any font, language or size, and can also print bar codes and company logos.



A demonstration of the Econolase may be reviewed by entering the search word "Econolase". YouTube by For more detailed information, visit this Tri-Star link: <https://www.tri-star-technologies.com/econolase-uv-laser-wire-marker>.

Siemens Expands ODB Data Exchange Format; Adds Electronics Manufacturing Information Flow to Comprehensive Digital Twin

- Industry-leading ODB++ data exchange format extended to the ODB++family for a complete end-to-end digital solution covering design, process and manufacturing information flows
- The new ODB++Process format completes the full solution of open formats for the entire digital thread to help customers achieve fast and reliable new product introductions with a complete dataset for machine programming
- A complete digital twin of the electronics manufacturing flow (product, process, and performance), helps customers realize their latest Smart Factory or Industry 4.0 initiatives with confidence and efficiency



Siemens announced the expansion of its industry-leading ODB++™ language intelligent, single data-structure for transferring PCB designs into fabrication, assembly and test with a unified electronics manufacturing solution of open data formats for the entire digital thread. With over 50,000 worldwide ODB++ users, rebranded as ODB++-Design, ODB++Process, ODB++Manufacturing and grouped under the ODB++ umbrella, Siemens' newest data exchange format, ODB++Process (previously known as OPM), helps enable the open exchange of process engineering information between disparate machines, software vendors, and stand-alone processes, helping accelerate new product introductions (NPIs) and first-time-right manufacturing. This is unique to the industry as no other standards body or solution provider offers a data exchange format for this capability.

This free and proven data exchange solution helps users to easily transfer machine programs from one machine type to another, such as a target machine from a different vendor or a machine on a different platform. ODB++Process format provides the open exchange of process engineering information which then converts the data for immediate use on any production machine or workstation.

"By using a single assembly format file output like ODB++Process, which standardizes machine package library's with vShapes across the entire production line, Koh Young is able to minimize program variations between machines like inspection and mounters," said Mr. JD Shin, Chief Sales Office for Koh Young Technology. "The enhanced approach to programming reduces human error and variation and significantly reduces the NPI programming cycle time. What's more, the single file assembly format output like ODB++Process is machine agnostic and easily enables moving production assembly data and process requirements between lines – and more importantly factories across the world."

Thus, with ODB++Design supporting full product design data representation, and ODB++Manufacturing (previously known as OML) neutralizing machines' shop floor data, the ODB++Process now completes the open design-through-manufacturing digital thread for electronics. Each of these intelligent data exchange modules

is designed to be neutral and open, supporting all SMT machine vendors (placement, inspection, test and soldering) and all EDA software providers. With a complete digital twin of the electronics manufacturing flow (product, process, and performance), customers can realize their latest Smart Factory or Industry 4.0 initiatives with confidence and efficiency.

These data exchange format solutions deliver the complete digital twin of the electronics manufacturing information flow:

- **ODB++Design:** Full product design data representation, created by design tools, used for design for manufacturing, fabrication, test and assembly analysis (DFx), as well as being the single carrier of design data to electronics assembly and fabrication.
 - **ODB++Process:** The format into which the design data is prepared and converted ready for use at any production machine or workstation.
 - **ODB++Manufacturing:** The specification for all shop-floor events, bidirectionally between machines, and between machines and Smart Industry 4.0 software solutions.
- "Siemens is an active member of the IPC and we will continue to invest in our own data exchange formats to ensure that quality and resources are available to the global community," stated Dan Hoz, general manager, Valor Division of Siemens Digital Industries Software. "Our focus on multi-domain digitalization solutions will continue to be a critical advantage to our customers so they can manufacture innovative products with minimal risk and faster time to profit."
- The ODB++ family of formats are supported by an active community, via an open, inclusive partnering program, free of charge and without membership fees. To access these formats, visit www.odbplusplus.com.

Siemens Digital Industries Software is driving transformation to enable a digital enterprise where engineering, manufacturing and electronics design meet tomorrow. Our solutions help companies of all sizes create and leverage digital twins that provide organizations with new insights, opportunities and levels of automation to drive innovation. For more information on Siemens Digital Industries Software

products and services, visit www.sw.siemens.com or follow us on LinkedIn, Twitter, Facebook and Instagram. Siemens Digital Industries Software – Where today meets tomorrow.

Sequel Wire and Cable Announces a Welcome Addition!

If you've ever had the pleasure of working with a great team at some point, you might dream about reassembling that team and creating a new and reimagined company. That's exactly what Rich Carr did with a new wire and cable manufacturing company. It's also why he chose the name Sequel.

Rich Carr, CEO and partner Denise Feece, just announced that Mike Frigo will be joining them as a partner, and will serve as Chief Commercial Officer.

Rich commented, "We are ecstatic to have Mike join as a founding member of the team. He has 36 years of experience in the OEM space and has an excellent understanding of the market, the customer base and exactly how Sequel can fit into that space. His process and product knowledge allow him to quickly identify and address how to help customers solve any problems as they arise. Throughout his career Mike has created and maintained a very high level of credibility both within the organizations he was with and in the marketplace as a whole."

Rich shared, "Mike and I worked together for many years at Copperfield and we developed a great reputation in the OEM space, and to a lot of folks in the industry, that will mean something. After Mike joined Copperfield in 2005, he helped us more than double Copperfield's sales in less than 24 months. We had a magic formula as a group back then and it worked very well for us. We are excited to have the opportunity to assemble this leadership team that has the benefit of a strong history. We know what success looks and feels like. Our reputation, wisdom from years of experience, and passion for customer service will help us stand apart."

Mike agrees that his addition to the Sequel team will indeed be significant to the customers they are targeting. "The reason Rich, Denise, and I team up so well together is because our skill sets complement each other. We can all wear many hats, but when we focus on our individual strengths, we bring



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Continued from page 51

something to the industry that frankly doesn't exist.”

Mike is excited that Sequel is bringing a high level of technology to the new venture, “Sequel has an advantage that it doesn't have to replace legacy systems.” He is also enthusiastic about the systems they will create on the plant floor for real-time manufacturing order status, and with the level of transparency to the customer on Sequel's service performance metrics, which will be incredibly advanced and unique to the industry. Mike reiterated that the delivery system for information is up to the cus-



Mike Frigo (left), Chief Commercial Officer and Rich Carr, CEO of Sequel.

tomers. “Whatever their preference is, we will be able to accommodate it without a lot of

effort on their part.”

Mike concluded, “We recognize that the market has changed significantly in the last 10 years, but what has remained constant is the need to have an unrelenting focus on taking care of the customer, and that is one of the main components and backbone of Sequel.” Together we will execute and carry out what other wire and cable companies can only talk about.”

For more information on Sequel Wire and Cable, visit www.sequelwire.com, email sales@sequelwire.com, or call 574-626-1515.

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Improving Quality of Testing: Military Imaging Systems Cables and Harnesses

Founded in 1974, and located in Tustin CA, PVP Advanced EO (AEO) started in the commercial video products business as Pacific Video Products. They re-branded in 1997 when they began focusing on military and homeland surveillance technology systems.

AEO now specialize in development and integration of high-end, highly reliable electro-optical (EO) and infrared (IR) sensors and systems for space, airborne, ship and land-based applications that incorporate the latest infrared and image-intensified cameras, lasers, and laser range-finders.

Their customers include US Customs and Border Patrol, the US Secret Service, US Marine Corps, US Air Force, US Navy, US Department of Homeland Security, NASA, the Panama Canal, the South Korean Navy, Saudi Aramco Oil, and MIT Lincoln Lab.

A Class “3” AS9100D manufacturer, AEO has had to develop capabilities to build cables and harness subassemblies, test complete systems, design and test test-fixture cables, and evaluate and test returned product

– oftentimes for mission-critical systems.

Following an evaluation period in 2004, AEO invested in CableEye in order to check continuity of multi-headed cables. Spurred by a need to measure quality of connections, they purchased a resistance-measuring model M3U in the spring of 2019. Then later that year, added an M4 to their tool chest to be able to check capacitance and twisted pairs.

Cables for AEO surveillance devices are usually low-volume and custom for each product, and so require a tester with a high degree of flexibility to deal with unique test settings, connector types and combinations. Because PC-based testers log the data, post-deployment comparisons of cable integrities are a cinch. This ensures there has been no changes giving the go-ahead for reinstallation, and can provide diagnostics feedback to engineers for potential design improvement. These automation-ready testers provide for barcode tracking and detailed, wire-by-wire, wiring reports.

Continued on page 54



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A close-up photograph of a black, braided cable, showing the intricate weaving of the fibers.

A close-up photograph of a white, braided cable, showing the intricate weaving of the fibers.

A close-up photograph of a black, braided cable, showing the intricate weaving of the fibers.

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Improving Quality of Testing: Military Imaging Systems Cables and Harnesses

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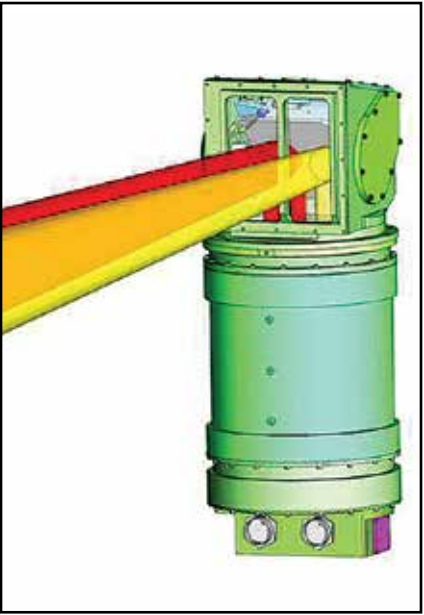
CableEye testers have many benefits and can be used for the testing of all cables through prototyping and manufacture to post deployment diagnostics. These multiconductor testers easily link to custom test fixtures and harnesses and instantaneously check for faults, identify the type of faults, and pinpoint fault locations. Depending on the model, the testers detect and dynamically display continuity (opens, shorts, miswires, and intermittent defects), resistance, capacitance, diodes, dielectric breakdown, insulation resistance, and can check twisted pairs for correct pairing. Testing for intermittent defects pre-screens the cables for the kinds of faults that can be stimulated by vibration.

We will now look at three AEO cases.

Test Evaluation of Returned Product: Stryker Mobile Gun “Commanders Pan Viewer” (CPV)

The CPV, or Commanders Pan Viewer, was a system developed under contract specifically for General Dynamics Land Systems (GDLS) for the Mobile Gun variant of the Stryker wheeled combat vehicle line (US Army). The CPV system was designed and built by PVP Advanced EO, and consisted of an azimuth (pan) drive assembly, single axis (elevation) head assembly, servo controller, and drive amplifier card sets. GDLS then installed the completed system into the Stryker.

A two-sensor camera set (infra-red and standard video) is dropped into the azimuth unit and looks up at the gyro-stabilized mirror in the single axis head. The servo card and power amp cards are installed into a backplane rack in the vehicle. When in operation, the tank commander can pan and tilt the system to view targets/threats, assess the general battlefield situation, etc. The CPV system was qualified for military deployment in battlefield conditions: The units have been in service with the US Army since the early 2000s, and have been deployed in active hostile regions around the world. There are more than 200 systems in use and maintained under service contract by Advanced EO Systems.



Striker Commander Pan Viewer



Figure 1. Stryker CPV Slip-Ring

One of the main support functions AEO performs is troubleshooting returned product, such as the CPV, for evaluation and then to effect repair. Some of the products have seen many years of use. “Our recently purchased CableEye testers have allowed us to detect approaching catastrophic failures of our slip-ring & connections before they get back out in the field,” explained David Reynolds, AEO Engineering Technician.

By way of example in (Figure 1, Engineering Technician, Anne Wade, has loaded the test file, run the image, and noted out of spec continuity limits on a ready-to-ship slip ring unit. This could mean that the slip ring may have sustained field related stress. “We were able to pull the unit back for further evaluation. Being able to

check resistance thresholds will help manufacturing, test and repair departments ensure a reliable product to our end users,” says Reynolds.

Cables in motion experience fatigue causing complete or intermittent failures whether or not that motion is constant. Cables may flex intentionally as part of a pre-programmed robotic move, or unintentionally due to operationally- or environmentally-induced vibration.

Fortunately, advanced cable and harness test systems can easily identify and pinpoint the source of even the most elusive intermittent failure. The intermittence test is properly performed when the sample rate is high enough to statistically capture enough random events to raise the confidence level in the test result to

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an acceptably high degree. Companies running stringent quality programs will be looking for the fastest cycle time possible (rates can be as fast as 11ms/cycle). They need testers that deliver diagnostic information above a simple pass/fail, so they can provide quantitative and qualitative data to their process-improvement feedback loop. Note that although the intermittence test mode is often referred to as the ‘continuous test’, the test signal itself is always pulsed in order to sweep through the full set of test points. In this context, ‘continuous’ simply means that the test is continuously sweeping through these test points. If the sample speed were set too low, there would be a high likelihood that a cable would falsely pass the intermittence test. Care must be taken when setting test parameters to avoid such false positives. Christopher E. Strangio, President of CAMI Research notes that not all intermittence tests are equal, adding that, “We have seen a side-by-side test where under default settings CableEye easily indicates intermittent errors in a fixture that has been ‘passed’ by another brand of tester.”

Testing Complete Systems:

AEO continues to support legacy devices such as NASA’s long-range telescope with Mid-Wave and Long-Wave IR, as well as current offerings; Night Hawk High-Performance systems with HD-IR, Laser Rangefinder, Laser Designator, and long range Day Light HD cameras.



Night Hawk F

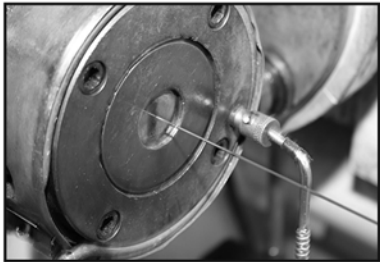
Part of the challenge with this wide-ranging product line is to develop a test procedure to ensure the cabling is correctly fabricated and consistent with the engineer’s designs. “We could do all hand continuity checking but that is laborious, and inaccurate. This where our first CableEye ‘M2’ (obtained 16 years ago), helped to ensure cables were correctly pinned and passive continuity assured. With purchase last year of the ‘M4’ system, we are able to verify resistance ranges and capacitance measurements so we are even more assured cables are in spec,” said Reynolds.

Continued on page 56

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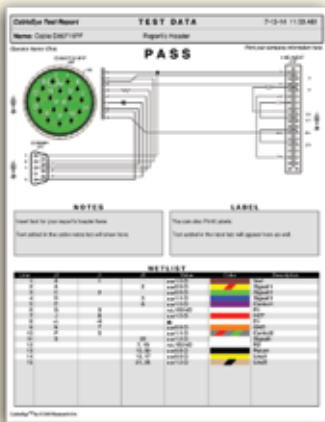
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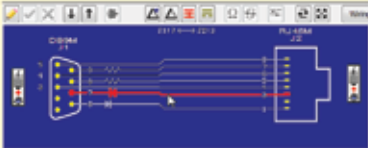


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• If you need reliable, fast diagnostic tools to find intermittent connections, locate shorts, opens, or miswires, our live graphic wiring display makes this a snap.

Line	#1	#2	Value	Tolerance	Color	Power	Description
1	5	8	NC	100.0	+15/-5%		Power
2	1	2	NC	100.0	+15/-5%		Power
3	4	6	NC	100.0	+15/-5%		Power
4	8	5	NC	100.0	+15/-5%		Power
5	2	1	NC	100.0	+15/-5%		Power
6	6	4	NC	100.0	+15/-5%		Power
7	4	2	NC	100.0	+15/-5%		Power
8	2	6	NC	100.0	+15/-5%		Power

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Improving Quality of Testing: Military Imaging Systems Cables and Harnesses

Continued from page 55



Figure 2. Test-interface-Fixtures

Test Cable Design: *Test Interface Fixtures and Custom Product Sub-Assemblies*

Custom cables are needed for almost all AEO products. The first step is the design, build, and test of the test fixture that will interface the product sub-assembly cable to CableEye. This will be some combination of standard or custom connector boards and/or custom cables that may connect directly to the 64-pin header

of the tester. These test interface fixtures seen in Figure 2, are themselves tested with CableEye.

The Golden Cable of a new product cable design may be created physically, or digitally within CableEye. AEO often creates a physical Golden Cable. In this pictured case (below), at a click of a button, Wade uses CableEye to “learn” a new Golden Cable that has been manually tested and

verified. In this learning process, all key wiring and electrical data (including resistance values) are automatically detected by the tester. Wade verifies the wire nets are correct and that they correspond to the red-line engineering document. PASS/FAIL criteria such as resistance thresholds are programmed in if they differ from the default settings and the cable file saved to the searchable database as ‘Match’ data against which subsequent product is tested.

Being AS9100 certified, means that AEO is required to maintain documentation to show continuing improvement. “The CAMI Research products have been instrumental in helping us to meet and exceed these requirements,” noted Reynolds. “Each new cable now ends up in the database and we require the CableEye test reports to be included. CAMI has been instrumental in guiding us in how to improve the test procedures and test library.”

Measuring resistance accurately is necessary to check the quality of a connection whether or not a resistor is inline. Dual threshold set-up is required for this whereby the user programs both a maximum conductor resistance and a minimum isolation resistance (see next photo). Without measuring resistance, the tester would tell you when your intended connection is connected (passing a simple continuity check), but not whether that connection is compromised by something that affects the total resistance of that connection perhaps, for example, because of poor soldering, or by leakage between conductors because of contaminant material.

This graphic in Figure 3 shows that the upper and lower limits of measurement are model-dependent: With their model M4, AEO can measure as low as 0.02 Ω, and with their model M3U up to 10 MΩ. HiPot testers HVX and HVX21 can measure considerably higher resistances.

Reynolds continues, “Once Pass/Fail criteria are programmed, we then run the cables to be tested. I absolutely LOVE the GUI with the CableEye product line! Passes are CLEARLY indicated on both test platform and on the GUI. Moreover, the CableEye product makes everyone who uses it a ‘Star’. We catch our mistakes BEFORE they get to the final test environment, which makes the time ‘fabrication, build, test and ship to customer’ much more efficient and makes for even happier customers.”

Reynolds summarizes “CableEye has made our testing much more efficient, cables more thoroughly assured to perform in the end environment, and clearly tells us when we need to address assembly errors. I love this machine! Our Chief Technology Officer has mandated all future cables be tested with CableEye, and we will likely be purchasing another unit soon to keep up with the testing demand.”

About CableEye®

CableEye is a highly versatile, expandable and upgradable diagnostic and Pass/Fail check Cable and Harness Test System that’s PC-based. It’s used for assembly, prototyping, production, and QC of standard or custom wire cables and harnesses. The entire suite of products is powered by the same easy-to-use operating software and, with the help of its signature easy-to-interpret color-coded graphics, instantly identifies not only when there is a fault, but what type of fault and where.

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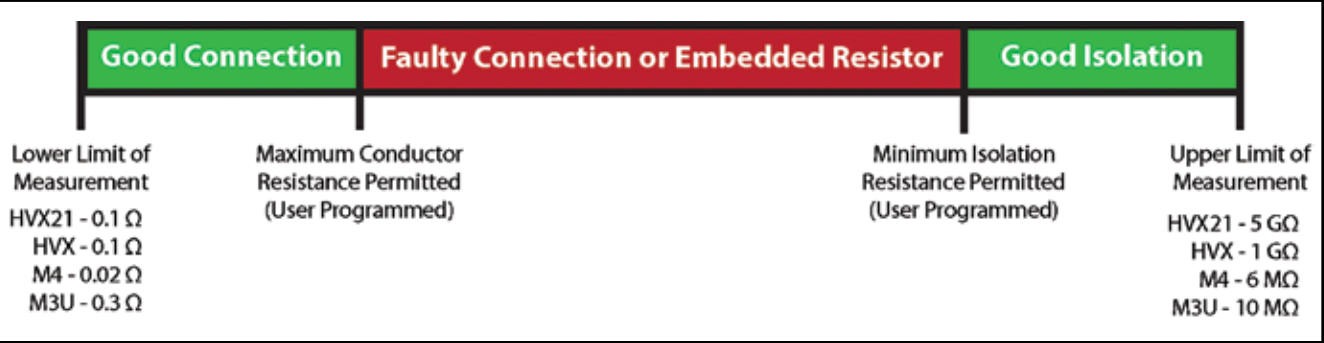


Figure 3. Dual Thresholds

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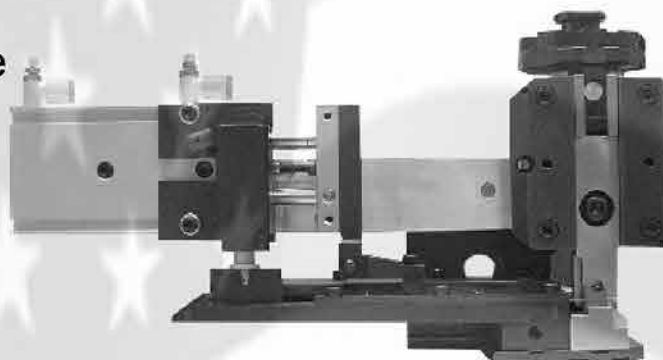


Model 1700

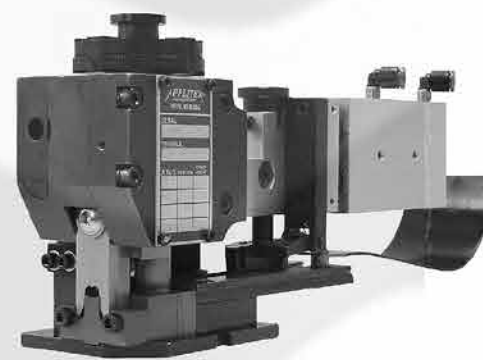


Model 2000

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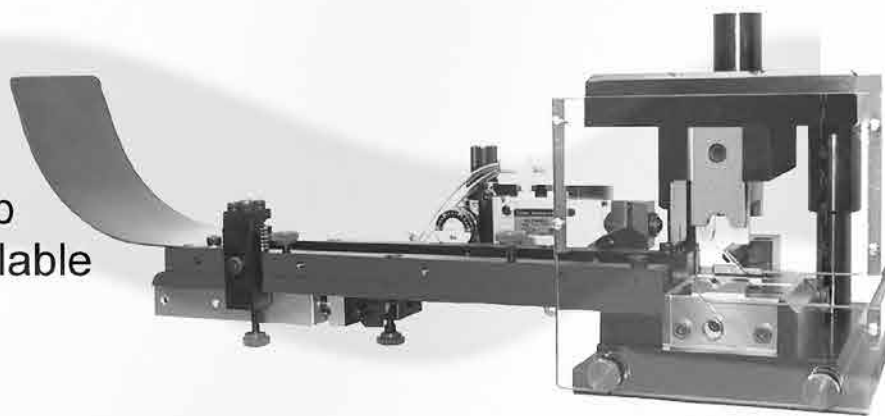


Model 1500



Model 2100

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IPC to Help Grow Electrical Wire Processing Technology Expo, Contracted to Manage Event Beginning in 2021

To help add new benefits, attract more attendees, increase exhibitor participation and cultivate a higher level of training, education and engagement seminars for guests and participants, IPC has been selected to manage the Electrical Wire Processing Technology Expo (EWPTE) in Milwaukee for the years 2021 to 2025.

EWPTE, held annually at the Wisconsin Center, is one of the leading shows for the electrical wire and cable processing industries. The past few years have drawn an expanded roster of exhibitors and visitors and the 2019 event saw close to 3,000 attendees from 40 states and 25 countries and nearly 200 exhibiting companies. Major automotive manufacturers such as Ford, Fiat Chrysler, and General Motors, plus notable international companies including Boeing, General Electric, Briggs & Stratton, and Harley-Davidson sent representatives to the two-day show to see the latest trends, technologies, and products shaping the future.

In addition to IPC providing logistical and marketing support, including exhibit and sponsorship sales, event promotion, exhibitor and attendee registration, hotel room contracting and additional general event administration, IPC will also develop a technical conference component to the event as well as host our summer committee meetings, IPC Summer-Com in conjunction with the event.

“IPC’s affiliation with the Wiring Harness Manufacturer’s Association (WHMA), the only trade association exclusively representing the cable and wire harness manufacturing industry, will help grow EWPTE as a globally recognized tradeshow. IPC and WHMA look forward to working with Wisconsin Center staff and the EWPTE Advisory Committee to produce a world-class event for the wire processing industry,” said David Bergman, WHMA executive director and IPC vice president of standards and technology.

“IPC has a proven track record in tradeshow management. IPC’s annual flagship event, IPC APEX EXPO, is the largest event in North America for electronics manufacturing and draws attendees and exhibitors from around the world. We believe their expertise will help grow EWPTE as a globally recognized tradeshow,” said Marty Brooks, president and CEO of Wisconsin Center District.

The next Electrical Wire Processing Technology Expo will be held May 12-13, 2021 at the Wisconsin Center in downtown Milwaukee. For more information on the Expo, contact Alicia Balonek, IPC senior director, tradeshow and events, at AliciaBalonek@ipc.org.

About IPC

IPC (www.IPC.org) is a global industry association based in Bannockburn, Ill., dedicated to the competitive excellence and financial success of its 5,900 member-company sites which represent all facets of the electronics industry, including design, printed board manufacturing, electronics assembly and test. As a member-driven organization and leading source for industry standards, training, market research and public policy advocacy, IPC supports programs to meet the needs of an estimated \$2 trillion global electronics industry. IPC maintains additional offices Washington, D.C.; Atlanta, Ga.; Miami, Fla.; Brussels, Belgium; Bangalore and New Delhi, India; Bangkok, Thailand; and Qingdao, Shanghai, Shenzhen, Chengdu, Suzhou and Beijing, China.

About the Wisconsin Center

The Wisconsin Center District (WCD) is a government body created under Wisconsin State Statute in 1994 to fund, build and operate the Midwest Express Center (now Wisconsin Center) in downtown Milwaukee, and continue operating the existing venues now called the UW-Milwaukee Panther Arena and Miller High Life Theatre.



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