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ECIA MEMBER



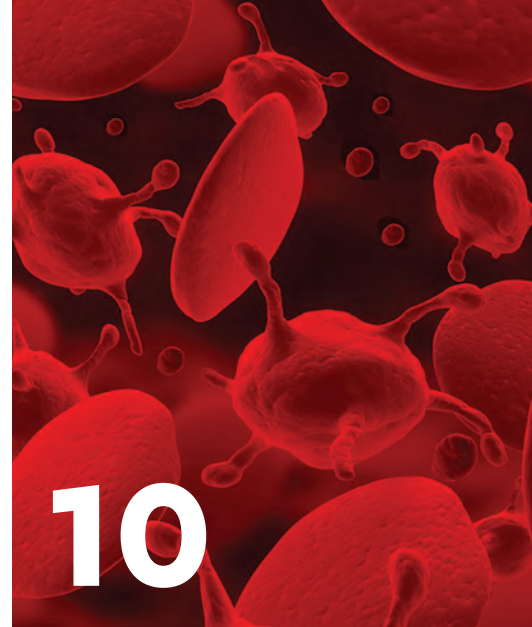
[illegible]The logo for Digi-Key Electronics is prominently displayed in the upper center. It features the company name "Digi-Key" in a large, bold, red, italicized sans-serif font, with a registered trademark symbol (®) to the upper right of the "y". Below "Digi-Key", the word "ELECTRONICS" is written in a smaller, black, all-caps, sans-serif font. The entire logo is enclosed within a thick, red, three-dimensional oval border that has a slight shadow effect. The background of the slide is a grayscale image of a construction site with cranes and building structures.

**ECIA MEMBER**  
Supporting The Authorized Channel





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Photos (this page, from top): LightIntegra Technology; Laird Technology; Getty Images



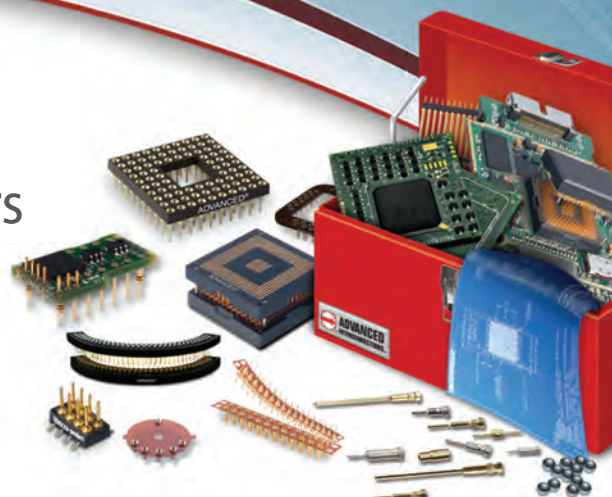
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# Collision conference impacts Toronto



There is simply no denying it anymore – Toronto has firmly arrived on the world's tech scene. This fact was punctuated

when the global tech community flocked to Canada's largest metropolis last month to attend Collision.

Touted as one of the fastest growing tech conferences in North America, the four-day gathering attracted the global technology industry, including more than 25,000 attendees comprised of 3,750 CEOs and 750 journalists (including me) from 125 countries.

Collision made no attempt to hide the growing concerns that surround the tech sector (data breaches and scandals to environmental responsibility and employee burnout). It's clear that Big Tech is still moving on – and the stakes are being raised.

## Stakes Raised in Tech

All things indicate that the next wave of tech will be even more disruptive. Ideas like artificial intelligence, self-driving cars and blockchain will reshape societies and impact people lives in countless ways. There's an urgent need for a more responsible approach to innovation – and Canada is pioneering it.

The country has built a new model that convenes startups, global corporates, investors and scientists together in innovation hubs linked to the country's leading universities. It promotes collaboration between academia and industry and prevents echo chambers from forming by bringing multiple different perspectives to bear.

Driving it all is this country's multiculturalism. It gives

Canadians a unique lens on the world, helping them see strength in diversity. That viewpoint has allowed Canada to see opportunity in the rising tide of campaigning to attract the world's best tech talent. An influx of skilled workers is now fueling start-up ecosystems throughout the country – and Toronto's rise to be named the fastest-growing tech market in North America.

## Canada's Diversity Dividend

Canada's diversity helps its startups differentiate themselves and spot market openings that others might miss. It fuels research in AI, which demands diverse datasets. And, it opens the door to a smarter, more inclusive way of creating new technologies. Above all, it helps engineers look beyond the code to see its consequences and act deliberately to solve real-world problems.

It's no coincidence that Canadian companies tend to cluster around important verticals like healthcare or clean technology, the brightest people want to work on the biggest problems. Increasingly, the place they're choosing to do that is Canada.

## New Talent Migration North

As the U.S. government stifles the flow of H-1B visas on which the tech industry depends, Canada is aggressively campaigning to attract the world's best talent. In one year alone (June 2017 – July 2018), 12,000 skilled workers were brought to Canada through its Global Skills Strategy, a suite of programs that streamline the visa processing of work permit applications for highly skilled talent – in some cases reducing it to just two weeks.

As a result, Canada admits 10 times more skilled workers per

capita than the U.S.

## Innovation Hubs Galore

It takes more than ambition and inspiration to create breakout technologies. Entrepreneurs need investors, engineers, access to markets and advice from other founders who've been there and done it. The Toronto tech region has an extensive network of more than 20 incubators and innovation centres, including MaRS, DMZ, OneEleven and Communitech. These accelerate startup growth by connecting entrepreneurs with the talent, capital and expertise they need to build their companies.

## The AI Advantage

Canada is the home of artificial intelligence. Much of the foundational research on machine learning was carried out in the labs of Geoffrey Hinton, at the University of Toronto and Yshua Bengio at the University of Montreal, who shared the 2019 Turing Award for their work. As a result, Canada has built deep pools of talent and expertise in AI – and it's pressing its advantage.

Canada was the first country to create a national AI strategy and has committed \$125-million to the sector.

## The Mayor's Echo

Echoing Toronto Mayor John Tory's opening night comment, "Toronto's tech industry isn't just booming because of the strength of its homegrown startups, but as a result of access to enthusiastic partners from well-established adjacent industries, such as finance and health care."

May the disruptors continue disrupting. **EP&T**

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**EP&T**  
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## ADVANCED MANUFACTURING

### C2MI AND VARITRON INAUGURATE ADVANCED MANUFACTURING CENTRE

C2MI and Varitron, an integrated electronic manufacturing services (EMS) provider, have officially opened what it is calling ‘the first’ Advanced Manufacturing Centre in Canada dedicated to electronic card assembly and printed electronics. Set in the C2MI research centre facility in Bromont Quebec, the facility provides state-of-the-art equipment in the printed electronics, circuit assembly, nano protection and advanced cooling fields, as well as an integrated supply chain leading to high-volume production.

The goal of this new facility is to accelerate the development of emerging technologies in every market segment, according to facility president & CEO Normand Bourbonnais.

“Offering new products, new possibilities and new applications so that they stay at the forefront of the supply-and-demand process,” he says. “Highly skilled teams from both industry and academia will assist companies with their product development and process design while staying focused on high-volume production targets in the different solutions they advance.”

Companies can have access to à la carte services or bring to the table an idea that has yet to be tested and developed, using the full array of services from conception to commercialization. A strong incentive for foreign companies to use the Advanced Manufacturing Centre’s services is the Industrial and Technological Benefits (ITB) Policy that requires companies awarded defence contracts to do business in Canada.

The Advanced Manufacturing Centre project, a total investment of \$6.5-million, was made possible with the collaboration of the Université de Sherbrooke and Varitron for scientific contribution and is financed by the Ministère de l’Économie et de l’Innovation du Québec (\$3M) and C2MI (\$2.1M) while equipment suppliers contributed up to \$1.4-million in added-value capabilities.

“The Advanced Manufacturing Centre will be key to keeping Canadian companies a step ahead of the competition by accelerating the development of innovative solutions and products in order for them to reach the market faster. As a research and development Centre, one of our main roles are to

**C2MI and Varitron’s Bromont facility is dedicated to electronic card assembly and printed electronics.**

**\$6.5 MILLION**

The total investment for the Advanced Manufacturing Centre project

make sure we have the equipment in our facility that ensure the competitiveness of our clients and members, no matter what their industrial sector is,” says Normand Bourbonnais, C2MI’s CEO.

“This centre is a stepping stone toward ensuring that the innovation ecosystem has access to cutting-edge facilities, state-of-the-art equipment and the latest scientific expertise to accelerate its technological development,” adds Michel Farley, Varitron president and CEO. “Varitron is proud to see this project come to life after more than four years of planning and fine-tuning.”

## INNOVATION



### GOVERNMENT FUNDING BOOSTS CMC FUTURE

Changes to federal funding for science and innovation are good news for CMC Microsystems (CMC) and Canada’s National Design Network (CNDN), says Gord Harling, president & CEO of CMC.

“The increase to the Canada Foundation for Innovation (CFI) Major Science Initiatives (MSI) Fund is a significant investment and will directly benefit the CNDN,” he says.

CNDN, managed by CMC and hosted by Queen’s University, is recognized by CFI as a Major Science Initiative. Enhancements to CFI’s MSI program will directly benefit seven of Canada’s 16 MSIs.

“We welcome changes that enhance Canada’s innovation ecosystem and help address gaps in CMC’s funding,” says Dr. Bozena Kaminska, chair of the board of CMC. “We applaud Minister Kirsty Duncan for this investment in research, and we continue to look for other strategic partners, federal and provincial, to help us address their science and innovation priorities.”

Services for developing micro-nanotech innovations will continue.

“These recent developments mean our services for developing micro-nanotech innovations will continue to be accessible to more than 10,000 academic and industry researchers in the coming year,” Harling observes. “But we are also adapting to ensure long-term sustainability of our programs.”

## ARTIFICIAL INTELLIGENCE



### NEXOPTIC BRINGS AI SOLUTIONS TO IMAGING

NexOptic Technology Corp., reports that it has made significant advancements to its cutting-edge Artificial Intelligence (AI) imaging solution.

NexOptic’s Advanced Low Light Imaging Solution (ALLIS) provides immediate solutions to problems that have plagued the imaging industry for decades. NexOptic’s engineered AI drastically reduces image noise common to all imaging systems while improving performance in low light conditions. This is accomplished with NexOptic’s expanding suite of patent-pending, deep learning algorithms.

Some of the key benefits of ALLIS include: improved low-light performance; dramatic reduction in image noise; improved downstream applications (computational imaging, facial recognition); enhanced long-range image stabilization; major reduction in file sizes.

“We are at a watershed moment in the imaging industry, and ALLIS puts us at the forefront of learning-based technology enhancement,” says Rich Geruson, chairman of NexOptic’s board of directors. “Canada, and Edmonton in particular, has become a global hub for ground-breaking AI development, and we are taking full advantage of our geographical location





by adding talented new team members to our organization.”

NexOptic’s technology is designed to perform in a variety of lighting conditions, enabling more compact optics with less expensive electronics. This technology also greatly reduces file sizes for compressed media and lowers bandwidth usage during data transmission. NexOptic’s AI improves imaging quality not just for the human eye, but for other companies’ applications, such as facial recognition or object classification, and could become a critical component of the AI infrastructure of tomorrow.

NexOptic has increased its capacity to develop leading solutions with the recent commissioning of its AI lab in Edmonton. The region is home to top AI companies, such as Google’s Deepmind and has garnered financial and other support from the Federal and Alberta governments. Due to growing industry interest, the company continues to expand its AI operations and adding new team members.

#### HAPTIC SOLUTIONS

### TDK COOPERATES WITH BORÉAS ON SMART HAPTIC SOLUTIONS



TDK Electronics has signed a cooperation agreement with Bromont QC-based Boréas Technologies

Inc., developer of ultra-low-power haptic technologies, in order to accelerate the adoption of piezo haptic solutions in a broad range of applications. Under the agreement, the partners will jointly design and market advanced touch response solutions using TDK’s PowerHap and PiezoHapt families of piezo actuators for haptic feedback combined with Boréas’ piezo haptic driver technology.

The firms will develop demonstrators for haptic effects and drivers for high-definition piezo haptic systems and market these solutions on a global scale. This will enable customers to implement advanced haptic solutions with the high performance actuators in a broad spectrum of

applications that includes smartphones and tablets, automotive displays and controls, wearables, gaming consoles, industrial equipment, medical devices and more.

#### TEXTILE COMPUTING

### MYANT AND SMK PARTNER IN TEXTILE COMPUTING SUPPLY

Toronto-based Myant Inc., designers and developers of textile computing solutions, has partnered with SMK



Electronics Corp. U.S.A., Chula Vista CA, a global maker of advanced OEM electronic components. The aim will be to catalyze the development of new electronic components and mechanical interfaces

for application in the emerging field of textile computing.

“We can develop innovations in health care, fitness, AR/VR, automotive, aerospace and more,” says SMK president Paul Evans. **EP&T**

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# Enforcement of the EU's updated RoHS2 regulation is coming: Are you ready?

*SGS white paper highlights pending crack-down on electronic products headed for Europe*



Manufacturers of electronic equipment (EEE) will face fresh challenges to maintain the CE Mark for their products as new regulations within the European Union's Restriction of Hazardous Substances (RoHS) Directive, or RoHS2, (2011/65/EU) come into force this summer.

In a recent White Paper 'European Union RoHS2

– Understanding Requirements and Compliance Strategies', SGS reviews the aims and objectives of the directive and explores the likely impact and consequences for electronic equipment OEMs.

Introduced in 2002 to contribute towards the protection of human health and the environment, the RoHS Directive now forms an important part of the foundation for supply chain

compliance in the EEE industry. From tumble dryers and TVs to laptops and lamps, the Directive provides an effective start point for the identification and removal of hazardous and/or toxic substances from such products. By designing these substances out of products and focusing on the product's entire life cycle, materials can be recycled and waste restricted.

From July 2019 enforcement

of restrictions will be extended from six to 10 substances, including lead, cadmium and mercury. Crucially, products that fail to conform to its requirements cannot display the CE Mark and are prohibited from being offered for sale in countries of the EU.



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“Ensuring that products stay compliant is a time-consuming concern. This white paper highlights the ongoing challenge it places on all manufacturers,” says David Linder, RSTS technical manager, SGS. “Regulations change, additional hazardous substances are being identified and suppliers may revise formulations or construction of their products at any time.”

### Ensuring Conformity through DoC

To ensure conformity, manufacturers must create a technical file and issue a Declaration of Conformity (DoC), which requires them to collect current declarations from all operators in the supply chain, or perform a Complete Assessment of Finished Product.

Manufacturers can assess their products in the following ways:

- Review the product and Bill of Materials (BoM) to determine the required information
- Contact the supply chain to get applicable material and/or compliance information
- Review and determine if the information obtained from suppliers is trustworthy and acceptable.

For many manufacturers the DoC approach can be extremely labor intensive, especially if they have complex products and/or supply chains. It compels the EEE manufacturer to obtain a current DoC or statement of compliance from every supplier, from raw material providers to

sub-assembly manufacturers. In addition, the manufacturer becomes legally accountable if supplier information is out of date or inaccurate.

A Risk-Based Approach (incl. Complete Assessment of Finished Product)

Alternatively, manufacturers can commission a certified laboratory or testing facility to analyze the supplied material or finished product for the presence of hazardous substances.

Complete testing may be necessary, where the product is broken down into its smallest “homogeneous” components, but in many cases the process can be minimized by either:

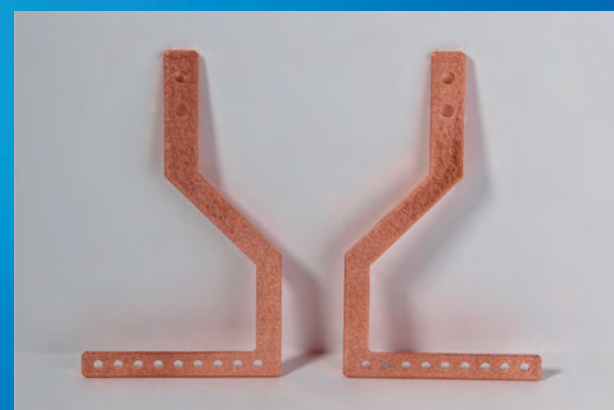
1. Testing the parts that would logically use a restricted substance (risk assessment) or
2. Testing for those substances that would likely be found in such a product, e.g. testing for phthalates in flexible plastics

A trustworthy supply chain will help with obtaining the material content, hazardous substance statuses and/or declarations. Where testing is needed, the IEC 62321 series of standards can provide test methods and criteria for evaluating components and materials for restricted substances. This approach places the manufacturer in control. **EP&T**

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# LightIntegra's blood analyzer infuses fresh pulse within medical circles

Vancouver-based maker of ThromboLUX medical device nets funding support **BY SOHAIL KAMAL**



Understanding how painful failed transfusions are for physicians, the blood bank - and most importantly, the patients, Vancouver-based LightIntegra Technology Inc. has infused medical circles with a life-saving solution. A medical device called ThromboLUX, represents the first analyzer to provide a routine test for platelet activation status.

Since its inception more than 10-years ago, LightIntegra has strived to provide patients with the best possible chance for platelet transfusion success by ensuring all hematology-oncology patients receive non-activated platelets.

The premise of the ThromboLUX technology is that activated platelets are optimal for clotting and are therefore most effective for trauma or surgery patients and non-activated platelets are optimal for cancer patients. The current standard of care assumes all platelet bags are the same; however, up to 50% of a platelet bag inventory may be activated. When activated platelets are given to immune-compromised patients, such as cancer patients, it potentially leads to failed transfusions with multiple failed transfusions leading to platelet refractoriness, which can ultimately result in death.

With 32% of platelet transfusions failing, finding a solution to determine activation status becomes imperative, according to Dr. Elisabeth Maurer, founder and CTO of LightIntegra, which benefitted from a lot of early support and funding from Canadian Blood Service (CBS), as well as significant investment from Genome BC.

"The ThromboLUX analyzer delivers a five-minute test that can be



**Dr. Elisabeth Maurer, Ph.D., founder and CTO of LightIntegra**

used to definitively characterize each platelet bag as activated or non-activated, and it could save lives," says Maurer, Ph.D.

## **Shaken by the patient's death**

After studying platelets during her doctoral research, Maurer began the journey with LightIntegra when she accepted a position as a research scientist with CBS in their research facilities at the University of British Columbia (UBC).

Her research team conducted an observational pilot study at Vancouver General Hospital (VGH) in 2007 using the first ThromboLUX prototype. During the study, patient number 12 died, and Dr. Maurer noticed that the final three transfusions the patient received all had a similar characteristic, as measured by ThromboLUX. All three transfusions contained activated platelets.

Shaken by this patient's death, Dr. Maurer asked the question: "If the platelet bags had been tested beforehand and these particular platelets had not been transfused, would patient 12 still be alive?" This question continues to drive her, and LightIntegra, today.

CBS supplies all blood products to Canadian patients outside Quebec, including platelets. However, not much was known about the

characteristics of platelets in platelet products that were supplied. Dr. Maurer researched ways to quickly characterize the platelets inside a platelet bag and determine if the platelets were functional.

"Platelets dramatically change their shape when exposed to room tem-

**We don't view ourselves as selling a medical device to hospitals and blood banks. Our mission is to make the most of a precious commodity by allocating the right platelets to the right patient right now.**

perature, which prompted the question of its biological purpose," Maurer explains. "Platelets are the primary carriers of serotonin in the blood, and since one of the parameters that is controlled by serotonin is body temperature I thought that this might provide the link."

Maurer found that activated platelets are more sensitive to cooling, and incorporated this temperature sensitivity to test platelet activation status with ThromboLUX, a machine that measures dynamic light scattering.



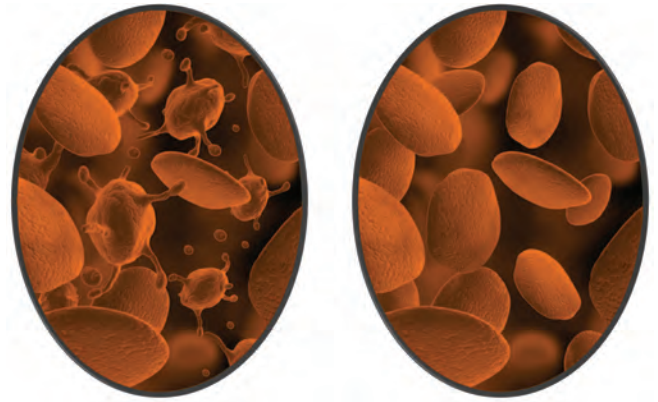


property potential of the work and supported the filing of the first six patents.” After the successful observational pilot study at VGH that propelled the ThromboLUX project beyond basic research and development, a license agreement was reached between CBS and LightIntegra – which was then officially a CBS spin-off company. In November 2008, Maurer founded LightIntegra.

“By July 2009, we moved into our first office, hired a CEO, hired an engineer, won first place in the New Ventures competition and closed a round of financing. With a management team, \$1 million dollars in the bank, a ThromboLUX prototype and some preliminary data, we were set on our path,” says Maurer.

### Research support was critical

It appears that many organizations and researchers beyond Maurer had a hand in helping LightIntegra’s early success. Maurer notes that programs like BC Excels and New Ventures BC were instrumental in getting LightIntegra started and funding through The National Research Council of Canada Industrial Research Assistance Program (NRC IRAP) and Genome BC, as well as Scientific Research and Experimental Development (SR&ED) tax credits, also served as great incentives to grow a business in Vancouver. LightIntegra has also been fortunate to be supported by a group of local angel investors. In April of this year, Genome BC, who leads genomics innovation on Canada’s West Coast and facilitates the integration of genomics into



**At Left: The ThromboLux unit performs a simple 5-minute test that determines the platelet activation status.**

society, announced a \$1-Million investment in LightIntegra.

“Various members of our board had interacted with GenomeBC previously and brought this opportunity to their attention,” says Maurer.

Innovation in health care can be a challenge, and like all technologies, have to overcome proof of concept and proof of value. After this, health care providers need to adopt the new technology, which Maurer explains can be a major hurdle: “The number and type of objections why hospital blood banks or platelet transfusion providers cannot adopt ThromboLUX have been astounding. Changing health care is hard but LightIntegra is determined to improve the use of this precious resource, platelets, worldwide.”

Maurer offers a bit of advice to future entrepreneurs who aim to garner similar success that LightIntegra has earned.

“Don’t be a salesman, be an expert. We don’t view ourselves as selling a medical device to hospitals and blood banks. Our mission is to make the most of a precious commodity by allocating the right platelets to the right patient right now,” she says.

Maurer also spoke highly of her team, and how the people around her have been a big part of the success:

“Surround yourself with smart people – from the initial idea to the people who have helped ensure the financing, the production, the clinical testing, the marketing, even the hiring of those people, we’ve been committed to bringing on the best and the brightest to support our mission.”

For more info on LightIntegra and the Thrombolux device, visit [www.lightintegra.com](http://www.lightintegra.com). **EP&T**



**Sohail Kamal** is EP&T’s West Coast correspondent. [sohail@nextgear.ca](mailto:sohail@nextgear.ca)

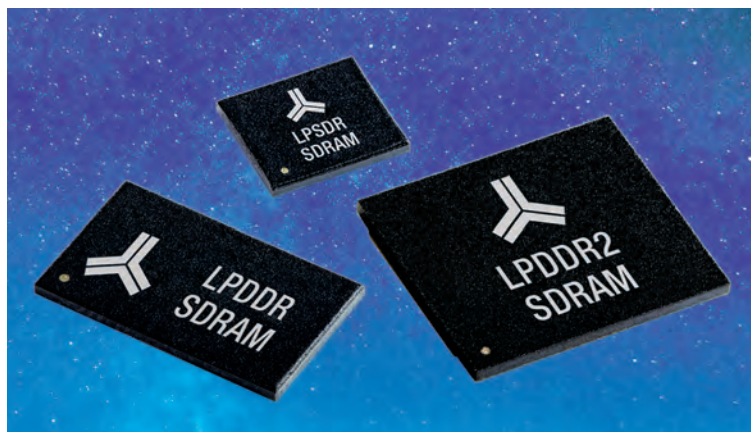
Another hurdle for LightIntegra was finding a way to shift the team from a research team to a privately-funded corporation.

“CBS grant funding supported the early discovery research that the CBS research team and I conducted under the mentorship of Dr. Dana Devine,” explains Maurer. “Dr. Mark Scott joined CBS and became the associate director for intellectual property and business development in 2006. Dr. Scott recognized the intellectual



**Visual inspection is not sufficient to know the activation status of platelets for transfusion. The platelets on the left are activated and the platelets on the right are resting.**





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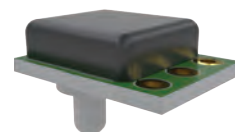
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FEATURE

# Storage cooling remains critical in medical settings

*Industries such as biotech use liquid chromatography equipment to break down the chemical composition of complex liquids* **BY ANDREW DEREK**



Liquid chromatography equipment and other analytical instrumentation are used in a variety of industries for sample analysis. Samples to be tested are typically stored in a refrigerator, and then moved to a temperature-controlled sample storage compartment located near the test equipment while awaiting analysis.

### Background

Industries such as biotech, pharmaceutical and food science use liquid chromatography equipment to break down the chemical composition of complex liquids and determine their makeup on an elemental basis by relative proportions. The process normally operates by passing small amounts of liquid through a stationary phase. These small samples are analyzed one at a time, requiring much testing to increase the accuracy and to accelerate the time frame for completing the analysis. Liquid chromatography is often used in R & D laboratories for product development or for reverse engineering the composition of a given liquid. In addition to industry, governments and universities also make use of liquid chromatography equipment for their research.

Liquid chromatography systems have a high throughput and utilize add-on sample storage chambers to control the specific temperature of the samples prior to separation. Temperature



**Liquid-chromatography-mass-spectrometry-equipment.**

control of these samples is important, as the temperature influences the interaction between the components within the liquid sample and the adsorbents. The liquid samples generally require cooling, down to as low as 4°C (39°F). However, some samples may need to be heated as high as 40°C (104°F). Each storage chamber requires a system to provide cooling or heating, as needed.

### Design Objectives for Storage Chamber Cooling

Given the small sample sizes used in liquid chromatography, the storage chambers are generally small units that are stacked on top of one another to save bench space. Stacking the storage chambers presents some challenges because the air cannot flow vertically through the chambers; it can only move horizontally through the units, usually from front to back. This leaves limited

access to airflow circulation.

The space constraints for the storage chambers require that the thermal solution be efficient. Cooling the compartment and rejecting air out of the system necessitate effective heat exchanger mechanisms operating in a limited space. Insulating the compartment properly is also important to minimize passive losses. Finally, cooling the storage chambers must be done at a reasonable cost with minimal maintenance. TEA's generally require no maintenance, only cleaning dust built up on heat sinks with compressed air.

Thermoelectric assemblies (TEAs) or Peltier module cooler assemblies are an advantageous technology to use for this application. They can provide both cooling and heating, maintaining the control temperature of the storage chamber between 4 and 40°C in ambient temperatures of 23 to 30°C. They offer compact form factors to accommodate the tight geometric space constraints. Operation is either 12 or 24 Vdc, which is helpful with universal power supply when shipping products to multiple regions. Heat load requirements can range from 25 to more than 100 Watts.

TEAs contain thermoelectric modules (TEMs) or thermoelectric coolers, which are solid-state Peltier heat pumps. Heat transfer mechanisms are used to absorb heat from one side and dissipate heat thru the other side. Usually exhausting into air environment. A temperature controller (TC) regulates the temperature of the TEA, and thereby the temperature within the storage chamber, by adjusting the output of its power supply.

### Challenges and Opportunities

There are three big challenges in storage chamber temperature control. The first is proper insulation of the storage chamber itself. Poorly insulated chambers will make any thermal solution less effective due to passive heat losses.

The second challenge is the heating and cooling capacity of the TEA. If the chamber is poorly insulated, then the TEA has to

work harder and it will take longer to reach its cooling capacity. Also, the space limitations inside the chamber can affect the heat pumping capacity and time to cool down as well.

The third challenge is managing condensation. As the temperature drops below its dew point, moisture can form on the cold surfaces and seep into the TEM cavity, causing it or other components to deteriorate and fail. This is a good reason to have properly designed insulation materials.

These challenges require that there be a robust solution at the TEA level to keep condensation out of the TEA cavity to provide moisture protection. Incorporating features such as gasket sealing, or even double barrier protection, are some ways to avoid condensation from penetrating into the cavity. One item that is not an issue in cooling of the storage chambers is precise temperature control. Control to within  $\pm 1^\circ\text{C}$  is sufficient for this application.

Many opportunities exist in the analytical instrumentation market. In addition to liquid chromatography, mass spectrometers, incubators and protein analyzers are other applications that may require sample storage cooling.

Finally, TEAs do wear out, providing an opportunity in the service and replacement parts business. Some units fail in operation after one year in the field. As they try to maintain the 4°C chamber temperature, condensation forms on the cold side and penetrates the TEA cavity, getting in contact with a sensor or an over-temperature thermostat switch, which can cause the unit to fail.

### Conclusions

The use of thermoelectric or peltier module assemblies are ideal for sample storage compartments in analytical instrumentation. These units provide a compact thermal solution that is efficient, stable and reliable with low total cost-of-ownership including low to no maintenance. **EP&T**

*Andrew Derek is product director, Laird Thermal System*

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# Google identified as semiconductor technology leader of tomorrow

*Google, Amazon, Xilinx and Micron are among eight companies set to flourish in the data centre space, says GlobalData*



Google, Amazon, Xilinx and Micron are among the world's leading semiconductor

companies best placed to succeed in the data centre space in the next two to five years, according to analytics group - GlobalData.

According to GlobalData, data centres is one of the top 10 themes that will impact the semiconductor sector, alongside high performance computing, AI, ambient commerce, autonomous vehicles, Industrial Internet, gaming, 5G, M&A and geopolitics.

"Data centre developments are important for the semiconductor sector due to the global growth in demand for computing power. The need to analyze and process dramatically increasing volumes of data - much of it unstructured - is in

turn driving demand for computer memory," says Cyrus Mewawalla, research head at GlobalData.

The recent report reveals that Samsung, SK Hynix, TSMC, and Barefoot Networks also make the top eight companies in the data centres theme.

"Companies who invest in the right themes become success stories, with those who miss the big themes ending up either falling behind their competitors or failing altogether," Mewawalla adds. "Automobile manufacturers, for example, can no longer carry on with business as usual. They face threats from four disruptive themes concurrently: the connected car, autonomous driving technology, electric vehicle technology and transport-as-a-service. However, Tesla's market value has grown by

2,700% to \$56bn over the last 10 years because they took ownership of that electric and autonomous vehicles theme."

**Companies who invest in the right themes become success stories, with those who miss the big themes ending up either falling behind their competitors or failing altogether**

GlobalData's research reveals that in 2019 ever-larger volumes of digital data will fuel demand for storage, compute and other data centre resources. The use of

Cloud-based resources in the form of servers, storage and networking services is now mainstream.

Cloud-based infrastructure spend is currently growing at 10 times the speed of traditional 'on-premise' infrastructure spend and we are now entering a world in which the ability to process large quantities of data, draw inferences from it, and act quickly in response to the insight it gives will determine the survival of many organizations.

"The compounding demands of IoT, Cloud computing, smart TVs, gaming and AI on digital lives are leading to a supply gap in the data centre market which the Internet giants, deploying their expertise in semiconductors, are rushing to fill: centers across the world at a fast pace," Mewawalla concludes. **EP&T**

## Semiconductor market lurching into worst-in-a-decade downturn

*Chip forecast takes a 10-percentage-point downside swing in 2019: IHS Markit*



Conditions in the global semiconductor market have deteriorated rapidly since the start of

the year, with business information provider IHS Markit slashing its 2019 growth outlook by more than 10%.

The worldwide microchip industry is set to suffer a 7.4% drop in revenue this year, according to the latest figures from the IHS Markit Application Market Forecast Tool (AMFT). Revenue will fall to \$446.2 billion in 2019, down from \$482.0 billion in 2018.

This represents a major swing in the market outlook compared to the previous forecast in December, which anticipated the market would expand by 2.9% this year. A 7.4% decline will mark the semiconductor industry's biggest annual percentage decrease since the Great

Recession year of 2009, when chip sales plunged by nearly 11%, as illustrated in the figure (below).

"After the chip industry attained a heady revenue expansion of 15% in

**The chipmakers' confidence quickly transformed into apprehension as they witnessed the depth and ferocity of the current downturn**

2018, many semiconductor suppliers remained optimistic that they could achieve modest growth early this year," says Myson Robles Bruce, semiconductor research manager at IHS Markit. "However,

the chipmakers' confidence quickly transformed into apprehension as they witnessed the depth and ferocity of the current downturn. The latest data indicates the semiconductor business now is destined for its worst year in a decade."

### **The chips are down**

The precipitous nature of the downturn is due to increasingly soft demand, combined with a rapid rise in inventory levels in the first quarter. These events have impacted some semiconductor product segments more than others. DRAM, NAND flash, general-purpose microprocessors (MPUs), 32-bit microcontrollers (MCUs) and analog application-specific integrated circuits (ASICs) were among the worst-affected products, with all of them double-digit revenue declines

in Q1 of 2019 compared to 2018.

Recent concerns over DRAM market conditions, a harsh drop in average selling prices and weak demand all served to slash DRAM revenue projections for 2019. In the NAND flash memory space continued oversupply has been responsible for an aggressive erosion in pricing.

Another segment set for steep decline this year is the logic application-specific standard product (ASSP), where demand is driven by the mobile handset business, a market that is struggling to generate due to nearly universal saturation.

The challenging conditions in the semiconductor market will linger through Q2. Sharp declines in the first half of the year have set things on a course for the worst revenue performance since 2009. **EP&T**



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www.diasemi.com

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(minimum) to 280nm (typical) to 285nm (maximum)

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www.optodiode.com

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# Taking the temperature of the white-hot micro LED market

BY MARK RITZHEIMER



What do laptops, mobile devices, flat panel display TVs, digital signage, automotive infotainment systems and augmented/virtual reality (AR/VR) headsets all have in common? Displays are the obvious answer, but there's an additional nuance that electronic engineering and design firms can't afford to overlook in this rapidly-changing technology landscape: the growing emergence and importance of micro LEDs.

## What is micro LED?

Micro LED is an emerging technology for flat panel displays for a variety of electronic devices. The name comes from their microscopic size: from 50µm to 2µm, depending on packaging. Micro LEDs have better performance over LCD displays, including significant higher resolution and contrast, better colour saturation, lower latency and lower energy requirements.

Compared to traditional LEDs, there is an emissive diode, meaning that they also have the added benefit of generating their own light output built into the diode itself. Micro LEDs have the potential to deliver the higher quality and immersive experience of OLED displays, but at a lower cost.

## What are major benefits?

Compared to traditional, larger LEDs, micro LEDs deliver several attributes that makes them a great fit for devices that are frequently used around high ambient light, such as car infotainment system displays or digital signage. Their higher energy efficiency also makes them ideal for battery-powered devices.

Although it's a relatively new technology, the micro LED display market already was worth



\$272 million in 2018, according to Zion Market Research. By 2025, it will hit \$21.1-billion. That's a compound annual growth rate of over 86 percent.

## How are micro LEDs made?

Micro LEDs are manufactured, or you might even say 'grown,' in large-scale reactors that employ metalorganic chemical vapor deposition processes, or commonly known as 'MOCVD.' These reactors produce LEDs in large batches using multiple wafers and series of deposition techniques that are controlled by temperature and gas flow of reactants into the chambers.

Many of the traditional LED making infrastructure can be easily converted to produce micro LEDs. But, when they're making that transition, manufacturers must upgrade some of its measurement equipment.

One of the most important is around temperature measurement and control, and the use of optical temperature pyrometers. These pyrometers precisely measure temperature and are necessary for maximizing yields.

To understand why, let's look at how MOCVD reactors work and how their temperatures are

measured. Reactor pyrometers traditionally used 940nm wavelengths to measure the temperature susceptor, or the carrier, that holds the wafers that are being processed.

The catch is that at 940nm, the pyrometer can't 'see' the sapphire wafers for the LEDs that are actually grown, or some of the thin films that are being deposited, so it can't precisely measure their temperatures during production.

Instead, the pyrometers do the next best thing: measure the carriers' temperatures and extrapolate from that to estimate the wafers' temperatures. This traditional measurement technique has been state-of-the-art for many years, but does not provide the precision required to produce today's more sophisticated micro LED structure.

In an effort to upgrade these capabilities, LED manufacturers began exploring the use of a 'shorter' wavelength with their optical temperature pyrometers that provided new insight into the process. By selecting a different measurement wavelength, around 400-430 nm, it enables pyrometers to see the wafers throughout the entire production

process, from start to finish.

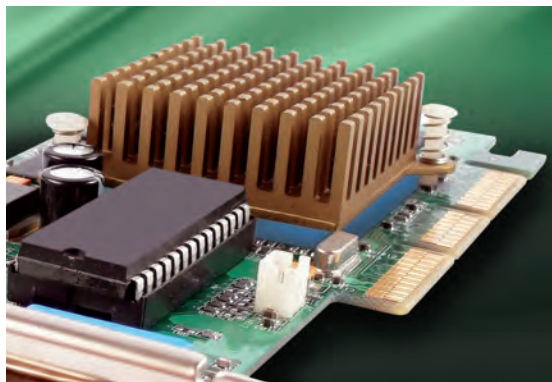
One of the greatest challenges for optical temperature pyrometers measuring at these shorter wavelengths is the limited thermal radiation being emitted, which makes the measurement more difficult, especially at some of the critical temperatures necessary for the growth of micro LEDs. Pyrometers in this space not only have to be able to measure correctly at these shorter wavelengths, but simultaneously deliver razor-sharp performance.

The early phases of the MOCVD production process are critical, and serve as the foundation of the Micro LED being produced, and have direct correlation to the results emittance of the microLED. Direct measurement of the sapphire and early layer growth significantly increases micro LED uniformity and repeatability, and maximizes yields, which also boosts profits.

For example, even a small error in processing temperature - even less than 5C - can result in a colour shift in the LED. A 400-430nm pyrometer can monitor temperatures from start to finish, enabling OEMs to meet these tighter requirements throughout their entire production process. That means less binning and less waste because manufacturers have a better chance of getting the wavelengths they want.

As current LEDs make the transition from traditional to micro LEDs, many of them will do this using existing MOCVD reactors and upgrade the instrumentation with the equipment to make this transition possible. There is also a learning curve in this process, as chambers are converted and production recipes not have to be rewritten to accommodate for micro LED growth, but manufacturers will have to perfect the recipes and incorporate years of learning into this transition. This is no easy step, and the LED producers who can make this transition more easily and efficient may lead the pack, and gain a competitive advantage. **EP&T**

**Mark Ritzheimer** is a senior product manager, thermal products at Advanced Energy.



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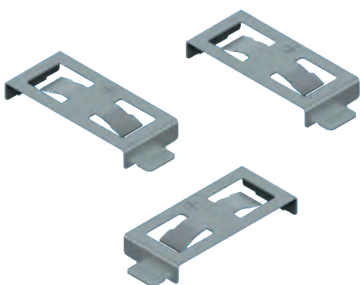
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sealing grommets. The frame is made from fiberglass reinforced plastic and is available in four different sizes. An optional internal locking frame is available for added tamper proof protection. The one-piece frame is configurable when using the snap-in inlays which provide an easy, configurable method to generate small to large entry points with sealing grommets of various sizes (full range: .06" – 1.4" dia.).

➤ [www.weidmuller.com](http://www.weidmuller.com)



## Schleuniger



### MultiStrip 9480



[schleuniger.com](http://schleuniger.com)

#### Most Versatile Cut & Strip Platform

The MultiStrip 9480 family covers a wide range of applications and budgets. Its high speed indexing cutter head and programmable rotary incision capability set the benchmark for high precision processing of coaxial and other shielded cables while SmartBlade technology and magnetically held guides reduce changeover times.

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## DIN RAIL MOUNT REDUNDANCY MODULE ASSISTS LOAD CURRENT BALANCING

TDK-LAMBDA AMERICAS



DRM40 series DIN rail mount redundancy modules are available in two 20A 10V to 30Vdc rated inputs and can be connected

to provide a 20A redundant configuration, or using the load balancing option, to deliver a 40A output. For capacitive and inductive loads, product will support an additional 50% peak load for four seconds. The use of low-loss MOSFET reverse current protection devices reduces the internal voltage drop to just 200mV. Applications include industrial process control, factory automation, battery chargers, and test and measurement equipment.

➤ <https://us.tdk-lambda.com/lp/products/drm-series.htm>

## EVALUATION BOARDS PROVIDE DESIGNER WITH DIY BUILD PROCESS

SCHURTER



DKIH-EVB Evaluation Board is a printed circuit board (pcb) that provides the end-user with

a DIY build process to achieve a suitable EMC filter, specific to the suppression requirements of their unique application. Board assists designers in complying with international EMC guidelines, regarding emission and immunity. A current-compensated choke with capacitors is an efficient approach to EMC suppression.

➤ [www.schurterinc.com](http://www.schurterinc.com)

## ULTRASONIC SENSOR DELIVERS ABSOLUTE FLEXIBILITY, EFFICIENCY

PEPPERL+FUCHS

UCC-50GK series ultrasonic sensor uses ultrasonic pulses to measure the distance to the target and reports information through one of three sensor outputs. Versatile configuration options make the



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➤ [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com)

## ELECTRICALLY-CONDUCTIVE SILICONE ADHESIVE ADDRESSES EMI SHIELDING CHALLENGES

DOW



DOWSIL EC-6601 Electrically Conductive Adhesive is a next-generation material engineered for reliable performance and electromagnetic compatibility (EMC) in demanding applications. Product combines strong electromagnetic interference (EMI) shielding capabilities across a wide range of frequencies with durable mechanical and conductive properties over time. Product is formulated to form strong bonds to many substrates and has greater than 150% elongation to enable flexibility at the joints.

➤ [www.dow.com](http://www.dow.com)

## LED INDICATOR OFFERS RGB ILLUMINATION LENS OPTIONS

APEM

Q Series LED Indicator line now includes RGB illumination lens option and can be customized to provide a vast assortment of tones and colours, including cyan, magenta, yellow and



white. The LED lens is available in flush or prominent and fits the Q10, Q14, Q16, Q19 & Q22 series bezels. Product line includes sizes ranging from 6mm to 22mm, also features select options such as stainless steel bezels, anodized bezels and custom engraving.

➤ [www.apem.com/us](http://www.apem.com/us)

## MOBILE LABEL PRINTER DELIVERS REMOTE SOLUTION

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convenient remote solution to industrial label printing. Unit permits identification tasks to be completed outside of the traditional office setting. Product utilizes the firm's Workstation Express Labels mobile app, which includes a touch-screen interface for fast and easy label creation. It also includes smart-cell technology that communicates with the software, labels and ribbon materials – ultimately streamlining the label setup and creation processes.

➤ [www.heilind.com](http://www.heilind.com)

## DUAL WAVELENGTH INGAAS APD RECEIVER SUPPORTS EYE-SAFE LASER RANGE

CMC ELECTRONICS

264-339814 series Dual Wavelength InGaAs Avalanche Photodiode (APD) Preamplifier Module supports accurate and consistent eye-safe laser range finding and LiDAR designs under a variety of moisture and altitude conditions. Device facilitates accurate decision making due to the speed and precision of the information it provides in low signals or high, warm weather or cold and for distances near or far. Receiver combines high-density microcircuit with advanced overload recovery optoelectronics in a compact, ruggedized and hermetic TO-8 package.

Device facilitates accurate decision making due to the speed and precision of the information it provides in low signals or high, warm weather or cold and for distances near or far. Receiver combines high-density microcircuit with advanced overload recovery optoelectronics in a compact, ruggedized and hermetic TO-8 package.

➤ [www.cmcelectronics.ca](http://www.cmcelectronics.ca)



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➤ [www.masterbond.com/properties/biocompatible-adhesives](http://www.masterbond.com/properties/biocompatible-adhesives)

## MESH EVAL KIT SERVES BLUETOOTH SIG-COMPLIANT MESH

MOUSER ELECTRONICS



Cypress Semiconductor EZ-BT Mesh Evaluation kit is battery or USB-powered and allows designers to evaluate the Bluetooth SIG mesh networking functionality of the CYBT-213043-02 EZ-BT WICED module. Kit contains four evaluation boards that allow engineers to evaluate a mesh network with just one kit. Each board includes the fully certified CYBT-213043-02 EZ-BT module; thermistor, ambient light sensor, and PIR motion sensor; coin cell battery holder; micro-USB connector; and on-board programmer and USB-UART bridge. Module is based on an ultra-low-power and highly integrated CYW20819 dual-mode Bluetooth 5.0-qualified device.

➤ [www.mouser.com/cypress-cybt-213043-mesh-eval-kit](http://www.mouser.com/cypress-cybt-213043-mesh-eval-kit)

# PRODUCT SOURCE GUIDE

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TE Connectivity CII FCC-360 60-Amp contactor provides 2.5" x 2.1" footprint, packing high-performance and durability into a small case size. Device features a rugged double make contact design, reduces wear and tear for long life and the gasket seal allows it to stand up to tough military, aerospace and marine environments. Device provides significant



size, weight and performance advantages over current products on the market. It is built in a 3 SPST normally open contact configuration, with 2 SPDT auxiliary switches. It is rated at 60 Amps for both 28 VDC and 115 VAC 60Hz/400Hz switching.

www.ttiinc.com

## ULTRA-TIGHT STABILITY CLOCK OSCILLATOR DELIVERS ±5PPM STABILITY

WURTH



IQD IQXO-923 series of ultra-low frequency stability HCMOS based clock oscillators is available with a

frequency stability of only ±5ppm over the full industrial operating temperature range of -40 to 85°C. Available in either a voltage of 1.8V (IQXO-923-18) or 3.3V (IQXO-923-33) device is housed in an hermetically sealed 3.2 x 2.5mm ceramic package with a height of 1.1mm. Frequencies can be specified in the range 10MHz to 160MHz and provide a start-up time of 5ms. With a phase jitter (12kHz to 20MHz) of 0.4ps typical and a phase noise of -99dBc/Hz at 100Hz and -144dBc/Hz at 10kHz these oscillators are suitable for use in designs where a clock oscillator can be used in place of an expensive TCXO.

www.we-online.com



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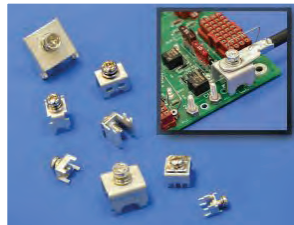
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# A Look Back

*Celebrating four decades of electronics design*



Marking its 40<sup>th</sup> anniversary this year, EP&T will feature this special column throughout 2019, providing readers with a peek at our past, while paying homage to our history.

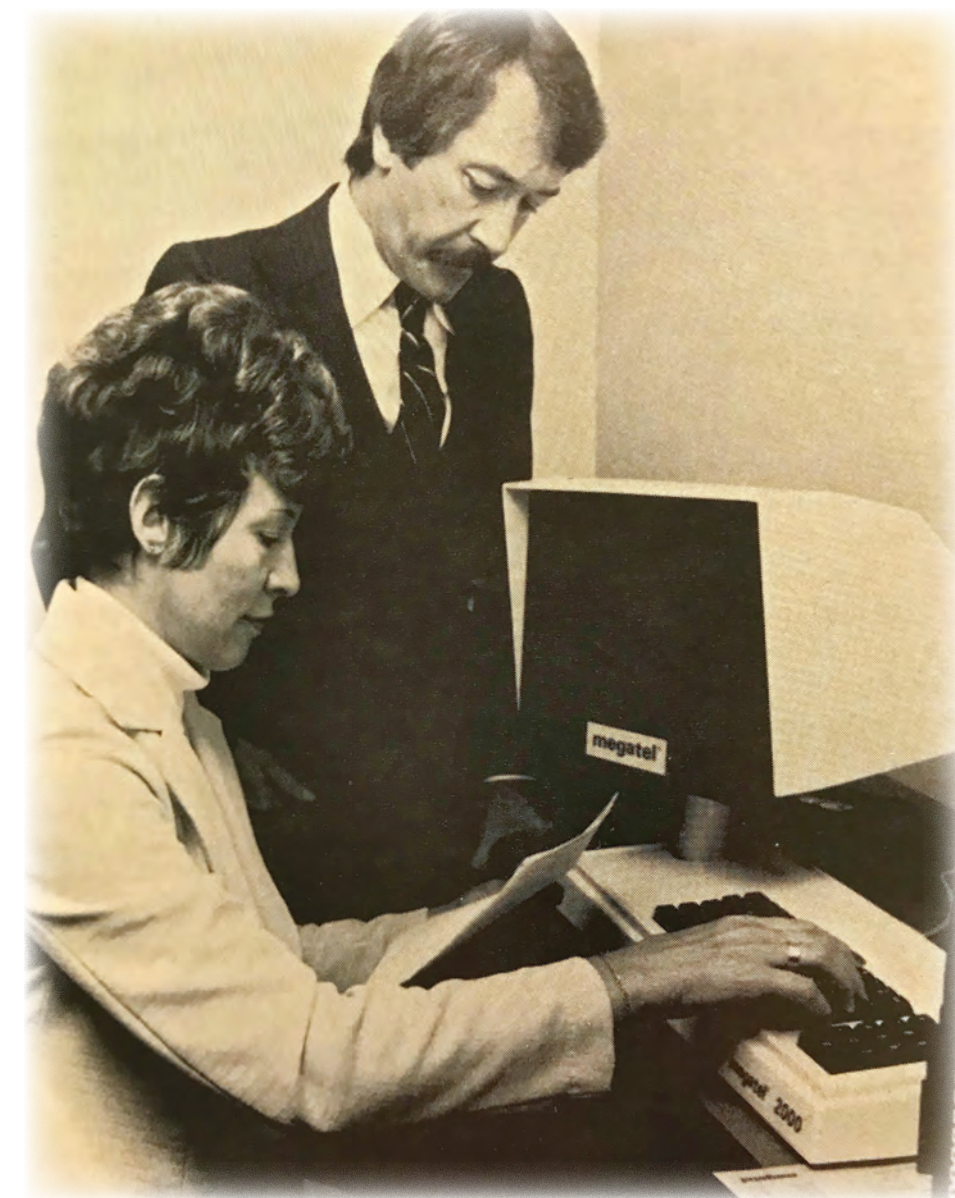
In this issue, A Look Back puts its focus on a Technology Report which appeared in EP&T's November issue in 1979. The article, titled: *Multiple-processor computer aims at first-time business users*, details a 'state-of-the-art' computing system produced by independent Canadian manufacturer, Megatel Computer Corp. Inc. of Toronto.

Called the Megatel 2000, the computing system was created to capture the burgeoning market for low cost, small business data processing equipment. The unit used multiple processors and was packaged on a single printed circuit board (pcb). The basic system consisted of a central processor with 64 kbytes of main memory, a dual floppy disc drive capable of storing 2 megabytes of data, a 9-inch visual display unit with keyboard and a system printer.

What made Megatel 2000 unique was the fact that it contained less than 70 individual components. This low component count helped increase reliability within the system's user base of small businesses. The central processor, CRT controller and disc controller were all contained on one pcb built into the keyboard unit.

"Our customer base are users who will accept the system as it is," stated Megatel president Geoff Treseder. "We find that most customers don't want changes to our system, which has been developed to be a flexible and comprehensive package suitable for handling just about all of the normal accounting and related functions found in small businesses today."

The system's CRT screen could display up to 128 characters by 28



**Megatel Computer Corp. of Toronto released the Megatel 2000 computing system in 1979, aimed at the small biz user.**

lines, and since a programmable 8x8-dot character generator is used, lower case letters and special graphical characters are available.

With a real-time clock and maskable priority interrupt system, the unit was capable of handling 'on-line' and batch applications. The Intel CPU handled all I/O operations using a group of LSI controllers. Several bipolar processors were used in the system in addition to the main one. A system control processor (SCP) resolves requests by the CRT controller and main processor for system resources. Internal microcoding has been designed to optimize throughput

between different components in the overall system.

Back in the day, distributors and dealers of the Megatel 2000 system could deliver software customizing changes if necessary, as Fortran, Cobol, Basic, Pascal and Assembler were supplied.

At the end of the article, the story stated that Megatel was working on two newer computing designs with upgraded capability. While not yet finalized in 1979, one of these new units would support up to 128 kbytes of main memory, feature multiple CRT screens and a 20-megabyte Winchester-technology disc drive. **EP&T**





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