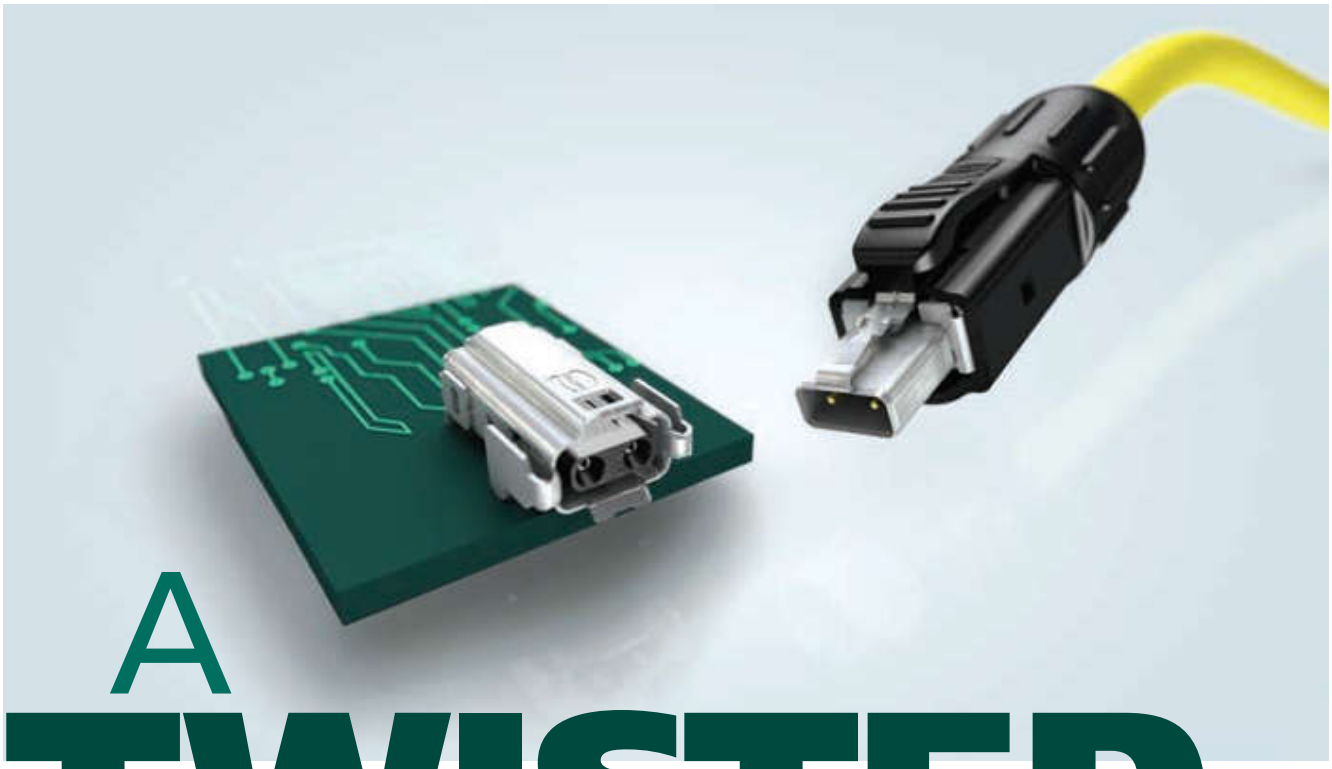

A TWISTED PAIR

Single Pair Ethernet cable promises to supercharge Industry 4.0

By Jon DeSouza

Single Pair Ethernet (SPE) is about to take off as a transformative technology for unlocking the full potential of the digital revolution in industry. Rather than the two or four pairs of twisted copper wires in conventional Ethernet, SPE uses just one pair to deliver high speed data – 100Mbit/s (100BASE-T1) and 1Gbit/s (1000BASE-T1) – over distances up to 15 or 40 meters respectively or 10Mbit/s (10BASE-T1) up to 1,000 metres. That single twisted pair also can deliver data and power (up to 50W) simultaneously. With such capabilities, a myriad of benefits await.

Foremost, SPE offers the fastest, simplest and cheapest solution to connect every small device on the shop floor to the cloud via Ethernet. The digital manufacturing environment will require hundreds, even thousands of these smart sensors, actuators, vision systems, switches and controls to collect data vital to functions like process monitoring and optimization, flexible manufacturing, real-time energy management, predictive maintenance and enhanced worker safety.

With only a single pair of wires, Single Pair Ethernet cabling is thinner and takes up much less space than cabling for conventional Ethernet or bus system. Connectors and sockets are similarly smaller. For example, the socket width for Harting's T1 Industrial (IP20) – the basis for the new global SPE interface standard – is 9.4mm (0.37in.), and the interface itself is 3.1mm x 6.1mm, ideal for connecting even the smallest IIoT devices.

With less copper, SPE cabling is also lighter and cheaper. In transportation modes, widespread usage of SPE cabling translates into less energy used in propulsion. In articulated robots, thinner cables provide more flexibility with regards to bending radius and the promise of a longer service life; the thinner the cable, the more it can withstand bending and torsion cycles.

On a network level, Single Pair Ethernet can end the inefficient interpolation of different transmission technologies within a plant. With its lower cost, greater speed, standardized content and plug & play capability, it has the potential to replace all fieldbus systems. Manufacturers of automation products wouldn't have to develop variants for multiple fieldbus protocols, just Ethernet.

In late-January, Harting's T1 Industrial interface was formally recognized by the IEC as the IEC 63171-6 standard for an SPE connector for industrial and outdoor environments ($M_3I_3C_3E_3$). MICE stands for Mechanical, Ingress, Climate and Electromagnetic – $M_3I_3C_3E_3$ is the classification for a worst case industrial envi-

ronment. This mating face is fully bracketed by global standards, including transmission and cabling. A separate IEC standard for a connector from CommScope for building environments [$M_1I_1C_1E_1$] has also been adopted.

This IEC connector standard has been incorporated into ISO/IEC cabling standards and endorsed by other international bodies such as TIA 42. Power transmission – Power over Data Line (PoDL) – has been standardized by IEEE 802.3bu-2016. PoDL establishes 10 power classes from 0.5W to 50W.

For the most part, Single Pair Ethernet won't replace conventional two and four pair Ethernet, which continues to produce even faster speeds – well into the Terabit range – and other performance enhancements. Rather, SPE's true calling is to serve where its comparatively modest speeds, smaller size, lighter weight and lower price point make it the practical choice for meeting new IIoT connectivity needs.

That, in turn, will cement the astounding growth of Ethernet in industry. As recently as 2014, fieldbus accounted for 71% of all new nodes installed globally, with 29% for Industrial Ethernet. By 2019, that had largely reversed, with 59% of new nodes being Ethernet and 31% fieldbus. (Wireless installations remain flat with a 4-6% annual share of new nodes.)

Though Harting has been playing a lead role in promoting SPE for the industrial space, Single Pair Ethernet is generic rather than proprietary technology and promises to offer plenty of competitive options in all product categories. It has the enthusiastic support of all major stakeholders in the industrial space: Cabling and patch cord companies, connector manufacturers, chipset makers and software developers, etc. Many are participating in partner groups, that include some of their competitors, to promote SPE development and implementation.

In conjunction with six other companies, Harting launched the Single Pair Ethernet – Industrial Partner Network. Other members include TE Connectivity, Hirose, Leoni, Murrelektronik, Würth Elektronik, Softing IT Networks, Igus, Dehn, Helukabel, Molex, Amphenol, Lütze, Escha, Perinet, EKF and Zheijang.

Others are taking different approaches to the same end, but further development by serious players is expected to occur entirely within the framework of globally recognized standards.

So, when and how does SPE reach the wider marketplace? With standards covering transmission, cabling and connectors now in place, device manufacturers are proceeding with the initial stages of developing components to which it can connect.

Harting introduced T1 Industrial with an IP20 model. IP65/67 versions in M8 and M12 formats which use snap-in technologies are planned for this year. M8 and M12 connectors using screw-in and push-pull locking will follow.

The innovation R&D groups at major suppliers are considering how to add it to their product portfolio. They need connectors to test designs, then build prototypes they can use to demonstrate their SPE products to end users. That's the major market for T1 Industrial connectors today.

When will Single Pair Ethernet see widespread usage in industrial automation? Perhaps 2-3 years, says Joachim Finke, head of global product management, network interface connectors, at Harting.

"Today, you need chipsets that are special to Single Pair Ethernet to proceed with development," says Finke. "There are prototypes of those chipsets, but as far as we know, the first serious production chipsets will be launched at the end of 2020. And then companies will be able to be more concrete with their R&D developments. It will still take a little bit of time, but I think in 2-3 years at the latest, we'll see products based on Single Pair Ethernet."

Early adopters include automotive, which promoted SPE to replace heavier, bulkier CAN bus harnesses. Agriculture – smart farming – industrial automation, and building automation are among other early adoption candidates. Large end users will begin testing it in parts of their operations. However, it will take a bit longer for a wide enough range of components to emerge for SPE to enter into general use in industry.

When it does, it will present system designers with possibilities for reorganizing data flows in an IIoT environment, including how devices and processes are controlled. The traditional automation pyramid, with its PLC-dominant control level and SCADA/DCS-defined operations level, may not be a pyramid at all in future iterations of IIoT architecture. There are no preconceived notions of what that future should look like. How you imagine it is entirely up to you. DE

www.harting.com

Jon DeSouza is President and CEO of Harting Americas