What Is the Difference Between Ethernet and Industrial Ethernet?

Industrial Ethernet systems must be more robust than office Ethernet.

Ethernet and, specifically, industrial Ethernet have recently become popular industry terms in the manufacturing world. While similar, they both offer different characteristics and benefits. This article will explore what Ethernet and industrial Ethernet are and how they differ.

What Is Ethernet?

Ethernet was first developed in the 1970s and was later standardized as IEEE 802.3. Ethernet is the group of local area network (LAN) products covered by IEEE 802.3—a group of Institute of Electrical and Electronics Engineers (IEEE) standards that define the physical layer and data link layer of a wired Ethernet media access control.[1] These standards also describe the rules for configuring an Ethernet network and how the elements of the network work with one another.[2]

Ethernet allows computers to connect over one network—without it, communication between devices in today's modern world would not be possible. Ethernet is the global standard for a system of wires and cables to conjoin multiple computers, devices, machines, etc., over an organization's single network so that all the computers can communicate with one another. Ethernet began as a single cable, making it possible for multiple devices to be connected on one network. Now, an Ethernet network can be expanded to new devices as needed. Ethernet is now the most popular and widely used network technology in the world.[3]

How Industrial Ethernet Works

Figure 1. This advanced technology is needed in industrial settings to ensure specific manufacturing data is correctly sent and received. If using an example of a bottle-filling plant, industrial Ethernet automation technology is able to send filling data over the network to ensure the bottles are being filled as intended.

When using Ethernet, streams of data are separated into shorter pieces, or frames—each containing specific information such as the source and destination of the data. Such data is necessary in order for the network to accept and send data as needed.

Other terminology of Ethernet technology includes:

▶ Medium: In modern Ethernet technology, a medium is a twisted pair or fiber optic cabling that Ethernet devices connect to provide a path for the data to travel on.

▶ Segment: A single shared medium.

▶ Node: Devices that attach to a segment.

Standard Ethernet is able to send data at speeds of 10 Mbps to 100 Mbps. Gigabit Ethernet is a term used under the IEEE 802.3 standard to describe Ethernet speeds that travel at a rate of 1 Gbps. Gigabit Ethernet was first typically used for backbone network transport and for high performance or high capacity servers. However, over time, desktop connections and PCs have been able to support it.

Other Info on Ethernet

Ethernet is not to be confused with Wi-Fi—Ethernet uses cables to connect computers and devices, *PC Magazine* explained.[4] Almost every reference to a network or LAN connection is Ethernet.

What Is Industrial Ethernet?

Industrial Ethernet is just as it sounds—Ethernet applied to an industrial setting, which often requires more rugged connectors, cables, and—most importantly—better determinism. In order to achieve better determinism, industrial Ethernet uses specialized protocols in conjunction with Ethernet. The more popular industrial Ethernet protocols are PROFINET®, EtherNet/IP®, EtherCAT®, SERCOS III, and POWERLINK®.

With industrial Ethernet, data transmission rates range from 10 Mbps to 1 Gbps.[5] However, 100 Mbps is the most popular speed used in industrial Ethernet applications.

Industrial Ethernet Conditions

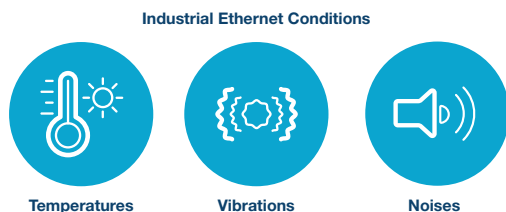Temperatures · Vibrations · Noises

Figure 2. Industrial Ethernet requires additional considerations not seen in Ethernet systems used in an office. Manufacturing equipment on plant floors is exposed to different temperatures, vibrations, and other potentially disturbing noises.

How It Works

Industrial Ethernet protocols like PROFINET and EtherCAT modify standard Ethernet in a way to ensure specific manufacturing data is not only correctly sent and received, but also sent and received on time when the data is needed to perform a specific operation. For example, a bottle filling plant using industrial Ethernet automation technology is able to send filling data over the network to ensure the bottles are being filled as intended. When a bottle is full, a stop filling command will be sent over the network, Real Time Automation reported.[6]

Such a message would not be as crucial in an office setting, the source said. If a webpage is lost, a user just hits the refresh button. In the factory, however, a little problem could turn into a disaster—the company can't take the time for someone to notice the error and manually press a button. The industrial Ethernet automation network, however, can sense an error in the bottling process and automatically stop a process, preventing wasted time, product, and money.

Other Differences Between Ethernet and Industrial Ethernet

Ethernet may be used in more offices than in industrial settings, Real Time Automation reported. Office Ethernet is designed for a base level of use, while industrial Ethernet can be considered for multiple levels and applied to more heavy duty environments.

Industrial Ethernet is better suited to handle factory noise, factory process needs, and harsher environments, and is even able to respond better to data collisions at the plant floor.

Cables and connectors may also differ in industrial Ethernet technology. For example, connectors used in an industrial setting will not be basic snap-in lock mechanisms, Real Time Automation reported. Due to the rougher environment, heavier lock mechanisms are needed. Sealed connectors are also often needed in heavy duty applications.

Cabling, too, can differ between commercial or office Ethernet and industrial Ethernet. Light duty industry cables may have a higher quality of jacketing than regular Ethernet cables. And, as expected, the jacket around the heavy duty cables and the metal used also increases in quality to make them more durable.

Determinism is an important factor when defining Industrial Ethernet and separating it from Ethernet. Standard Ethernet is not deterministic on its own,[7] but industrial environments require determinism. They need packets of data to be sent and received at specific times, and they need a guarantee that data will be delivered each and every time. This is because a loss of data or a delay of data between equipment in an industrial setting can end in disaster—like a major flaw in the production process, for instance. This real-time information transfer is often a major deciding factor for a company when it comes to choosing what type of Ethernet solution to deploy. Companies will need to assess their specific needs and determine what Ethernet solution is best for their organization.

References

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