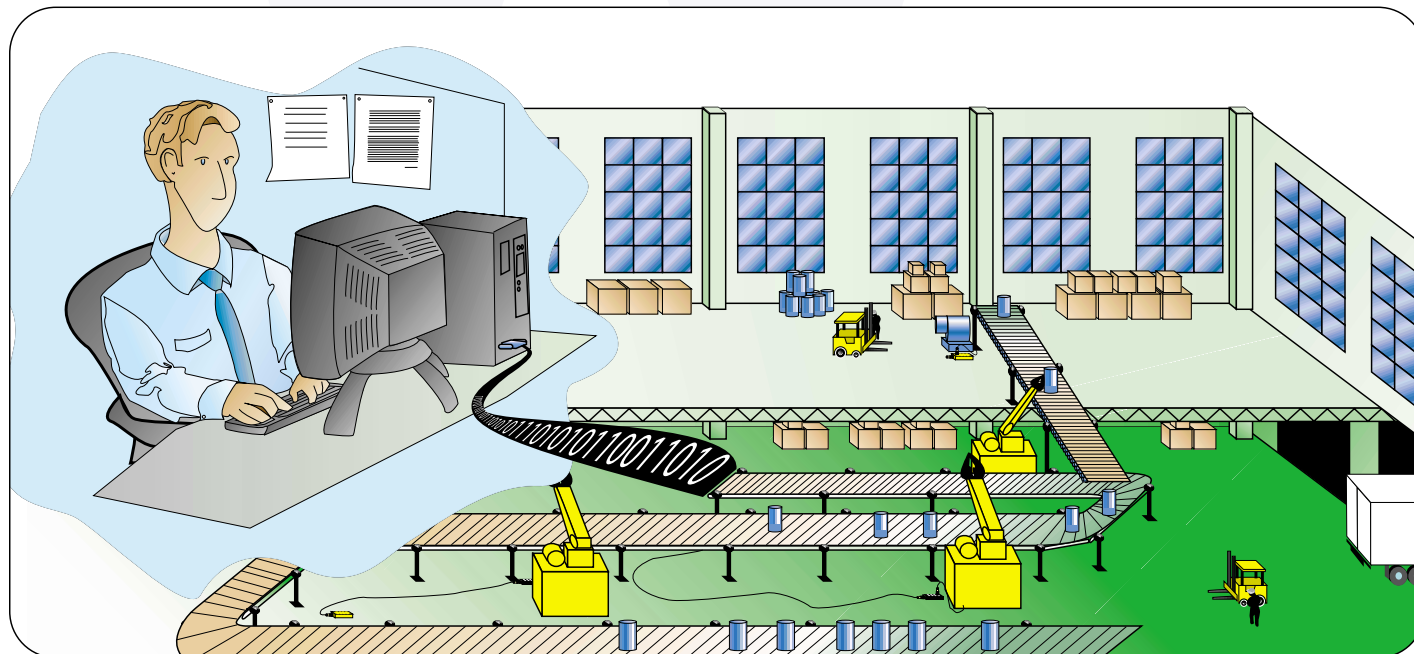


BENEFITS OF USING ETHERNET IN A MANUFACTURING OPERATION

- **Enhanced information flow between the manufacturing process and the enterprise computing system:** Numerous manufacturing entities have recently invested large amounts of money in installing Enterprise Resource Planning (ERP) software, and implementing Just in Time (JIT), cellular production systems. One key to realizing a return on these types of initiatives is extracting real time data from the factory floor. Having to traverse multiple networks to get this data to the point it can be utilized adds a great deal of complexity to the endeavor. Having a single network simplifies the process, and in the case of Ethernet, the ability to carry multiple application layers on the same wire enables both factory floor and front office computing devices to receive information without excessive amounts of data manipulation.
- **Ease of maintainability:** One obstacle that prevents customers from implementing networks in their plant is the issue of who's responsible for its operation. For current open industrial networks, the common solution is to designate a specific controls/maintenance engineer to be specially trained to provide support. By standardizing on Ethernet, the number of support options greatly increase, and in many cases the Ethernet experts already in your IT department can be utilized.
- **Ability to web enable machinery:** Once the plant floor equipment and controls are wired together via Ethernet, it is a simple next step to collect information and provide a Human Machine Interface (HMI) via intranet/Internet, often by utilizing standard browser technology. Individual machines can also be designed to serve up web pages that can provide key diagnostic information, potentially preventing having to send service personnel to a remote site.
- **Leverage commercial technology:** With the myriad of resources devoted on the commercial side, Ethernet technology and products evolve at a highly dynamic pace. The vast market volumes can often lead to lower hardware costs, particularly in the area of Network Interface Cards (NIC).



3 COMMON OBSTACLES TO USING ETHERNET ON THE FACTORY FLOOR WHICH CAN NOW BE OVERCOME:

Determinism

Ethernet networks regulate how devices gain access to the channel for message transmission through a concept known as Carrier Sense Multiple Access Collision Detect (CSMA/CD). All devices listen to the network, and may try to send a message if they do not sense any other traffic on the channel. However, if more than one device tries to access the channel at the same time, a collision occurs. All of the devices backoff and will try again a random amount of time later. This is different than many other industrial networks which use arbitration schemes so critical messages receive priority in reaching their destination. CSMA/CD makes Ethernet inherently non-deterministic because it can't be known exactly how many times a collision may occur. While this may seem to preclude the use of Ethernet to deliver control-related information, there are two factors that need to be looked at:

Throughput: The network user needs to understand if what they really need is determinism (the ability to calculate a repeatable amount of time in which the message will be delivered) or throughput (having the message reliably delivered within a certain time frame, even if that time is variable within that range). The wire speeds of Ethernet are often orders of magnitude faster than other industrial networks, meaning that even with multiple collisions there is an extremely high likelihood that Ethernet will provide much quicker delivery of control related messages.

Switching technology: When devices are connected to a repeater hub, those devices are all part of a collision domain, vying for channel access. Using a switching hub eliminates collisions by creating dedicated bandwidth between the device and the switch. While there is still a latency variable for the switch to forward the message, using only switches for network design can satisfy a large amount of applications that do require determinism.

RJ-Lnxx Industrial Ethernet
DIN Rail-mounted Switch**Lack of an open application layer**

Ethernet, even when combined with TCP/IP, still does not provide the complete specification for network transmission, as it does not call out an application layer (analogous to the language the network speaks). Unlike in an office where a handful of application layers (FTP, SMTP) are supported by most computing devices, most vendors of factory automation equipment have implemented their own application layer, precluding interoperability. Recently standards for open application layers have evolved, including Modbus TCP, and Ethernet/IP, which utilizes the application layer from DeviceNet. As vendors begin to adopt these open applications layers for use in their devices, the issue of multi-vendor interoperability will rapidly decrease.

Inability of the physical media to withstand the factory environment

Ethernet cabling and connectors were designed with an office environment in mind, and aren't intended to withstand the conditions commonly found on a factory floor or in harsh commercial applications. The RJ-Lnxx line of Industrial Ethernet Connectivity products overcomes this obstacle by combining standard RJ-45 connection technology with the industrially proven mini form factor. The result is a lineup of products designed to preserve the integrity of your data transmission even in the harshest settings. Specific benefits include:

- **Sealing against environmental contaminants:** The RJ-Lnxx® Industrial Ethernet Connector provides protection from ingress of typical factory hazards such as water, oil, dirt and dust, which would corrupt a standard RJ-45 connection.
- **Protection against the effects of vibration:** While commercial RJ-45 connectors can expect a long life when mounted in a communications closet, they are not designed to withstand any level of vibration. The overmolding process and addition of the mini connector on the RJ-Lnxx cordset isolates the gold contacts from the effects of vibration, significantly increasing the life of the product.
- **Provides a secure robust connection:** In the industrial world it is not uncommon for maintenance personnel and operators to come in contact with the cabling system. The threaded mini connector with integrated strain relief makes it nearly impossible for the connection to be broken when force is applied to the cable.
- **Performs in electrically noisy conditions:** Motors, drives, transmitters are all elements found on the factory floor, and all generate EMI (Electro-Magnetic Interference). The RJ-Lnxx Industrial Ethernet shielded cordset and receptacle enhances data integrity in this environment while the PUR jacketed cable protects against oxidation

