**Using DeviceNet™ and Ethernet in industrial environments**

DeviceNet and EtherNet/IP® are protocols used in industrial environments to control and transfer data. While both of these protocols serve similar functions on the plant floor, their strengths are in the separate features inherent to each protocol. These features allow DeviceNet and EtherNet/IP to be implemented where they are best suited.

**DeviceNet**

DeviceNet is a low-cost communications protocol that connects and networks industrial devices such as limit switches, photoelectric sensors, valve manifolds, motor starters, process sensors, bar code readers, variable frequency drives, panel displays and operator interfaces, among other things. DeviceNet is based on Controller Area Network (CAN) broadcast-oriented communication architecture. CAN uses a bus arbitration method, CSMA/BA, that assures the highest priority message always has access to the bus in the event of a data collision. DeviceNet further defines message priorities such that I/O messages are given top priority and configuration messages have lower priority. It operates on a client/server basis and allows peer-to-peer data exchange (where a DeviceNet node can initiate communication with other nodes or peers), and a master/slave operation in which the master node initiates all communication and all other nodes, or ‘slaves’, respond to the master node’s requests.

The DeviceNet network eliminates point-to-point wiring by allowing direct connection to control devices. The direct connection provides improved communication between devices, as well as important device-level diagnostics not easily accessible or available through point-to-point I/O interfaces. DeviceNet is dedicated to the network and connected to PLCs by a single network cable. The stations obtain and transmit messages to the network via these PLCs and are typically programmed via PCs. DeviceNet stations are designed to transfer data from industrial devices to the controllers, but also serve to perform different control functions, such as PID loops, start/stop motors, turn indicators ON and OFF, and position valves, among other things.
Devices connected to DeviceNet stations can also be hot swapped – removed and replaced without affecting other operations connected to the station.

A DeviceNet network supports up to 64 nodes and virtually an unlimited amount of I/O. The bus uses a trunkline-dropline topology, where bus power and communication are supplied on a single cable. Bus power is 24 VDC and supplies current to operate the nodes and (typically) power input devices. Some DeviceNet stations require an additional 24 VDC auxiliary power to supply current for outputs.

DeviceNet is a flexible network with the capability of bridging other networks such as PROFIBUS®, As-interface®, RS485, etc. Further, multiple manufacturers’ products are compatible with DeviceNet, thereby allowing stations to be added to existing operations with the ability to connect to virtually any device.

**Ethernet**

EtherNet/IP is relatively a newcomer to the industrial arena. Since inception, Ethernet’s primary purpose is to convey large amounts of information. This relegated Ethernet to office level networks where multiple clients use this network to share information.

Ethernet specifications were developed by the IEEE (Institute for Electrical and Electronic Engineers), which regulates and further defines Ethernet technology. Ethernet has been taken to the plant floor with the advent of EtherNet/IP. In EtherNet/IP networks, exchange of data is based on the producer/consumer model where a transmitting device produces data on the network and many receiving devices simultaneously consume this data. Traffic generated during data exchange can include input/output data and status produced by a remote device for consumption by one or more programmable controllers.
EtherNet/IP can control and collect data through an unacknowledged method of sending data between devices on a network, therefore delivery of this data is not guaranteed. A higher layer must be implemented to transfer this data, and the way in which this is done determines the effectiveness of data collection, configuration and control.

Further, Transmission Control Protocol/Internet Protocol (TCP/IP) provides a set of services so devices may communicate over an Ethernet network. TCP/IP usage has grown with the use of the internet and intranets for internal information distribution. TCP/IP has been transported to every major computer platform in the world, including Windows NT™, Windows 2000™, and Windows XP™ operating systems.

Today, a typical installation of an Ethernet TCP/IP network may extend plant-wide and be connected to a corporation’s worldwide network via the internet. It is generally used to perform program maintenance, transfer data, retrieve web pages, perform supervisory control, provide connectivity for operator interfaces, and log events and alarms. Applications where this has been successful take advantage of Ethernet’s high capacity, but do not require a high level of determinism or repeatability for message response time.

**Like Apples & Oranges**

A typical automation configuration involves applications required to perform multiple functions. A single network will not necessarily provide the capabilities needed in operation, i.e. not be able to transfer data outside of immediate network. Further, network protocols like DeviceNet and Ethernet have differing, yet complementary, benefits to the operation and consequently the end user. It is important to note that all network protocols must work with all programs/functions on the network.

A benefit users of EtherNet/IP will generally experience is maximizing Ethernet infrastructures by capitalizing on the vast availability and knowledge of Ethernet in the market. Further, a wide variety of Ethernet components are available from multiple vendors. Another benefit
implementing EtherNet/IP provides is to standardize the control portion of the Ethernet infrastructure.

EtherNet/IP and DeviceNet protocols offer users separate functions and subsequent benefits. One protocol need not be chosen over the other for use in industrial environments. Ethernet is great for data collection, transmission and monitoring, and can provide information technology personnel the information they need. Contrary, DeviceNet is best suited for collecting and managing the I/O data the machine and process control systems need. Most advanced automation architectures need both data and control networks to run well.