

## MAKING THE CONNECTION: ETHERNET-APL HELPS PETROCHEMICAL PLANTS ACHIEVE MORE WITH SMART DEVICE DATA



**Ethernet-APL solves many of the problems of connecting field devices, controllers and automation systems in harsh industrial environments. ABB's David Bowers, Product Manager – Process & DP Flow, explains how this open physical layer standard extends the benefits of Ethernet connectivity all the way to the field, allowing petrochemical plant operators to optimize process efficiency and realize fresh value from the torrent of instrumentation data generated by today's smart devices.**

Billions of Ethernet cables link PCs, servers, routers, printers, Wi-Fi hubs, cameras, smart TVs and other connected appliances in data centres, factories, commercial buildings and homes around the world. Standardized over 40 years ago, this ubiquitous family of wired networking standards has progressively displaced legacy technologies in a huge range of commercial and industrial settings.

Ethernet is no stranger to the process industries. It's commonly used as the physical layer to carry instrumentation data between devices and controllers, sitting beneath other higher-level protocols like PROFINET and Modbus TCP. But despite its near-universal popularity, it has been conspicuously absent from hazardous environments like petrochemical plants. Originally conceived for use in computing labs and offices, Ethernet was never designed to carry signals to and from field devices in potentially flammable and explosive atmospheres where there's a very real risk of electrical sparking. Nor was it specified to connect sensors, actuators and other devices with their controllers over long cable runs of several hundred metres in a refinery or processing plant.

### The challenges of digitalization

Like other sectors, the petrochemical industry faces the pressing challenges of optimizing production efficiency, reliability and sustainability while reducing complexity and costs. Process plants are steadily digitalizing their operations with the introduction of smarter instrumentation to measure and control process parameters including flow, temperature, pressure and fluid levels. This new wave of smart field devices generates large amounts of real-time information that can be harnessed by plant operators to inform asset optimization and preventative maintenance strategies. It's a trend that demands

fresh approaches to the efficient management of steadily increasing volumes of data generated and consumed in the field. From the perspective of petrochemical plant owners, key obstacles are the complexity and cost of assimilating different communication protocols and underlying physical layers, many of which are vendor-specific and incompatible with other solutions.

Reflecting these challenges, there have been increasing calls over the last decade for a uniform, highly reliable and intrinsically safe communication technology for process automation that can accommodate today's requirements whilst also supporting future applications. In parallel with these evolving requirements, plant owners are increasingly reluctant to be locked into vendors' proprietary solutions. Hence there is growing demand for cost-effective, future-proof solutions built around robust open industry standards that allow automation users to benefit from 'best of breed' solutions that can scale smoothly with their evolving business needs.

Unlocking the true value of this data deluge can mean grappling with numerous communication protocols and control standards as well as the physical networking infrastructure that underlies them. The complexity of managing all these technologies means that much of the data collected at field sensor level is often inaccessible for use by other enterprise systems, thus preventing process plants from realizing its true value.

### Opening new paths for data

In recent years, ABB has been actively involved in efforts to broaden the applicability of Ethernet across a wider spectrum of industrial applications, notably connecting field devices to their controllers in hazardous environments typically encountered in the process industries. The result of this initiative is Ethernet-APL (Advanced Physical Layer), a variant of the ubiquitous Ethernet set of standards that features a number of enhancements to extend reliable high-speed connectivity all the way to field devices.

Ethernet-APL extends the familiar benefits and cost efficiencies of high-speed Ethernet communications to the field, leveraging open IEC and IEEE standards. In addition to simplifying direct connections with enterprise-level systems, it streamlines the installation, configuration, and maintenance of instrumentation and automation technology, delivering significant cost savings and enabling plant owners to unlock new value from their existing investments.

Ethernet-APL accommodates full duplex (bidirectional) data transmission speeds of up to 10 Mbps, orders of magnitude faster than legacy HART and digital serial Fieldbus technologies. This makes it ideal for carrying process, configuration and diagnostic data between automation systems and the latest generation of smart field devices. Data as well as power for devices are carried over a single twisted pair cable, reducing costs and simplifying migration from slower, older Fieldbus infrastructures to Ethernet-APL in existing installations.





Reflecting its intended use in hazardous environments typical to petrochemical production, an Ethernet-APL has been developed with the consideration of intrinsic safety as a key requirement. A range of defined power classes includes a port profile that limits maximum supply voltage and current. This prevents levels of electrical energy capable of causing sparking from reaching the physical connector in flammable or explosive atmospheres.

A further barrier to wider adoption of regular Ethernet in field-level applications has been a maximum point-to-point cabling length rated at 100 meters. Beyond this distance, progressive degradation in data transmission speed and reliability makes the standard unsuited to large process plants. Ethernet-APL, by comparison, stretches point-to-point connection distances by an order of magnitude. It also accommodates trunk and spur network topologies that are commonly encountered in the process industries, with a maximum trunk length of up to 1,000 meters carrying signals and high power. Meanwhile shorter spurs can carry lower power with optional intrinsic safety for lengths up to 200 meters.

Further must-haves in the specification include flexible installation options to suit the needs of modern plant operations. Devices are typically connected through a point-to-point link with the Ethernet-APL switch that can be part of a network ring of many devices. This provides media redundancy when increased availability is important.

Reinforcing its appeal in a wide range of process control and automation environments, Ethernet-APL naturally plays nicely

with various industrial communication protocols. PROFINET, Open Platform Communication Unified Architecture (OPC UA), Ethernet/IP and ModbusTCP are all supported. What's more, migrating to Ethernet-APL from conventional Fieldbus or analogue 4-20 mA HART solutions eliminates the need for gateways or other protocol conversions. From a plant operator's perspective this realizes the benefits of reduced system complexity as well as lower ownership costs.

The ease with which Ethernet-APL allows different field instrumentation technologies and communication protocols to be combined is highlighted when it's teamed with Field Device Integration (FDI) technologies. Offering native support for PROFIBUS, PROFINET, WirelessHART, FOUNDATION Fieldbus and other communication protocols, FDI standardizes the software tools needed to integrate FDI-compliant devices with an FDI-enabled DCS or other host system.

This flexibility offered by Ethernet-APL and FDI also opens the door to streamlined configuration and commissioning of large fleets of field devices. Fieldbus device management tools such as ABB Ability™ Field Information Manager (FIM) support new and legacy communication protocols alike, with the capability to integrate Ethernet-APL devices via either FDI packages or the current PA Profile 4.02 device package also allows Ethernet-APL field switches to be integrated, facilitating both configuration and diagnostic checking using the same workflow and tooling. Furthermore, FIM offers an OPC UA interface that opens up integration with higher-level asset management, performance management and diagnostic applications.

### Realizing the benefits of Ethernet APL

The first field devices incorporating Ethernet-APL connectivity are already coming to market, offering petrochemical plant operators the benefits of simplified connectivity together with high-speed collection and analysis of process and diagnostic data. ABB's latest-generation VortexMaster and SwirlMaster flowmeters, for example, bring robust, reliable cost-effective industrial Ethernet communications to extremely precise liquid, gas, and steam flow measurement.

The full benefits of Ethernet-APL connectivity can be realized with tools like ABB's SmartMaster Asset Performance Management platform. Powerful but easy-to-use, SmartMaster enables rapid troubleshooting, remote diagnostics, non-invasive process analytics, and more by combining operational data, engineering data, and IT services.

As the scale and complexity of industrial process operations increase, petrochemical plant operators are seeking new opportunities to optimize production efficiency through better visibility, control and management of their instrumentation assets.

Addressing many of the practical obstacles that have limited the utility of Ethernet communications in challenging industrial environments, the recently ratified Ethernet-APL physical layer standard simplifies the collection and exchange of high-speed digital data from the latest generation of connected field devices. Building on the foundations of the world's most widely used wired networking technology, Ethernet-APL supports plant owners' progressive digitalization strategies by simplifying the combination of different field instrumentation technologies and communication protocols – especially when it's teamed with Field Device Integration (FDI) technologies.

### Transforming possibilities – both today and tomorrow

By breaking down the barriers that have historically limited Ethernet's reach in hazardous and complex industrial environments, Ethernet-APL opens exciting possibilities for real-time data utilization and smarter process management in petrochemical applications. With its open standards, seamless compatibility with existing and emerging communication protocols, Ethernet-APL not only addresses today's challenges but also paves the way for future innovations.

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