TURCK

Your Global Automation Partner

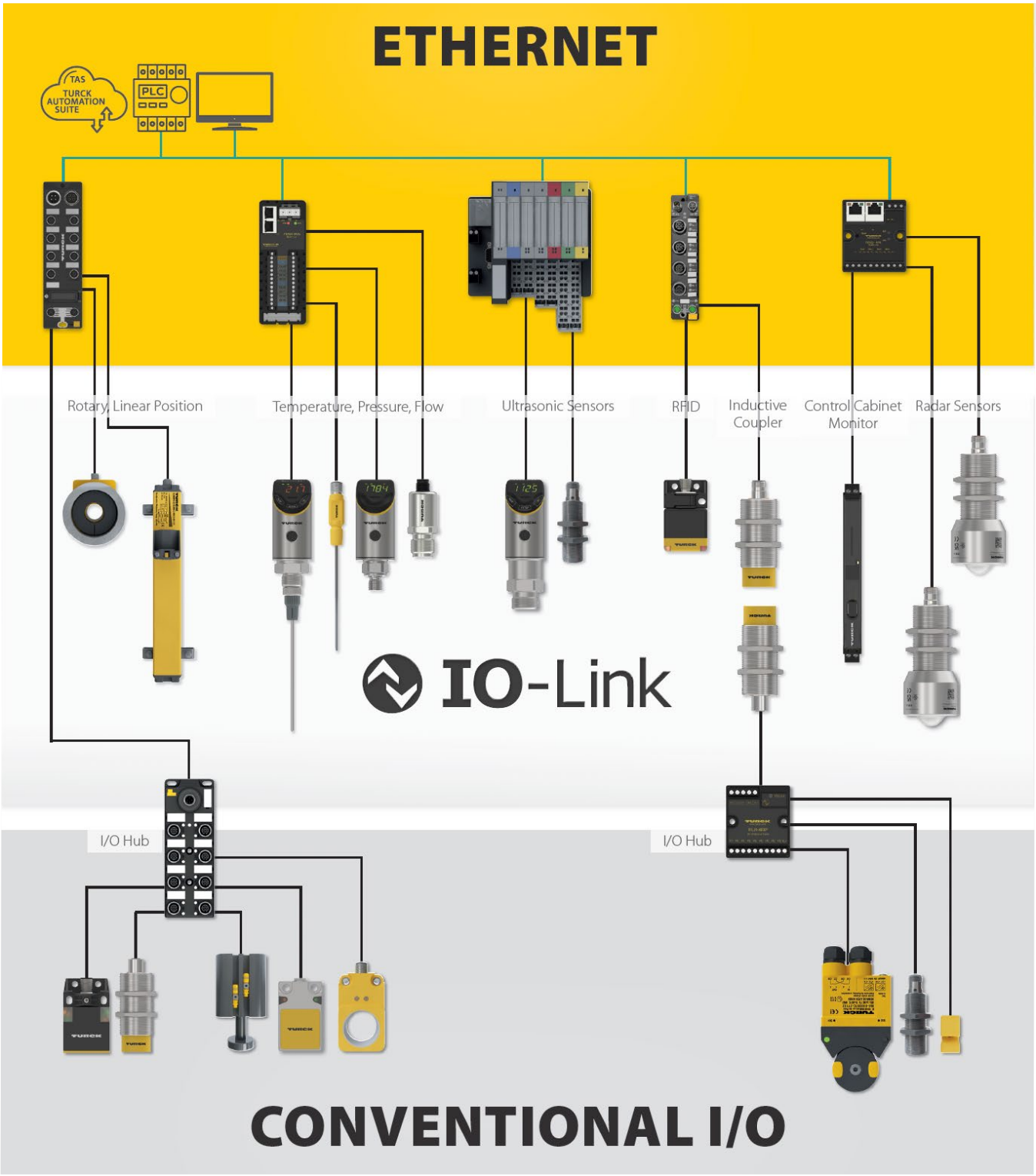
IO-Link Technology

Learn the capabilities, limitations and benefits

Whitepaper

IO-LINK OVERVIEW

IO-Link is based on a point-to-point connection between the sensor/actuator and an interface module. Turck provides one of the most comprehensive IO-Link portfolios worldwide, from a variety of sensors, cables and active IO-Link junction boxes to interfaces for various industrial fieldbus protocols, including Turck Multiprotocol Ethernet products.



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From parameter storage to detailed diagnostics, IO-Link's advanced features and functionality have generated plenty of excitement.

However, this intensive focus has created the common misconception that advanced capabilities are the only reasons to implement this technology.

The primary goal of IO-Link is to improve sensor or field-level device communication capabilities through a standardized interface. This goal is not only relevant for complex installations or operations. It is also useful for simpler applications found in many automated systems.

Engineers often implement IO-Link to improve essential functions such as data processing. They can also achieve higher I/O density, standardize interface technology and improve capabilities compared to traditional I/O systems.

While it is now possible to implement this technology in most modern automated control systems, not every application is an ideal fit.

By understanding IO-Link – both its capabilities and its limitations – automation systems engineers can decide if it is a worthwhile investment for their company.

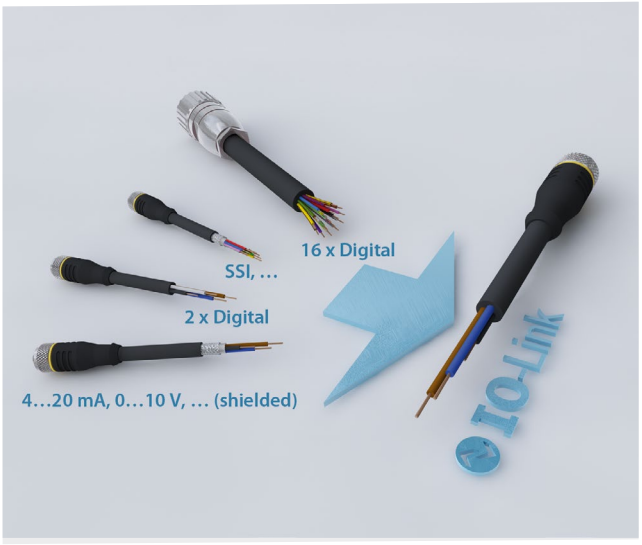
IO-LINK OVERVIEW: HOW IT WORKS AND THE BENEFITS IT DELIVERS

IO-Link is a point-to-point communication protocol between a field device like a sensor, actuator or I/O hub, and an IO-Link master. The data is generally transmitted from the
IO-Link master device via a higher-level fieldbus communication protocol (whether industrial Ethernet or a serial-based fieldbus) to a PLC or industrial computer.

IO-Link is manufacturer and fieldbus independent, allowing it to be implemented across a large variety of higher-level fieldbus protocols and product platforms. This delivers a big benefit to engineers because they can standardize on a single sensor interface, creating uniform integration across many field-level devices. IO-Link becomes the unified tool for configuring complex sensor devices and/or simply communicating data back to the PLC.

IO-Link can also help to reduce costs of specialty cabling and connectors because process data is transmitted digitally.

In analog systems, connectivity components must be robust to eliminate interference. IO-Link is standardized to utilize inexpensive 3-conductor, unshielded M12 cables.



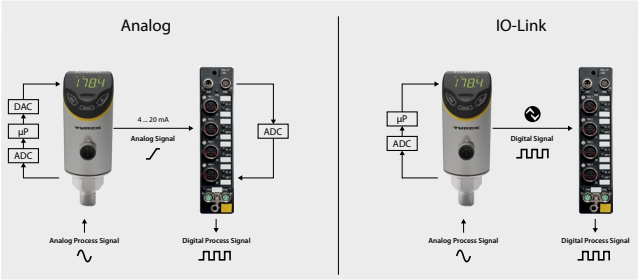
This eases integration into the larger system, as one type of cordset can replace varied analog and proprietary cables. The cost benefit continues to grow with the complexity of a system, especially in high-density I/O situations.

Another fundamental advantage of IO-Link is simplified commissioning and replacement of complex I/O devices.

The configuration and parameter data of IO-Link devices can be viewed, changed and stored via simple-to-use software configuration tools or directly through the PLC. This reduces labor-intensive manual configuration and ensures that the correct parameters are programmed to devices every time. Using the parameter storage function of the IO-link master further simplifies configuration of new devices during a changeout. It automatically pushes the stored parameter data to the newly connected device.

Engineers also turn to IO-Link to improve data quality.

As a universal digital communication interface, IO-Link represents what would traditionally be transferred as analog or discrete data. In analog systems, data collected at the sensor level must go through multiple analog-to-digital conversions before reaching the PLC. IO-Link reduces the number of conversions required to one at the sensor itself, thereby limiting accuracy losses.



UNDERSTANDING THE ADVANCED FUNCTIONS OF IO-LINK

Advanced functions of IO-Link include parameter storage, device verification, advanced sensor diagnostics, acyclic read/write parameter access and application-specific tags.

These functions can give organizations unique capabilities and added insights into the status and health of their field devices. It can also take additional time and programming effort to access these benefits. It is important to ensure your company is able to support the inherent complexity of these functions before implementation.

- Parameter storage: IO-Link stores parameters. When a replacement device connects to the system, IO-Link automatically uploads the correct parameters for easy installation and programming.

- Device verification: When a device is replaced, IO-Link is able to verify that the replacement is the correct product. This is helpful when sensors or hubs are physically similar, but have different capabilities. Verification can include device type, manufacturer or even a serial number.

- Advanced sensor diagnostics: IO-Link allows engineers to read additional information regarding the history and health of a sensor in an application. With a non-contact rotary sensor, for example, data can go beyond position readings by also detecting a weakened signal so that preventative maintenance can be scheduled.

- Acyclic read/write parameter access: Because IO-Link is a digital communication interface, it offers the ability to read and write parameters from the upper-level fieldbus devices, such as the PLC. This gives full control of the IO-Link device to the fieldbus controller.

- Application-specific tags: IO-Link gives users the ability to read and write a string value to a defined "application-specific tag" object within an IO-Link device. This improves identification of devices within a system. This is useful, for example, in the case of a tool-changing application to allow identification and verification of correct tooling.

WHEN IO-LINK IS – OR ISN'T- RIGHT FOR YOUR APPLICATION

IO-Link applies to a broad range of applications in the automation industry, and beneftis exist for even the simplest of implementations. These benefits increase with the complexity of the overall automation system and number of installed IO-Link nodes.

The sheer number of IO-Link use cases make it impossible to come up with a one-approach-fits-all solution, but the five application challenges below will help in identifying how IO-Link might benefit you.

Challenge 1: Your I/O needs are changing, but PLC upgrade options can be inflexible or limited in I/O density.

Why IO-Link works: I/O points can be expensive when it means upgrading or purchasing a PLC. By implementing IO-Link master fieldbus nodes, IO-Link-capable sensors, actuators or hubs can be combined as needed to create high-density or mixed I/O systems without needing to change the PLC's capabilities.

Because IO-Link is a point-to-point protocol, each IO-Link master port can connect to a single sensor or IO-Link hub. By combining a variety of IO-Link field devices as needed, companies can gather the required data from end devices throughout the plant. The data is then transferred via a fieldbus network from the IO-Link master to the PLC.

Challenge 2: Analog system updates are too expensive, but you need to update your system.

Why IO-Link works: Many engineers and system designers use IO-Link as an interface to replace legacy analog sensor technology. IO-Link effectively creates a universal signal from what would traditionally be analog, serial or discrete systems. This gives companies more flexibility and cost savings by installing IO-Link sensors and masters. Powerful microprocessor technology allows for 16-bit digital accuracy via IO-Link, offering greater precision compared to 8- to 16-bit accuracy of traditional analog devices.

In addition to improved signal quality, IO-Link also offers the ability to simultaneously transmit status and diagnostic information without sacrificing data accuracy. This seamlessly extends diagnostics down to the field-device level, which is not possible using standard analog signals.

Challenge 3: System costs are rising because of complicated device integration.

Why IO-Link works: IO-Link products simplify integration by consolidating sensor signal types, cables and programming. Traditional analog sensors may have different pinouts and require different cabling. IO-Link sensors require only standard 3-conductor, unshielded M12 cables.

IO-Link can also greatly limit wiring complexity in an application, as one user found when upgrading components for a turntable application.

As a product rotates to multiple stations, a sensor

at each station verifies the previous action was performed. To update the application, the user deployed IO-Link sensors with inductive coupling, connected to an I/O block. Now, 16 digital sensor signals can be sent to the PLC using only a single signal wire for communication.

Challenge 4: Technology needs are increasing, but the footprint of your operation is not.

Why IO-Link works: IO-Link is an advanced technology that can unlock data in applications without additional components. Sensors with IO-Link generally look physically the same as those without, thanks to microprocessor capabilities within the sensors. This means that replacing devices requires no additional space.

IO-Link master devices are available in two different formats, providing options and flexibility regardless of the physical requirements of an installation. Some are block I/O systems, generally with four or eight master ports. Others are modular I/O systems, which allow a significant number of IO-Link master ports to be built up in a single remote I/O node.

Challenge 5: IO-Link sounds great but you're not quite ready to fully adopt this new technology.

Why IO-Link works: Futureproofing is a key benefit of IO-Link. Many IO-Link devices can operate as standard switching or analog devices when connected to standard I/O fieldbus devices.

The advantage of IO-Link devices is that the configuration is greatly simplified using software tools to read, write and store sensor configurations. This can ease the transition from standard I/O devices to IO-Link by spreading out the learning curve. Furthermore, these devices can be switched seamlessly to use IO-Link by simply connecting them to an IO-Link master fieldbus node down the road.

Engineers who replace simple sensors and masters with IO-Link products over time ensure current operations carry on as usual while readying for the IO-Link switch in the future.

WHEN IO-LINK MAY NOT BE RIGHT FOR YOUR ORGANIZATION

While IO-Link offers numerous benefits for many industrial applications, there are situations where existing solutions fit better.

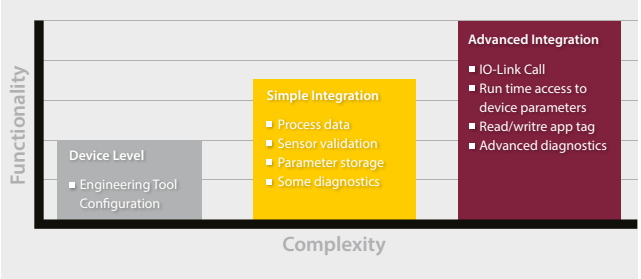
For example, simple standalone applications might not greatly benefit from the features of IO-Link. If your current solution is delivering the data and operational capabilities you need, you likely will not see a large benefit from switching to IO-Link. Applications that require specialty sensors are another example, as IO-Link has not expanded to all sensors yet. Your current solution may be a better choice if you are getting the data you need.

Two other limitations for IO-Link are the update time and size of the process data. With update speeds of 2.3 ms or greater, IO-Link is typically not fast enough for high-speed or motion-control applications. The technology also cannot process large amounts of data because the available input and output process data is limited to 32 bytes. Data volume of RFID applications often exceeds the capabilities of IO-Link without multiple read/write operations and buffering, for example.

Implementing advanced IO-Link functions at the fieldbus and PLC level increase the complexity of the system and programming time. Labor and component costs may outweigh the benefits for

this level of implementation if expensive system updates are needed for small gains in functionality or data.

Companies should examine hardware costs, device replacement costs and the installation process when evaluating the switch to IO-Link.



THE FUTURE OF IO-LINK

IO-Link is a proven technology for extracting more information from low-level devices across a range of manufacturing environments. By digitally communicating data from sensors back to the PLC, this technology helps many organizations save on cabling costs and integration time, and expand the amount of I/O available.

As the number of installed IO-Link devices has stretched into the millions over the past decade, new updates seek to unlock even more capabilities.

One of the biggest updates for IO-Link came in 2017, when the IO-Link Community released its specification for IO-Link Safety. Until this specification, there was no standard for implementing safety over IO-Link.

The new standard has opened the door to the future of IO-Link for industrial applications. New safety I/O devices will be introduced that communicate safety signals directly over IO-Link. These devices will extend the advantages of IO-Link into functional safety systems by facilitating high-density safety I/O hubs, simplifying wiring, and seamlessly implementing more complex safety sensors.

IO-Link also continues to be an important enabler technology for the Industrial Internet of Things, or IIoT. As companies look to connect all areas of the plant for real-time data, insights and analytics, IO-Link can reliably communicate exactly what is happening at the device level. By implementing this capability now, companies can prepare themselves for IIoT.

To discuss how IO-Link can help your company improve data communication, contact us at (800) 554-7769 or app.support@turck.com.

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