Turck supports its customers on the way to Industry 4.0 with an extensive IO-Link portfolio

Planning with Foresight

IO-Link overall concepts enable users to save costs already today – and use tomorrow intelligent sensor data for Industry 4.0

IO-Link has rapidly penetrated the market over the past years. Whilst the number of IO-Link nodes was 2.19 million in 2014, it had already increased to 5.3 million by 2016. Exponential growth is also expected for the coming years. As a digital communication standard, IO-Link is designed as the integral component for the last meter of the smart factory. However, this is precisely the problem. Many users associate the technology exclusively with future applications that they have not yet defined. Sometimes they even assume that the transition would also require basic proximity switches to be replaced with expensive variants. However the opposite is the case. Furthermore, not every switch in an IO-Link system has to have an IO-Link interface. In several applications, IO-Link firstly reduces costs. The customer therefore benefits immediately. At the same time, it establishes the basis for new applications that will arise through Industry 4.0.

Digital instead of analog

Hardly one sector sticks so closely to analog signal transmission as the automation sector. Digital information here requires considerably less bandwidth than analog. At the same time, digital transmission is more robust. IO-Link offers a bidirectional point-to-point connection with up to 230.4 kBaud, ensuring very reliable communication via unshielded standard cables. IO-Link sensors are often cheaper than their analog counterparts, as they do not require a D/A converter. This firstly enables the user to make savings in wiring and secondly in terms of the device itself. Another benefit is the fact that the IO-Link master channels are downward compatible with conventional binary sensors with one or two switching outputs. Compared to analog inputs, spare channels can mostly still be used.

Turck supports IO-Link from the start and today offers one of the most extensive IO-Link portfolios. This ranges from multiple sensors to connection technology, right through to fieldbus and Ethernet I/O systems with IO-Link masters with degree of protection to IP20 and IP67.

From the passive junction to Ethernet and IO-Link

In most applications, binary I/O signals, such as from inductive proximity switches, represent the most frequently used signal type. Even today, these are frequently collected in the field by passive junctions (IP67) and routed via multipole cables in control cabinets to central or decentralized I/O modules (IP20). In order to save costs for devices and wiring, more modern concepts use active decentralized IP67 I/O modules in the field. These can collect the signals as closely as possible to the action and transfer them

»The decision to use IO-Link systems prepares users already today for Industry 4.0 scenarios and also reduces costs.«

directly to higher-level controllers via Industrial Ethernet (or other fieldbuses). This eliminates the need for decentralized modules in the control cabinet, which itself can be designed with smaller dimensions. An additional benefit is the cheaper wiring via Industrial Ethernet. This architecture with IP67 I/O modules, which collect signals directly in the field, plays an important role in automation, particularly if only a few signals are collected in situ, for example on robots.

IO-Link can also reduce the costs in applications with a high I/O density. So-called I/O hubs enable up to 16 additional signals to be compressed and transferred via IO-Link. IO-Link masters with four or eight ports collect this data over distances of up to 20 meters and transfer it to the controller in bundles via an Ethernet cable. In this variant users make savings three times over: Compared to industrial Ethernet modules, I/O hubs are cheaper; instead of shielded Ethernet cables, unshielded standard cables are used; and as IO-Link requires only one cable for data and power, separate power supply cables become unnecessary. A further benefit is the fact that IP addresses are only required for each IO-Link master and not for every I/O module. Turck's TBIL I/O hubs (IP67) for IO-Link transfer up to 16 I/O signals via M12 round connectors with metal threads.

With actuators to the IO-Link overall system

It was thought for a long time that any smart actuators or sensors would be based in future on Industrial Ethernet. However, current engineering practice shows the limits of Ethernet in automation. Ethernet, with a transfer rate of 100 Mbit/s or even 1 Gbit/s and a minimum frame size of 64 bytes, is simply over dimensioned for many devices. Ethernet interfaces are also comparatively expensive and produce a lot of heat. IO-Link can technically fill this gap with a very good cost-benefit ratio. Although IO-Link is often defined as a smart sensor interface, the technology was specified from the beginning for communication with sensors and actuators. This gives it a critical advantage over Ethernet, since power and communication are transferred in a single cable.

One of the best known examples of field devices with an IO-Link interface are valve blocks. All major manufacturers now have IO-Link valves and valve blocks in their portfolio. Complex connections using adapters with Sub-D multipole connectors can be replaced by inexpensive standard cables. Gripper systems, motors, first frequency inverters and IO hubs with digital outputs are other examples of actuator modules using IO-Link. Turck's TBEN-L-8IOL IO-Link masters were specially optimized for actuator operation. Unlike other manufacturers they provide up to 4 amperes at two ports.

Users particularly benefit from the possibilities that IO-Link offers, such as with signal indicators with several segments. The connection of light indicators with more than two segments using digital multipole cables was already very complicated. However, IO-Link lights with configurable colors for each segment, audible signals and several additional functions can be wired and operated easily via a standard cable. The TL50 indicators from Turck's optical sensor partner Banner Engineering are available with IO-Link. The configuration and number of indicator elements is therefore no longer limited by the wiring effort involved. Users therefore more often decide to use more than two signal elements. This makes it possible to show other machine states than just "OK" and "Error".

Integration in higher-level systems

Different options are available for the configuration and integration in higher-level systems. Devices can firstly be assigned via IO-Link masters or USB masters or USB adapters with the help of configuration tools. Alternatively, the configuration can be carried out with

QUICK READ

IO-Link is playing a major role in the development of smart factories and smart data. The communication standard offers digitalization right down to the sensor level. The growth figures of recent years impressively demonstrate its popularity. Nevertheless, many users associate the transition with higher costs. This is the case even though IO-Link allows expenditure for hardware and installation to be significantly reduced, particularly when it is used as an overall system.

Stack lights with an IO-Link connection, such as TL50 from Banner Engineering, ensure fast and simple connection and parameter setting, even with more than three elements

IO-LINK FREES UP DEVELOPMENT RESOURCES

A key benefit of IO-Link is its independence from any fieldbus protocols. The number of relevant fieldbuses and industrial Ethernet protocols presents manufacturers of decentralized field devices with a real challenge. Developing device variants for each protocol, maintaining them over the entire life cycle and providing also the necessary support involves considerable costs. This also ties down personnel resources, which are blocked from deployment in future developments and innovations. Some manufacturers have therefore already committed themselves exclusively to the IO-Link interface and are going without the integration of bus interfaces. They are leaving the integration in higher-level systems up to the manufacturers of the IO-Link masters. In this respect, IO-Link is thus also an innovation motor since it frees up development resources.

function blocks in the controller. This makes it possible, for example, to change the configuration of a device during operation as part of a profile change. The properties of higher-level networks such as Profinet or EtherNet/IP means that there are still no manufacturer-independent options for configuring IO-Link devices directly from the engineering system. However, an improvement of the situation is in sight. In June 2017, the "IO-Link Integration – Edition 2 for Profinet IO" specification defined the interfaces for manufacturer independent engineering for Profinet.

The IO-Link masters of the TBEN-L and TBEN-S series, with the simple IO-Link device integration function (SIDI), already offer today the possibility of integrating Turck and Banner devices by plug and play. All the company's IO-Link devices are integrated in the station GSDML files of the IO-Link masters of the TBEN series. This considerably simplifies the setup. When the GSDML file is read in by an engineering software (TIA Portal or other), all Turck devices can be selected as a specific port configuration. Any additional parameterization or programming is no longer necessary.

Cost benefit of the overall system

If the change to IO-Link is made dependent on an individual component, IO-Link masters can be seen to be a disadvantage due to the overhead costs for IO-Link masters. However, if the system is considered in its entirety and a change of sensors and actuators and I/O systems assessed as well, considerable costs can be saved with IO-Link. The cost saving benefits of IO-Link do not become fully apparent until the time required for wiring and cable assembly are taken into account.

The many Industry 4.0 scenarios, which frequently involve connection with the intelligent interface, are unnecessary. However, the IO-Link system makes users already well prepared for these scenarios. The more flexible setting of sensors from the controller or the querying of sensor data for predictive maintenance can be set up at a later time. Not only IO-Link devices – the capabilities of the master are also critical for using the system intelligently at a later time. However, the devices of the manufacturers also vary here, although the communication standard is the same. The Turck IO-Link masters installed in multiprotocol I/O modules can thus also be accessed with Modbus TCP in parallel with Profinet. This enables the transfer of data to higher-level I4.0 or IIoT systems such as SAP PCo, Microsoft Azure or IBM Bluemix.

Outlook

The IO-Link product landscape already offers all components today for the economical implementation of complete solutions for automation. The latest activities of the IO-Link community show how IO-Link also equips customers for the future. The IO-Link Safety Specification makes it possible to also implement safety concepts in future for all aspects of IO-Link. The IO-Link community also has specifications under way that enable standard access to IO-Link masters and devices from higher-level I4.0 systems.

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The TBEN-IO-Link master with "Simple IO-Link Device Integration" (SIDI) already enables today the integration of Turck and Banner devices with plug and play