

# IO-Link

## Into the Future With a Profile

Maximum benefit thanks to customer-oriented application profiles



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# Management Summary

Global – manufacturer-independent – cross-fieldbus: The requirements and expectations for IO-Link technology are high and, in the future, they are expected to extend to the standardization of the smallest and customized applications. The commitment that manufacturers are undertaking to make the IO-Link standard a key technology for flexible, safe and smart manufacturing concepts is correspondingly high.

The goal is to establish different IO-Link profiles that bring benefits to end customers, system integrators and device manufacturers alike. The result for all stakeholders is an offer of different harmonisation levels of device description files (IODDs) for control and diagnostics of sensors and actuators in the field.

These can be divided into three classes:

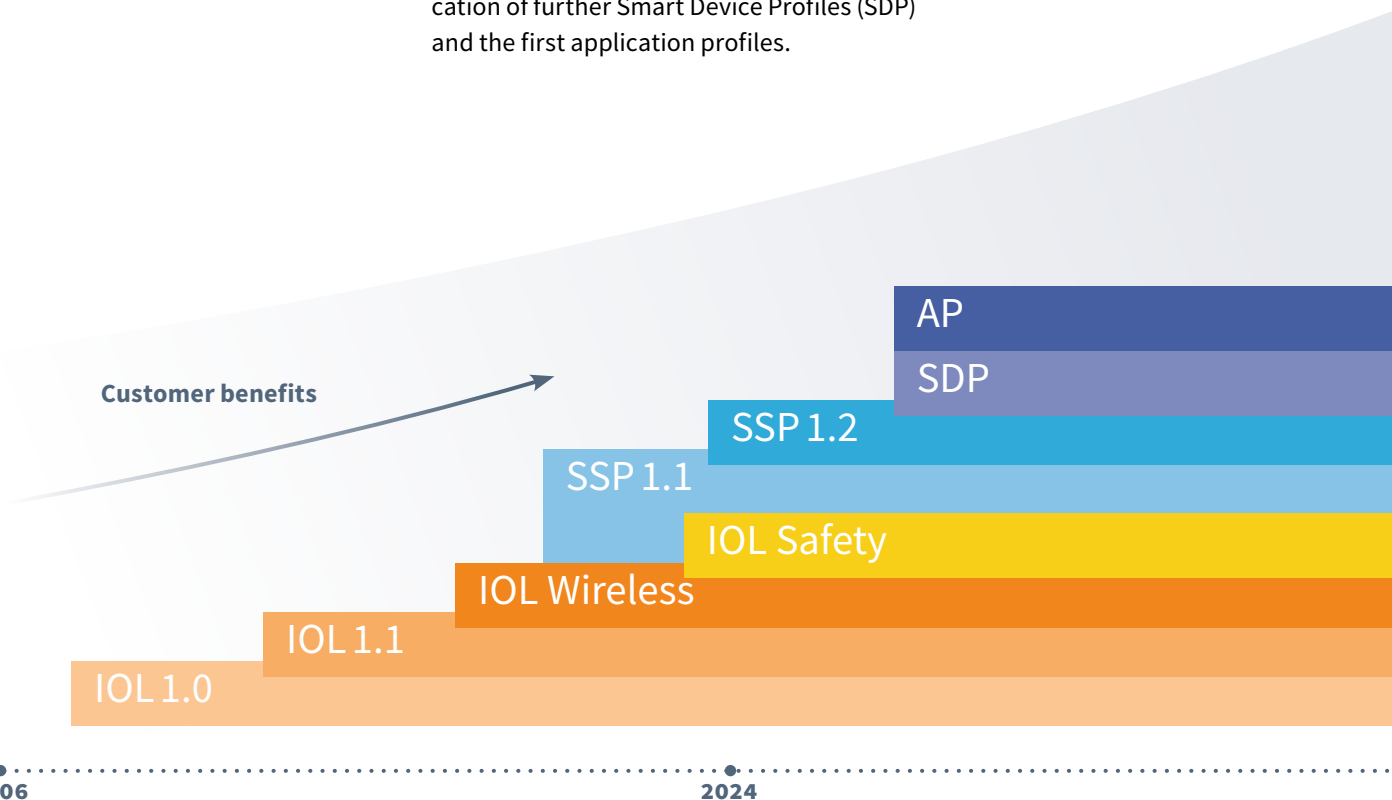
- **Manufacturer-specific characteristics** with specific IODDs
- **Smart Device Profiles** with harmonized IODDs
- **Application Profiles** for specific applications with Community IODDs

Thanks to this harmonization, various requirements can also be met for individual IO-Link devices in specific applications. This increases planning security for users and significantly reduces the integration effort.

In a roadmap, the IO-Link community has described the path to the Application Profiles (AP). It envisages the coming years, the publication of further Smart Device Profiles (SDP) and the first application profiles.

## PROFILE

Harmonization increases planning security and significantly reduces the integration effort.



# From the Communication Protocol to a Key Player in Industrial Automation

## DEVICE DESCRIPTION FILE

The IO Device Description (IODD) is a unified view of device properties and capabilities.

IO-Link technology has become an indispensable part of industrial automation. What began in 2006 as a communication protocol and as a tool to improve communication between sensors and a master device has become a respected and successful standard internationally and throughout the industry. But the journey continues, because IO-Link can do much more! The more than 500 companies united in the IO-Link community are continuously developing the standard with the aim of comprehensively establishing control and diagnostics in industrial automation via IO-Link, thus making it reliable, flexible in use, safe and thus future-proof.

Wireless features and improved security features bring a new level of flexibility, safety and thus efficiency to industrial automation. Manufacturers, system integrators and customers are offered completely new possibilities in industrial automation that reaches deep into the field level.

With the harmonization of device description files through profiles, IO-Link is opening a new chapter in the book of standardization of manufacturing processes.

In this way, a number of profiles are created:

- **the Common Profile,** which standardizes the basic functions,
- **the Smart Sensor Profile,** which enables sensors to provide detailed data and diagnostics,
- **the Smart Device Profile,** which allows for more sophisticated device interactions, and
- **the Application Profile,** which is tailored to very specific application requirements.

Every step on this journey is a step towards a smarter, more connected industrial environment based on user requirements.

This white paper provides a concise overview of the groundbreaking development of IO-Link and highlights the key elements that will make this technology a key player in industrial automation in the future.



Digital communication  
»easy-to-use«



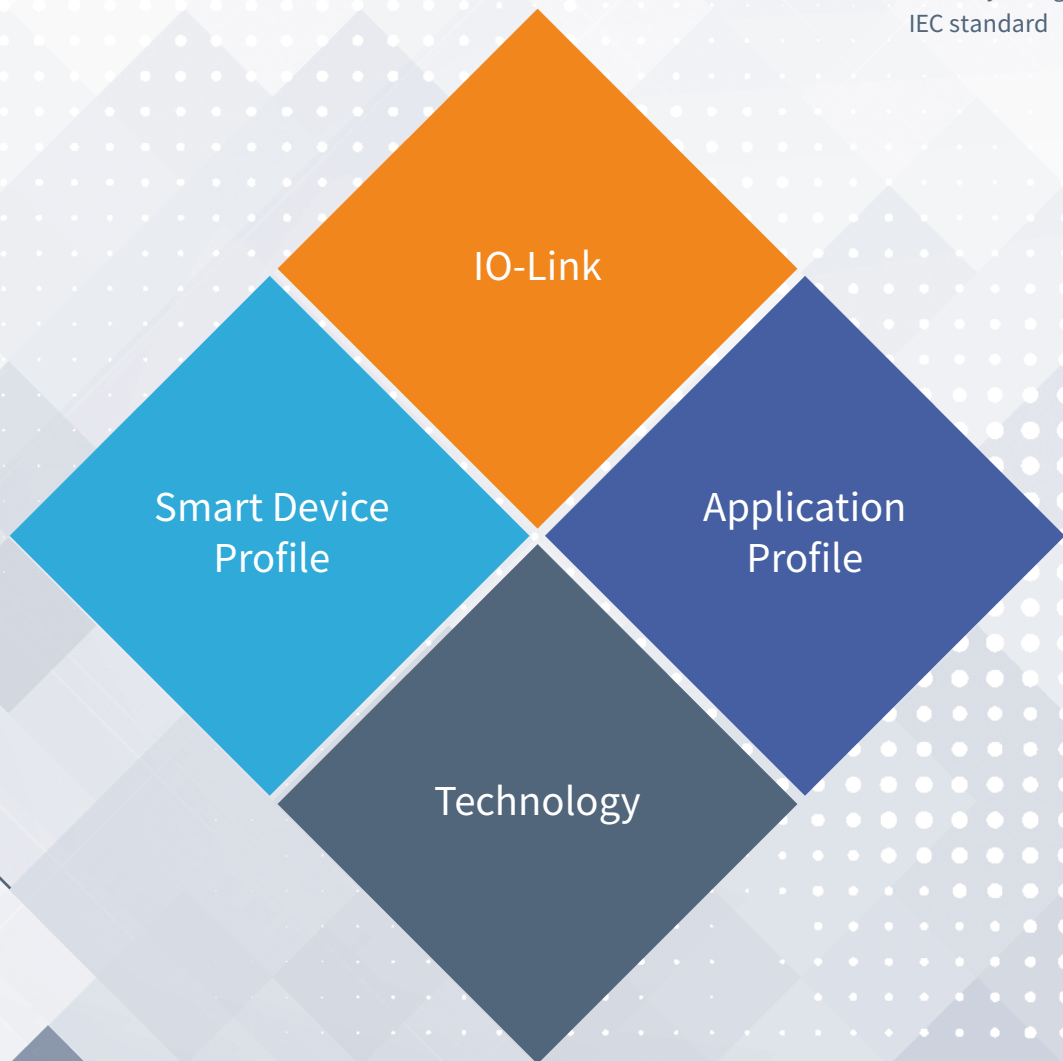
Increased cross-vendor  
harmonization of devices



Easy integration  
specific applications



Globally recognized  
IEC standard



# Technology

## IO-Link 1.0

### FIELDBUS INDEPENDENCE

IO-Link 1.0 stands for fieldbus-independent, bidirectional communication

Industrial automation technology has received a decisive impetus in its development through IO-Link.

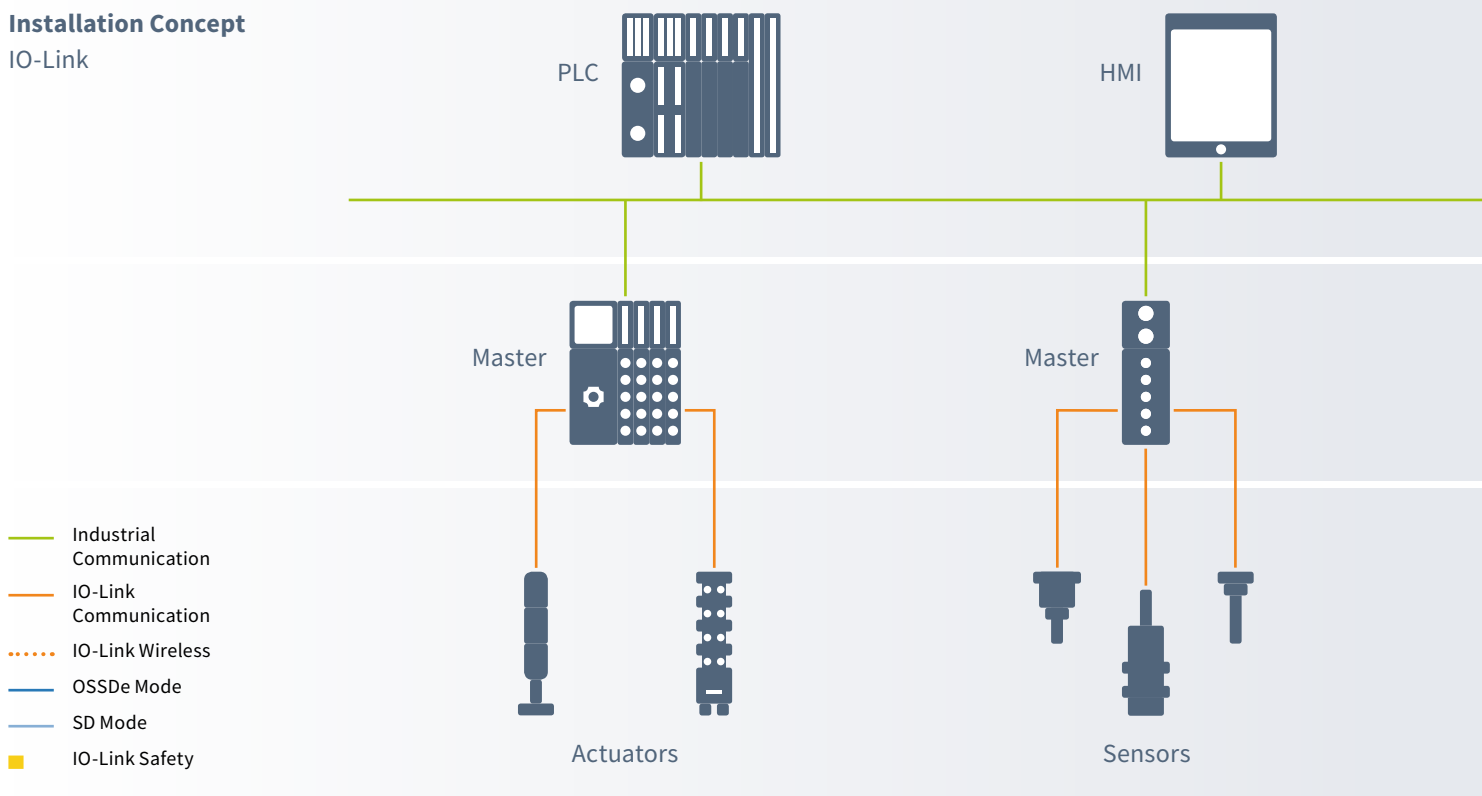
The year 2006 marked a milestone in automation technology. In this year, IO-Link was launched, bringing a completely new concept for integrating sensors and actuators (devices) into an automation system. For the first time, communication could be realized within an automated manufacturing process from the control system to the field level without being tied to a specific fieldbus.

An unprecedented openness and independence from manufacturers have contributed to IO-Link becoming not only an innovative technology, but also an accepted and sustainable solution for a wide range of applications.

The focus of IO-Link 1.0, the first IO-Link version, is on the "last meter" in the field, more precisely on the signal and communication connection of sensors and actuators to the higher-level control level. IO-Link 1.0 has successfully improved the intelligence of sensors and actuators up to the field level.

### Installation Concept

IO-Link



This allowed data to be recorded, transported and processed with the highest precision directly at the source. The foundation for more efficient and reliable automation was laid. IO-Link 1.0 did not only make fieldbus-independent communication possible, it also

worked independently of manufacturers. This paved the way for the IO-Link approach to an open standard. Even after almost two decades, IO-Link is still fieldbus independent, thus guaranteeing continuous customer benefit across all development phases.

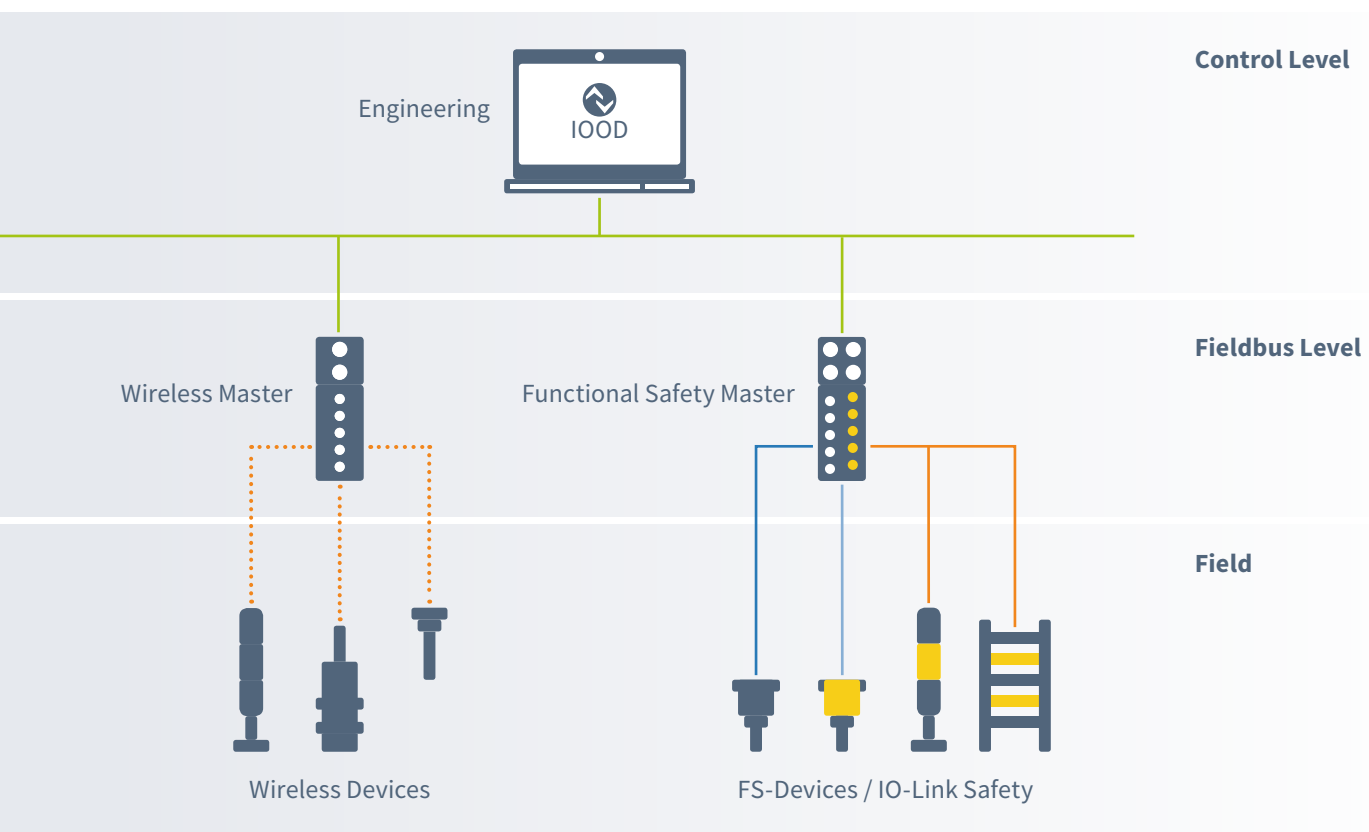
## IO-Link 1.1

IO-Link 1.1 expanded the field of application in 2012: Extended data backup makes the uniform integration through SMI (Service Messaging Interface) and the common profile and thus a more seamless interaction between different components. Significantly expanded and improved diagnostic functions simplify maintenance and make troubleshooting quicker, easier and more efficient.

Since the introduction of IO-Link 1.1, this standard has proven to be extremely robust and compatible. In contrast to the time-consuming certification, IO-Link 1.1 also offers small manufacturers cost-effective ways to bring IO-Link products to market with the manufacturer's declaration. This flexibility and scalability help IO-Link support a wide range of applications in various industries.

### DATA SAFETY

IO-Link 1.1 enables toolless device and master exchange.



## IO-Link Wireless

### WIRELESS

Wireless communication opens up completely new perspectives in automation technology when it comes to connecting devices in the field.

It was only a matter of time before the IO-Link community took up the topic of wireless data and signal transmission. With IO-Link Wireless, manufacturers and users have had a wireless communication system in automation technology at their disposal since 2022. It facilitates planning and, in particular, implementation and operation in industrial automation.

This extension allows for flexible integration of sensors and actuators, without the limitations of communication cabling. Not only does this make it much easier to adapt automation solutions to changing requirements and environments, it also saves time during installation and maintenance.

## IO-Link Safety

### CERTIFIED

IO-Link Safety is certified by TÜV.

In addition to the previous developments, IO-Link Safety is introducing an innovative extension for safety applications in automation technology. The specification was published in 2022 and now opens up the IO-Link world to safety relevant components.

IO-Link Safety opens up new possibilities for the use of IO-Link in safety-critical environments without compromising on performance or flexibility.

## Technology Profiles



### FW Update

The FW Update Technology Profile describes the manufacturer-independent process of the firmware update of an IO-Link device. FW Update makes it easy to update the firmware and keeps the devices up to date without having to physically adjust them. This feature is optional, but provides important flexibility for adapting to changing requirements.



### BLOB

The BLOB (Binary Large Object) technology profile describes the transfer of large amounts of data via IO-Link. It is used when extensive data, such as images or configuration files, need to be exchanged between devices. The BLOB profile enables efficient transfer of large amounts of data, thus contributing to IO-Link's flexibility and versatility.



### Common Profile

The Common Profile forms the basis for all IO-Link profiles. It specifies the type of profile definitions and identification of the profile properties in the devices. In addition, the Common Profile defines the general characteristics in all devices, such as mandatory identification parameters, diagnostic parameters, and device localization by means of optical flashing.



# Smart Device Profile

More intelligence and greater cross-vendor compatibility of IO-Link devices brought the introduction of the Smart Sensor Profile (SSP) 1.1 in 2017. SSP 1.1 defines standardized specifications for the mapping of functions. This means that devices behave in the same way according to these specifications.

Various devices from different manufacturers that implemented SSP 1.1 have been available on the market since then. SSPs map analogue and binary functions in a harmonized manner and independently of the sensor technology. The standard harmonization of the recurring parameters was achieved, which made

interoperability and the smooth exchange of devices from different manufacturers possible.

The continuous development of IO-Link also had an impact on the Smart Sensor Profile. On 1st January 2024, SSP 1.2 was released. Compared to its predecessor, SSP 1.2 brings some significant functional enhancements, including new elements such as a new switching scheme, a uniform teach procedure, uncertainty indication and the teach window, expand the possibilities for mapping functions. SSP 1.2 clearly shows how adaptable IO-Link is in industrial automation.

The success of the SSPs has the necessary need identified for further smart device profiles (SDP). SDPs unify the mapping of devices with comparable properties of basic functions, for example in the area of measured value transmission, control points, or actuator control. This is achieved by standardizing the device description of devices with identical basic functions. This includes the areas of sensor technology, actuators, diagnostics and identification.

The introduction was another step on the way to more efficient integration of devices. The smart device profiles enable an end-to-end process from planning to commissioning.

## SMART SENSOR PROFILE

Smart Sensor Profiles were the decisive step towards harmonization and further technological sophistication.

## SMART DEVICE PROFILE

Smart Device Profiles facilitate integration into the control environment through predefined function modules.

## MANUFACTURER'S SPECIFIC PROPERTIES

The IODD, which is based on a smart device profile, can and will provide other manufacturer-specific, non-profiled properties. The manufacturer creates the device-specific IODD based on the specifications of the Smart Device Profile and publishes it.

### Switching Scheme

Defined reaction to process value changes for measuring and object recognition systems.

### Teach the Switching Points

The standardization of the teach procedure allows for the first time the manufacturer-independent teaching of the current state as a switching point.

### Uncertainty Indication

Standardized indication of an uncertain measurement for certain sensor types such as optical sensors.

### Teach Window

Specialized teach to define the current state as good and any deviation upwards or downwards as bad.

# Application Profile

## APPLICATION PROFILE

Application profiles open up new user groups and make IO-Link accessible to a larger market.

Application profiles – AP for short – take the topics of simplicity and harmonization to a new level. Application profiles open up new technical options to simplify the integration of services in automation. This is particularly important in times of a shortage of skilled workers, when it is also a matter of simplifying the monitoring, control and maintenance of automation technology. Application profiles are technically based on smart device profiles. They ensure that the devices can be integrated into the systems even more

efficiently and replaced without explicit expertise in the event of a fault.

An application profile describes the specific function of an individual device. In the first step, these will be the metrological tasks such as pressure, temperature, flow and level measurement in a range of functions defined by the community. Manufacturer-specific extensions are not provided for devices with such profiles. The specific properties are described in an IODD which is developed and managed by the IO-Link Community. A device with an application profile only supports the functions described in the IODD and does not contain any other IO-Link-relevant functions.

The application profiles reflect the needs of the users and map them to specific devices on the basis of the smart device profiles. The focus here is on similar applications and process simplification thanks to standardized functionality. Advantage: When integrating the respective community IODD, the use of devices from different manufacturers is possible without any further effort.

### User Benefits

Application profiles support the long-term availability of application solutions through a 100 percent compatibility of device integration and make users' lives easier.

The advantages:

- Long-term security for the application
- Simplified integration through standardization (IO-Link module from PLC manufacturers)
- Devices can be integrated identically for similar applications
- Simplified architecture
- Standardization of tender texts possible
- Replacement of widely used 4... 20mA sensors
- No long downtimes required for device replacement
- No explicit expertise in device replacement is required

# Outlook

The future development of IO-Link is clearly heading in the direction of further exciting technology profiles. Among other things, further smart device profiles (SDPs) are already being planned, including Smart Indicator, Smart Identification, Smart Power and Smart Actuator. These make device integration even easier and maximise the benefits of IO-Link in an ever-growing number of applications. The IO-Link Community pursues the goal of promoting harmonization through profiles and thus creating an environment in which technology remains constantly open to innovation and change.

Without the open cooperation of the IO-Link Community there would not be an IO-Link success story. The success of this inno-

vating technology is based on the continuous close participation of more than 500 industrial partners from all over the world, working together without competition.

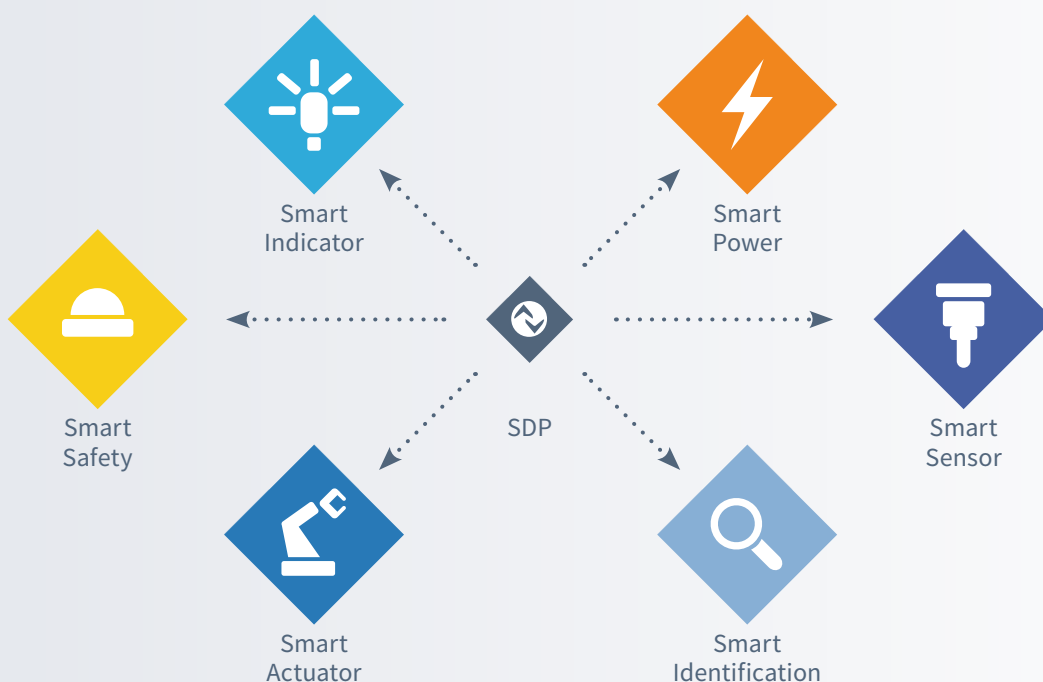
This alone explains and strengthens the claim that IO-Link is and will remain an open platform. This is the only way to provide enough room for innovation and growth. IO-Link remains agile and responds to the needs of users in order to continue to play a leading role in industrial automation in the future.

Discussion, comments and suggestions for improvement are always welcome

Contact: [marketing@io-link.com](mailto:marketing@io-link.com)

## IO-LINK

IO-Link is and remains an open community without its own economic interest and thus offers enough space for innovation and growth.



## Outlook

More Smart Device Profiles that are currently still in design.

