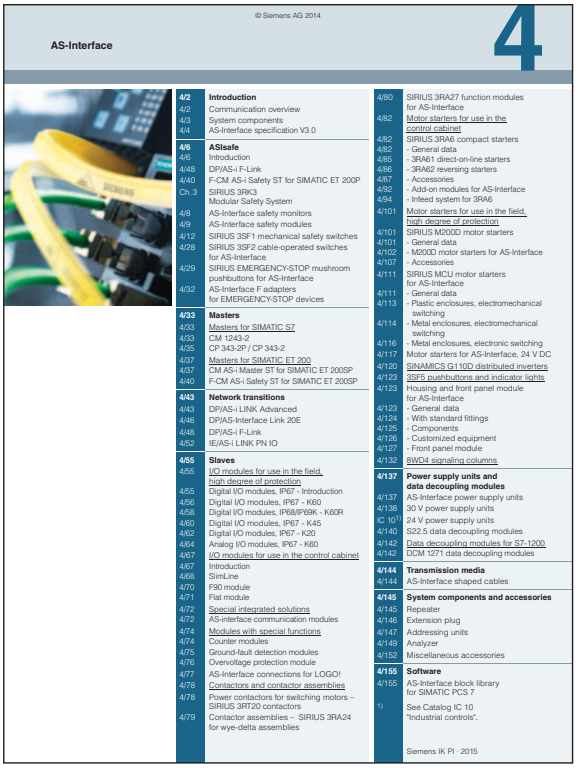


Siemens complete AS-Interface offering is found in Section 4 of the Siemens IK PI 2015 Catalog.

In this section you will find the Table of Contents for Section 4 of the Siemens IK PI 2015 catalog and overview information on AS-Interface and ASIsafe.

A PDF version of Section 4 on AS-Interface can be viewed from the Siemens' on-line version of this 2017 Industrial Controls Catalog.

contents of IKPI Sect 4

continued on next page

contents of IKPI Sect 4 (cont.)

1) See Catalog IC 10 "Industrial controls".

Catalog No. Prefix	Description
3RA24	Contactor Assemblies for Wye-Delta Starting
3RA27	Contactor Function Modules for AS-Interface
3RA6	Compact Starter
3RG783	SIMATIC FS600 Laser Scanner
3RK11	Safety Monitor, Analog I/O Modules
3RK12	Compact Safety Modules, I/O Modules, Counter Modules, Communication Modules
3RK13	Enclosed Motor Starters
3RK14	Compact Safety Modules, I/O Modules, Communication Modules, Ground Fault Protection Modules, Connections for LOGO!
3RK19	Accessories
3RK22	I/O Modules
3RK24	I/O Modules, Communication Modules
3RK27	ASI System Manual
3RK31	DP/AS-i F-Link
3RK43	MCU Enclosed Motor Starters
3RV19	Accessories for Compact Starter
3RX90	ASI Shaped Cables
3RX95	ASI Power Supplies
3S83	E-Stop Components
3SE50	Position Switches & Interlock Accessories
3SF1	Position Switches & Key Interlock Switches
3SF2	Cable Operated Switches
3SF54	F Adapters for E-Stops
3SF55	AS-i Slaves for Pilot Devices
3SF58	Pilot Device Stations, Front Panel Module
3SF59	Pilot Device Accessories
6GK12	Repeater/Extender
6GK14	DP/AS-i Links
6GK19	Manuals for SIMATIC S7 Masters
6GK7	Masters for SIMATIC S7
6SL35	SINAMICS G110D Drives
8WD4	Signal Columns

IO Link

Siemens complete IO-Link offering is found in Section 5 of the Siemens IK PI 2015 Catalog.

In this section you will find the Table of Contents for Section 5 of the Siemens IK PI 2015 catalog and overview information on IO-Link.

A PDF version of Section 5 on IO-Link can be viewed from the Siemens' on-line version of this 2017 Industrial Controls Catalog.

14 AS-INTERFACE AND IO LINK

contents of IKPI Sect 5

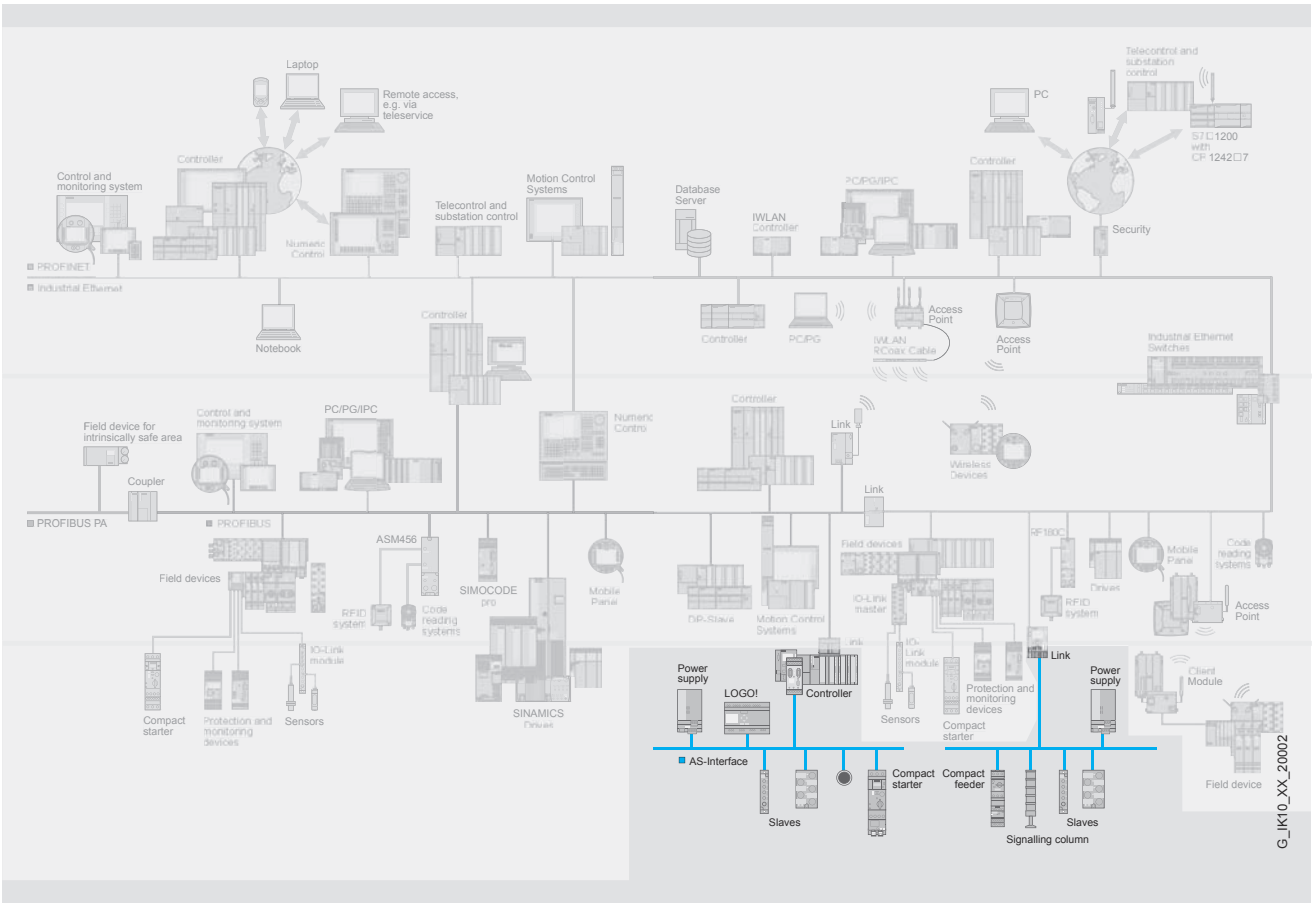
Introduction

Communication overview

Overview

AS-Interface is an open, international standard according to EN 50295 and IEC 62026-2 for process and field communication. Leading manufacturers of actuators and sensors all over the world support the AS-Interface. Interested companies are provided with the electrical and mechanical specifications by the AS-Interface Association.

AS-Interface is a single master system. For automation systems from Siemens, there are communications processors (CPs) communications modules (CMs) and routers (links) that control the process or field communication as masters, and actuators and sensors that are activated as AS-Interface slaves.



Benefits

A key feature of AS-Interface technology is the use of a shared two-conductor cable for data transmission and the distribution of auxiliary power to the sensors/actuators. A power supply unit which meets the requirements of the AS-Interface transmission method and has an external data decoupling module if required is used for the distribution of auxiliary power. The AS-Interface cable used for the wiring is mechanically coded and hence protected against polarity reversal and can be easily contacted by the insulation piercing method.

Elaborately wired control cables in the control cabinet and marshalling racks can be replaced by AS-Interface.

The AS-Interface cable can be connected to any points thanks to a specially developed cable and connection by the insulation piercing method.

With this concept you become extremely flexible and achieve high savings.

Application

I/O data exchange

The AS-i master transmits automatically the inputs and outputs between the control system and the digital and analog AS-Interface slaves.

Slave diagnostics information is forwarded to the control system when required.

AS-Interface masters according to the AS-Interface Specification V2.1 or V3.0 support integrated analog value processing. This means that data exchange with analog AS-Interface slaves is just as easy as with digital slaves.

Command interface

In addition to I/O data exchange with binary and analog AS-Interface slaves the AS-Interface masters provide a number of other functions through the command interface.

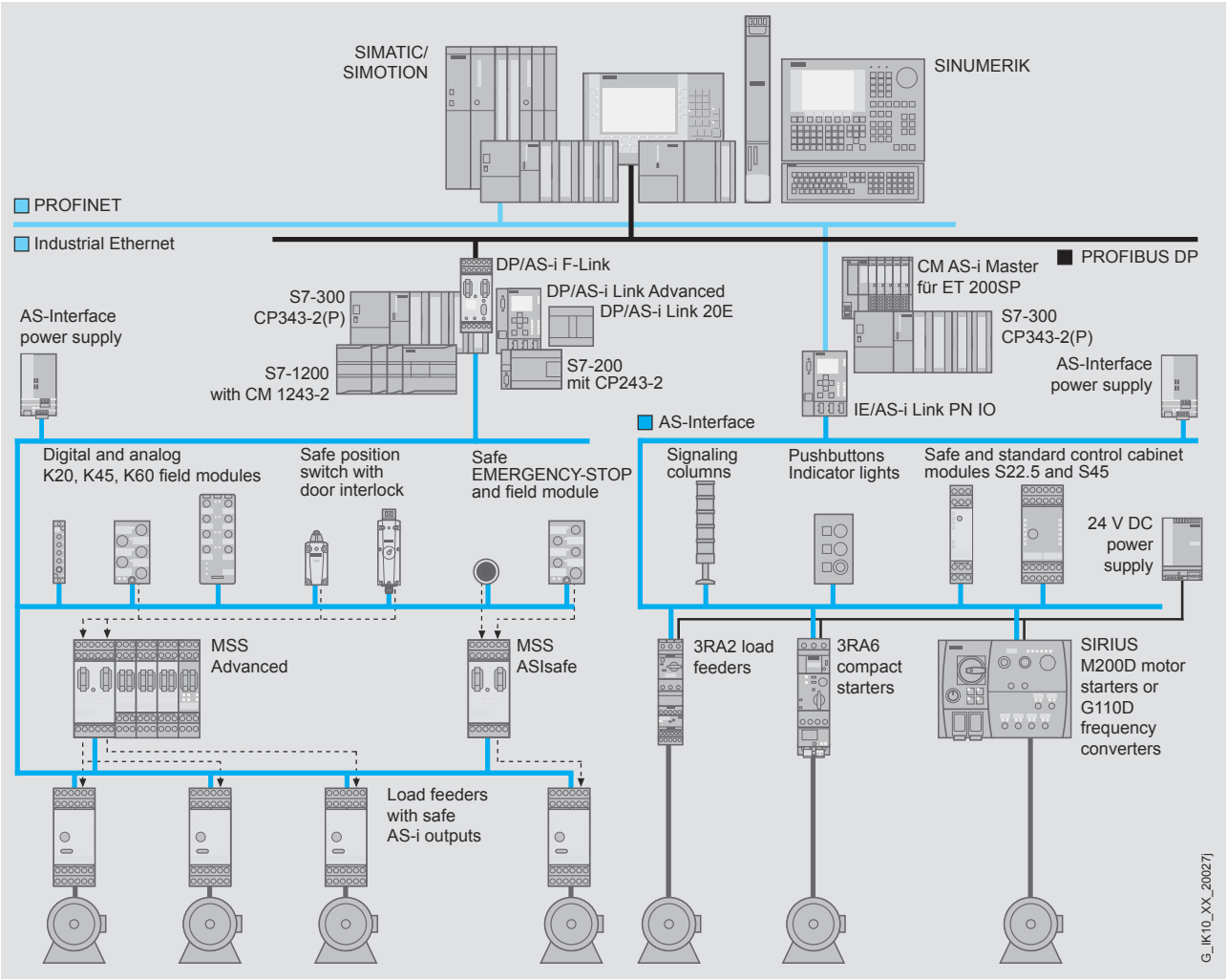
Hence it is possible, for example, for slave addresses to be issued, parameter values transferred or configuration information read out from user programs.

You can find more information on the Internet, see http://support.automation.siemens.com/WW/view/en/51678777

Overview

To implement communication, a system installation has the following main components:

- Master interface modules for central control units such as SIMATIC S7, ET 200 distributed peripherals, or routers from PROFIBUS/PROFINET to AS-Interface
- Power supply units, if required in combination with a data decoupling module for the power supply to the slaves
- AS-Interface shaped cables
- Network components such as repeaters and extension plugs (cannot be used for AS-i Power24V)
- Modules for connection of standard sensors/actuators
- Actuators and sensors with integrated AS-i slave
- Safety modules for transmitting safety-oriented data through AS-Interface
- Addressing units for setting the slave addresses during commissioning



Example of a configuration with the system components

Features

Standard	EN 50295 / IEC 62026-2
Topology	Line, star or tree structure (same as electrical wiring)
Transmission medium	Unshielded two-wire cable (2 x 1.5 mm^2) for data and auxiliary power
Connection methods	Contacting of the AS-Interface cable by insulation piercing method
Maximum cable length	• 100 m without repeater • 200 m with extension plug • 300 m with two repeaters in series connection • 600 m with extension plugs and two repeaters connected in parallel Larger cable lengths are also possible when additional repeaters are connected in parallel

Maximum cycle time	• 5 ms in full expansion with standard addresses • 10 ms in full expansion with A/B addresses, profile-specific for Spec 3.0 slaves
Number of stations per AS-Interface line	• 31 slaves acc. to AS-Interface Spec. V2.0 • 62 slaves (A/B technology) acc. to AS-Interface Spec. V2.1 and V3.0 • Integrated analog value transmission
Number of binary sensors and actuators	• Max. 124 DI/124 DO according to Spec. V2.0 • Max. 248 DI/186 DO according to Spec. V2.1 • Max. 496 DI/496 DO according to Spec. V3.0
Access control	• Cyclic polling master/slave procedure • Cyclic data acceptance from host (PLC, PC)
Error safeguard	Identification and repetition of faulty message frames

AS-Interface specification / Specification 2.0, 2.1 and 3.0

Overview

Scope of the AS-Interface specification

AS-Interface Specification	Maximum number of slaves			Number of digital inputs	Number of digital outputs
	Digital	Analog	ASIsafe	DI	DO
Version 2.0	31	31	31	31 × 4 = 124	31 × 4 = 124
Version 2.1	62	31	31	62 × 4 = 248	62 × 3 = 186
Version 3.0	62	62	31	62 × 8 = 496	62 × 8 = 496

Basic data of AS-Interface Specification 2.0

- AS-Interface Specification 2.0 describes a fieldbus system with an AS-i master and up to 31 AS-i slaves.
- Each AS-i slave has up to 4 digital inputs and 4 digital outputs.
- With full expansion, the complete transmission of all input/output data requires max. 5 ms cycle time.

Expansions of AS-Interface Specification 2.1

AS-Interface Specification 2.1 enables the number of network stations to be doubled from 31 to 62 as follows:

- The standard slaves continue to occupy one AS-i address (1...31).
- Slaves with extended addressing divide an address into an A address (1A...31A) and a B address (1B...31B). Up to 62 A/B slaves can be connected accordingly to one AS-Interface network.
- Mixed operation of standard slaves and A/B slaves is possible without difficulty. The AS-i master identifies automatically which type of slave is connected. No special adjustments are required of the user.

Another function of the AS-Interface Specification V2.1 is the integrated analog value transmission function. Access to both analog values and digital values is possible without the need for any special function blocks.

Expansions of AS-Interface Specification 3.0

- AS-Interface Specification 3.0 enables the connection of nearly 1000 digital inputs/outputs (profile S-7.A.A: 8DI/8DO as A/B slave).
- New profiles have also enabled the option of expanded addressing for analog slaves.
- Acceleration of analog value transmission through "Fast Analog Profile".
- Variable use of analog modules: Optional parameterization of resolution (12/14 bit) and 1- and 2-channel capability.
- Asynchronous serial protocol 100 baud or 50 baud, bidirectional.

AS-Interface master for A/B slaves

To be able to operate A/B slaves on an AS-Interface network you must use master modules that meet the minimum requirements of Specification 2.1.

AS-Interface specification	Available masters
Version 2.1	CP 243-2 (S7-200)
Version 3.0	CP 343-2, 343-2P (S7-300 / ET 200M), DP/AS-i Link Advanced, DP/AS-i F-Link, DP/AS-Interface Link 20E, IE/AS-i Link PN IO, CM 1243-2 (S7-1200), CM AS-i Master ST for ET 200SP new

The AS-Interface specification relevant for the respective slave is noted in the "Selection and ordering data".

For the exact slave profile see AS-Interface system manual.

Communication cycle

AS-Interface specification	Maximum cycle time (digital signals)
Version 2.0	5 ms
Version 2.1	5 ms with 31 slaves 10 ms with 62 slaves
Version 3.0	5 ms with 31 slaves 10 ms with 62 slaves, supplementary, up to 20 ms with A/B slaves using 4DI/4DO, up to 40 ms with A/B slaves using 8DI/8DO

Each address is queried in max. 5 ms cycle time. If two A/B slaves are operated on one basic address (e.g. 12A and 12B), a maximum 10 ms will be required for updating the data of both slaves.

All slave types can be mixed and used on a single AS-Interface network.
More information, e.g. whether an AS-Interface slave is a standard slave or an A/B slave, can be seen in the section "Selection and ordering data" or the "AS-Interface system manual".

More information

AS-Interface system manual

More information is available in the AS-Interface system manual.

The German AS-Interface system manual can be downloaded free of charge, see
http://support.automation.siemens.com/WW/view/en/26250840

The English AS-Interface system manual can be downloaded free of charge, see
http://support.automation.siemens.com/WW/view/en/26250840

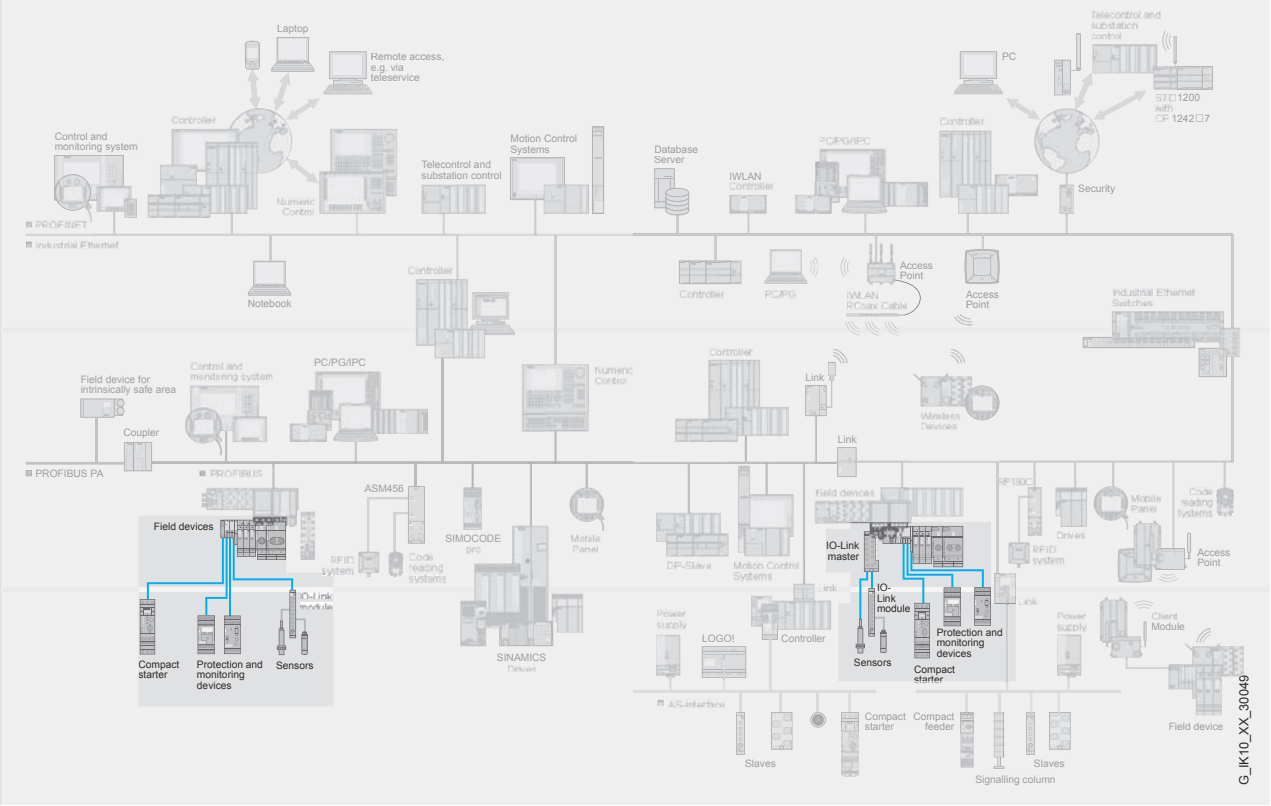
A print version of the AS-Interface system manual is also available under the following order number.

- German 3RK2 703-3AB02-1AA1
- English 3RK2 703-3BB02-1AA1

Overview

IO-Link is an open communication standard for sensors and actuators - defined by the Profibus User Organization (PNO). IO-Link technology is based on the point-to-point connection of sensors and actuators to the control system.

Parameter and diagnostics data are transmitted in addition to the cyclic operating data for the connected sensors/actuators. The simple, unshielded three-wire cable customary for standard sensors is used for this purpose.



Benefits

Engineering

- Standardized, open system for greater flexibility (non-Siemens IO-Link devices can be integrated in engineering)
- Uniform, transparent configuring and programming through integrated engineering (SIMATIC STEP 7)
- Unassigned SIMATIC function blocks for easy parameterization, diagnostics and read-out of measured values
- Efficient engineering thanks to pre-integration into SIMATIC HMI
- Low error rate in CAD circuit diagram design as a result of reduced control current wiring

Installation and commissioning

- Faster assembly with minimized error rate as a result of reduced control current wiring
- Less space required in the control cabinet
- Low-cost circuitry where there are several feeders by making full use of existing components

Operation and maintenance

- High transparency in the system right down to field level and integration into power management systems
- Reduction in downtimes and maintenance times thanks to system-wide diagnostics and faster fault correction
- Support of predictive maintenance
- Shorter changeover times, even for field devices, by means of parameter and recipe management

Application

IO-Link can be used in the following main applications:

- Easy connection of complex IO-Link sensors/actuators with a large number of parameters and diagnostic data to the control system
- Replacement of sensor boxes for connecting binary sensors with the IO-Link input modules optimized in terms of cabling
- Optimized cable connection of switching devices to the control system
- Simple transmission of energy values from the device to the control system for integration into a user program or power management

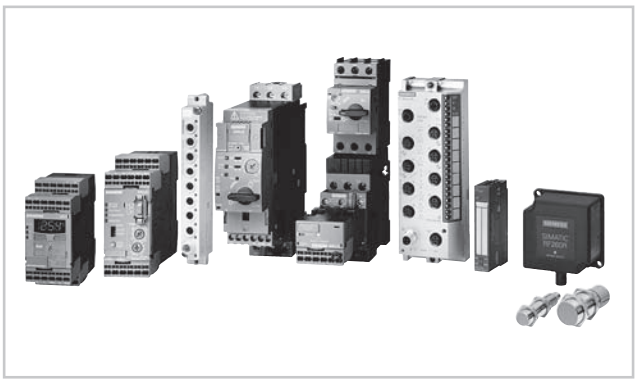
In these cases, all the diagnostics data are transmitted to the higher-level control system through IO-Link. The parameter settings can be changed during operation. Central data storage means that it is possible to exchange an IO-Link sensor/actuator without a PC or programming device.

Integration in STEP 7

Integration of the device configuration in the STEP 7 environment guarantees:

- Quick and easy engineering
- Consistent data storage
- Quick localization and rectification of faults

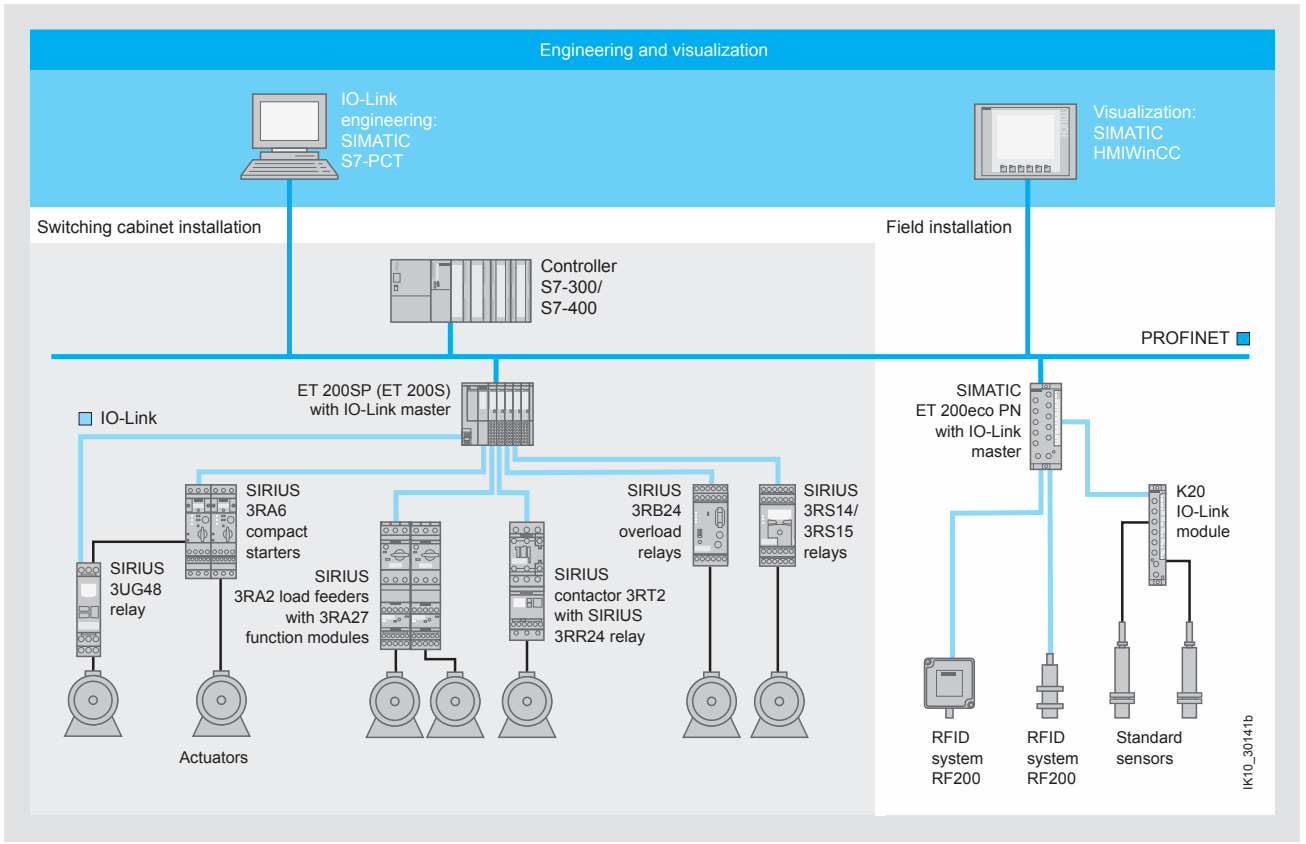
Overview



IO-Link product family

To implement communication, a system installation has the following main components:

- An IO-Link master
- Several IO-Link devices, usually sensors (RFID systems), actuators or combinations of these
- A standard 3-wire sensor/actuator cable



Example of a configuration with the system components

Compatibility of IO-Link

IO-Link guarantees compatibility between IO-Link-capable modules and standard modules as follows:

- IO-Link sensors can be operated both on IO-Link modules (masters) and standard input modules.
- IO-Link sensors/actuators as well as today's standard sensors/actuators can be used on IO-Link masters.
- If conventional components are used in the IO-Link system, then of course only the standard functions are available at this point.

Analog signals

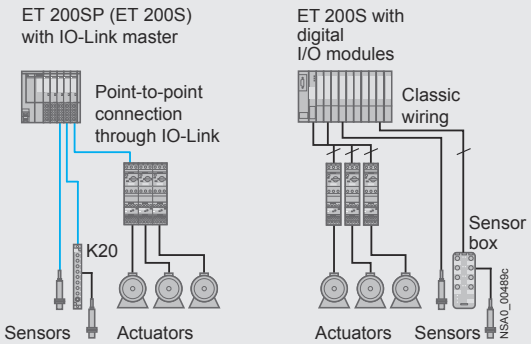
Another advantage of IO-Link technology is that analog signals are digitized already in the IO-Link sensor itself and are digitally transmitted by the IO-Link communication. As the result, faults are prevented and there is no extra cost for cable shielding.

Enhanced through IO-Link input modules

IO-Link compatibility also permits connection of standard sensors/actuators, i.e. conventional sensors/actuators can also be connected to IO-Link. This is particularly effective with the IO-Link input modules, which allow several sensors to be connected at one time via a cable to the controller.

Load feeders and motor starters

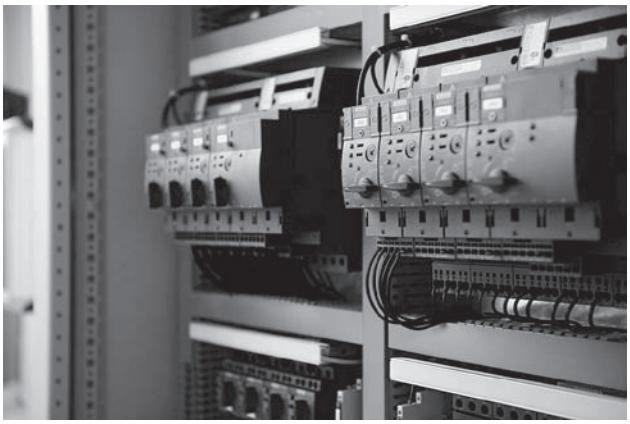
Through IO-Link it is possible to control not only sensors but also actuators in the form of load feeders and motor starters.



Possibilities for connecting load feeders and motor starters to IO-Link or in the conventional way

Grouping of motor starters

The SIRIUS controls allow four starters to be combined to form a group.

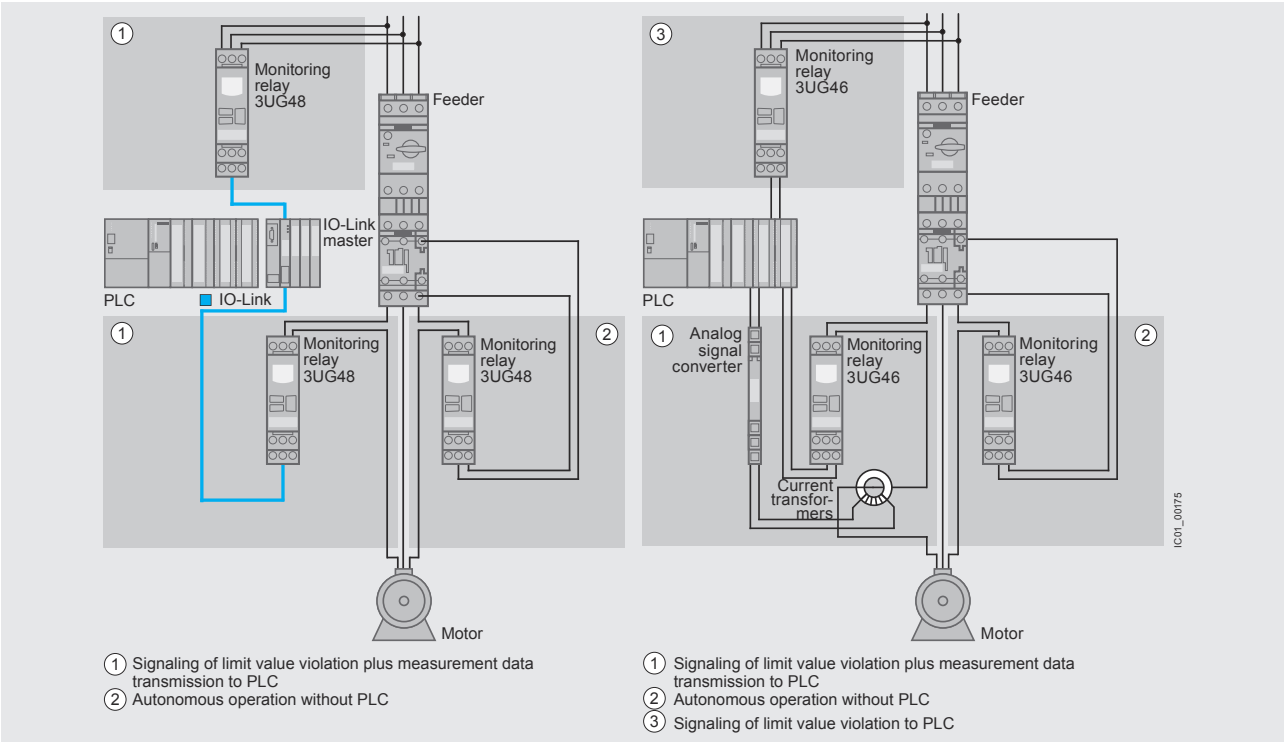


Connection of a motor starter group made up of three 3RA64 direct-online starters and a 3RA65 reversing starter

In this way up to 16 starters can be operated on a single IO-Link master. This leads to a reduction in the installation space and control wiring required.

Overload and monitoring relays

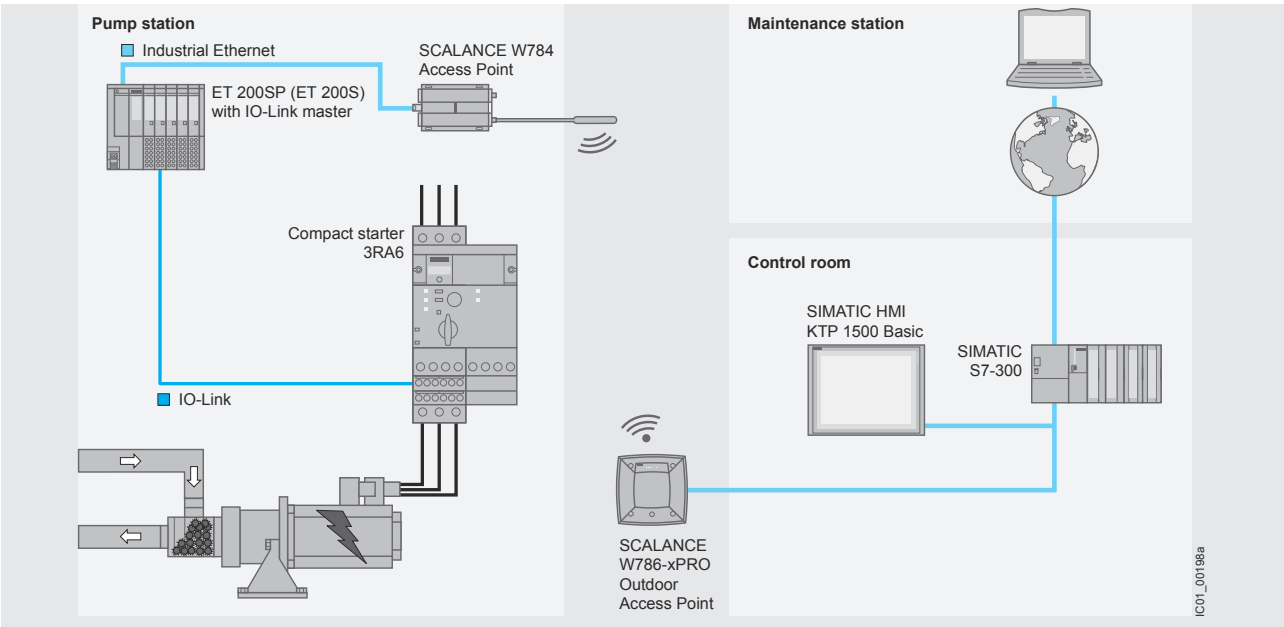
By combining overload/monitoring relays with IO-Link it is now possible to send data that has already been recorded and evaluated in the monitoring relays directly to the controller. This avoids the use of duplicated sensors.



Possibilities for connecting overload relays to IO-Link or in the conventional way

Wireless communication

Using an upstream IWLAN client module, such as SCALANCE W746-1PRO, allows IO-Link to be be integrated into the PROFINET world via a distributed I/O. Possible uses include acting as an alternative to fault-prone cable carrier or collector wire technology. The individual diagnostics options offered by the various IO-Link devices provide greater transparency for the production process. Just like the parameter data for a device, these diagnostics data can be evaluated remotely using the possibilities offered by SIMATIC. This supports remote maintenance down to the lowest level in the field.



Wireless communication between Industrial Ethernet and IO-Link components

IO-Link components

IO-Link master, software, cables

CM 4x IO-Link for ET 200SP

Masters

IO-Link master modules for ET 200SP

- CM 4x IO-Link

IO-Link master modules for ET 200S

- IO-Link 4SI electronic module
- SIRIUS 4SI electronic modules

IO-Link master modules for ET 200eco PN

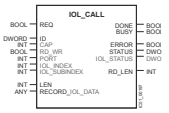
Software

STEP 7 PCT

STEP 7 PCT

Engineering software for configuring the IO-Link master modules for ET 200SP, ET 200S and ET 200eco

- Available as a stand-alone version or integrated into STEP 7 (Version 5.5 SP1 or later)
- Retrieving parameter and diagnostics data from the IO-Link devices connected to the master
- Monitoring of the process image of the IO-Link devices
- Open interface for importing further IODDs
- Freely available for download from Industry Online Support[1)]



IO-Link Call function block

IO-Link Call function block

STEP 7 function block for easy acyclical data exchange in the user program

- Freely available for download from Industry Online Support[2)]

WinCC flexible template project

WinCC flexible template project

Easy integration of IO-Link devices into the user program by using ready-made WinCC flexible templates

- Freely available for download from Industry Online Support[3)]

IODD files

IO-Link Device Description (IODD) files provide the device description for IO-Link

- Comprehensive IODD catalog of SIEMENS IO-Link devices
- Freely available for download from Industry Online Support[4)]

Cable

3-wire standard cable

IO-Link devices

K20 input module

Detection with IO-Link

IO-Link input modules

K20 input module

- 4 inputs, M12 connections
- 8 inputs, standard M8 connections

1) http://support.automation.siemens.com/DE/view/en/37936752
2) http://support.automation.siemens.com/DE/view/en/38487085
3) http://support.automation.siemens.com/DE/view/en/38006560
4) http://support.automation.siemens.com/DE/view/en/29801139/133100

IO-Link devices (continued)

SIMATIC RF210R, SIMATIC RF220R, SIMATIC RF260R

IO-Link RFID systems

SIMATIC RF200 RFID system in the HF range

- SIMATIC RF210R, SIMATIC RF220R, SIMATIC RF260R products
- Simple identification tasks (read-only), such as reading an ID number
- No RFID-specific programming, ideal for those new to RFID
- Simple connection via master modules for IO-Link, such as SIMATIC ET 200S and ET 200eco
- Use with the tried and tested ISO 15693 transponders (MOBY D)

Switching with IO-Link

SIRIUS 3RA27 11 function module for IO-Link

Contactors and contactor assemblies

Power contactors for switching motors

- SIRIUS 3RT2 contactors, 3-pole, up to 18.5 kW
- Contactor assemblies
- SIRIUS 3RA23 reversing contactor assemblies
- SIRIUS 3RA24 contactor assemblies for wye-delta starting
- SIRIUS 3RA27 function modules for IO-Link
- For direct-on-line starters, reversing starters and wye-delta starters

See chapter 2

SIRIUS 3RA64 direct-on-line starter

Motor starters for use in the control cabinet

SIRIUS 3RA6 compact starters

- 3RA64 direct-on-line starters
- 3RA65 reversing starters
- Infeed systems for 3RA6

See chapter 4

Contactors with IO-Link

SIRIUS 3RB24 overload relays

Overload relays

SIRIUS 3RB24 solid-state overload relays for IO-Link

- Evaluation module
- Current measuring modules from 0.3 to 630 A
- Controlling direct-on-line, reversing and star-delta starters via IO-Link in conjunction with contactors
- Full motor protection
- Diagnostics and current value transmission via IO-Link

See chapter 3

Monitoring with IO-Link

SIRIUS 3UG48 monitoring relays

Monitoring relays

SIRIUS 3UG48 monitoring relays for IO-Link

- Monitoring voltage, current, power, speed or p.f. according to device design
- ON-delay and tripping delay time can be adjusted

See chapter 11

SIRIUS 3RS14 temperature monitoring relays

SIRIUS 3RS14, 3RS15 temperature monitoring relays for IO-Link

- Temperature monitoring with connected sensors
- Two limit values, can be adjusted separately

See chapter 11

SIRIUS 3RR24 monitoring relays

SIRIUS 3RR24 monitoring relays for IO-Link

- Monitoring of current, phase failure, open circuit and phase sequence
- Designed for mounting on 3RT2 contactors

See chapter 2

Overview

Principles of the IO-Link specification

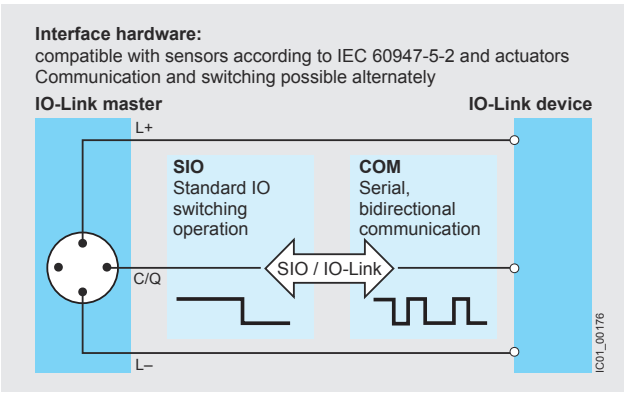
According to the IO-Link specification, communication functions as follows:

- Transmission takes place via an unshielded three-wire cable no more than 20 m long, of the kind normally used for standard sensors.
- Analog values which have already been digitized are transmitted in the form of message frames, which may correspond to +/- 10 V or 4 to 20 mA.
- Digital communication from 0 to 24 V on the so-called C/Q cable
- Most of the values transmitted are measured values from the sensors which include the units.
- The sensors and actuators are described by the IO-Link Device Description (IODD).
- While the IO-Link specification permits an infinite number of ports, an IO-Link master currently only supports four ports. Only one IO-Link device (slave) can be connected to each port (point-to-point connection).
- Transmission parameters between IO-Link master and the devices: 1 start bit. 8 data bits, 1 parity bit and 1 stop bit.
- The transmission rates between IO-Link master and the devices are as follows:
  - via COM1: 4 800 bps
  - via COM2: 38 400 bps
  - via COM3: 230 400 bps
- The average cycle time is 2 ms for the reading/writing of 16 data bits at a transmission rate of 38 400 bps.

IO-Link protocol

For the dialog between device and master, IO-Link uses a standard protocol, the standard asynchronous communication interface (UART) in "semi-duplex" mode.

The IO-Link protocol supports both the Standard IO mode (SIO) and the IO-Link communication mode (COM).



The structure of the protocol and its message frames depends on the types of data to be transmitted.

Data types

In the IO-Link specification a distinction is made between the following data types:

Process data

The process data of the devices are transmitted cyclically in a data frame, provided the process data width does not exceed 2 bytes. In the case of larger process data widths up to 32 bytes, parts are transmitted one after the other in several cycles. As of Version V1.1 of the specification, up to 32 bytes of process data can be transferred in a single cycle.

Service data (SD)

With the aid of the service data, parameter values or device statuses can be read out. It is also possible to write the parameter values or transmit commands via the service data. Service data are always exchanged acyclically and in response to an inquiry from the IO-Link master.

Events

Via events it is possible to transmit device events or statuses such as contamination, overheating, short circuits etc., from the the device via the IO-Link master to the PLC or to visualize them.

The events are sent on the initiative of the devices via the "event flag", which the master evaluates. The master itself can also generate events.

Three categories of event are defined:

- Error signals (errors)
- Maintenance data (warnings)
- Device functions (notifications)

M-sequence (message frames)

Parameter data, events and process data can be transmitted either in an M-sequence (message frame) or in separate M-sequences (message frame).

Data storage

As of Specification V1.1, a data storage concept has been created for IO-Link. In this concept, the IO-Link device initiates the storage of its data on a higher-level parameter server. In the event that a device is replaced, the parameter server can restore the original parameterization. It is therefore possible to replace the devices without re-parameterization.

The IO-Link master can contain the parameter server. The parameter server can also be implemented centrally in the PLC or in a system server. In this case the IO-link master passes on the corresponding information.

IO-Link master

The IO-Link master is the interface to higher-level control systems. The IO-Link master presents itself as a normal fieldbus node, and is integrated into the appropriate network configurator via the relevant device description (e.g. GSD, FDCML, EDS etc.).

IO-Link Device Description (IODD)

The IO-Link Device Description (IODD) has been defined to provide a full, transparent description of system characteristics as far as the IO-Link device. It is based on the open XML standard.

The IODD contains information on communication characteristics, device parameters, identification, process and diagnostics data, and is supplied by the manufacturer. The design of the IODD is the same for all devices from all manufacturers, and is always presented in the same way by the IODD Interpreter Tools. This therefore ensures that the handling is the same for all IO-Link devices, whatever the manufacturer.

New in IO-Link specification 1.1

The IO-Link specification is currently available in Version 1.1, and is currently standardized as IEC 61131-9 (CDV).

Specification 1.1 offers the following new features compared with the previous specification 1.0:

- New variable M-sequences allow transmission of up to 32 bytes of process or service data in a single cycle.
- Data storage concept