System Manual · 11/2008
with Supplements · 09/2010

AS-Interface / ASIsafe

as-interface

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AS-Interface

AS-Interface system

System Manual

The following supplements (**Edition 09/2010**) belong to this documentation:

System Expansions
1.1 AS-i Power24V and data decoupling units
1.2 AS-i data decoupling units

ASIsafe: Safe AS-i outputs
2.1 Safe SlimLine module S45F

A5E01216655-02

11/2008
3RK2703-3BB02-1AA1

Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

WARNING
This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Automation and Drives
Postfach 48 48
90327 NÜRNBERG
GERMANY

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Table of contents

1 Introduction

1.1 Preface

Purpose of this document

This system manual describes the hardware and software components of the AS-Interface system. It provides an overview of the individual system components and describes solutions in which the system continuity of the products (Totally Integrated Automation: TIA) is of prime importance.

The manual is aimed at planners, configuration engineers, fitters, technologists, and decision-makers to provide support during planning and implementation. It is also aimed at service and maintenance technicians who install additional components or carry out fault analyses.

Validity of this documentation

This documentation describes the version shipped as of August 2007.

1.2 Guide to the system manual

Contents format	Content
Table of contents	Detailed breakdown of the document with relevant pages/sections
Introduction	Overview of the AS-Interface
Notes on safety	All the generally applicable safety aspects from legal specifications
Product portfolio	Overview of all the AS-Interface system components
Getting Started	Basic/introductory information for first-time users
Operating principle	Information about the AS-Interface communication system
Master Power supply units Slaves	Overview of the system components
Integrated safety equipment: ASIsafe	Concept for integrating safety-oriented components
System accessories	Support accessories for assembly, installation, operation, and diagnosis
System integration	Information about integration in SIMATIC and third-party systems
System diagnosis	Diagnosis telegrams and data sets
Planning and configuration	Overview
Appendix	References

1.3 What is AS-Interface?

AS-Interface

AS-Interface ("AS-i" for short) stands for actuator sensor interface. It is an industrial field bus system that retrieves the signals at the lowest field level.

Cost-effective alternative to standard wiring methods: the yellow AS-i cable

- The sensors and actuators no longer need to be connected individually to the controller via parallel cables, which is an extremely time-consuming process, but simply via **one** joint AS-i cable.
- The input signals are gathered from AS-i modules and automatically sent to an AS-i master, which forwards the data to the controller (e.g. SIMATIC S7). At the same time, the output signals travel in the opposite direction.
- The AS-i cable also supplies the power for the modules and sensors.
- The modules can be easily connected to the yellow AS-i flat ribbon cable by means of the insulation displacement method so that they are protected against polarity reversal.
- The following terminal devices can be connected to AS-i modules:
  - Binary sensors (e.g. proximity switches, positions switches, pushbuttons)
  - Binary actuators (e.g. valves, indicator lights)
  - Analog sensors (e.g. temperature sensors (KTY, PTC, NTC), level indicators)
  - Analog actuators (e.g. analog displays)
- The following sensors and actuators with integrated AS-i slave can also be connected to AS-i modules:
  - Control devices
  - Signal columns
  - Motor feeders
  - Position switches

Direct assembly

- Since the AS-i field modules are available with housings with a high degree of protection (e.g. IP67), they can be assembled in the immediate vicinity of sensors and actuators. AS-i modules and sensors/actuators can be quickly and easily connected using short prefabricated cables (e.g. M12 or M8 plug-in cables).
- Modules with degree of protection IP20 are available for use in control cabinets.

AS-i logo

AS-Interface devices have the following logo:

Figure 1-1 The AS-Interface logo

Optimum quantity structure

AS-Interface is optimized in line with the data volume that fulfills the requirements of the lowest field level. Up to 31 modules (standard slaves) each with four digital inputs and outputs can be connected for each AS-i network. The cycle time here is max. 5 ms.

The number of modules can be doubled to 62 when modules with an extended addressing mode (A/B slaves) are used.

Analog input and output modules are also available in addition to digital modules.

Safety-oriented signals (EMERGENCY STOP, door tumbler, two-hand operations etc.) can also be transferred.

International standard

The AS-Interface concept was elaborated in 1992 by a consortium originally comprising 11 companies, including Siemens AG, in the area of industrial automation. Since then, approx. 300 companies worldwide have helped create an established system with this technology.

AS-Interface complies with the international standards EN 50295 and IEC 62026-2 for field bus communication.

The system properties are defined in an open, manufacturer-independent manner in the AS-i specifications (AS-i Spec. for short) by the umbrella organization AS-Interface Association.

For more information and contact addresses, please visit the following website:

www.as-interface.net

1.4 The automation pyramid and deployment of AS-i

The automation pyramid levels

The automation pyramid is divided into three levels.

The control level

Here, individual automation islands are connected to each other to create larger units, e.g.:

- Several machines in a hall
- Several halls in a plant
- Several plants in a company at different locations

Data exchange takes place in large data blocks and is not critical from a time perspective.

The field control level

At this level:

- Central and distributed automation devices are used
- Complex field devices are connected

Data is usually exchanged on a byte-dependent basis.

The actuator/sensor level

At this level, the most commonly-used components are connected:

- Binary actuators
- Simple analog devices

Data is usually exchanged on a bit-dependent basis.

Totally Integrated Automation

The Siemens Totally Integrated Automation (TIA) concept covers all the automation levels and is optimized in line with the interfaces.

Siemens offers:

- AS-Interface communication processors (CP) that can be installed directly in the SIMATIC rack
- Gateways (links) for transferring data from AS-Interface to PROFIBUS and PROFINET

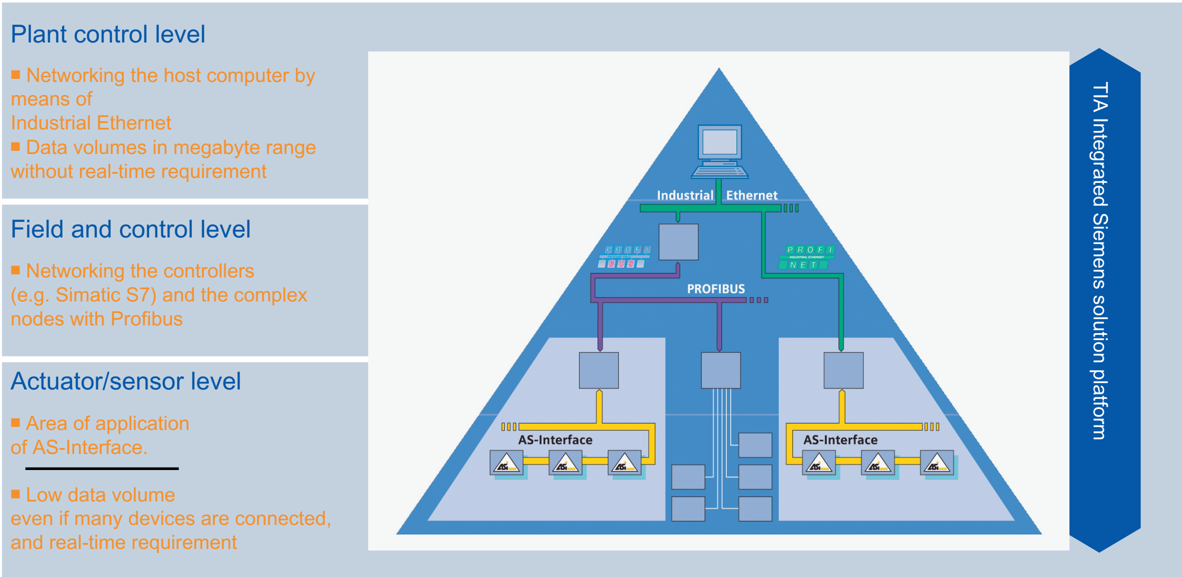


Figure 1-2 Integration of AS-i in the TIA automation pyramid

1.5 Benefits of AS-Interface

The actuator sensor interface offers the following benefits:

- No need for complex cable harnesses to the sensors and actuators
- Smaller control cabinets due to the lack of I/O modules
- Rapid installation thanks to the IP67 housing and AS-i insulation displacement method
- Plug-in methods allows sensors and actuators to be connected without errors
- Signals are mapped in the PLC in the same way as for standard I/O modules
- Comprehensive range of diagnosis options covering even individual modules
- Modules can be replaced while the system is live

These benefits not only help cut the cost of configuration, installation, documentation, and maintenance, but also reduce downtime.

For more information, see:

www.siemens.de/as-interface

Product portfolio 2

2.1 Master

As a communications processor (CP) or link, the AS-Interface master acts as an interface with higher-level controllers. It organizes data exchange on the AS-Interface cable independently, queries signals, sets parameters, and performs monitoring/diagnostic functions.

- Up to 62 AS-Interface slaves can be connected.
- Integrated analog value transfer
- Standard operation in the input/output address range
- The individual AS-Interface slaves either can be configured in STEP 7 HW Config, or the AS-i ACTUAL configuration can simply be adopted as the TARGET configuration
- Monitoring of the power supply on the AS-Interface shaped cable
- User-friendly diagnosis and commissioning
- Degree of protection IP20

Communications processors (CP)


Simple connection to SIMATIC S7-300 with CP343-2 / CP343-2 P or to SIMATIC S7-200 with CP343-2.

Links to PROFIBUS DP or PROFINET IO


A compact router integrated in STEP 7 from AS-Interface to PROFIBUS with DP/AS-i Link Advanced and DP/AS-i Link 20E or with IE/AS-i Link PN IO to PROFINET

- Single and double master to spec. 3.0
- Vertical, Web-based integration (i.e. commissioning and diagnosis can be performed via a standard Web browser)
- PROFINET link with integrated Ethernet 2-port switch

Safety-related F-link to PROFIBUS DP

Compact router allowing efficient integration of ASIsafe in PROFIsafe

- Degree of protection IP20
- In one device: Fully-fledged AS-i master (Spec. 3.0) for standard and safety signals
- Transfer of safe input signals to PROFIsafe architectures
- Exchange of digital and analog I/O data
- Safety functions parameterized via STEP 7 Distributed Safety

2.2 AS-Interface power supply units

AS-Interface power supply units are primary switched-mode power supply units that generate a regulated DC voltage of 30 V DC with high control stability and low residual ripple. They are a key component of the AS-Interface network and allow data and power to be transferred simultaneously in one cable.

Power supplies

Optimum power for all applications: AS-Interface power supply units

- Degree of protection IP20
- Broad power spectrum (from 3 A DC to 8 A DC)
- Removable terminal blocks
- Integrated overload and ground-fault detection
- Diagnostic memory, signaling contacts and remote reset function, LEDs
- Ultra-wide input range with 8 A version
- CLASS 2 variant available
- Variant with 24 V DC input available

2.3 Slaves

Slaves are used to connect the sensors and actuators in the field or in the cabinet unit. A maximum of 62 slaves can be connected to an AS-i network. The connected slaves exchange data with the AS-i master cyclically.

K60, K45, and K20 compact modules

The K60, K45, and K20 compact modules reduce installation and commissioning times by up to 40%.

- Degrees of protection IP65/IP67 or IP68/IP69K available
- Particularly compact dimensions as of a construction width of 20 mm
- ATEX-certified modules for hazardous zone 22 available
- Connection sockets in M8/M12
- Up to 8 inputs and 4 outputs
- A/B technology available (to AS-i spec. 2.1 and AS-i spec. 3.0)
- Polarized contacting
- DIN rail and wall-mounting possible
- Module can be mounted on a baseplate with just one screw
- Diagnostic LEDs
- AS-i/AS-i data coupler with construction type K60
- Rapid connection by means of insulation displacement method (flat cable adapters for K20)

K60 analog modules

The K60 analog modules allow analog values to be easily integrated.

- Degree of protection IP65/IP67
- Records/supplies analog signals on site
- 1, 2, or 4 channels
- Input modules for up to 4 current sensors, voltage sensors, or temperature sensors (Pt 100, Ni 100) or resistance measurement
- Output modules for current or voltage
- Analog modules with rapid data transfer in extended address mode (A/B technology) to spec. 3.0 available

SlimLine and flat modules

SlimLine and flat modules can be used in control cabinets and small local switchboxes.

- Degree of protection IP20
- Up to 16 inputs
- A/B technology available (also to AS-i spec. 3.0)
- SlimLine modules with construction widths as of 22.5 mm
- Removable SlimLine terminal blocks safe against finger touch and coded
- Flat modules for small control cabinets and areas with restricted space
- Connection via screw-type or cage-clamp terminals
- DIN rail and wall mounting possible
- Diagnostic LEDs

Counter modules

Counter modules are used for transferring count values for pulses of up to 769 Hz.

- Degree of protection IP20
- For evaluating digital pulses
- Connection via removable screw-type or cage-clamp terminals

2.4 Motor starters

24 V DC starter

Simple motor starter with tried-and-tested K60 module construction type for 24 V DC motors

- Degree of protection IP65/IP67
- Direct-on-line starter, double direct-on-line starter, or reversing starter
- For motors up to 70 W
- Quick-stop function

Compact starter for AS-Interface

Motor starters for AC motors

- No local control cabinets required
- Degree of protection IP65/IP67
- Up to 5.5 kW for 400/500 V AC
- Electromechanical or electronic design
- With optional brake contact
- Hand-held device for local operation available

Motor starters for ECOFAST

Saving space in the control cabinet: the ECOFAST motor starter can be installed near to or directly on the motor.

- Degree of protection IP65/IP67
- Standardized connector to ECOFAST® specifications (conforms with DESINA)
- Mechanical switching function or as reverse starter with soft start

Load feeders

Prefabricated load feeders facilitate wiring activities in the control cabinet.

- Degree of protection IP20
- Available fully pre-wired or as individual components
- Power range up to max. 7.5 kW
- Can be snapped directly onto busbar systems
-
-

2.5 LOGO!

Local intelligence with the LOGO! communications module

AS-i interface for LOGO!

- AS-i slave for connecting LOGO!
- LOGO! I/Os can be extended by four inputs/outputs
- Small local control units with an interface to a central controller via AS-i

2.6 Integrated AS-i slaves

Pushbuttons/indicator lights

Complete 3SB3 control system with simple AS-Interface connection for your plant.

- Customized, modular structure
- Metal or plastic design
- A/B or standard technology
- Indicator light with integrated LED

Signaling columns

Signaling columns for monitoring production procedures and for providing a visual or acoustic alarm in emergencies with a simple AS-Interface connection.

- A range of visual and acoustic elements can be combined as required
- Up to four signal elements can be connected via an adapter element
- With LEDs or incandescent lamps
- A/B or standard technology

Communication-capable contactors (55 to 250 kW)

- Contactors (55 to 250 kW)
- Integrated switchover function from automatic to manual/local control
- Control and message signals via AS-Interface
- Remaining life time indicated via AS-Interface

2.7 ASIsafe

ASIsafe allows safety-oriented signals to be transferred in an AS-Interface network, thereby enabling EMERGENCY STOP buttons, protective door switches, safety light arrays etc. to be easily connected to the AS-i network without compromising the simplicity of AS-Interface wiring.

Safety monitor / expanded safety monitor

The safety monitors allow safety functions to be easily configured.

Safety category to EN 954-1	4
Safety Integrity Level (SIL) to IEC 61508	3

- Core elements of ASIsafe
- Monitors safe nodes and connects safe inputs
- Ensures safe shutdown
- Removable terminal blocks
- Available with 1 or 2 enabling circuits
- Expanded safety monitor with extended RAM and functional scope
- Quick-and-easy configuration of the safety monitor via the PC software asimon

Safe modules

Safe modules K45F, K20F, and SlimLine allow safe signals to be easily integrated, whether in the control cabinet or field.

- Degrees of protection IP65/IP67 or IP20
- Available as K60, K45, or K20 compact module or SlimLine module
- Two inputs in safety category 2 to EN 954-1 / Safety Integrity Level (SIL) 3 to IEC 61508 or one input in safety category 4 to EN 954-1 / Safety Integrity Level (SIL) 3 to IEC 61508
- Four inputs in safety category 2 to EN 954-1 / Safety Integrity Level (SIL) 3 to IEC 61508 or two inputs in safety category 4 to EN 954-1 / Safety Integrity Level (SIL) 3 to IEC 61508
- Modules available with additional standard outputs

EMERGENCY STOP

Simple, direct connection of tried-and-tested controls to ASIsafe

- Degrees of protection IP65/IP67 or IP20
- EMERGENCY STOP can be connected directly to AS-Interface via integrated modules
- Metal or plastic housing
- Also available as F adapter for snapping on to actuator for front plate mounting

Position switches / cable-operated switches

Direct wiring of safety functions via AS-i

- Degrees of protection IP65 or IP66/67
- Direct connection of position switches or cable-operated switches for detecting safe signals
- ASIsafe electronics integrated in the housing
- Available with separate actuator or tumbler
- Metal or plastic housing

Non-contact protective equipment

Active personnel protection can be connected directly to ASIsafe.

- Degree of protection IP65
- Can be connected directly and safely to AS-Interface
- Up to safety category 3 to EN 954-1 / Safety Integrity Level (SIL) 3 to IEC 61508 or in safety category 4 to EN 954-1 / Safety Integrity Level (SIL) 3 to IEC 61508
  - (Laser scanner)
  - (Light arrays/curtains)
- Also with integrated muting function

2.8 System components and accessories

Accessories for facilitating assembly, installation, operation, and diagnosis

Range extension

Reduced infrastructure costs, greater range of applications, and greater freedom in plant design.

- An extension plug is available to extend an AS-i segments to max. 200 m (without additional power supply unit)
- AS-i network can be extended to include more than one bus segment with AS-i repeater
- Maximum expansion (with star topology) to more than 1000 m possible

Addressing unit

Simplest method of addressing and parameterizing the slave

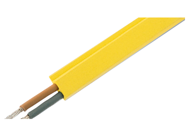
- All the nodes in the AS-Interface network can be addressed (standard and A/B slaves)
- Profile codes of the slaves can be read (IO, ID, ID2, and ID1)
- ID1 code can be set
- Parameter bits can be temporarily set or the parameter strings permanently set
- AS-Interface voltage can be measured
- Outputs can be set directly and slave inputs read
- Complete plant configurations can be saved

Analyzer

Quality assessment of an AS-Interface network with function for printing reports as well as performing on-site analyses and remote diagnose

- Quality and reliability of an AS-Interface installation can be checked
- Data can be transferred to a PC via an RS232 interface
- Software-based evaluation
- Simple, user-friendly operation
- Test reports generated automatically
- Advanced trigger functions enable precise analyses
- Multiple error display enables preventive diagnosis
- Process data (digital, analog, and Safety) can be viewed online

AS-i shaped cable



- Rapid exchange and connection to AS-Interface by means of piercing technique.
- Trapezoidal profile protects against incorrect polarity
- Cables made of materials optimized for different applications
- Special version available to UL class 2

Distributors / M12 feeders

Quick and easy redistribution and branching to the AS-i shaped cable

- Simple distribution of the AS-i shaped cable with a high degree of protection
- Branching from AS-i and U_{aux} to round cable
- Connection of slaves with M12 bus connection
- Extremely user friendly

Special modules


Diagnosing ground faults and protecting against overvoltages on AS-i

- Advanced diagnosis function that detects, displays (LED), and signals (1 changeover contact) ground faults.
- Greater operational reliability thanks to overvoltage protection

3 Getting Started

What information does Getting Started contain?

The Getting Started chapter is aimed at people who are new to AS-Interface systems.

This chapter provides a step-by-step example showing you how to create a fully-functional AS-i system.

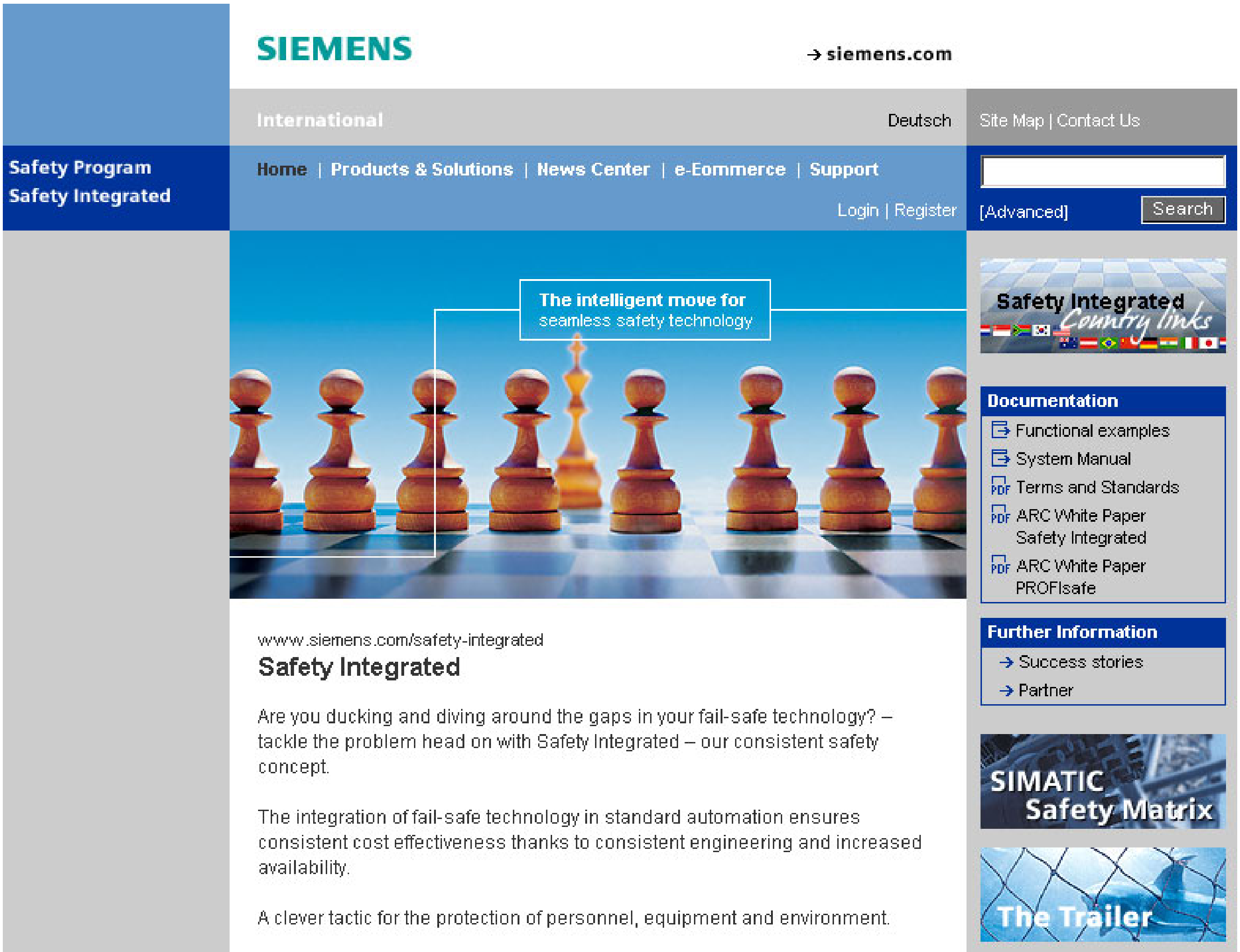
Example: Creating an AS-Interface system

1. Components required for creating AS-Interface system
2. Commissioning the AS-Interface system
3. Addressing the I/O modules
4. Mounting the AS-i components on the DIN rail
5. Programming the AS-i system in STEP 7
6. Functional test

Functional examples for Safety Integrated

Functional examples with safety technology for AS-Interface can be downloaded from:

www.siemens.de/safety



To download, click "Functional examples" in the documentation area.

3.1 Components required for creating AS-Interface system

Key components of an AS-Interface system

An AS-Interface essentially comprises four components:

1. **AS-Interface master**
   The AS-Interface master (in this example: communications processor **CP343-2 P**) controls data exchange with the connected nodes (slaves).
2. **AS-Interface slaves/modules**
   All the nodes that are addressed by the master are called "slaves". In this example, K45 digital I/O modules are used to which the sensor (inductive proximity switch) and an actuator are connected.
3. **AS-Interface cable**
   The AS-Interface cable, an unshielded two-wire cable, transfers the signals and power supply for the sensors and actuators connected via AS-Interface. If necessary, the power supply for actuators can be taken from the black shaped cable.
4. **AS-Interface power supply unit**
   The AS-Interface power supply unit supplies the network electronics (AS-Interface modules) and connected sensors. The integrated data decoupling ensures that the data and power are kept separate, which means that data and power can be transferred in one cable.

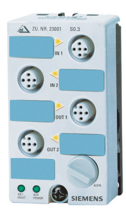
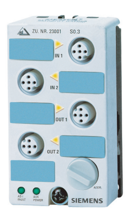
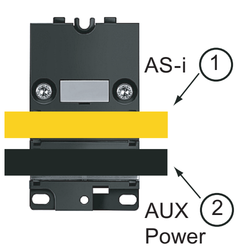
Note

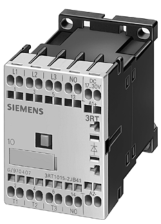
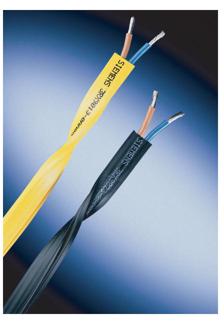
AS-Interface power supply units are among the **essential and functionally-critical components of an AS-Interface network and cannot be replaced by conventional power supply units!**

The components required for creating the system described in this example are listed below. If other components are used, the steps involved may differ from the description provided here.

Components required for creating a standard AS-Interface system				
Components		Type	Order no.	Qty
	Rail	Length 480 mm	6ES7 390-1AE80-0AA0	1
	SIMATIC S7-300, PS 307	Load power supply, 120/230 V AC, 24 V DC, 2A	6ES7307-1BA00-0AA0	1

Components required for creating a standard AS-Interface system				
Components		**Type**	**Order no.**	**Qty**
	SIMATIC S7-300	CPU 312	6ES7312-1AE13-0AB0	1
	MICRO MEMORY CARD F	64 KBYTE	6ES7953-8LF11-0AA0	1
	STEP 7	V5.4, or higher, trial license for 14 days	6ES7810-4CC08-0YA7	1
	CP343-2 P	AS-Interface communications processor	6GK7 343-2AH10-0XA0	1
	Front connector	20-pole, with screw-type contacts	6ES7392-1AJ00-0AA0	1

Components required for creating a standard AS-Interface system				
Components		Type	Order no.	Qty
	AS-Interface power supply unit IP20	3A power supply unit with integrated ground-fault and overload detection	3RX9501-0BA00	1
	AS-Interface input module K 45	Digital I/O module, IP 67, 4 inputs	3RK1 200-0CQ20-0AA3	1
	AS-Interface output module K45	Digital I/O module, IP 67, 4 outputs	3RK1 100-1CQ20-0AA3	1
	Mounting plate	for standard rail	3RK1901-2DA00	2

Components required for creating a standard AS-Interface system				
Components		Type	Order no.	Qty
	M12 inductive proximity switches	15 ... 34 V DC, SN = 4 mm, PNP, 3 conductors, nickel-plated brass with M12 connector	3RG4012-3AG01	1
	M12-M12 connection cable	3-pole, with 1m PUR conductor, black, 3 x 0.34 mm^2, straight cable plug, straight connector	3RX8000-0GF32-1AB0	1
	Contactor relay	Contactor, AC-3, 3KW/400V, 1OE DC 24V, 3-pole, module S00, cage-clamp connection, integrated diode	3RT1015-2VB42	1
	Connection cable M12 cable connector – open cable end	4-pole, with 5m PUR conductor, black, 4 x 0.34 mm^2	3RX8000-0CD42-1AF0	1
	AS-Interface shaped cable	Yellow, rubber, 2 x 1.5 mm^2, length 100 m	3RX9010-0AA00	1
	24 V cable (AUX)	Black, rubber, 2 x 1.5 mm^2, length 100 m	3RX9020-0AA00	1
	AS-Interface addressing and diagnostics unit	Connection via M12 socket, IP40	3RK1 904-2AB01	1

3.2 Overview of the hardware structure

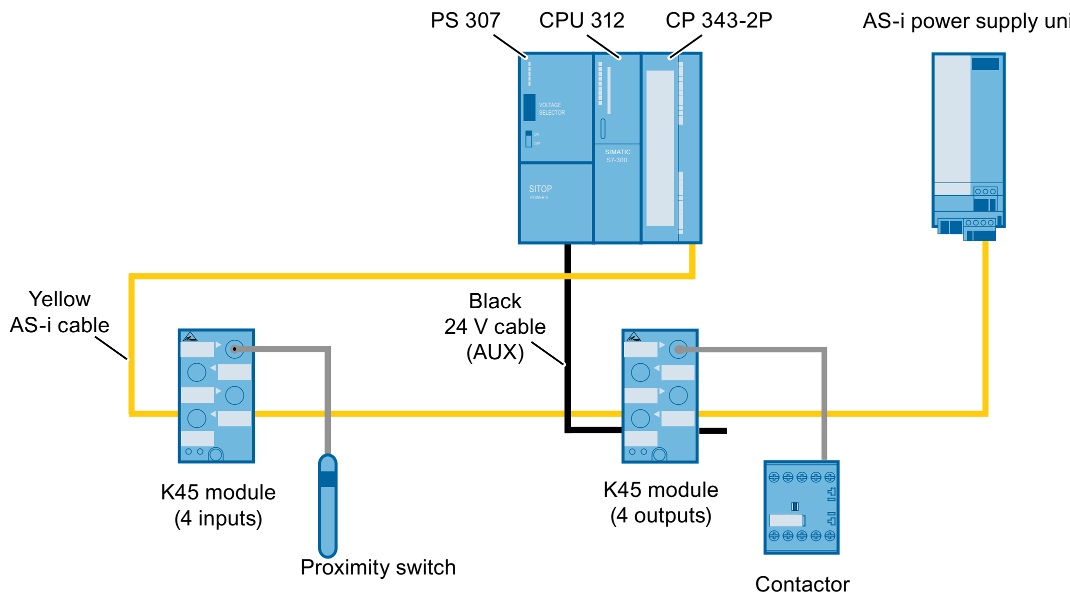


Figure 3-1 Hardware structure: basic system

3.3 Commissioning the AS-Interface system

Step-by-step guide to creating a fully-functional AS-Interface system

To commission a fully-functional AS-Interface system, we recommend that you carry out the following steps:

1. Address the I/O modules with the addressing unit
2. Mount all the components on the DIN rail
3. Connect all the components to the AS-i bus.
4. Program the AS-i system in STEP 7.
5. Carry out a functional test.

3.4 Addressing the I/O modules

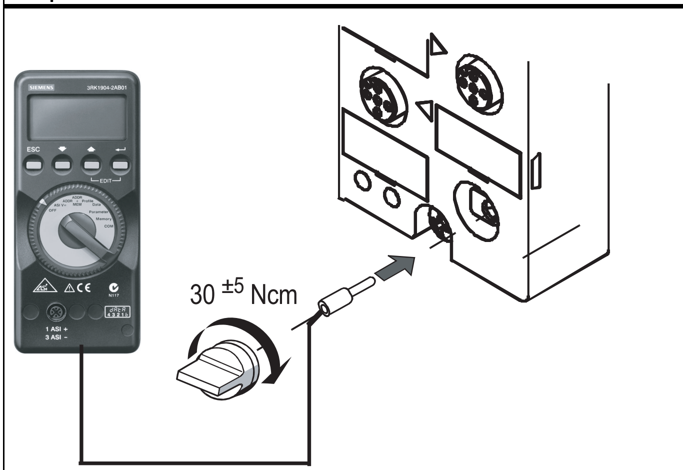
Unique addressing

In the as-delivered condition, the address of each I/O module (slave) is set to 0. It is detected by the master as a new slave that has not yet been addressed and, in this condition, has not yet been integrated in standard communication/data exchange.

To enable data to be exchanged between the master and slaves, you have to assign a **unique address** for all the slaves before creating the interface network. The following addresses are used in this example:
Input module K 45 = address 1
Output module K 45 = address 2

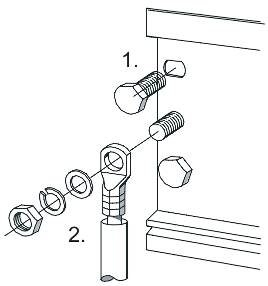
Note

When addressing the slaves via the addressing socket, you must switch off the AS-i voltage for safety reasons.

Steps	
	1. Unscrew the cap for the addressing socket on the module.
	2. Connect the module to the addressing unit (3RK1904 2AB0).
	3. Assign an address to the module. – Switch the selector switch to **ADDR.** – Press ↵. The address of the connected module is read and displayed. – Select the address with ▼ ▲. – Transfer the address to the module with ↵.
	4. Remove the addressing cable with the cap.
	5. Seal the addressing socket with the cap.
	6. To address the K45 output module, repeat steps 1 to 4. This time, however, choose the address 2.

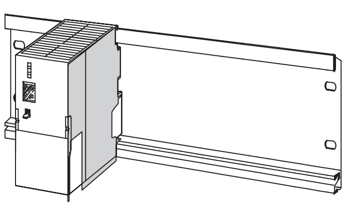
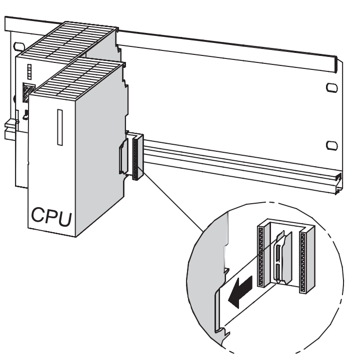
3.5 Mounting the SIMATIC and AS-i components on the DIN rail

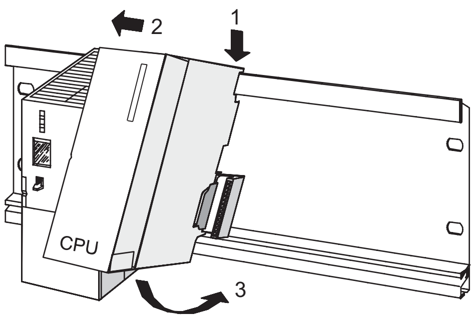
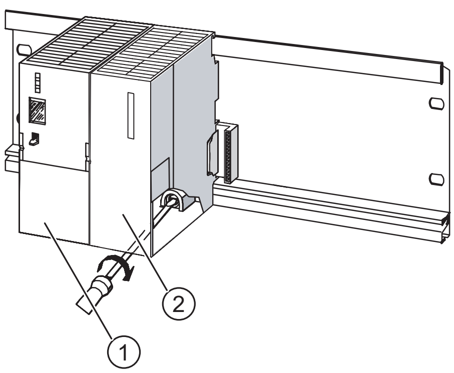
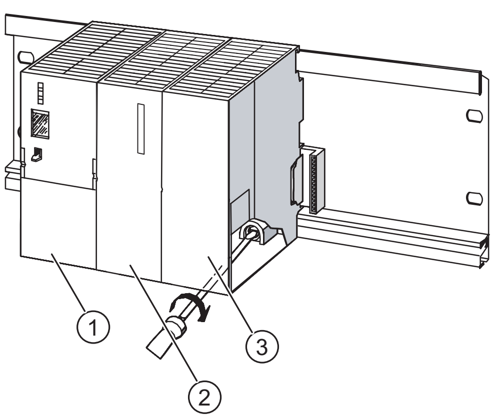
Mounting and grounding the DIN rail

Steps	
	1. Screw on the mounting rail (screw size: M6). Make sure that you maintain a clearance of at least 40 mm above and below the DIN rail.
	2. Connect the DIN rail to the protective conductor using the M6 protective conductor screw. The prescribed minimum cable cross-sectional area for the protective conductor is 10 mm^{2}.

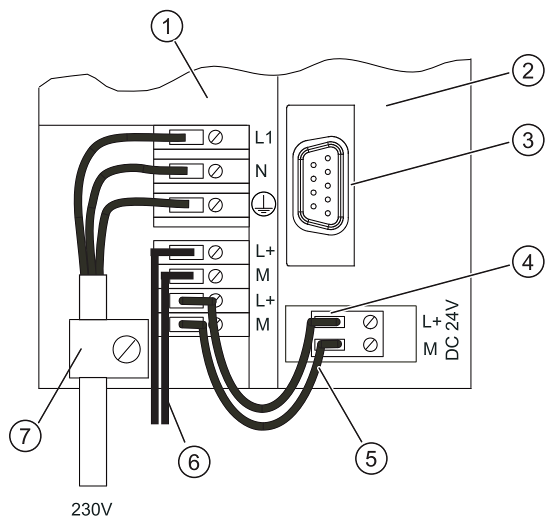
Mounting the modules on the DIN rail.

Mount the PS 307 power supply unit, CPU 312, and CP 343-2 P AS-i master on a DIN rail one after the other.

Steps	
	1. Hook the PS 307 power supply unit onto the DIN rail. Push it to the left until it reaches the grounding screw of the DIN rail and tighten it.
	2. Connect a bus connector (see excerpt of graphic) to the CPU 312 to establish a connection with the other modules.

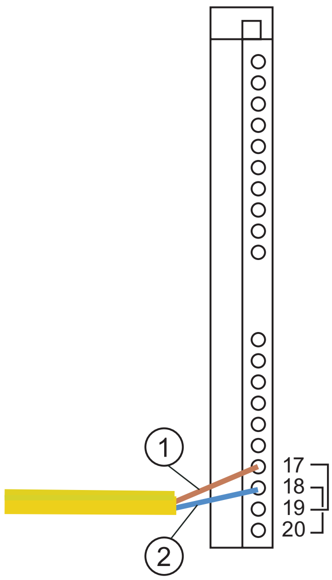
Steps	
	3. Hook the CPU onto the DIN rail (1). 4. Push it along the rail until it reaches the module on the left (2). 5. Now pull it down (3).
 ① = PS 307 ② = CPU 312	6. Screw the module onto the DIN rail (tighten by hand). 7. Insert the micro memory card into the module slot of the CPU 312.
 ①= PS 307 power supply unit ② = CPU 312 ③ = AS-i master CP 343-2 P	8. Mount the AS-i master CP 343-2P on the right next to the CPU. To do so, repeat steps 3 to 6.

3.6 Connecting the CPU312 to the PS 307 power supply unit

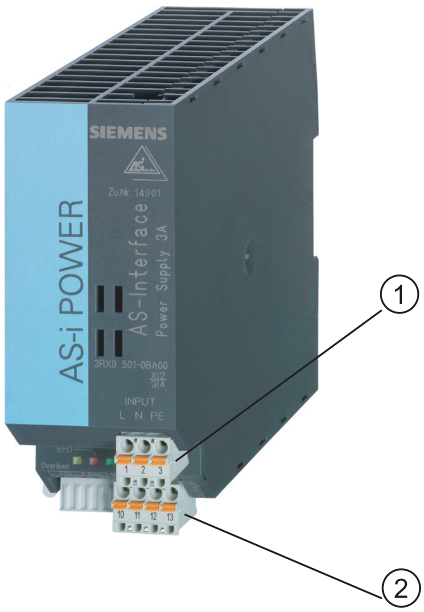
<table>
<tr><th colspan="2">Steps</th><th>Result</th></tr>
<tr><td rowspan="4">

①= PS 307 power supply unit
② = CPU 312
③ = MPI interface for connection to PC/PG
④ = 24 V power supply connection
⑤ = Connection cable between PS 307 and CPU 312
⑥ Black flat ribbon cable, 24 V (AUX power)
⑦ Cable strain relief, 230 V / 120 V</td>
<td>1. Connect the flexible power cable to the PS 307 power supply unit:
- Phase L1 to terminal L1
- Neutral conductor to terminal N
- Protective conductor to terminal PE</td>
<td>PS 307 is connected to the power supply.</td></tr>
<tr><td>2. Check whether the switch for selecting the line voltage is set in accordance with the line voltage in your plant. The power supply is defaulted to a line voltage of 230 V AC. To change this setting, open the protective cap, set the switch to the existing line voltage, and then close the protective cap.</td>
<td>The line voltage is now set.</td></tr>
<tr><td>3. Use the connection comb provided to connect the CPU 312 to the power supply. Alternatively, use the flexible cable with a 1 mm2 cross-section. Strip the ends to approx. 6 mm and press wire end ferrules onto the ends. Now connect terminals L1 and N on the power supply unit to those on the CPU.</td>
<td>The CPU is connected to the power supply unit.</td></tr>
<tr><td>4. Connect the black AS-i auxiliary cable to the PS 307 power supply unit:
- Brown to terminal L+
- Blue to terminal M</td>
<td>The AS-i auxiliary cable is connected to the power supply unit.</td></tr>
</table>

3.7 Connecting the CP343-2P master to the AS-i bus

Steps		Result
 ① = AS-i+ (brown) ② = AS-i- (blue)	1. Open the cover on the front of the CP 343-2 P and push the front connector onto the module so that the cables can be connected.	—
	2. Connect the yellow AS-i shaped cable to the CP: – Brown to terminal 17 (AS-i +) – Blue to terminal 18 (AS-i -)	The CP 343-2 P is connected to the AS-i network.

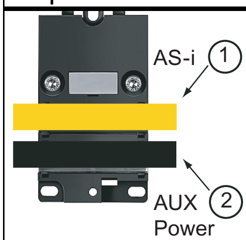
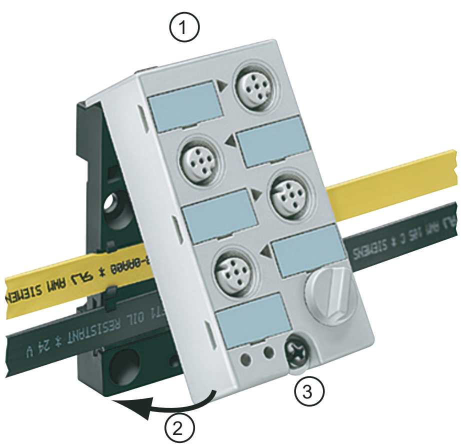
3.8 Connecting the AS-i power supply unit to the AS-i bus/power supply

Steps		Result
 ① Input side 230 V / 120 V ② Output side AS-i bus	1. Supply the input side of the power supply unit ① with 230 V / 120 V: - Phase L1 to terminal L1 - Neutral conductor to terminal N - Protective conductor to terminal PE	The power supply unit is supplied with 230 V.
	2. Check whether the switch for selecting the line voltage (see cut-out section on the top of the housing) is set in accordance with the line voltage in your plant.	The line voltage is now set.
	3. On the output side of the power supply unit ②, connect the yellow As-i shaped cable: – Brown to terminal 11 (AS-i +) – Blue to terminal 12 (AS-i -) In industrial operation, terminal 13 (GND) must be connected to the system ground.	The power supply unit is connected to the AS-i bus.

3.9 Connecting the K45 modules to the AS-i bus

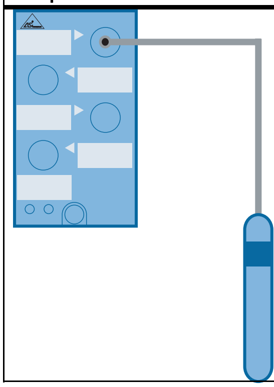
This example shows you how to mount the K45 modules on a DIN rail.

Rapid contacting thanks to piercing technology

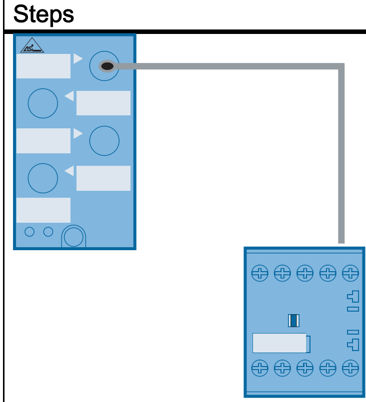
Steps		Result
	1. The mounting plate for the module carries the shaped flat cable. Hook the mounting plate onto the DIN rail. Insert the yellow ① and black ② shaped cables.	The mounting plate locks onto the DIN rail. The cables are secured.
	2. Hook the module ① onto the holding studs on the mounting plate.	
	3. Push the module ② onto the mounting plate.	
	4. Secure the upper part onto the mounting plate using the screw ③. The contact rods of the module penetrate the insulation of the shaped cable and establish contact with the copper conductors.	The K45 module is connected to the bus.
	5. Carry out steps 1 to 4 for both K45 modules.	

3.10 Connecting the proximity switch and contactor to K45 modules

1. Connecting the proximity switch to the K45 input module

Steps	
	1. Connect the proximity switch to the M12-M12 connection cable. 2. Plug the M12 connector of the connection cable into the IN 1 socket on the K45 input module.

2. Connecting the contactor to the K45 output module

Steps	
	1. Strip the open end of the connection cable (with M12 cable connector). 2. Connect the wires to terminals A1 and A2 on the contactor: – A1 = PIN 4 = black wire (switched output) – A2 = PIN 3 = blue wire (ground) 3. Plug the M12 connector into the OUT 1 socket on the K45 output module.

3.11 Configuring and programming the AS-i system

Prerequisites for this example

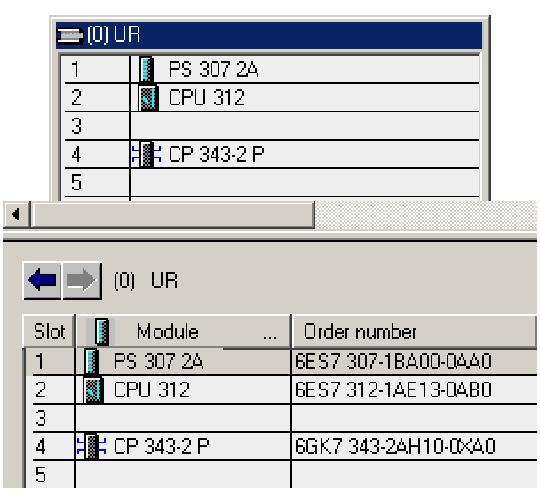
The following prerequisites must be fulfilled:

- To properly understand the following information, you need a general knowledge of automation technology and the basic STEP 7 software.
- All the hardware has been set up and connected.
- STEP 7 is installed and fully functioning on your PC/PG.
- The PC/PG is connected to the CPU 312 via the MPI interface.

1. Creating a new project in STEP 7

Steps	Result
1. Choose **File** > **New...** and name the project "Getting Started", for example.	The "Getting Started" project is created.
2. Choose **Insert** > **Station** > **SIMATIC 300 Station...**	The SIMATIC 300 station appears in SIMATIC Manager.

2. Carrying out basic configuration with HW Config

<table>
<tr><th>Steps</th><th>Result</th></tr>
<tr><td>1. Open HW Config by right-clicking the SIMATIC 300 station and then open the object by right-clicking the mouse.</td><td>HW Config opens.</td></tr>
<tr><td>2. Drag and drop the following components from the Hardware Catalog area (normally on the right of the screen) to the HW Config window. These components are stored in the following directory structures (you can double-check your selection using the order numbers displayed):
• DIN rail: \SIMATIC 300\RACK-300 (6ES7 390-1AE80-0AA0)
• Power supply: \SIMATIC 300\PS-300\PS 307 2A (6ES7307-1BA00-0AA0)
• CPU 312: \SIMATIC 300\CPU-300\CPU 312 (6ES7312-1AE13-0AB0)
• CP 343-2 P: \SIMATIC 300\CP-300\AS-Interface\CP 343-2 P AS-i (6GK7 343-2AH10-0XA0)

</td><td>The hardware is configured.</td></tr>
</table>

3. Saving, compiling, and loading the hardware configuration

Steps	Result
1. Choose **Station > Save and Compile**.	The "Getting Started" project is compiled.
2. With the CPU in STOP mode, transfer the configuration by choosing **Target System > Download to Module**	The "Select Target Module" dialog box is displayed.
3. Choose the CPU 312.	The data is transferred from the PC/PG to the CPU 312. This completes the basic configuration for "Getting Started". The Simatic system has been informed of the access path to the CP 343-2 P, which means that the "Download to PG" action described below can now be carried out.

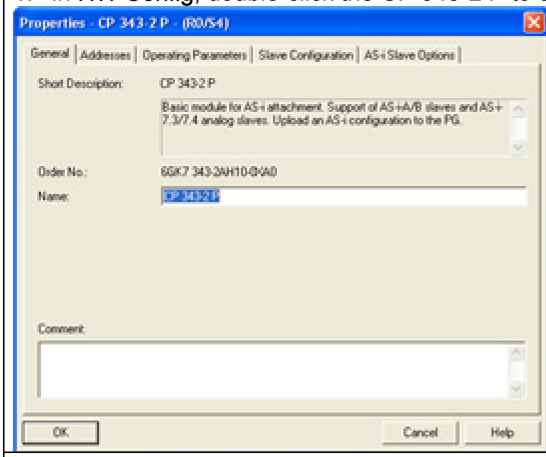
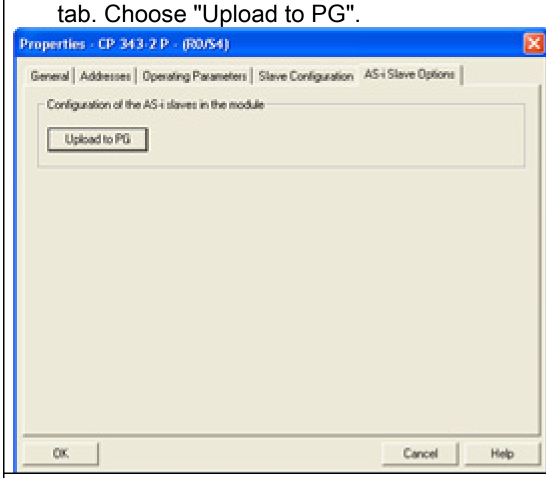
4. Defining the I/O addresses for the slaves (I/O modules) and loading the AS-i configuration

The CP 343-2 P occupies 16 input bytes and 16 output bytes in the I/O address space of the S7-300 system. The CP assigns 4-bit inputs and 4-bit outputs to each slave on the AS-i cable. The S7-300 has write (slave output data) and read (slave input data) access to these four bits. The first four input bits are reserved.

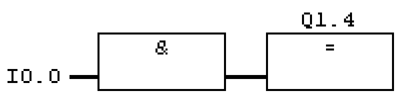
The following is defined as the start address **n**: **n = 0**.

This is used to define the I/O bits:
The sensor is wired to slave 1, IN1, and occupies E 0.0
The contactor is wired to slave 2, OUT1, and occupies A 1.4

I/O byte number	Bit 7-4				Bit 3-0			
n+0	reserved				Slave 1			
					Bit 3	Bit 2	Bit 1	Bit 0
n+1	Slave 2				Slave 3			
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
. . .								
n+15	Slave 30				Slave 31			
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Steps	Result
1. In **HW Config**, double-click the CP 343-2 P to open it.  	The Properties window is displayed.
2. Choose the **Addresses** tab. Set the start address for the inputs and outputs to "0".	The CP 343-2 P occupies the set input and output bytes on the S7-300 system.
3. Choose the **AS-i Slave Options** tab. Choose "Upload to PG".  	The current AS-i configuration is downloaded to the project file.
4. The Slave Configuration tab shows the AS-i modules (incl. the input and output addresses) that have been read.	
5. Choose **Station > Save and Compile**.	The revised "Getting Started" project is compiled.
6. With the CPU in STOP mode, transfer the configuration by choosing **Target System > Download to Module**	The data is downloaded to the CPU 312. This completes the AS-i configuration for "Getting Started".

5. Programming and testing the circuit

Steps	Result
1. Double-click the following icons: – CPU 312 > S7 program > Modules > OB1	The "**Properties**" dialog box for OB1 is displayed.
2. In this dialog box, choose the programming language "FUP" and confirm with OK.	The program editor is displayed.
3. Use **F2** to insert an "and" box and **F7** to insert an "assignment" box. Assign address E 0.0 to the first input. Delete the second connector. Assign address A 1.4 to the "assignment" box. 	The signal status of the proximity switch is forwarded to the contactor.
4. To close the editor, choose **File > Exit** and then "Yes" to confirm that you want to close the editor.	Module OB1 is saved and the editor is closed.
5. Select station "SIMATIC 300(1)".	
6. In the **PLC** menu, choose **Download** to transfer the program and hardware configuration to the CPU. Choose the CPU 312. Confirm all the subsequent prompts with **Yes**	The program and configuration are downloaded from the PC/PG to the CPU 312.

3.12 Testing the circuit

Testing the circuit

Steps	Result
1. Set the operating switch on the CPU 312 to **RUN.**	The **STOP LED** extinguishes. The **RUN LED** switches from flashing to a continuous light.
2. Activate the proximity switch by moving a metal object (e.g. screwdriver) toward the head of the proximity switch.	The status LED IN1 on the input module illuminates. The output can be activated via the S7 program. The status LED OUT1 on the output module illuminates. The contactor switches.

3.13 Result

The inputs and outputs on the AS-Interface slaves are interconnected via the STEP 7 program in the same way as for Simatic I/O modules.

Operating principle 4

4.1 ISO/OSI reference model

AS-Interface in the ISO/OSI reference model

Like all communications systems, AS-Interface can be integrated in the ISO/OSI reference model. The functionality is implemented at layers 1, 2, and 7.

ISO/OSI layer	Function	Implementation in AS-Interface
Level 7: Application layer	Makes network services available to users.	Messages, cycle, profiles, automatic address assignment
Level 6: Presentation layer	Converting network data formats to applications data formats	
Level 5: Session layer	Logging connections on/off	
Level 4: Transport layer	Transparent data formatting for routers	
Level 3: Network layer	Address formatting, addressing	
Level 2: Data link layer	Data structure, framework, validation, troubleshooting	Data telegram, start/stop bit, validation, troubleshooting
Level 1: Physical layer	Mechanical and electrical connection for transferring data	Cable, power supply unit, data decoupling, APM, power supply

4.2 Physical layer

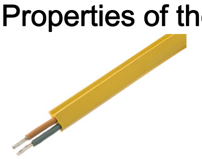
4.2.1 Elements in the physical layer

This chapter provides information on the following:

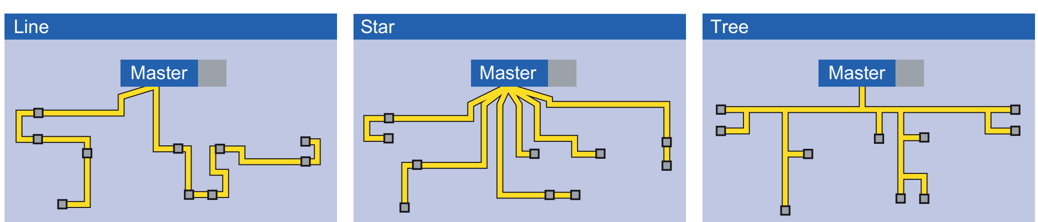
- The AS-Interface cable and network
- The AS-Interface power supply and data decoupling
- Modulation procedure

4.2.2 The AS-Interface cable

Properties of the AS-Interface cable



- The AS-Interface cable connects all the network nodes.
- The cable has two wires (ASI + and ASI -) and is unshielded.
- The trapezoidal profile with the profiled lug ensures a high degree of protection against polarity reversal (mechanical code).
- The shaped cable transfers data and power.
- The AS-Interface shaped cable offers a high degree of flexibility when you structure network topologies, which means they can be optimized in line with physical conditions.



Line, star, tree as well as any other combination of topology configurations are possible.

The nodes can be connected at any point in the network.

Up to 62 slaves, one master, and up to four additional passive nodes (without their own AS-i address) can be connected to a network.

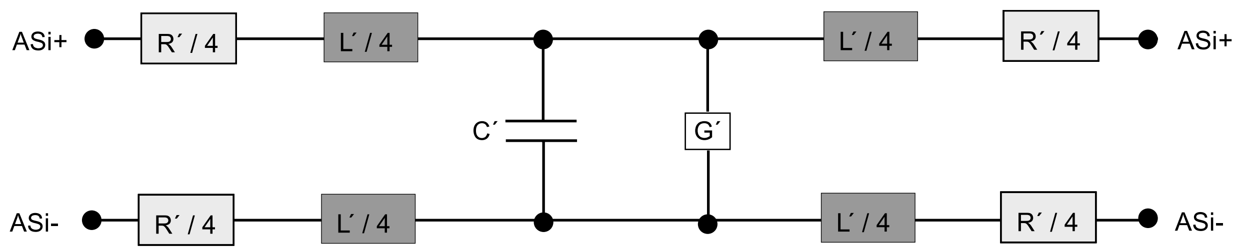
No shielding is required. The cable must not be twisted. A line terminator is not required.

The total length of the cable is restricted to 100 m. A range of components (e.g. repeater, extension plug) are available for extending the maximum length of the cable.

The nodes receive their power supply via the same cable with a rated voltage of 24 V DC and a total current of up to 8 A.

Electrical specifications for the AS-Interface cable

In principle, any two-wire cable that complies with the following electrical specifications can be used as an AS-Interface cable.



Specification:

- R' < 90 mΩ/m
- L' 400 to 1300 nH/m
- C' < 80 pF/m
- G' < 5 μS/m

⇨ Surge impedance |Z| in the range of 70 to 140 Ω

⇨ Group delay time t' < 8.3 ns/m

Note

An unshielded standard round cable (H05VV-F 2 x 1.5 mm^2) in accordance with the AS-i specifications can also be used for special applications.

Note

Using cables that do not comply with AS-i specifications

If a cable that does not comply with the specifications above (shielded cable in particular) is used as an AS-i cable, a correction factor of 1.3. must be taken into account when the length of this cable is calculated.

From an electrical point of view, therefore, approx. 75 m of a non-compliant cable corresponds 100 m of an AS-i-compliant cable.

4.2.3 The AS-Interface power supply

Functions of the AS-Interface power supply unit

Because both data and energy are transferred via the same cable for AS-Interface, the power supply is part of the physical layer.

For this reason, AS-Interface power supply units have a special design.

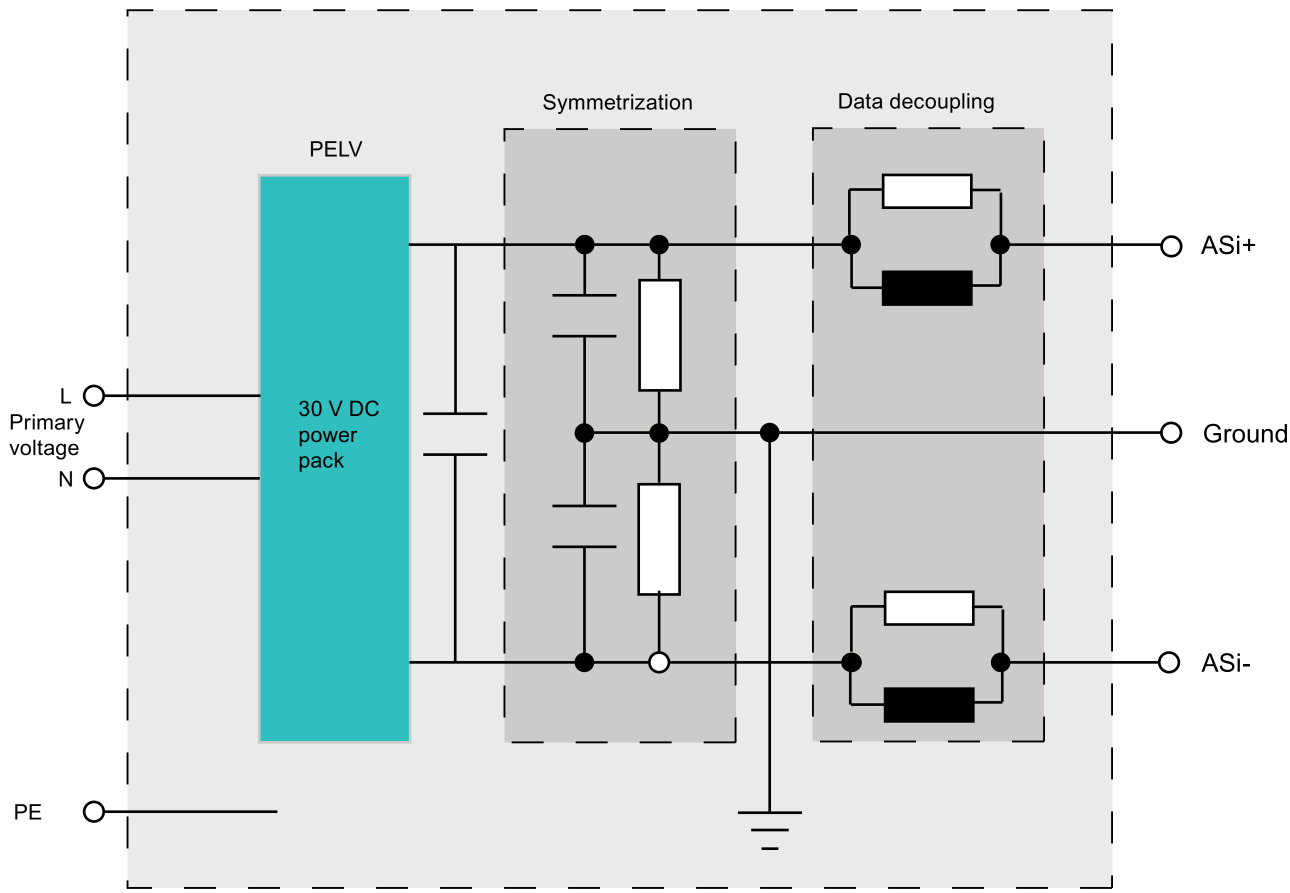


Figure 4-1 AS-Interface power supply unit

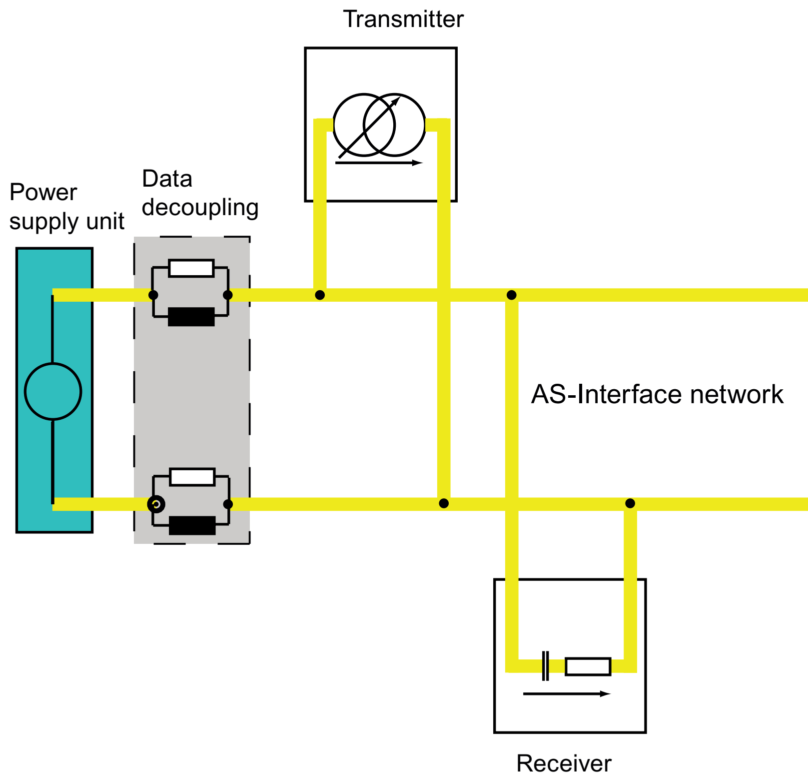
Each AS-Interface power supply unit performs four functions.

- Supplies the network with a rated voltage of 30 V DC
  To ensure that 24 V DC can also be ensured at the end of the AS-Interface network, the power supply unit has been specified with a rated voltage of 30 V.
  This design permits a voltage drop of approx. 3 V via the AS-Interface cable and another 3 V in all the slaves where the data and power path must be separated again.
  In principle, the current supplied to the AS-Interface network can be set as required. In practice, approx. 8 A is a sensible setting due to the standard conductor cross-sections of the AS-Interface cables.

- **Protective separation**
  AS-Interface is designed as a system for low voltages with protection separation (PELV: "Protective Extra Low Voltage" to IEC 60364-4-41). For this reason, a power supply unit that takes its primary voltage from 115 V AC or 230 V AC requires protective separation between the primary and secondary voltage in accordance with the applicable IEC standards.
  The PELV protective measure means that there is no need for a PE conductor. Other special shock-hazard measures are not required either.
- **Balancing the network**
  AS-Interface is operated as a symmetrical, ungrounded system. To ensure optimum interference immunity against symmetrical coupled-in noise, the AS-Interface cable must be designed to be as symmetrical as possible. A balancing circuit can be used for this purpose. The "ground" connection must be grounded at a suitable point in the machine or plant. With AS-Interface, only this point can be connected to ground (GND) directly. Proper balancing means that the cable does not need to be shielded or twisted.
- **Data decoupling**
  The data decoupling network is normally integrated in the AS-Interface power supply unit. It has two inductors of 50 µH each and two 39 Ω resistors connected in parallel. This network ensures that data transfer is not short-circuited by the power supply. At the same time, it converts the current pulses generated by the AS-Interface transmitters to voltage pulses that can be detected by the AS-Interface receivers.

4.2.4 The AS-Interface modulation procedure

How alternating pulse modulation (APM) works

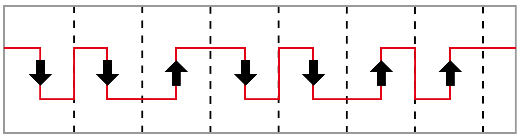
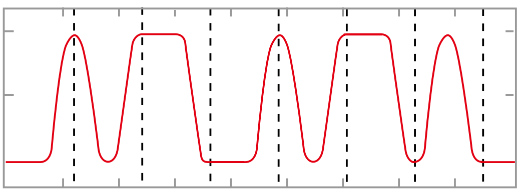
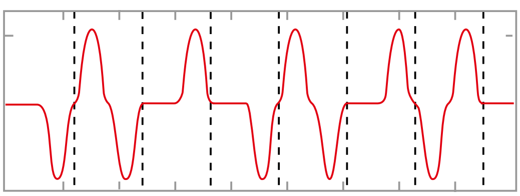
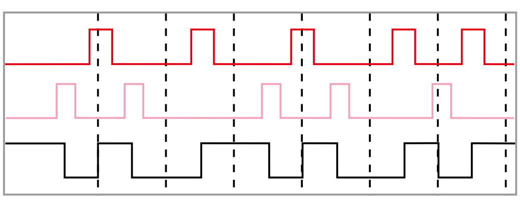


To transfer data, AS-Interface uses alternating pulse modulation (APM) with virtually sine^2-shaped current/voltage pulses, which means that the following prerequisites are fulfilled:

- The message signal is superimposed on the power supply for the actuators and sensors and must be free of DC current.
- The transmitter must be able to generate the signal as efficiently as possible.
- Since the AS-Interface cable has a steeply-rising damping characteristic over the frequency, the message signal must have a narrow band.

APM transfers the data serially in the baseband and is free of DC current.

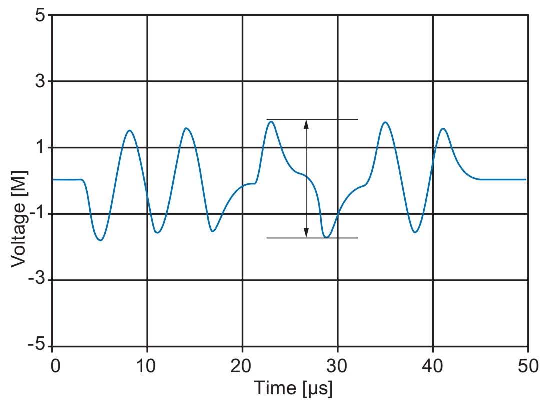
The individual steps involved in alternating pulse modulation (APM)

(1) 0 0 1 0 0 1 1	1. Send bit sequence
(2) 	2. With this coding type, the information regarding the level switch is in the center of the bit. With a logical zero, the signal in the center of the bit switches from "high" to "low" (and vice versa with a logical one). The send bit sequence is recoded as a bit sequence that carries out a phase change whenever the send signal changes (Manchester coding).
(3) 	3. This bit sequence is converted to a send current.
(4) 	4. The send current is converted by the inductor in the AS-i power supply unit to a voltage, which can be detected by the receiver: When the send current increases, this results in a negative voltage pulse (and vice versa).
(5) 	5. The receiver detects these voltage signals on the cable and converts them to the send bit sequence; it interprets the first negative pulse as the start bit of a message.
(6) 0 0 1 0 0 1 1	6. Bit sequence received

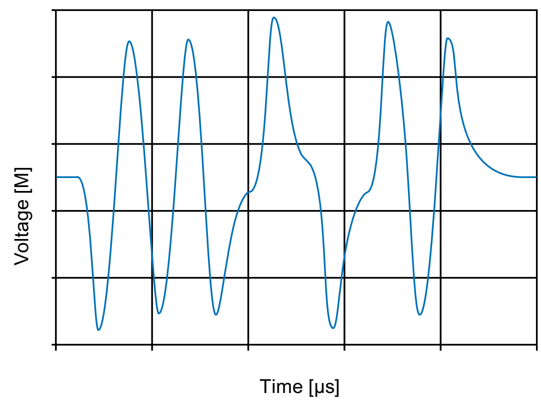
The special shaping of the send current pulses means that the radiation of high-frequency electromagnetic waves is reduced to the extent that cables that the non-shielded AS-i cable complies with the prescribed limit values.

Alternating pulse modulation and the required topology criteria enable bit times of 6 µs and, in turn, a gross transmission rate of 167 kbit/s to be achieved.

Permissible limit values for alternating pulse modulation



Response from slave near power supply unit

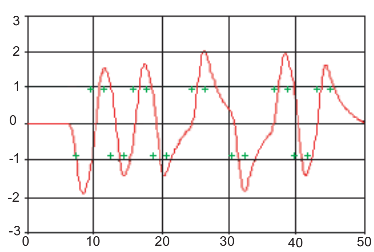


Response from slave far from power supply unit

The AS-Interface data transfer amplitude can fluctuate within relatively wide limits. The differences result from the tree-like branched network and the cable, which is terminated at just one end by the power supply unit.

Thanks to this stable operating principle, AS-Interface permits a high degree of flexibility with regard to the topology.

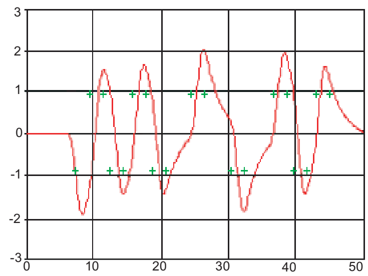
Limit values within a telegram



Permissible amplitude fluctuations:
35% of U_{max}

Permissible overshooting:
max. 30% of amplitude U_{max}

Limit values for the pulse edges



Permissible fluctuations of the pulse edges with respect to time:
(n x 3 µs) + 1/-0.5 µs
(measured from the first negative edge)

Note

Radiated emissions:
Due to the narrow spectral bandwidth of sine^2 pulse modulation used for AS-i and the symmetrical design, radiated emissions from the AS-i system are minimal. Other devices are not affected.

Noise immunity:
The symmetrical design and the coding method used (Manchester coding, APM (alternating pulse modulation)) ensure that AS-i is highly immune to noise. In noisy industrial environments, transmission errors are impossible to avoid. These are detected by the coding procedure, however, and rejected as invalid. This means that the data made available to users is always reliable.

4.2.5 Structure of the AS-Interface system

System components

An AS-i system essentially comprises three components:

- A master
- An AS-i power supply unit
- Nodes (slaves with integrated AS-i connection / AS-i modules)

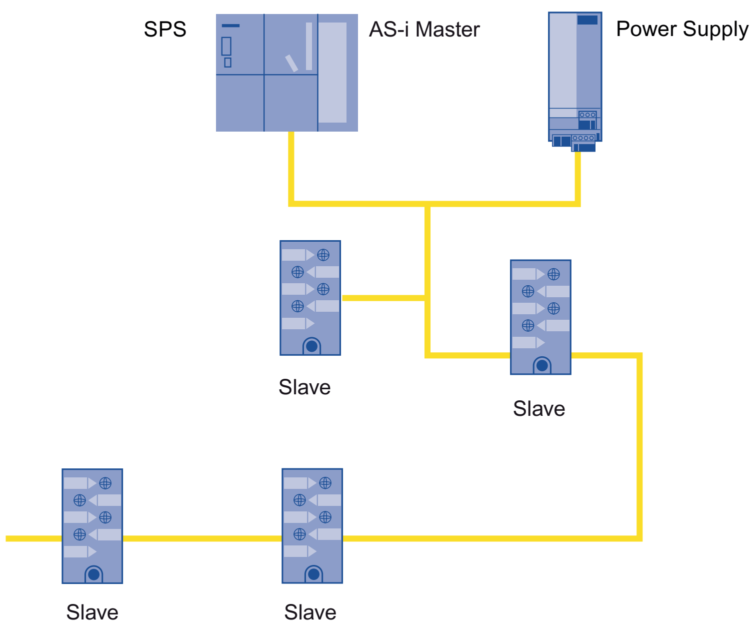


Figure 4-2 Structure of the AS-i system

The AS-i master

The AS-i master controls data exchange with the connected nodes by means of cyclic polling.

During a cycle, four data bits are exchanged with each slave in both the input and output direction.

AS-i power supply unit

Thanks to integrated data decoupling, the AS-i power supply unit allows data and energy to be transferred simultaneously via a two-wire cable.

4.2.6 Alternative structures

Direct or distributed structure

AS-Interface can be integrated as required in the existing structure with communications processors and routers.

AS-Interface connected directly to the controller

As a communications processor (CP), the master is an integral part of the controller (e.g. ET 200, SIMATIC S7-200 and SIMATIC S7-300).

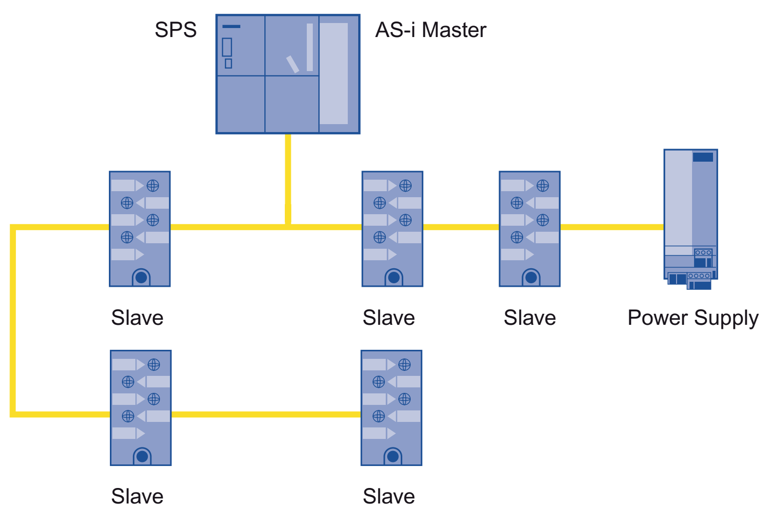


Figure 4-3 Direct connection to the controller

AS-Interface as a subsystem

If AS-Interface is configured as a subsystem on a higher-level bus system, routers (links) (e.g. IE/AS-i LINK PN IO, DP/AS-i LINK Advanced or DP/AS-Interface Link 20E) are used as the AS-Interface master.

This configuration allows functional units to be set up and commissioned before the central controller is fully programmed.

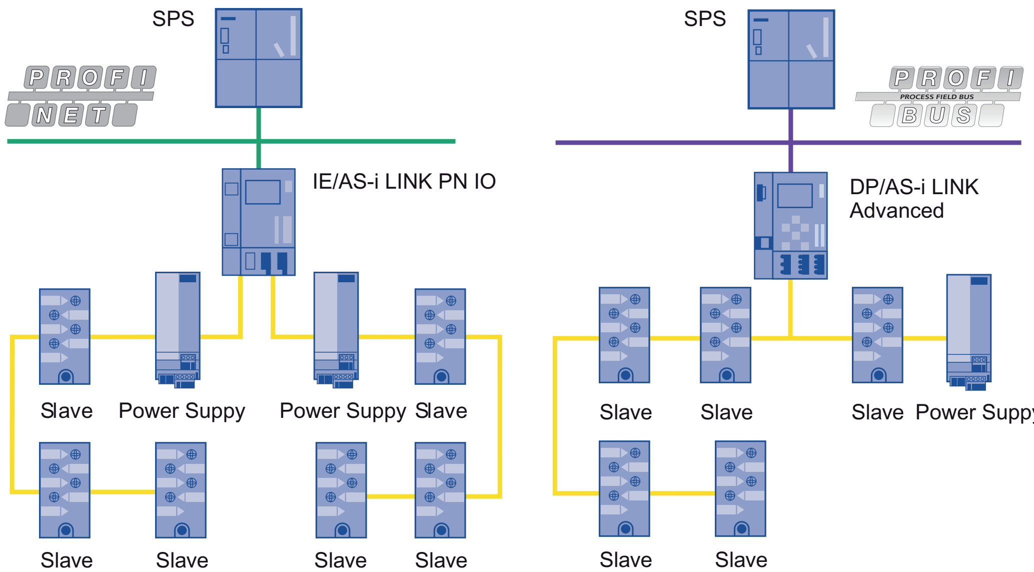


Figure 4-4 AS-Interface as a subsystem

4.2.7 Cable lengths and extending an AS-i network

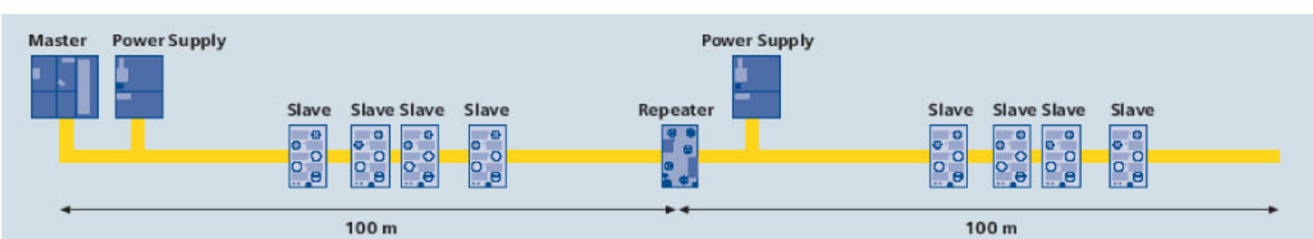


Figure 4-5 Network extension - so far max. 100 m per segment

An AS-i line can be up to 100 m long without additional components. Repeaters can be used, however, to increase the length of the line. Two repeaters can be connected in series, which can extend the network to 300 m (line structure). A separate AS-i power supply must be provided in each new segment.

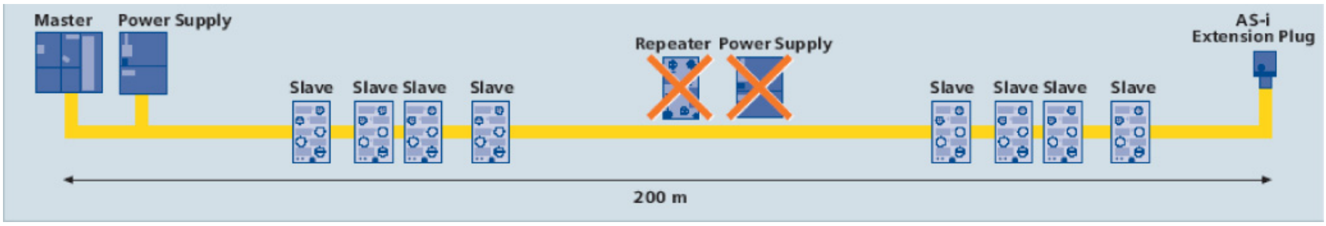


Figure 4-6 Network extension - now with AS-i extension plug, max. 200 m per segment

An extension plug can be used to double the length of an AS-i line to 200 m. Since repeaters cannot be connected in series when they are used in conjunction with AS-i extension plugs, this results in a maximum distance of 400 m between the master and slave and a maximum cable extension of 600 m (master in the center of the network). Repeaters can be connected in parallel in a star configuration each with up to 200 m long segments.

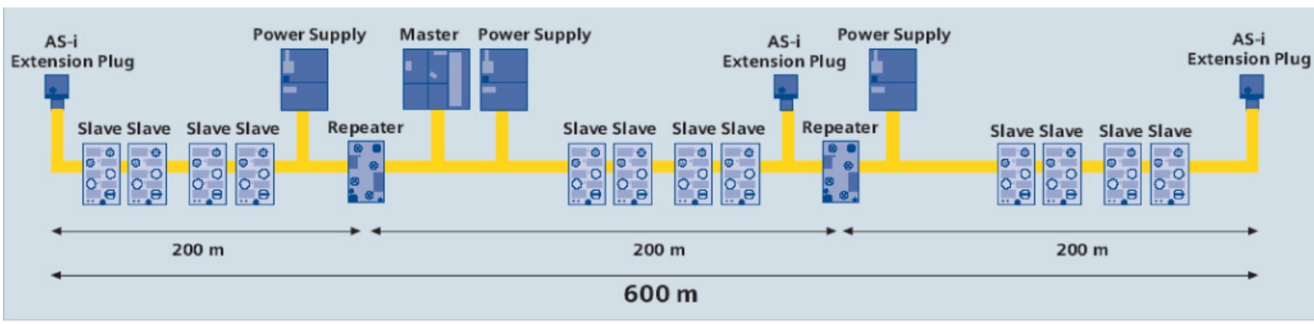


Figure 4-7 Network extension - now with AS-i extension plug, max. 200 m per segment, only one repeater connected in series

The network can be extended even further if additional network components are used. An extender can increase the length of the AS-Interface cable by 100 m. When this is used, however, the first subline must not contain any slaves.

4.3 Data link layer

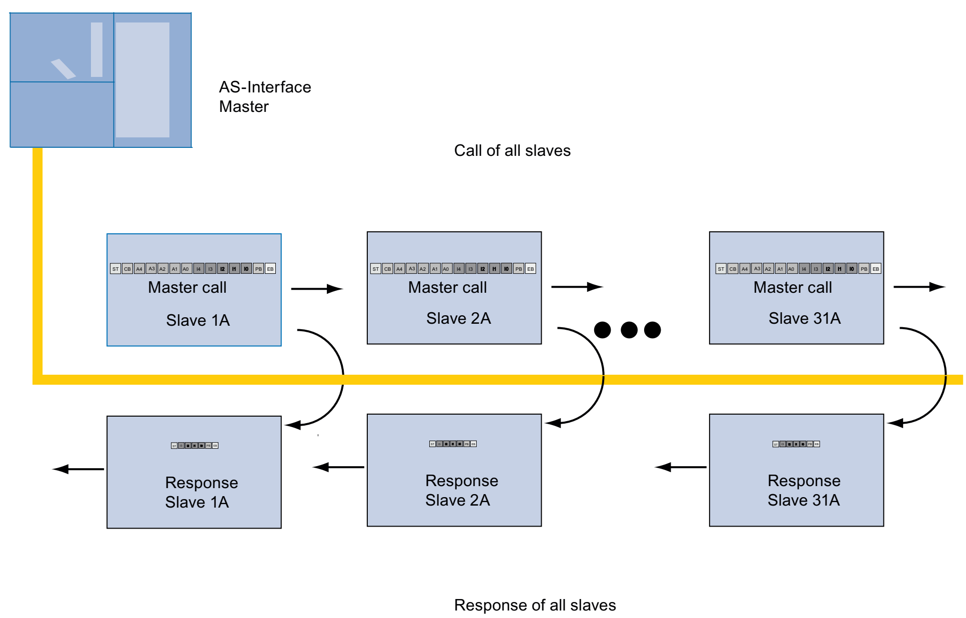
4.3.1 The elements of the data link layer

This chapter provides information on the following:

- The AS-Interface bus access procedure
- The AS-Interface message
- Data backup

4.3.2 The AS-Interface bus access procedure

Master/slave procedure with cyclic polling



In the master/slave procedure with cyclic polling, the master polls all the connected slaves one after the other at defined intervals and reads the responses.

Cycle time for AS-Interface

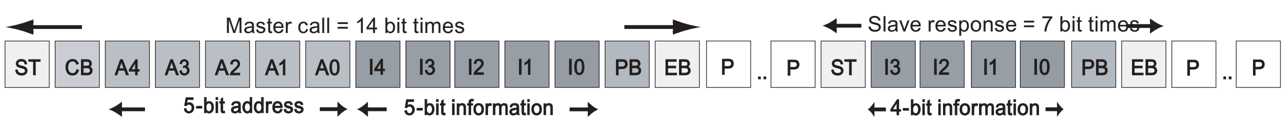
The bit time for AS-i is 6 μs. A transaction (master call and slave response normally take 156 μs). With 31 slaves and one management call per cycle, the cycle time is 5 ms.

The cycle time comprises different intervals:

- Times with exact duration
  - Master call: 14 bit times exactly
  - Slave response: 7 bit times exactly
- Waiting and synchronization times with non-fixed duration
  - Master interval: at least 2 bit times, max. 10 bit times
  - Slave interval:
    under normal circumstances, synchronized: 1.5 to 2 bit times
    during startup, non-synchronized: 4 bit times

4.3.3 The AS-Interface message

Structure



An AS-Interface message comprises the following elements:

- Master call: each master call comprises exactly 14 bit times
- Master interval: at least 2 bit times, max. 10 bit times
- Slave response: each slave response comprises exactly 7 bit times
- Slave interval:
  - under normal circumstances with synchronized slave: 1.5 to 2 bit times
  - During startup with non-synchronized slave: 4 bit times

Structure of master call to standard slave

ST	CB	A4	A3	A2	A1	A0	I4	I3	I2	I1	I0	PB	EB

ST	Start bit	Marks the beginning of the master call. The following always applies: ST = 0
CB	Control bit	Indicates the type of call in the information bits 0 = data/parameter/addressing call 1 = command call
A4 .. A0	Address	These 5 address bits contain the address of the slave that is being called
I4 .. I0	Information	Depending on the call type, these 5 information bits contain the information sent to the slave.
PB	Parity bit	This means that the sum of all "1s" in the master call must be even (the end bit is not counted here).
EB	End bit	Marks the end of the master call. The following always applies: EB = 1

Structure of the standard slave response

ST	I3	I2	I1	I0	PB	EB

ST	Start bit	Marks the beginning of the slave response. The following always applies: ST = 0
I3 .. I0	Information	These 4 bits contain the information sent to the master.
PB	Parity bit	This means that the sum of all "1s" in the slave response must be even (the end bit is not counted here).
EB	End bit	Marks the end of the slave response. The following always applies: EB = 1

4.4 Application layer

4.4.1 AS-Interface module parameters

When the system is started up, the master sends parameters to each slave in order to define its physical properties. The parameters are stored temporarily in the slave. The slave sends a parameter echo, which means that is ready to exchange data with the master.

Parameter bits

Parameter bits are usually called "parameters" for short. These parameters can be used to set the properties of the slaves (e.g. the signal range for A/B slaves, 0-20 mA or 4-20 mA). A parameter set comprising 4 parameter bits (default value: 1111_{bin}) is defined for each slave in the master. The properties of most digital slaves are predefined and cannot be changed. The default value is usually sent for these slaves. With A/B slaves, only 3 bits are available because the highest bit is used for determining the address.

To find out which parameter bits can be used to set which slave properties, see the operating instructions issued by the slave manufacturer.

In the SIMATIC system, you can set the slave properties in plain text via HW Config for all the current masters. The parameter bits are then set accordingly by the system. This means that you do not have to refer to the parameter lists in the operating instructions.

Configured parameters / permanent parameters

The parameter sets defined in the master are stored in a permanent memory in the master, that is, the parameter bits are not lost when the master is switched off.

Current parameters / parameter image

When the master is switched on or once Profibus/Profinet communication has begun (e.g. insert/remove plug or download the HW Config data to the station), the parameter bits are copied from the permanent memory to a volatile memory in the master. These are then transferred to the individual slaves.

When the master is switched on, each slave automatically receives the current parameter bits from the master. These are then stored in a volatile memory, that is, these values are lost in the event of a power failure.

Parameter bits cannot be read from the slave. In the parameter image, the master stores the values that were last written to the slaves.

Note

If parameters are sent to the slave by means of the addressing unit, the slave "forgets" these parameters as soon as it is disconnected from the addressing unit. The parameters active in the slave are always defined by the connected AS-i master.

Parameter echo

If the master sends parameter bits to the slave, the slave responds with a parameter echo. The parameter echo is a block of 4 bits in each slave, but it cannot be read directly. In principle, it is completely independent of the parameter bit values that are sent. The master saves the parameter echo to a volatile memory. Once the parameter echo has been sent, the slave begins exchanging data cyclically. If a slave fails, the master sets the parameter echo, which is stored internally, to the default value 1111_{bin}.

Parameter string

Only special AS-i slaves (with the slave profile 7.2 or 7.4) contain the parameter string.

No AS-i slaves from Siemens currently use this parameter string.

The parameter string is stored in the slave permanently (non-volatile) and can be written or read. It comprises several parameter bytes with a length of up to 220 bytes. For more information about the parameter string, see the operating instructions issued by the slave manufacturer.

Data cannot be exchanged cyclically when the parameter string is being transferred from the master to the slave (or vice versa). For this reason, the system must be switched to parameter string exchange mode. The parameter bits and parameter echoes which, as a result, are not actually available to users, are required for this purpose.

4.4.2 Setting parameters via the ASI_3422 command interface

ASI_3422 command interface

This function block can be used to transfer changes from the PLC to the permanent memory in the master and read them back to the PLC.

The FC can be adapted for non-SIMATIC systems (see the instructions in the link description provided by the manufacturer).

You can download the FC function block "ASI_3422" from the following address: www.siemens.de/automation/service&support

Commands available in the ASI_3422 command interface

Call	
00_{hex}	• Writes the parameters for an individual slave to the permanent memory. • This does not affect the parameter image. • No data is forwarded to the slave.
01_{hex}	• Reads the parameters for an individual slave from the permanent memory. • Independent of the content of the parameter image and status of the slave.
39_{hex}	• Reads the complete configuration of the AS-i bus, including all the current parameters from the parameter images of all the slaves.
19_{hex}	• Same as call 39_{hex}, but for older masters (without A/B slaves, spec. 2.0)
$3A_{hex}$	• Writes the complete configuration of the AS-i bus to the master, that is, parameters are overwritten in the permanent memory and copied automatically to the parameter image, which is then forwarded automatically to the slaves. • This call performs a full reset on the AS-i bus, that is, all the slaves are momentarily "switched off" and then restart cyclic data exchange.
$1A_{hex}$	• Same as call $3A_{hex}$, but for older masters (without A/B slaves, spec. 2.0)

Note

With more recent masters, this call is executed in both configuration mode and protected mode.

With older masters, this call is only executed in configuration mode, that is, the master may have to be switched from protected mode to configuration mode (e.g. via call $0C_{hex}$ - set operating mode).

$3C_{hex}$	• Writes the current parameters for all slaves to the parameter image. • This does not affect the permanent memory. • The master only transfers the parameters whose values have changed vis-à-vis the previous parameter image to the slaves (i.e. slaves whose parameters have not changed do not send a parameter echo to the master).
$1C_{hex}$	• Same as call $3C_{hex}$, but for older masters (without A/B slaves, spec. 2.0)

03_{hex}	• Writes the current parameters for an individual slave to the parameter image. • This does not affect the permanent memory. • The master transfers the parameters to the slaves regardless of whether the parameter value has been changed and forwards the parameter echo received from the slave directly in the command response to the user.
04_{hex}	• Copies the parameter image to the permanent memory.

4.4.3 Setting parameters via the display/WBM

DP/AS-i Link Advanced and IE/AS-i Link PN IO offer a range of functions via WBM that can be used via an Internet browser.

A Java script is required for this purpose, which is stored in the links and loaded by the browser.

Prerequisites

An IP address with a suitable subnet screen form must be set in the link (DP/AS-i Link Advanced or IE/AS-i Link PN IO).

To access the link via WBM, you need a PC with an Internet browser. We recommend Microsoft Internet Explorer (as of version 6.0).

Java must be active in the browser so that the script can be executed.

The PC must be connected to the LAN connection of the link by means of a standard or crossed Ethernet cable (autocrossing).

Note

In this configuration, the PC is not connected to the LAN (company network).

To enable both the LAN and link to be used at the same time, a second network card or a USB Ethernet adapter are recommended.

If you require direct integration in the LAN, contact your network administrator.

Note

The browser must be set in such a way that whenever it accesses a page, it always downloads the latest version from the server. In Internet Explorer, you can set this by choosing **Tools > Internet Options... > General** and then "Settings..." under "Temporary Internet files".

Note

Firewall

When a firewall is used, you must ensure that the following ports can be accessed:

- TFTP port 69
- http port 80/TCP
- SNMP port 161/UDP
- SNTP port 25
- Trap port 162/UDP

Setting the IP address/subnet screen form on the link

1. **Deactivate DHCP:**
   In the link display, choose the sub-menu **IND. ETHERNET > DHCP**.
   Deselect the checkbox.
2. **Set the IP address**
   Choose the sub-menu **ETHERNET > IP Address**.
   Enter the IP address using the cursor keys, e.g.:

```
192.168.000.001
```

1. **Set the subnet address**
   Choose the sub-menu **ETHERNET > Subnet Mask**.
   Enter the subnet address using the cursor keys, e.g.:

```
255.255.255.000
```

1. **Set the gateway address**
   Choose the sub-menu **ETHERNET > Gateway**.
   Enter the gateway address using the cursor keys e.g.:

```
000.000.000.000
```

These settings must be compared with the network settings on the PC.

Network settings on the PC

1. On your PC, choose **Start > Settings > Control Panel > Network Connections.**
   Choose a connection and display its properties
   on the **General** tab. This connection uses the following element "Internet Protocol (TCP/IP)". Display its properties.
2. Select "Use Following IP Address" and enter the IP address and subnet mask e.g.:

```
IP Address        192.168.000.010
Subnet Mask       255.255.255.000
```

Starting the WBM

To start the WBM, enter the following data in your browser:

```
http://<IP address of the link>
```

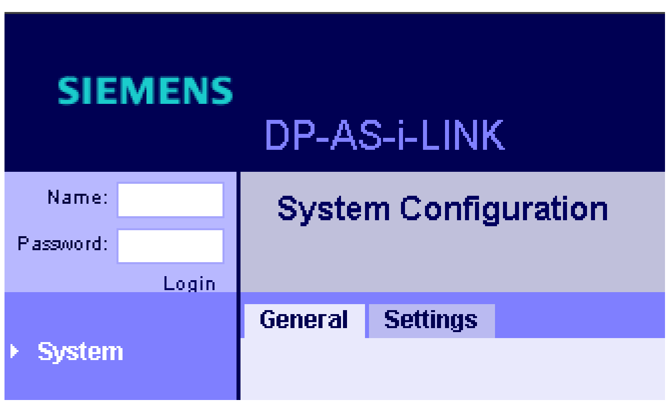
For example:

```
http://192.168.000.001
```

The WBM starts with the system configuration menu. You now have read access to the menus.

You have to log in if you want to make any changes.

Login



Note

The screenshots are from Microsoft Internet Explorer Version 6.0. If you are using a different browser (e.g. Netscape, Mozilla etc.), the menus may differ.

In this screen, make the following settings:

- Name
- Password

The factory default settings are as follows:

```
Name      admin
Password  admin
```

Confirm your entries by choosing "Login".

NOTICE
You must change your password for security reasons. When the factory settings are restored, the password is also reset.

Note

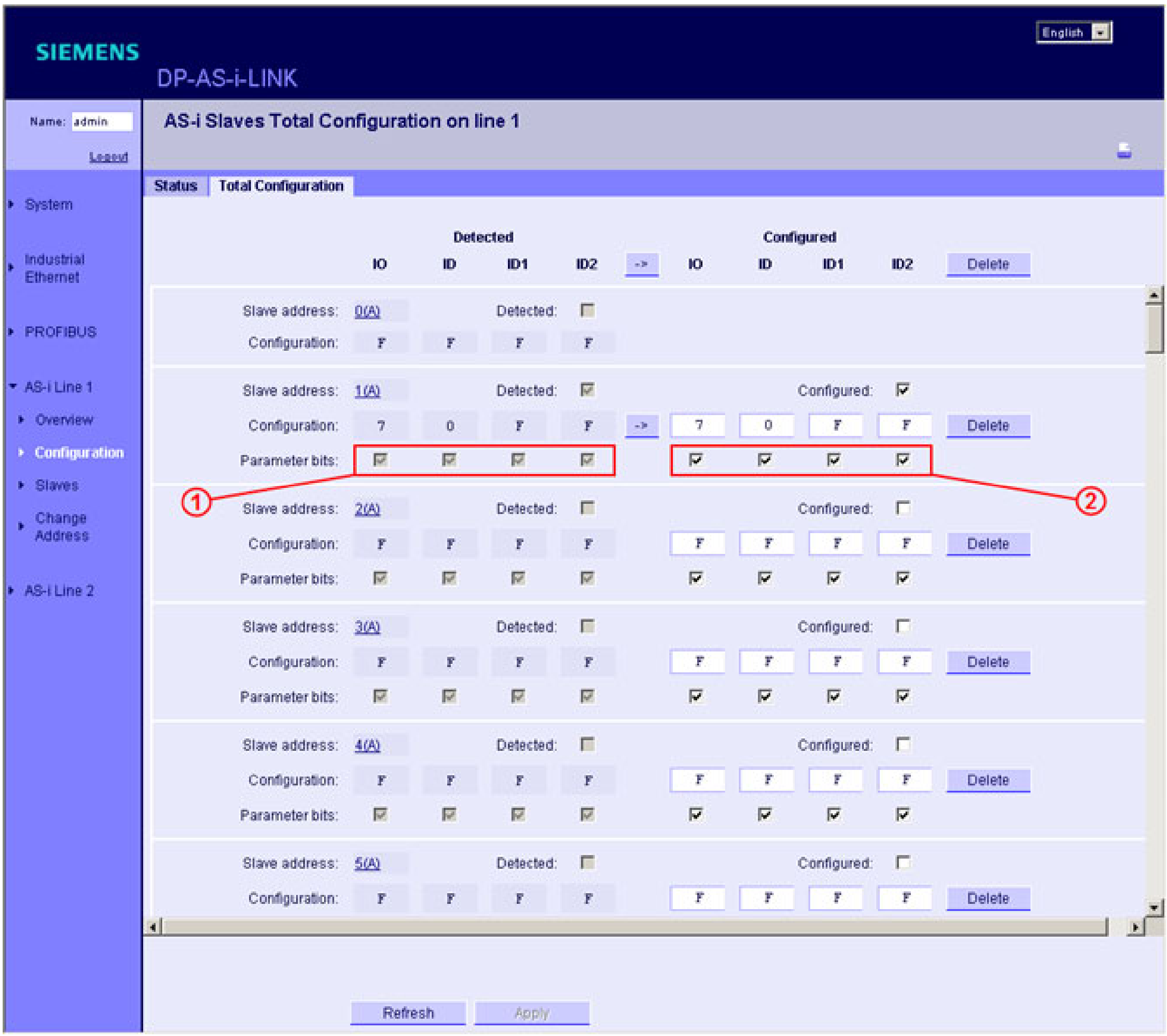
You cannot make any changes without logging in.

If you do not carry out any actions for more than five minutes (this default setting can be changed), the system logs you off automatically.

"AS-i Slaves Total Configuration" tab

The menu is divided into two areas and covers all the slaves detected on this line:

- Detected:
  All the slaves detected on this line are listed here, including their configuration (display fields).
- Configured:
  You can set the configuration data for the slaves here.

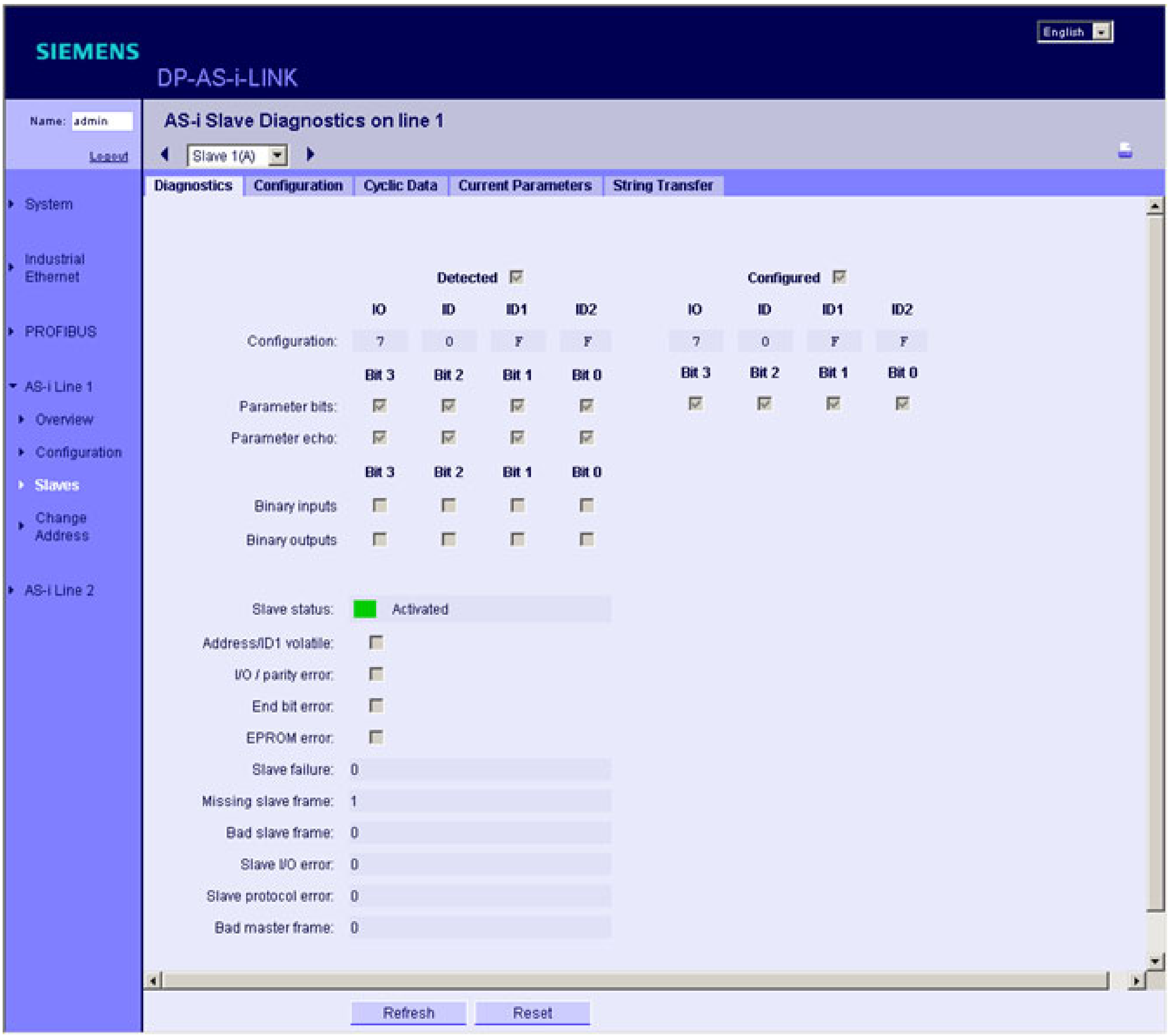


① = Parameter image

② = Permanent parameters

"AS-i Slave Diagnostics" tab

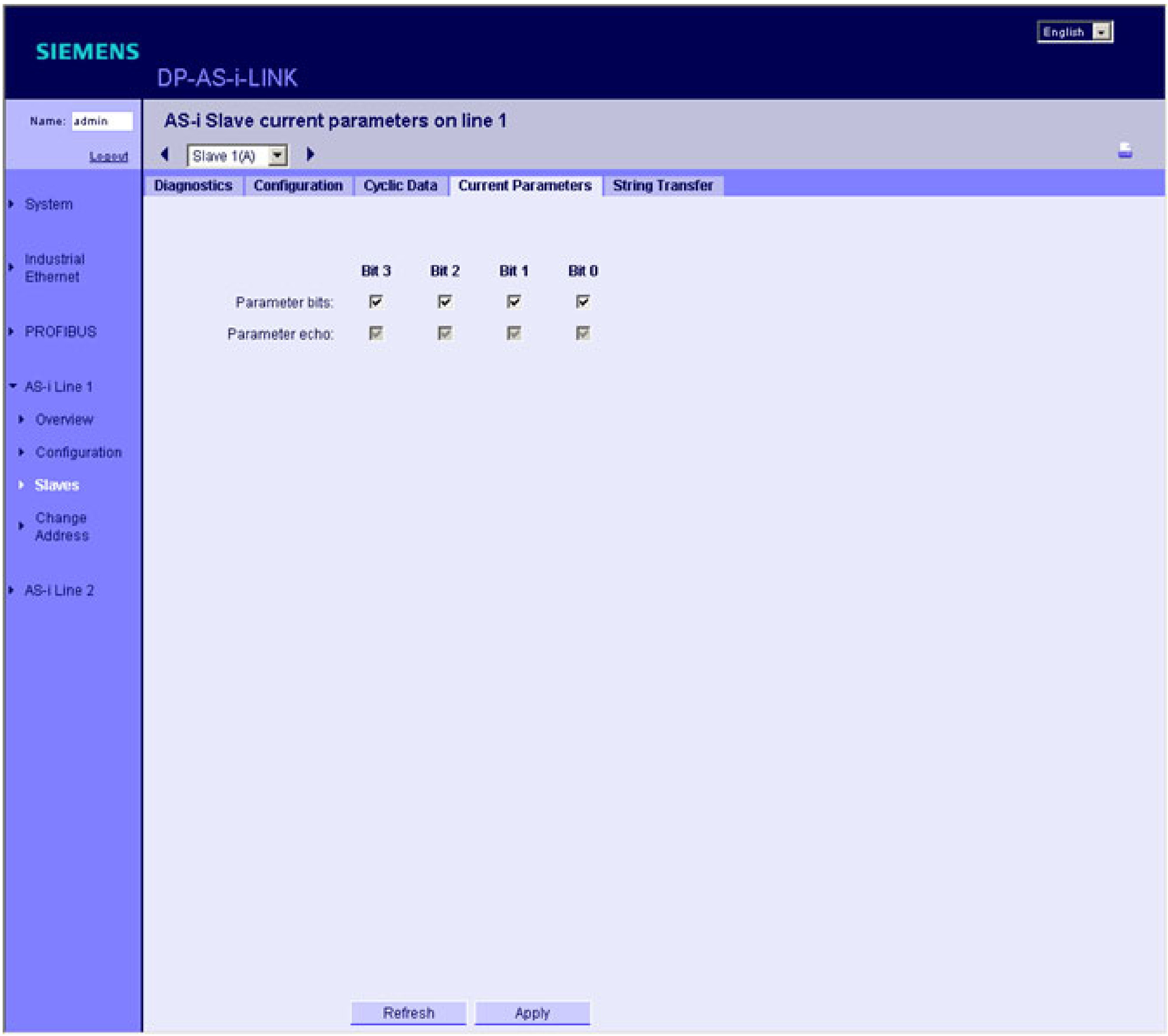
This menu contains all the relevant data for the selected slave.



"AS-i Slave current parameters" tab

In this menu, you can set the parameter bits. The parameter echo is returned.

Note that these changes are only valid until the DP master is started. The system is then restarted with the configured parameter values.



System extensions

5

5.1 Technical development of the AS-Interface

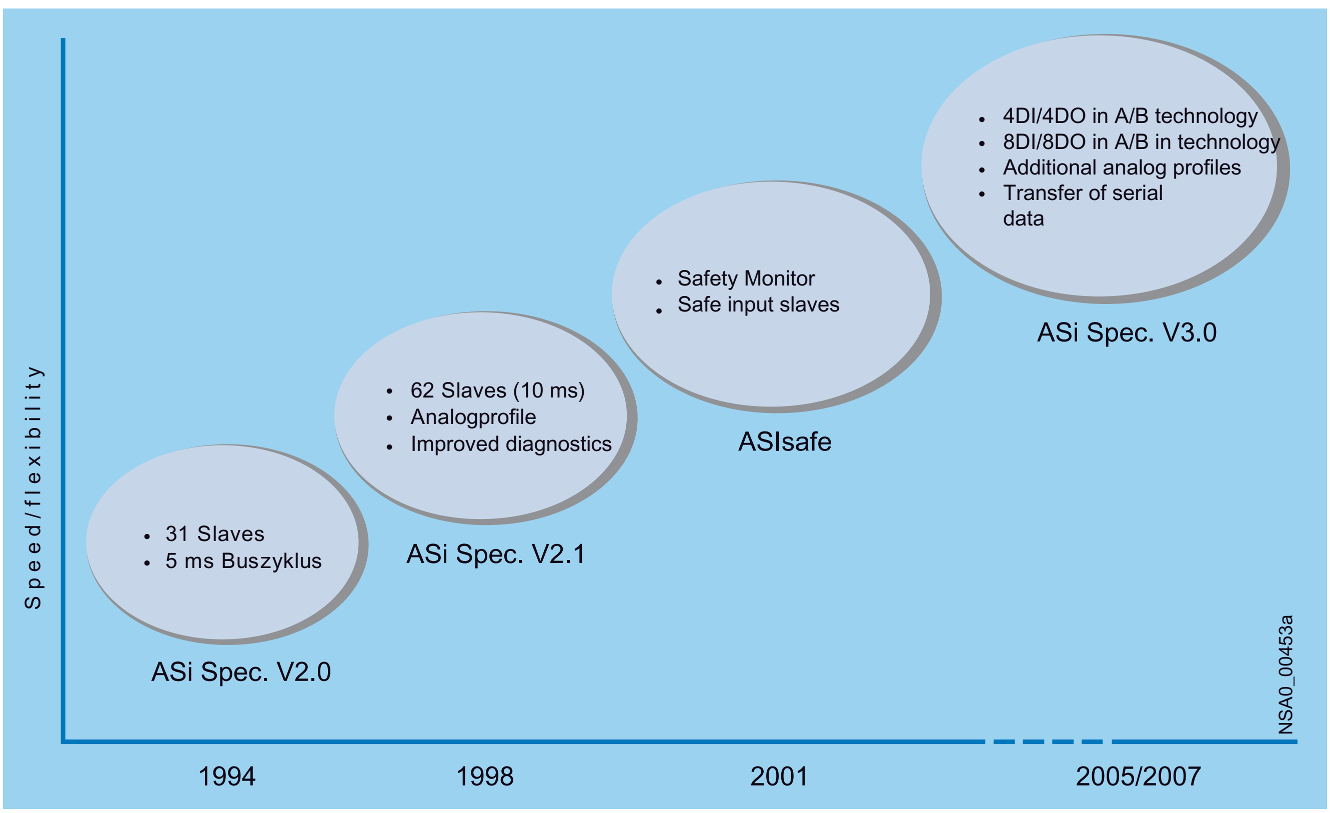


Figure 5-1 AS-i technical development: Levels of the AS-Interface Complete Specification

5.2 System limits of the AS-Interface specification

AS-Interface specification	Max. no. of slaves			No. of digital inputs	No. of digital outputs
	digital	analog	ASIsafe		
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

5.3 Extensions of the AS-Interface specification 2.1

- AS-Interface specification 2.1 enables the number of network nodes to be double from 31 to 62. The "advanced addressing" function can be used to split the 31 addresses supported in an AS-Interface network.
- If this function is used for all 31 slaves, this means that max. 62 nodes can be implemented in an AS-Interface network. The A/B slaves can be equipped with a maximum of four inputs and three outputs. Advanced addressing can be used for digital slaves but not for analog slaves or safety-oriented slaves (ASIsafe).
- AS-Interface specification V2.1 also features an integrated analog value transfer function. Integrated here means that the AS-i master is responsible for compiling the analog values over several AS-i cycles. This relieves the workload on the user program. Depending on the master, the values can now be transferred to the PLC by means of a transfer call or transferred to the process image. Analog values can be accessed here just as easily as digital values. The integrated analog value transfer function can be used with analog slaves that support profiles 7.3 and 7.4.

5.4 Extensions of the AS-Interface specification 3.0

- AS-Interface specification 3.0 enables a maximum of 1000 digital inputs/outputs to be connected (profile S-7.A.A: 8DI/8DO as A/B slave).
- New profiles allow advanced addressing to be used for analog slaves too.
- "Fast analog profiles" accelerate the speed at which analog values are transferred.
- Flexible use of analog modules: resolution (12/14 bits) and single/double channel can be set as required.
- Asynchronous serial protocol 100 baud or 50 baud bidirectional.

5.5 AS-Interface master: depending on the AS-Interface specification version

To operate A/B slaves in an AS-Interface network, master modules that comply with specification 2.1 at least must also be used.

A/B technology is supported by SIMATIC S7 masters and the DP/AS-Interface links from Siemens. Only standard and A slaves (= A/B slave with an A address) can be operated on masters that do not support specification 2.1.

The default sub-address of A/B slaves is "A".

The new masters to specification 3.0 support all the new slave profiles and are also downward compatible.

AS-Interface specification	Available masters
Version 2.1	S7-200 (CP 243-2), S7-300 (CP 343-2, 343-2P), DP/AS-i Link 20E
Version 3.0	DP/AS Link Advanced or IE/AS-i Link PN IO

For the AS-Interface specification applicable to the relevant slave, see "Selection and ordering data".

For the exact slave profile, see "Technical specifications".

5.6 Communication cycle: depending on the AS-Interface specification version

AS-Interface specification	Max. cycle time	Slave profile
Version 2.0	5 ms	S-X.0, S-X.1, S-X.F
Version 2.1	5 ms for 31 slaves 10 ms for 62 slaves	S-X.A, S-7.3, S-7.4, S-7.F
Version 3.0	As for version 2.1, and profile specific, 10 ms for inputs/outputs (e.g. 20 ms for 4DI/4DO and 40 ms for 8DI/8DO)	S-7.5.5; S-7.A.5, S-B.A.5; S-7.A.7, S-7.A.8; S-7.A.9, S-7.A.A, S-6.0

Standard slaves are polled in each cycle (max. cycle time: 5 ms). If just one A or B slave is installed at an address, this slave is also polled in each cycle (max. cycle time: 5 ms). If an A/B slave pair is installed at an address, the A slave is polled in the first cycle and the B slave is polled in the next cycle (max. cycle time: 10 ms). If only a standard and/or A slave is installed in a network, the cycle time is the same as that for standard masters (max. cycle time: 5 ms).

The AS-Interface specification for the relevant slave is specified in "Technical specifications" along with the exact slave profile.

Any combination of slave types can be used in the same AS-Interface network.

Master 6

6.1 SIMATIC integrated masters

6.1.1 Overview

AS-Interface master operating modes

Each AS-i master has two operating modes:

- Configuration mode
- Protected mode

Configuration mode

Configuration mode is used for commissioning an AS-i installation:

- The AS-i master can exchange data with any AS-i slave connected to the AS-i cable (except for the AS-i slave with address "0").
- New AS-i slaves on the bus are immediately detected, activated, and included in cyclic data exchange.
- The AS-i master cannot issue any error messages to the PLC via the slaves.

If the AS-i master is operated in configuration mode when a plant is in production mode, all the I/O data can be freely exchanged with the PLC, although any fault messages are suppressed.

Protected mode

In protected mode, the AS-i master only exchanges data with the configured AS-i slaves.

If any discrepancies between the target and actual configuration are identified, the AS-i master can output a fault message to the PLC automatically.

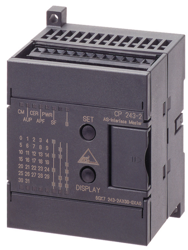
Potential discrepancies:

- The AS-i slave is configured but is either not available or defective.
- The AS-i slave is configured but the wrong AS-i slave type has been connected.
- The AS-i slave has not been configured but is available on the bus.

6.1.2 CP 243-2

6.1.2.1 Overview

Master connection for CPUs 22x for the state-of-the-art SIMATIC S7-200 generation



The CP 243-2 is the AS-Interface master for the state-of-the-art SIMATIC S7-200 generation. The communications processor (6GK1 243-2AX01-0AX0) supports the extended AS-Interface specification V2.1 and offers the following functions:

- Supports up to 62 AS-Interface slaves and features an integrated analog value transfer function (in accordance with the extended AS-Interface specification V2.1)
- Supports all the AS-Interface master functions in accordance with the extended AS-Interface specification V2.1.
- Displays indicating the operating state and LEDs on the front plate indicating the operational readiness of the connected slaves.
- Fault indications (including AS-Interface voltage errors, configuration errors) by means of LEDs on the front plate.
- Compact housing in keeping with the design of the state-of-the-art SIMATIC S7-200 generation.

Benefits

- SIMATIC S7-200 offers greater flexibility and a wider range of applications thanks to the increased number of
- Available digital and analog inputs/outputs
- Commissioning times reduced thanks to the simple configuration process at the touch of a button.
- The LED displays help reduce downtime and service times in the event of a fault.
- CP status
  - All the connected slaves and their operational readiness are displayed.
  - The AS-Interface supply voltage is monitored.

Scope of application

The CP 243-2 is the AS-Interface master connection and is designed exclusively for the CPUs 22x of the state-of-the-art SIMATIC S7-200 generation. The AS-Interface dramatically increases the number of available digital inputs and outputs for S7-200 (max. 248 DI / 186 DO for each CP).

Integrated analog value processing also means that analog values (max. 31 analog slaves for each CP, each with up to 4 channels) are also available on the AS-Interface for the S7-200. Up to two 243-2 CPs can be operated on the S7-200 simultaneously.

Structure

The CP 243-2 is connected to the S7-200 in the same way as an expansion module. It is equipped with:

- Two terminal connections for connecting the AS-Interface cable directly.
- LEDs on the front plate for indicating the operating state and operational readiness of all the connected and activated slaves.
- Two pushbuttons for indicating the status information of the slaves, switching the operating state, and adopting the existing actual configuration as a target configuration.

Function

The CP 243-2 supports all the functions defined in the extended AS-Interface specification V2.1, which means that dual address assignments (A-B) allow up to 62 digital or 31 analog slaves to be operated on the AS-Interface.

Thanks to integrated analog value processing, the analog values can be accessed just as easily as digital values.

In the process image for the S7-200, the CP 243-2 is assigned one digital input byte (status byte), one digital output byte (control byte), and eight analog input words and 8 analog output words. As a result, the CP 243-2 occupies two slots. The status and control byte can be used to set the operating mode of the CP 243-2 via the user program.

Depending on the operating mode, the CP 243-2 defines the I/O data for the AS-Interface slave or diagnostic values, or enables master calls (e.g. re-addressing the slaves) in the analog address space of the S7-200.

Configuration

All the connected AS-Interface slaves can be configured at the touch of a button. No further configuration settings need to be made for the CP.

6.1.2.2 Order numbers

Type	Order no.
CP 243-2 communications processor For connecting SIMATIC S7-200 (2nd generation) to AS-Interface with a bus connector	6GK7 243-2AX01-0XA0
Manual for CP 243-2 Including AS-Interface basics and disk with sample programs • German • English • French • Spanish • Italian	6GK7243-2AX00-8AA0 6GK7243-2AX00-8BA0 6GK7243-2AX00-8CA0 6GK7243-2AX00-8DA0 6GK7243-2AX00-8EA0 (or can be downloaded from the Internet)

6.1.2.3 Connecting the CP 343-2

Slots on the S7-200

The CP 243-2 can be inserted in the S7-200 automation system (CPUs 22x) in any of the slots for expansion modules.

Note restrictions

The restrictions imposed by the CPU or power supply used apply, however. These relate to the following areas:

- Expandability with more than one expansion module (for more information about this, see the "SIMATIC S7-200" system manual, order no. 6ES7298-8FA24-8AH0 or available as an Internet download).
- Electrical configuration

The maximum current consumption from the S7 backplane bus must not be exceeded. To determine this, use the calculation table in the "SIMATIC S7-200" system manual (order no. 6ES7298-8FA24-8AH0, or available as an Internet download).

Connections to the AS-i cable

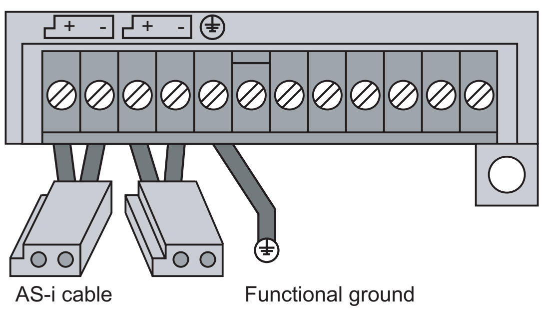


Figure 6-1 Connecting the AS-i cable

The following connections are located on the front of the CP 243-2 under the lower cover of the front flap:

- Two connections to the AS-i cable (bridged internally)
- One connection for functional ground

The two connections for AS-i cables are bridged internally in the CP 243-2, which means that the CP 243-2 can be "looped in" to the AS-i cable.

CAUTION

The load-carrying capacity of the AS-i connection contacts is max. 3 A. If this value is exceeded on the AS-i cable, the CP 243-2 must not be "looped in" to the AS-i cable but must instead be connected via a spur line (only one connection occupied on the CP 243-2). The CP 243-2 must be connected to the protective conductor via the ground terminal.

Note

Functional ground (terminal ⏚)

The CP 243-2 has one connection for functional ground. This connection must be connected to the protective conductor with as little resistance as possible.

6.1.2.4 Diagnostics

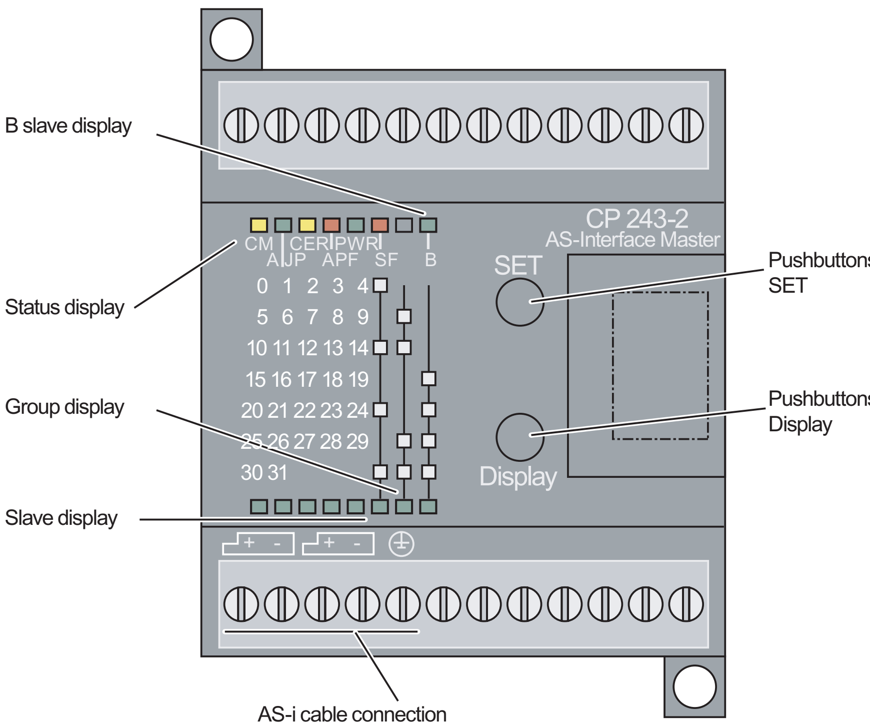


Figure 6-2 CP 243-2 front plate

The following are located on the front plate of the CP 243-2:

- The indicator/display elements (group display, status display, slave and B slave display)
- Connection of the AS-i cable
- SET button
- DISPLAY pushbutton
- Unassigned terminal block

Switching display statuses – DISPLAY pushbutton

You can switch between the status display (default setting) and the slave display using the DISPLAY pushbutton. When you press the pushbutton repeatedly, the system switches to the next display status and then finally back to the original status.

In the slave display, you can see the slaves on the AS-Interface. Five slaves are displayed simultaneously. To switch to the next group of five slaves, press DISPLAY. The standard or A slaves are displayed first followed by the B slaves (the "B" LED lights up).

The system switches back to the status display in the following cases:

- Once the final group has been displayed (slave 30B, 31B) and you press DISPLAY
- If you do not press DISPLAY for a long period (approx. 8 minutes)

Meaning of the LEDs

Two rows of LEDs are located on the front of the CP 243-2.

- The LEDs CM, AUP, CER, APF, PWR, and SF in the top row represent the status display.
  The "B" LED indicates the B slaves. When the slave display is active, this LED also lights up when B slaves are displayed.
- The first five LEDs in the bottom row indicate the connected slaves (slave display).
  The remaining three LEDs indicate the slave group.

The meaning of the LEDs depends on the status of the group displays.

If none of the LEDs in the group display is lit, this means that the status display is active (i.e. the LEDs CM, AUP, CER, APF, PWR, and SF show the status of the CP 243–2).

If at least one of the LEDs in the group display is lit, the system switches to the slave display (exception: the "PWR" LED is lit).

SET button

The SET button is required for configuring the CP 243-2.

Status display

When the status display is active, none of the group LEDs is lit.

The status display is the preselected standard display when the CP 243-2 is in its initial state.

The LEDs have the following meaning:

LED label	LED color	Status	Meaning
CM	Yellow	Configuration mode	This indicates the operating mode of the CP 243-2. • LED ON: configuration mode • Display OFF: Protected mode Configuration mode is only required commissioning the CP 243-2. In configuration mode, the CP 243-2 activates all the connected AS-i slaves and exchanges data with them. For more information about configuration mode, see the manual "CP 243-2 AS-Interface Master".
AUP	Green	Autoprog available	When the CP 243 2 is in protected mode, this indicates that the address of an AS-i slave can be programmed automatically. Automatic address programming makes it easier to replace a defective AS-i slave on the AS-i cable. For more information about this, see the manual "CP 243-2 AS-Interface Master".
CER	Yellow	Configuration error	This LED indicates whether the slave configuration detected on the AS-i cable matches the target configuration (LPS) in the CP 243-2. If any discrepancies are detected, the CER LED lights up. The CER LED lights up in the following cases: • If a configured AS-i slave is not detected on the AS-i cable (e.g. the slave has failed). • If an AS-i slave that has not yet been configured is detected on the AS-i cable. • If a connected AS-i slave has different configuration data (I/O configuration ID code, extended ID1 code, extended ID2 code) to the AS-i slave configured in the CP 243-2. • When the CP 243-2 is in the offline phase
APF	Red	AS-i power failure	Indicates that the voltage from the AS-i power supply unit on the AS-i cable is too low or has failed.
PWR	Green	Power	The PWR LED (power) indicates that the CP 243-2 is supplied with power.
SF	Red	System error	This LED lights up in the following cases: • The CP 243-2 detects an internal error (e.g. EEPROM defective). • The CP 243-2 is currently unable to switch modes when the user requires this (e.g. an AS-i slave with the address "0" exists)

Slave display

To switch to the slave display, press the DISPLAY pushbutton. You can also switch from group to group by pressing DISPLAY. The slave display is active when at least one group LED is lit.

The slave display has the following properties:

- If the CP 243–2 is in configuration mode, all the detected AS-i slaves are displayed.
- If the CP 243–2 is in protected mode, all the active AS-i slaves are displayed. In protected mode, the relevant LED starts flashing if AS-i slaves have either failed or if they have been detected but not configured.

Details of the display statuses

The AS-i slaves are displayed in groups of five. The three group LEDs indicate (binary coded) which group of five is being displayed. The five LEDs in the slave display then indicate the detected or active AS-i slaves within this group.

To determine which slaves are active, find the group (row) in which the boxes equate to the group LEDs that are lit. The LEDs in the slave display that are currently lit indicate which slaves within this group are currently active.

If a group of B slaves is displayed, the "B" LED also lights up.

Example of a slave display

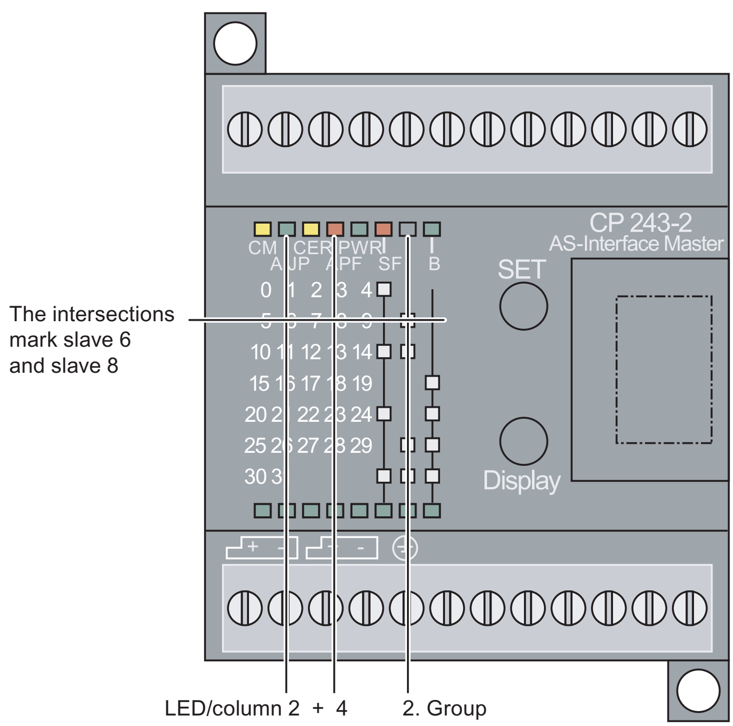


Figure 6-3 Example of a slave display

In the above image, you can see the following:

- The 2nd group LED is lit, that is, the 2nd row from the top ($2^1 = 2_{dec}$; 2nd group of 5; slaves 5–9).
- If the 2nd and 4th LEDS in the slave display are also lit, this means that slave 6 and 8 are active.
- If the "B" LED is also lit, this means in this example that slave 6B and 8B are active.

6.1.2.5 Technical specifications

Technical specifications	
AS-Interface specification	V2.1
Interfaces	
• Assignment of analog address space in addressing unit	Accordingly, 2 I/O modules (8 DI/8 DO and 8 AI/8 AO)
• AS-Interface connection	Terminal connection
Current consumption	
• Via backplane bus	Typ. 220 mA at 5 V DC
• Via AS-Interface from the AS-Interface shaped cables	Max. 100 mA
Power loss	Approx. 2 W
Permissible ambient conditions	
• Operating temperature	
• Horizontal installation	0°C to +55°C
• Vertical installation	0°C to +45°C
• Transport / storage temperature	-40°C to +70°C
• Relative humidity	Max. 95% at +25°C
Design	
• Module format	S7-22x expansion module
• Dimensions (W x H x D) in mm	71.2 x 80 x 62 (H+16 mm with holes for wall mounting)
• Weight	Approx. 250 g
• Space requirements	1 slot

6.1.3 CP 343-2, CP 343-2 P

6.1.3.1 Overview

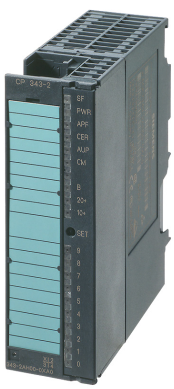
Difference between the CP 343-2 and CP 343-2 P

The functions supported by the two device types CP 343-2 and CP 343-2 P are largely the same. The CP 343-2 P, however, features additional configuration options in STEP 7.

For this reason, the CP 343-2 P module must not be considered as a replacement for the CP 343-2, which will continue to be available.

In the following description, a distinction is only made between the types when different performance features are described. Unless otherwise indicated, this information provided for CP 343-2 applies to both device types.

Master connection for SIMATIC S7-300 and ET 200M



The CP 343-2 is the AS-Interface master for SIMATIC S7-300 programmable logic controller and the distributed I/O device ET 200M. The communications processor offers the following functions:

- Supports up to 62 AS-Interface slaves and features an integrated analog value transfer function (in accordance with the extended AS-Interface specification V2.1)
- Supports all the AS-Interface master functions in accordance with the extended AS-Interface specification V2.1.
- Displays indicating the operating state and LEDs on the front plate indicating the operational readiness of the connected slaves.
- Fault indications (including AS-Interface voltage errors, configuration errors) by means of LEDs on the front plate.
- Compact housing in keeping with the design of the SIMATIC S7-300.
- CP 343-2 P only: supports the configuration of the AS-Interface network with STEP 7 as of V5.2.

Benefits

- Commissioning times reduced thanks to the simple configuration process at the touch of a button.
- Flexible, distributed structures can be created when the device is implemented in the DP slave ET 200M.
- The LED displays help reduce downtime and service times in the event of a fault:
  - Status of the AS-Interface network
  - Connected slaves and their operational readiness
  - The AS-Interface supply voltage is monitored.
- Cuts the cost of storage and spare parts storage because the CP can be used for both the SIMATIC S7-300 and ET 200M.
- With the option of connecting 62 slaves along with integrated analog value processing, this device is suitable even for complex applications.

- CP 343-2 P only: improved system documentation and support during servicing because the AS-Interface configuration is documented in the STEP 7 project.

Scope of application

The CP 343-2 is the AS-Interface master connection for SIMATIC S7-300 and ET 200M. The connection to the AS-Interface permits a maximum of 248 DI/186 DO to be accessed for each CP.

Integrated analog value processing also allows simple analog signals (max. 31 analog slaves for each CP, each with up to 4 channels) to be evaluated.

The CP 343-2 functionality is identical to that of the CP 343-2 P, which means that an old S7 application program can be used without any restrictions with the new CP. The AS-Interface configuration can also be downloaded/uploaded with the STEP 7 hardware configuration.

Features

The CP 343-2 is connected to the S7-300 in the same way as an expansion module. It is equipped with:

- Two terminal connections for connecting the AS-Interface cable directly.
- LEDs on the front plate for indicating the operating state and operational readiness of all the connected and activated slaves.
- Pushbuttons for indicating the status information of the slaves, switching the operating state, and adopting the existing actual configuration as a target configuration.

Function

The CP 343-2 supports all the functions specified in the extended AS-Interface specification V2.1, which means that dual address assignments (A-B) allow up to 62 digital or 31 analog slaves to be operated on the AS-Interface. Integrated analog value processing provides easy access to the analog values.

In I/O mode, the CP 343-2 is assigned 16 bytes in the analog address space of the SIMATIC S7-300. The I/O data for the standard and A slaves is stored in this area. You can access the binary values of B slaves in the user program using the system function blocks SFC 58 "write_data_record" / SFC 59 "read_data_record" with data record number 150.

A and B slaves comply with the extended AS-Interface specification V2.1. A function call (FC) for the AS-Interface master calls (e.g. write parameters, read diagnostic values) is available on the disk provided with the manual.

Configuration

All the connected AS-Interface slaves can be configured at the touch of a button. No further configuration settings need to be made for the CP.

The CP 343-2 P supports configuration of the AS-Interface network with STEP 7 as of V5.2.

6.1.3.2 Order numbers

Type	**Order no.**
CP 343-2 communications processor For connecting SIMATIC ET 200X to the AS-Interface; without front connector	6GK7 343-2AH00-0XA0
CP 343-2 P communications processor For connecting SIMATIC S7-300 and ET 200M to the AS-Interface; without front connector	6GK7 343-2AH10-0XA0
Front connector 20-pole, with screw-type contacts	6ES7 392-1AJ00-0AA0

6.1.3.3 Connection

Permissible slots on the CP 343-2 in SIMATIC AS-300 and ET 200M

In principle, the CP can be inserted in any slot for I/O modules in the AS-300 and ET 200M automation systems.

The restrictions imposed by the CPU or power supply used apply, however. These relate to the following areas:

- Expandability with more than one rack (multi-tier configuration of the AS only possible as of CPU 314)
- Electrical configuration, that is, the total current consumption from the S7 backplane bus

For more details about this, see the relevant SIMATIC system manuals.

Connecting the AS-i cable

The front connector for connecting the AS-i cable is located under the cover on the front of the CP 343-2.

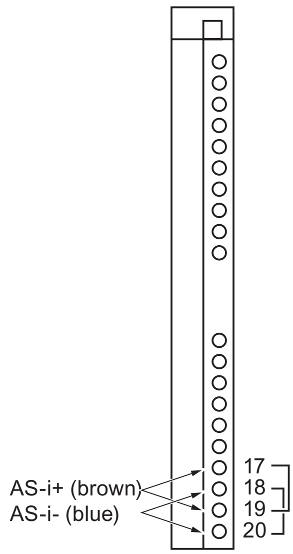


Figure 6-4 Front connector assignment for the CP 343-2 and CP 343-2 P

The CP is equipped with internal connections for two AS-i cables. These connections are bridged internally in the CP, which means that the CP 343-2 can be "looped in" to the AS-i cable.

CAUTION
The load-carrying capacity of the connection contacts is max. 4 A. If this value is exceeded on the AS-i cable, the CP 343-2 must not be "looped in" to the AS-i cable but must instead be connected via a spur line (only one connection pair occupied on the CP 343-2).

6.1.3.4 Diagnostics

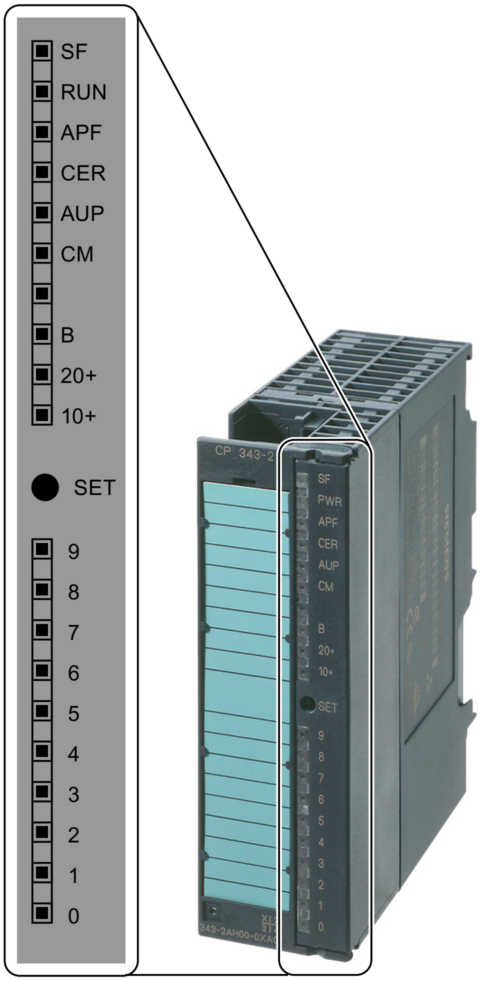


Figure 6-5 CP 343-2 front plate

The following are located on the front plate of the CP 343-2:

- The display elements (group display, status display, and slave display)
- Front connector for connecting the AS-i cable
- SET button

CP 343-2 status display

When the CP 343-2 is operating normally (the group display LEDs are not lit up), you can read its status.

LED label	Meaning
SF	System error This LED lights up in the following cases: • The CP 343-2 is in protected mode and an AS-i configuration error is present (e.g. slave failure) • The CP 343-2 detects an internal error (e.g. EEPROM defective) • The CP 343-2 is currently unable to switch modes (e.g. a slave with the address "0" exists)
RUN	Indicates that the CP has booted properly.
APF	AS-i power failure. Indicates that the voltage supplied by the AS-i power supply unit via the AS-i cable is too low or has failed.
CER	Configuration error This LED indicates whether the slave configuration detected on the AS-i cable matches the target configuration (LPS) in the CP. If not, the CER LED lights up. The CER LED lights up in the following cases: • If a configured AS-i slave is not detected on the AS-i cable (e.g. the slave has failed). • If a slave that has not yet been configured is detected on the AS-i cable. • If a connected slave has different configuration data (I/O configuration, ID code) to the slave configured in the CP 343-2. • When the CP is in the offline phase.
AUP	Autoprog available When the CP 343-2 is in protected mode, this indicates that the address of a slave can be programmed automatically. Automatic address programming makes it easier to replace a defective slave on the AS-i cable.
CM	Configuration mode This indicates the operating mode. Display ON: Configuration mode Display OFF: Protected mode

SET button

The SET button is required for configuring the CP 343-2 in standard mode. This button is only active when the AS is in STOP mode.

If the CP 343-2 is in configuration mode (CM LED lights up), the CP 343-2 is configured automatically when you press this button. Configuration is carried out as follows:

1. The CP 343-2 saves the existing slave configuration, which is indicated via the display of the active slaves, as the target configuration in a non-volatile memory.
2. The CP 343-2 then switches to protected mode.

When the CP 343-2 is in protected mode (the CM LED does not light up), the CP switches automatically to configuration mode when you press the button.

Slave display

The detected/active slaves are indicated by LEDs 0 to 9 and LEDs 10+, 20+, and B. The active slaves are displayed in groups of 10. The switchover is time controlled. LEDs 10+ and 20+ indicate which group of 10 is currently indicated by LEDs 0 to 9. If LED B lights up, this indicates that the slaves detected or activated are in the extended address space B.

The slave display has the following properties:

- If the CP 343–2 is in **configuration mode**, all the **detected** AS-i slaves are displayed.
- When the CP 343–2 is in **protected mode**, all the **activated** AS-i slaves are displayed with a continuous light. The relevant LED starts flashing if AS-i slaves have either failed or if they have been detected but not configured.

Examples of slave displays

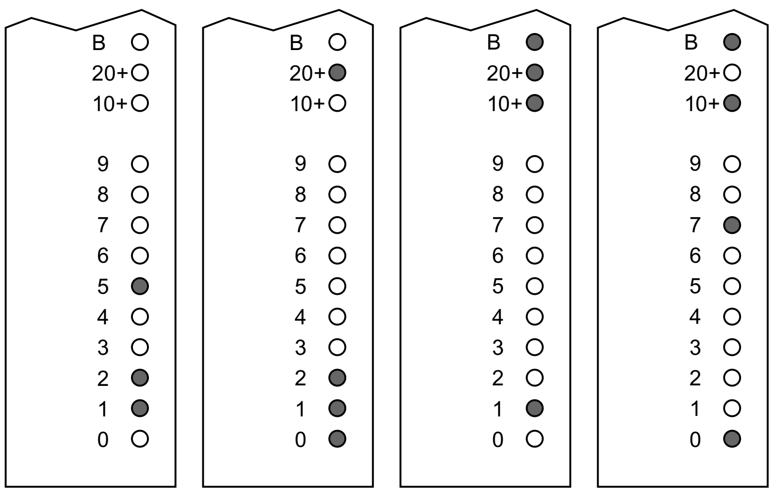


Figure 6-6 Sample displays for detected/activated AS-i slaves

Example (from left to right)	Meaning of the display
1	The slaves with addresses 1, 2, and 5 have been detected/activated.
2	The slaves with addresses 20, 21, and 22 have been detected/activated.
3	The slave with address 31B has been detected/activated.
4	The slaves with addresses 10B and 17B have been detected/activated.

6.1.3.5 Technical specifications

Technical specifications	
AS-Interface specification	V 2.1
Bus cycle time	5 ms with 31 slaves 10 ms with 62 slaves
Interfaces	
• Assignment of analog address space in addressing unit	16 bytes I/O and P bus S7-300
• AS-Interface connection	S7-300 front connector with terminal connection
Power supply	+5 V DC via backplane bus
Current consumption	
• Via backplane bus	Typ. 200 mA with 5 V DC
• Via AS-Interface from the AS-Interface shaped cables	Max. 100 mA
Power loss	2 W
Permissible ambient conditions	
• Operating temperature	0°C to +60°C
• Transport / storage temperature	-40°C to +70°C
• Max. relative humidity	95% at +25°C
Design	
• Module format	S7-300 design
• Dimensions (W x H x D) in mm	40 x 125 x 120
• Weight	Approx. 190 g
• Space requirements	1 slot
Configuration software (for CP 343-2 P)	Optional. STEP 7 as of V5.2

6.2 Routers

6.2.1 DP/AS-Interface Link 20E

6.2.1.1 Overview

Data exchange between the PROFIBUS DP and AS-Interface

DP/AS-Interface Link 20E connects the PROFIBUS DP to the AS-Interface. It performs the following functions:

- PROFIBUS DP slave and AS-Interface master
- Supports up to 62 AS-Interface slaves and features an integrated analog value transmission function (in accordance with the extended AS-Interface Specification V2.1)
- Supports all the AS-Interface master functions in accordance with extended AS-Interface Specification V2.1 (i.e. master class M3).
- Power supply via the AS-Interface cable, which means that no additional power supply is required.
- Enables the AS-Interface configuration to be loaded to STEP 7 (as of V5.2).

Benefits

- Reduced installation costs because the power is supplied entirely via the AS-Interface cable, which means that no additional power supply is required.
- Short commissioning times thanks to easy configuration at the touch of a button.
- The LED indicators help reduce downtime and service times if a slave fails.
- Quick and easy commissioning by reading the AS-Interface configuration (as of ES03)

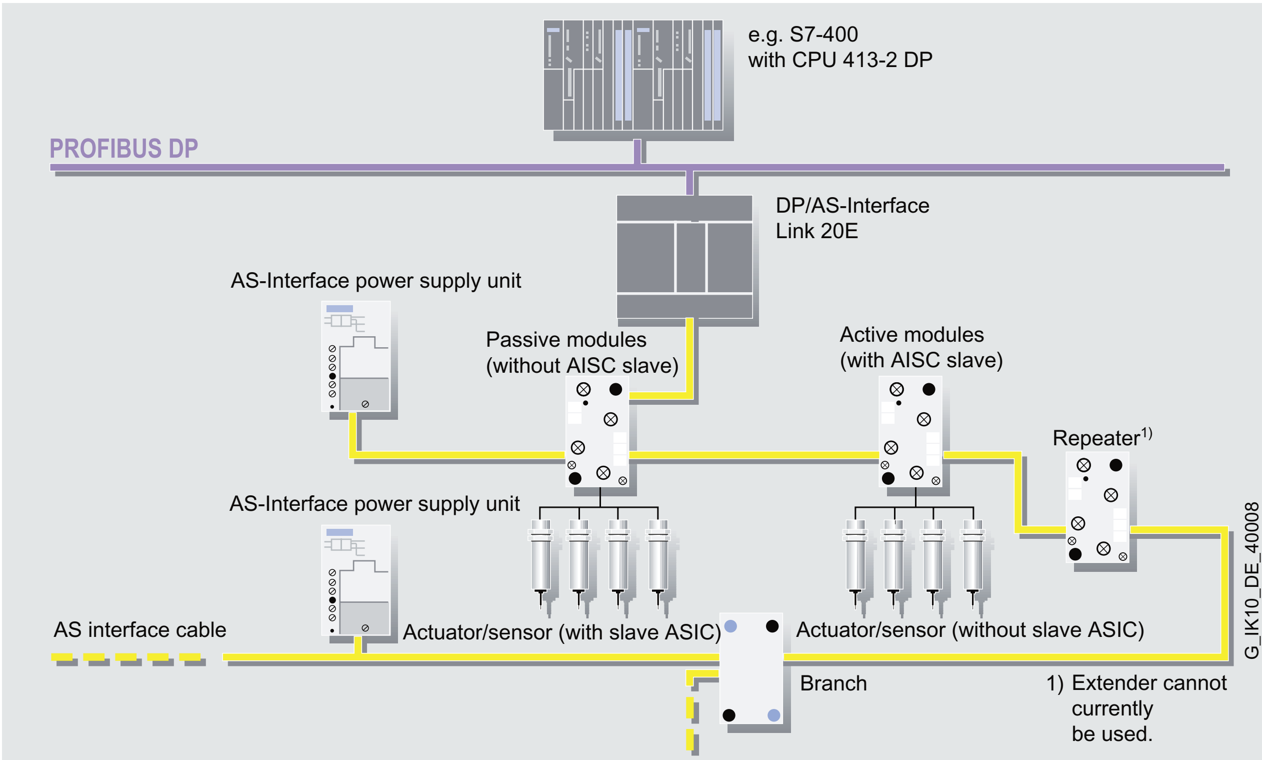


Figure 6-7 Transition from the PROFIBUS DP to the AS-Interface via DP/AS-Interface Link 20E

Scope of application

DP/AS-Interface Link 20E is a PROFIBUS DP slave (to EN 50 170) and AS-Interface master (to EN 50 295) and enables the AS-Interface to be operated on the PROFIBUS DP.

Simple PROFIBUS masters can exchange I/O data with the AS-Interface cyclically. Masters with acyclic services can exchange I/O data and carry out master calls. DP/AS-Interface Link 20E cannot be used in conjunction with the extender.

Design

- Compact housing with degree of protection IP20 for mounting on DIN rails.
- LEDs on the front plate for indicating the operating state and operational readiness of all the connected and activated slaves.
- The PROFIBUS DP address can be set at the touch of a button.
- LED for the PROFIBUS DP slave address, DP bus error, and diagnosis.
- Two buttons for switching the operating state and adopting the existing actual configuration as the target configuration.
- The power is supplied via the AS-Interface shaped cable.

Function

DP/AS-Interface Link 20E enables a DP master to access all the slaves in an AS-Interface segment. In accordance with extended specification (V2.1), up to 62 slaves each with four inputs and three outputs can now be connected.

DP/AS-Interface Link 20E is normally assigned 32 bytes of input data and 32 bytes of output data in the DP master in which the I/O data for the connected AS-Interface slaves is stored. The input/output buffer can be compressed so that only the required memory in the DP master is used.

PROFIBUS DP masters can also trigger AS-Interface master calls via the acyclic PROFIBUS services (e.g. write parameters, change addresses, read diagnostic values).

Configuration

DP/AS-Interface Link 20E can be configured on the PROFIBUS with STEP 7 or COM PROFIBUS.

The type and GSD files are also supplied with the manual, which means that configuration can also be carried out with STEP 7 versions in which DP/AS-Interface Link 20E is not yet available as standard.

The AS-Interface segment can be configured by means of STEP 7 or simply by adopting the ACTUAL configuration. Commissioning can also be performed without PROFIBUS.

When DP/AS-Interface Link 20E is configured with STEP 7, the AS-Interface configuration can be uploaded to STEP 7 as of V5.2.

6.2.1.2 Order numbers

Type	Order no.
DP/AS-Interface Link 20E Router between the PROFIBUS DP and AS-Interface with degree of protection IP20	6GK1 415-2AA01
DP/AS-Interface LINK 20E manual Including type and GSD files • German • English • French • Spanish • Italian	 6GK1971-2DS01-0AA0 6GK1971-2DS01-0AA1 6GK1971-2DS01-0AA2 6GK1971-2DS01-0AA3 6GK1971-2DS01-0AA4

6.2.1.3 Connection

Connections

DP/AS-i Link 20E has the following connections:

- Two connections to the AS-i cable (jumpered internally)
- One connection for functional ground
- One connection to PROFIBUS (9-pin SUB D socket)

The connections are located under the top cover on the front panel of DP/AS-i Link 20E.

Connections to the AS-i cable

DP/AS-i Link 20E has two connections (jumpered internally in DP/AS-i Link 20E) for AS-i cables.

This allows DP/AS-i Link 20E to be "looped in" to the AS-i cable.

> **CAUTION**
>
> **Maximum load-carrying capacity**
>
> The maximum load-carrying capacity of the AS-i connection contacts is 3 A. If this value is exceeded on the AS-i cable, DP/AS-i Link 20E must not be "looped in" to the AS-i cable but must instead be connected via a spur line (one connection pair only occupied by DP/AS-i Link 20E).

DP/AS-i Link 20E is supplied with power entirely from the AS-Interface.

The current consumption from the AS-Interface is 200 mA.

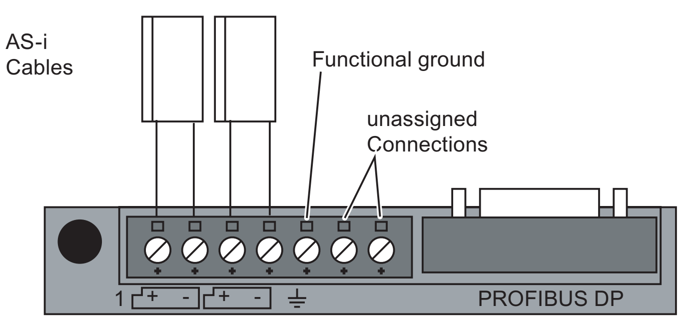


Figure 6-8 Connecting the AS-i cables

> **CAUTION**
>
> Connections 6 and 7 on the terminal block are unassigned and must remain so.

Note

Functional ground (terminal ⏚)

DP/AS-i-Link 20E features a connection for functional ground. This connection must be connected to the protective conductor with as little resistance as possible.

Connection to the PROFIBUS DP

The system is connected to the PROFIBUS DP via a 9-pin SUB D socket.

⚠ WARNING

When laying and installing the PROFIBUS DP cable and bus connector, refer to the instructions provided in "SIMATIC NET PROFIBUS Networks"
(order no.: 6GK1970-5CA20-0AA0, or can be downloaded from the Internet).

Bus connectors with the cable outlets at different angles (0°, 30°, and 90°) are available for connecting PROFIBUS DP. See also the notes in the manual "SIMATIC NET PROFIBUS Networks".

6.2.1.4 Diagnostics

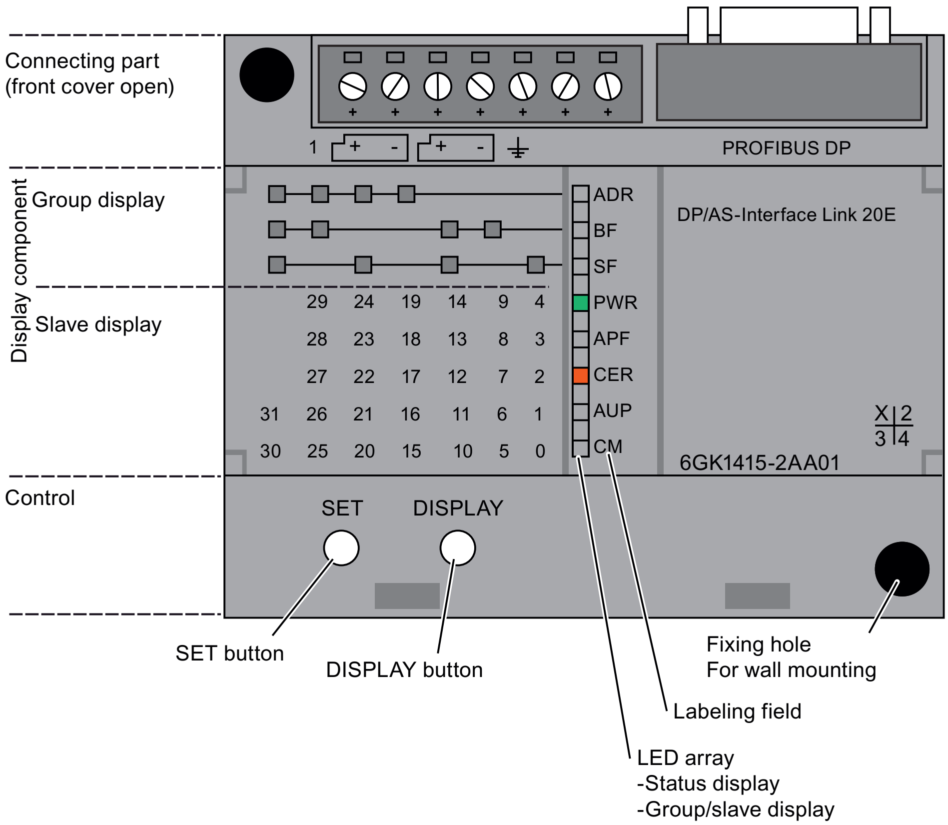


Figure 6-9 Front view of DP/AS-i Link 20E

The following can be found on the front panel of DP/AS-Interface Link 20E:

- The display section (group, status, and slave display)
- Under a cover on the front: the connecting part for the connections to the AS-i cable, functional ground, and PROFIBUS
- Under another cover on the front: the control with the SET and DISPLAY buttons

Reading the diagnosis on the device

DP/AS-Interface Link 20E has the following display modes:

- Status display of the master
- Slave display for the AS-i slaves
- PROFIBUS address display

You can use the DISPLAY button to switch from one display mode to the next or switch within the slave display.

Status display

When DP/AS-Interface Link 20E is in the initial state (e.g. once it has been switched on), you can read its status information from the LEDs (the three LEDs in the group display do not light up green and the ADR LED does not light up at all).

LED	Color	Status	Meaning
BF	Red	Bus failure	Indicates a fault on PROFIBUS DP. This LED lights up in the following cases: • The connection between the DP master and DP/AS-i Link 20E is interrupted or the DP master is not active. • DP/AS-i Link 20E has been incorrectly configured/parameterized by the DP master.
SF	Red	System error	This LED lights up in the following cases: • In protected mode: a diagnostic alarm (incoming) was triggered in the DP master. • DP/AS-i Link 20E detects an internal fault (e.g. EEPROM is defective). • DP/AS-i Link 20E cannot currently execute the required mode switchover when the SET button is pressed (e.g. a slave exists with the address 0).
PWR	Green	Run	This LED lights up when DP/AS-Interface Link 20E is supplied with power.
APF	Red	AS-i power failure	Indicates that the voltage supplied by the AS-i power supply unit via the AS-i cable is too low. Note: DP/AS-Interface Link 20E is supplied with power entirely from the AS-Interface. This means that if the AS-i voltage fails completely, this cannot be indicated by "AS-i power failure". You can identify this status when the "PWR" LED is not lit up.
CER	Yellow	Configuration error	This LED indicates whether the slave configuration detected on the AS-i cable matches the target configuration in DP/AS-i Link 20E. If not, the CER LED lights up. The CER LED lights up in the following cases: • If a configured AS-i slave is not detected on the AS-i cable (e.g. the slave has failed). • If an AS-i slave that has not yet been configured is detected on the AS-i cable. • If a connected AS-i slave has different configuration data (I/O configuration, ID code) to the AS-i slave configured in DP/AS-i Link 20E. • When DP/AS-i Link 20E is in offline mode.
AUP	Green	Autoprog available	When DP/AS-i Link 20E is in protected mode, this LED indicates that the address of an AS-i slave can be programmed automatically. Automatic address programming makes it easier to replace a defective AS-i slave on the AS-i cable.
CM	Yellow	Configuration mode	This display indicates the DP/AS-i Link 20E operating mode. • Display ON: Configuration mode • Display OFF: Protected mode Configuration mode is only required for commissioning DP/AS-i Link 20E. In configuration mode, DP/AS-i Link 20E activates all the connected AS-i slaves and exchanges data with them.

Slave display for AS-i slaves

To switch from the status display for the master to the status display for the slaves, press the DISPLAY button.

The AS-i slaves are displayed in groups of five. The top three group LEDs indicate which group of five is displayed by lighting up green. A further distinction is made between:

- Static: AS-i standard slaves and A slaves
- Flashing: B slaves

The LEDs below light up green to indicate which AS-i slaves within the group have been detected or are active.

To switch from group to group, press the DISPLAY button.

The system switches back to the status display in the following cases:

- Once the last group has been displayed (AS-i slave 30, 31) and when you press the DISPLAY button twice (i.e. switch to the PROFIBUS address display and then to the status display).
- If the DISPLAY button is not pressed for approx. 8 minutes.

Characteristics of the slave display

- If DP/AS-i Link 20E is in configuration mode, all the detected AS-i slaves are displayed.
- If DP/AS-i Link 20E is in protected mode, all the active AS-i slaves are displayed. In protected mode, the relevant LED starts flashing if AS-i slaves have either failed or if they have been detected but not configured.

Example of a slave display

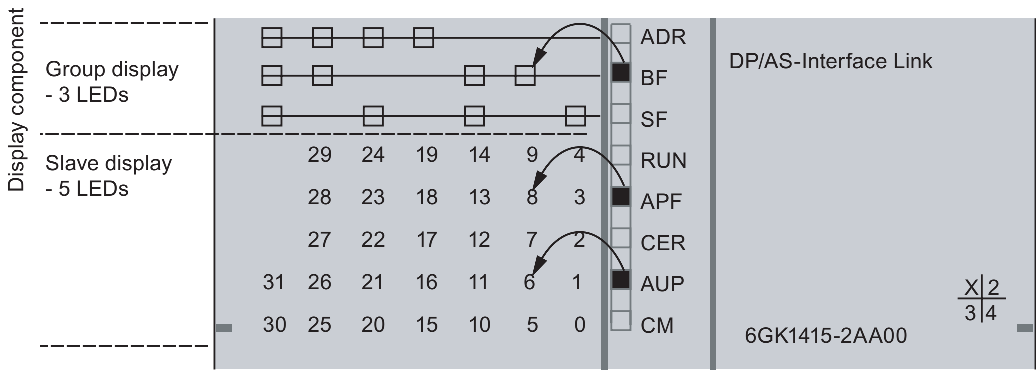


Figure 6-10 Example: slave display on DP/AS-i Link 20E

In the above image, you can see the following:

- The group LEDs select the second group of five.
- Within this group, the 5 LEDs at the bottom indicate the active AS-i slaves 6 and 8.

Displaying and setting the PROFIBUS address

If the top LED in the group display (ADR) is red, the 7 LEDs below this indicate the PROFIBUS address of DP/AS-i Link 20E in binary form.

To set the PROFIBUS address of DP/AS-i Link 20E, carry out the following steps:

1. Disconnect the DP master (e.g. unplug the PROFIBUS connector or switch the DP master to STOP).

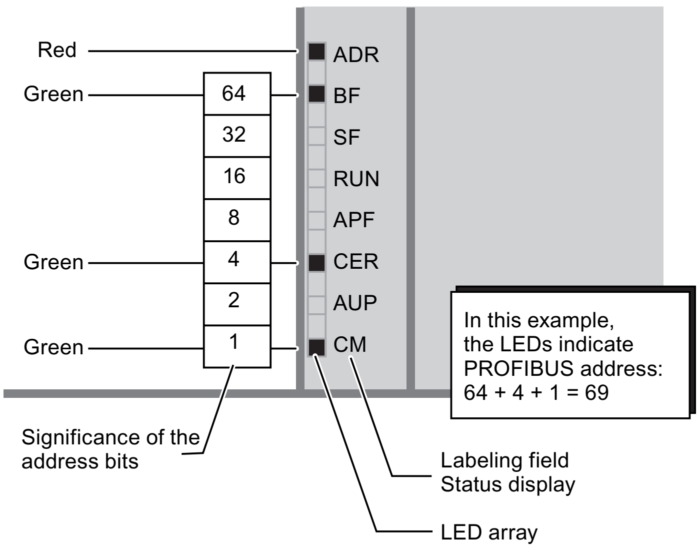
   Note

   The PROFIBUS address can only be set in this operating state.

2. Switch the DP/AS-i Link 20E display by pressing the DISPLAY button repeatedly until the ADR LED lights up red. (Note: from the status display, you have to press the button 15 times.)
   DP/AS-i Link 20E indicates the current PROFIBUS address with the seven LEDs at the bottom.
3. When you press the DISPLAY button, DP/AS-i Link 20E returns to the status display and the set PROFIBUS address is retained.
   If you press the SET button, however, you can reset the PROFIBUS address. When the BF LED flashes, this indicates the most significant bit in the PROFIBUS address.
4. When you press SET, this bit is set (LED on); when you press DISPLAY, however, the bit is reset (LED off). The display then switches to the SF LED (next address bit in the PROFIBUS address).
5. Using the same procedure as described in the previous step, you can now set/reset the individual bits in the PROFIBUS address one after the other.

6. When all the bits have been entered, the display for the set address bits switches rapidly from red to green or yellow to green (flashing). When you press SET again, the set PROFIBUS address is adopted by DP/AS-i Link 20E. If you press DISPLAY, however, the new address is rejected. You now have to enter the new address again (see steps 4 and 5).

The significance of the address bits in the PROFIBUS address indicated by the LEDs is explained in the following example:



In the example above, PROFIBUS address 69 was set using SET and DISPLAY.

The highest possible address is 126. Note that address 126 is reserved for special functions (address assignment) on the PROFIBUS. Addresses 1 to 125 can be used for exchanging data with the DP master.

6.2.1.5 Technical specifications

Technical specifications	
AS-Interface bus cycle time	5 ms for 31 slaves; 10 ms for 62 slaves
PROFIBUS transmission rate	Max. 12 Mbit/s
Supported AS-Interface master profiles	M3 (in accordance with Complete AS-Interface Specification V2.1)
Configuration of AS-Interface	Using the buttons on the front plate or with STEP 7 V5.1 SP2
Interfaces	
• AS-Interface connection	Terminal contacts
• Connection to PROFIBUS	9-pin SUB D socket
Power supply	
• From the AS-Interface cable	In accordance with AS-Interface Specification EN 50 295
Current consumption	
• From the AS-Interface cable	Max. 250 mA
Load-carrying capacity	
5 V DC at the PROFIBUS connection	Max. 90 mA
Current consumption from AS-i	200 mA
Power loss	3.7 W
Degree of protection	IP20
Permissible ambient conditions	
• Operating temperature	
• Horizontal installation	0°C to +60°C
• Vertical installation	0°C to +45°C
Transport/storage temperature	-40°C to +70°C
Relative humidity	Max. 95% at +25°C
Operating altitude	3000 m above sea level
Design	
• Module format	S7-200 design
• Dimensions (W x H x D) in mm	90 x 80 x 60
• Weight	Approx. 200 g

6.2.2 DP/AS-i LINK Advanced

6.2.2.1 Overview

Data exchange between AS-Interface and PROFIBUS DP

- Compact router between PROFIBUS (DP slave) and AS-Interface.
- Single and double AS-Interface master (to AS-Interface Specification V3.0) for connecting 62 AS-Interface slaves in each case and integrated analog value transmission.
- Integrated, high-performance ground-fault monitoring for the AS-Interface cable.
- User-friendly on-site diagnosis and commissioning functions via a graphical display and controls or via a Web interface with a standard browser.
- Optimum TIA integration via STEP 7, integration in engineering tools from third-party vendors via the PROFIBUS type file (GSD).
- Vertical integration (standard Web interface) via Industrial Ethernet.
- Power supplied via the AS-Interface cable or with 24 V DC (optional).
- Modules can be exchanged without the PG by means of C-PLUG (optional).

Benefits

- Quick PLC-independent commissioning by means of simple configuration at the touch of a button and testing the AS-Interface line via the display or WBM. (Page 72)
- User-friendly diagnosis via the display or Web interface and easy replacement of modules by means of the exchange medium C-PLUG helps reduce downtime and service times if a slave fails.
- Reduced installation costs because the power is supplied entirely via the AS-Interface cable, which means that no additional power supply is required.
- Reduced engineering overhead through convenient configuration of Siemens slaves per slave catalog in HW-Config (STEP 7)
- Lower costs for high quantity frameworks as result of the dual AS-Interface master

Scope of application

DP/AS-i LINK Advanced is a PROFIBUS DPV1 slave (to EN 50 170) and AS-Interface master (in accordance with AS-Interface Specification V3.0 to EN 50 295) and enables transparent data access to the AS-Interface from PROFIBUS DP.

PROFIBUS DP masters can exchange I/O data with the AS-Interface cyclically. DP masters with acyclic services can also carry out AS-Interface master calls. DP/AS-i LINK Advanced is, therefore, suitable for distributed configurations and for integrating a lower-level AS-Interface network.

The AS-Interface single master version of DP/AS-i LINK Advanced is suitable for applications with typical volumes of data.

The AS-Interface double master version of DP/AS-i LINK Advanced is suitable for applications with large volumes of data. In this case, the double data volumes can be processed on two separate AS-Interface lines.

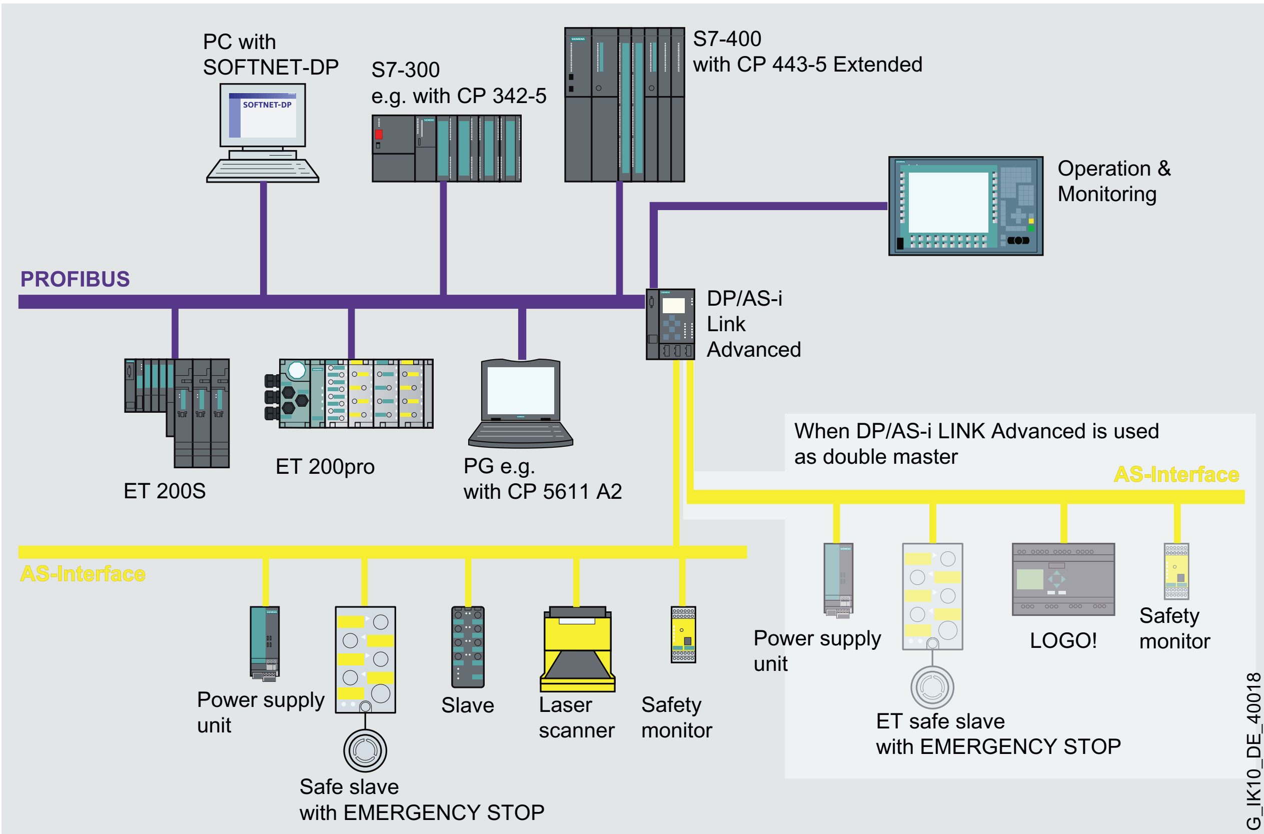


Figure 6-11 Integration of AS-Interface in PROFIBUS via DP/AS-i LINK Advanced as single/double master

Design

Robust plastic housing with degree of protection IP20 for mounting on DIN rails.

- Compact design
  - Display on the front plate for accurately indicating the operating state and operational readiness of all the connected and activated AS-Interface slaves.
  - Six buttons for commissioning and testing the AS-Interface line directly on DP/AS-i LINK Advanced.
  - LEDs for indicating the operating state of PROFIBUS DP and AS-Interface.
  - Integrated Ethernet port (RJ45 socket) for user-friendly commissioning, diagnosing, and testing of DP/AS-i LINK Advanced via a Web interface with a standard browser.
  - Power supplied via the AS-Interface shaped cable or with 24 V DC (optional).
  - Low installation depth due to lowered plug fitting.

- Easy installation on standard DIN rail
- Operation without fan or battery
- Rapid replacement of devices by means of the exchange medium C-PLUG (not supplied).

Function

DP/AS-i LINK Advanced provides the PROFIBUS DP master with cyclic access to the I/O data for all slaves in a lower-level AS-Interface segment. According to the extended AS-Interface Specification (V3.0), up to 62 slaves each with four inputs and four outputs (or eight inputs and eight outputs) as well as analog slaves on each AS-Interface line can be connected.

In the DP master, DP/AS-i LINK Advanced is normally assigned 62 input and 62 output bytes in which the I/O data for the connected digital AS-Interface slaves is stored. The input/output buffer can be compressed so that only the required I/O memory in the DP master system is used. The integrated function for analyzing analog signals is just as simple to use as the function for accessing digital values, which means that communication modules no longer have to be called up.

PROFIBUS DP V1 masters can also trigger AS-Interface master calls via the acyclic PROFIBUS services (e.g.: write parameters, change addresses, read diagnostic values).

An operator display in AS-i Link allows you to commission the lower-level AS-Interface line. DP/AS-i LINK Advanced is equipped with an additional Ethernet port that allows you to leverage the benefits of the integrated Web server, thereby making it even easier to use the operator display. The firmware can also be upgraded free of charge.

The optional C-PLUG allows you to replace modules without a PG, thereby minimizing downtime if a fault occurs.

Diagnostics

A comprehensive range of diagnostic functions are available via LEDs, displays, controls, a Web interface, or STEP 7. These include:

- Operating state of the link
- State of the link as a PROFIBUS DP slave
- Diagnosis of the AS-Interface network
- Telegram statistics
- Standard diagnosis pages for rapid access to diagnostic data by means of a standard browser

Configuration

DP/AS-i LINK Advanced can be configured with STEP 7 as of version V5.4 or simply by copying the actual configuration on the display.

Alternatively, DP/AS-i LINK Advanced can be integrated by means of the PROFIBUS type file (GSD) in the engineering tool:

- COM PROFIBUS
- Older STEP 7 versions (older than V5.4)
- Engineering tools from third-party vendors

When configuration is carried out with STEP 7, the AS-Interface configuration can be uploaded to STEP 7 as of V5.4. Siemens AS-Interface slaves can also be easily configured in HW Config (slave catalog).

6.2.2.2 Order numbers

Type	Order no.
DP/AS-i LINK Advanced Router between PROFIBUS DP and AS-Interface; master profiles M3 and M4, extended AS-Interface Specification V3.0; degree of protection IP20; manual on CD-ROM, German, English, Spanish, Italian Single master with display	6GK1 415-2BA10
DP/AS-i LINK Advanced Router between PROFIBUS DP and AS-Interface; master profiles M3 and M4, extended AS-Interface Specification V3.0; degree of protection IP20; manual on CD-ROM, German, English, Spanish, Italian Double master with display	6GK1 415-2BA20
C-PLUG Exchange medium for replacing the devices quickly and easily if a fault occurs; for recording configuration and application data, can be used in SIMATIC NET products with C-PLUG slot	6GK1 900-0AB00
IE FC RJ45 PLUG 90 RJ45 connector for Industrial Ethernet with a robust metal housing and integrated insulation displacement/terminal contacts for connecting the Industrial Ethernet C installation cables; with 90° cable outlet (e.g. for ET 200S)	6GK1 901-1BB20-2AA0 (1 package with 1 piece) 6GK1 901-1BB20-2AB0 (1 package with 10 pieces) 6GK1 901-1BB20-2AE0 (1 package with 50 pieces)
RS 485 bus connector with diagonal cable outlet (35°) With screw terminal max. transmission rate: 12 Mbit/s • Without PG interface	6ES7 972-0BA60-0XA0

6.2.2.3 Connection

Connections

DP/AS-INTERFACE LINK Advanced features the following connections:

- Two separate connections to the AS-i cable (with double master)
- One connection for an alternative 24 V DC power supply (optional) and functional ground
- One connection to PROFIBUS (9-pin SUB D socket)
- One LAN connection (RJ45) (can be assigned optionally)

Connections to the AS-i cable(s) and power supply

DP/AS-INTERFACE LINK Advanced has two connections for AS-i cables (lines 1 and 2). They are each connected via a 4-pin connector each with two + and two - terminals (jumpered internally).

This allows DP/AS-INTERFACE LINK Advanced to be "looped in" to the AS-i cable.

> **CAUTION**
>
> **Maximum load-carrying capacity**
>
> The maximum load-carrying capacity of the AS-i connection contacts is 3 A. If this value is exceeded on the AS-i cable, DP/AS-INTERFACE LINK Advanced must not be "looped in" to the AS-i cable but must instead be connected via a spur line (one connection pair only occupied by DP/AS-INTERFACE LINK Advanced).

DP/AS-INTERFACE LINK Advanced can receive its entire power supply from the AS-Interface (AS-i line 1 only). The current consumption from the AS-Interface here is 250 mA at 30 V.

Alternatively, DP/AS-INTERFACE LINK Advanced can be supplied via a separate power supply unit (24 V DC).

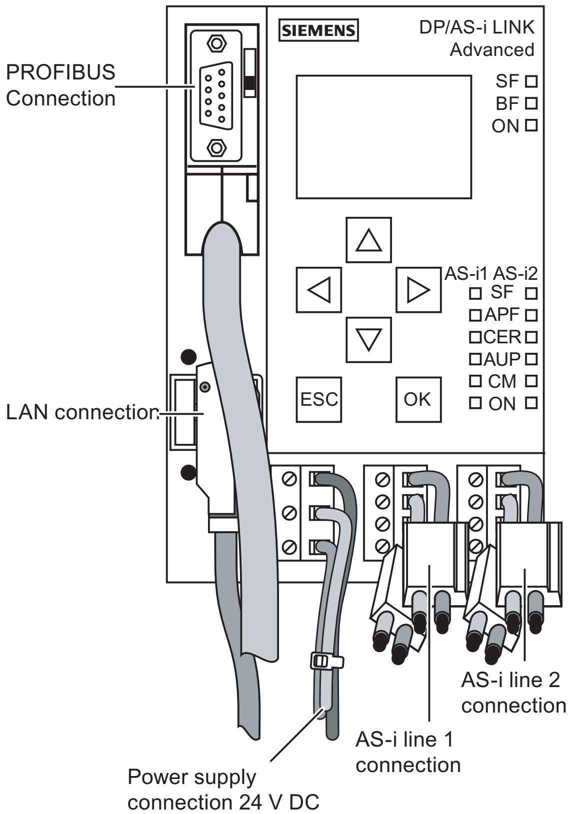


Figure 6-12 Connecting the AS-i cable(s) and power supply

Connector assignment for the AS-i line

PIN no. line 1	Signal
1	AS-i 1 +
2	AS-i 1 -
3	AS-i 1 +
4	AS-i 1 -

PIN no. line 2	Signal
1	AS-i 2 +
2	AS-i 2 -
3	AS-i 2 +
4	AS-i 2 -

PIN 1 and 3 as well as PIN 2 and 4 are jumpered internally with each other.

Connector assignment for the power supply

PIN no. line 1	Signal
1	Power +
2	Power -
3	PE

Note

Functional ground - PE

DP/AS-INTERFACE LINK Advanced features a connection for functional ground. This connection is required if the integrated ground-fault monitoring function is used. It must be connected to the protective conductor with as little resistance as possible.

Connection to PROFIBUS DP

The system is connected to the PROFIBUS DP via a 9-pin SUB D socket.

WARNING

When laying and installing the PROFIBUS DP cable and bus connector, refer to the instructions provided in "SIMATIC NET PROFIBUS Networks"
(order no.: 6GK1970-5CA20-0AA0, or can be downloaded from the Internet).

Bus connectors with the cable outlets at different angles (0°, 30°, and 90°; recommended: 30°) are available for connecting PROFIBUS DP. See also the notes in the manual "SIMATIC NET PROFIBUS Networks".

Connector assignment for the PROFIBUS-RS485 interface

PIN no.	Designation	Function
1	n.c.	reserved
2	n.c.	reserved
3	RxD/TxD-P	Data line B
4	RTS	Request to send
5	GND	Ground
6	VCC (5 V)	Power supply
7	n.c.	reserved
8	RxD/TxD-N	Data line A
9	n.c.	reserved

LAN connection

A PC (or network) can be connected via an RJ45 socket (an optional 90° FC connector can also be used). The LAN connection for DP/AS-INTERFACE LINK Advanced is used for carrying out configuration via Web-based management and for diagnostic purposes, for example. DP/AS-INTERFACE LINK Advanced supports autocrossing (i.e. crossed and uncrossed cables can be used).

Connector assignment for the LAN connection

PIN no.	Signal
1	RDP
2	RDN
3	TDP
4	n.c.
5	n.c.
6	TDN
7	n.c.
8	n.c.

6.2.2.4 Diagnostics

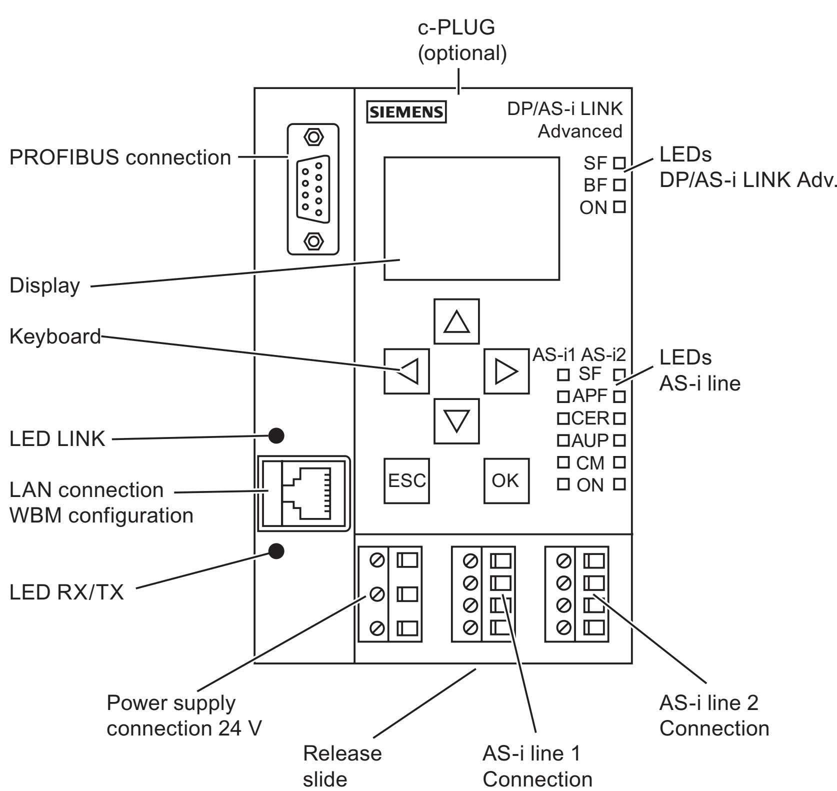


Figure 6-13 Front view of DP/AS-i LINK Advanced (double master)

The following LEDs are located on the front of DP/AS-INTERFACE LINK Advanced:

- Indicators for DP/AS-INTERFACE LINK Advanced
  - SF: System error
  - BF: Bus fault
  - ON
- Indicators for the AS-i line
  - SF = AS-i system error
  - APF = AS-i power failure
  - CER = Configuration error
  - AUP = Automatic address programming
  - CM = Configuration mode
  - ON

Meaning of the DP/AS-INTERFACE LINK Advanced LEDs

LED	Color	Status	Meaning
SF	Red	System error (link)	This LED lights up in the following cases: • In protected mode: a diagnostic alarm (incoming) was triggered in the DP master. • DP/AS-INTERFACE LINK Advanced detects an internal fault (e.g. EEPROM is defective).
BF	Red	Bus fault	Indicates a fault on PROFIBUS DP. This LED flashes in the following cases: • The connection between the DP master and DP/AS-INTERFACE LINK Advanced is interrupted or the DP master is not active. • DP/AS-INTERFACE LINK Advanced has been incorrectly configured/parameterized by the DP master.
ON	Green		This LED lights up when DP/AS-INTERFACE LINK Advanced is supplied with voltage.

Meaning of the AS-i line LEDs

LED	Color	Status	Meaning
SF	Red	System error (line)	This LED lights up in the following cases: • In protected mode: a diagnostic alarm (incoming) was triggered in the DP master.
APF	Red	AS-i power failure	Indicates that the voltage supplied by the AS-i power supply unit on the AS-i cable is too low or is faulty.

LED	Color	Status	Meaning
CER	Yellow	Configuration error	This LED indicates whether the slave configuration detected on the AS-i cable matches the target configuration in DP/AS-INTERFACE LINK Advanced. If any discrepancies are detected, the CER LED lights up. The CER LED lights up in the following cases: • A configured AS-i slave is not detected on the AS-i cable (e.g. the slave has failed). • An AS-i slave that has not yet been configured is detected on the AS-i cable. • A connected AS-i slave has different configuration data (I/O configuration, ID code) to the AS-i slave configured in DP/AS-INTERFACE LINK Advanced. • DP/AS-INTERFACE LINK Advanced is in offline mode.
AUP	Green	Autoprog available	When DP/AS-INTERFACE LINK Advanced is in protected mode, this LED indicates that the address of an AS-i slave can be programmed automatically. Automatic address programming makes it easier to replace a defective AS-i slave on the AS-i cable.
CM	Yellow	Configuration mode	This display indicates the DP/AS-Interface operating mode. LINK Advanced signals: • Display ON: Configuration mode • Display OFF: Protected mode Configuration mode is only required for commissioning DP/AS-INTERFACE LINK Advanced. In configuration mode, DP/AS-INTERFACE LINK Advanced activates all the connected AS-i slaves and exchanges data with them.
ON	Green		This LED lights up when the AS-i line is supplied with voltage.

Keyboard

You can use the operator input keys to switch operating mode. The lower-level AS-i line can also be configured using the operator input keys and display.

Display

The graphical display has a resolution of 128 x 64 pixels.

The lower-level AS-i line is configured using the display together with the keyboard, which means that commissioning and diagnosis can be carried out locally.

The following display appears when the device is switched on or if no user inputs are made over a long period:

Figure 6-14 Logo on the display

Note

Error message

If a fault occurs during operation, an error message is output even if the logo was displayed beforehand.

As soon as any keyboard input is made, the main menu appears from which you can navigate in the menu structure.

If an entry in the list is selected (inverse display), a ticker text automatically appears after a short period with further information (not in the main menu).

6.2.2.5 Technical specifications

Technical specifications	
Transmission rates on each AS-Interface line	
• AS-Interface bus cycle time	5 ms for 31 slaves; 10 ms for 62 slaves
• PROFIBUS transmission rate	Max. 12 Mbit/s
• Ethernet transmission rate	10/100Mbit/s, autosensing
Interfaces	
• AS-Interface connection	2 x 2-pin terminal contacts (plug-in type)
• Single master	2 x 2-pin terminal contacts (plug-in type)
• Double master (2 AS-i lines)	2 x 4-pin terminal contacts (plug-in type)
• Connection to PROFIBUS	1 x 9-pin SUB D socket
• Connection to Ethernet (optional)	1 x RJ45 socket / autocrossing
• Optional: 24 V DC power supply	3-pin terminal contacts (plug-in type) incl. functional ground for integrated ground-fault monitoring
• Slot for exchange medium	C-PLUG
Display	128 x 64 pixels with backlighting
Keys	Membrane keyboard (6 keys)
Power supply	
• From the AS-Interface shaped cable (line 1)	In accordance with AS-Interface Specification EN 50 295
• Optional: 24 V DC	24 V DC, protective conductor
Current consumption	
• From the AS-Interface shaped cable	Max. 250 mA
Load-carrying capacity	
5 V DC at the PROFIBUS connection	Max. 70 mA
Power loss	7.5 W
Degree of protection	IP20

Technical specifications	
Permissible ambient conditions	
• Operating temperature	
○ Horizontal installation	0°C to +60°C
○ Vertical installation	0°C to +45°C
Transport/storage temperature	-30°C to +70°C
Relative humidity	Max. 95% at +25°C
Operating altitude	3000 m above sea level
Design	
• Installation	On DIN rail
• Dimensions (W x H x D) in mm	90 x 132 x 88.5
• Weight	Approx. 380 g
Supported AS-Interface master profiles	M1, M2, M3, and M4 (in accordance with Complete AS-Interface Specification V3.0)
AS-Interface configuration	By means of buttons on the front plate, via Web interface (WBM) with STEP 7 as of version V5.4,

6.2.3 DP/AS-i F-Link

6.2.3.1 Overview

Link between PROFIsafe and ASIsafe

- Compact, safety-oriented router between the PROFIBUS (DP slave) and AS-Interface.
- Monitors the inputs of safety-oriented binary AS-i slaves (ASIsafe slaves) and forwards data via PROFIsafe. No need for additional safety-oriented components for AS-Interface (e.g. additional cables, safety monitor).
- AS-i master in accordance with AS-Interface Specification V3.0, master profile M4, for connecting up to 62 AS-i slaves and integrated analog value transmission.
- Direct integration in PROFIBUS networks. Integration in PROFINET environments via the PROFINET/PROFIBUS gateway (IE/PB Link) or via SIMATIC S7-315 F PN/DP, S7-317 F PN/DP, or S7-416F-3 PN/DP.
- Optimum TIA integration in STEP 7 via Object Manager, integration in engineering tools from third-party vendors via the PROFIBUS type file (GSD).
- Local diagnosis via LEDs and display with operator input keys.
- Module exchange without PG because startup data is transferred via the PROFIBUS DP master.

Benefits

- Gaps in (bus-based) safety technology closed: safety-oriented signals (EMERGENCY STOP, door tumbler, light curtains etc.) collected with AS-i and transferred to higher-level F PLC. This enables:
  - Quick installation, easy commissioning: benefits of AS-i can now be systematically leveraged in the field for Safety Integrated.
  - Cost-effective solution because ASIsafe is ideally suited for collecting "fewer but distributed failsafe bits".
- Price benefit: as a fully-fledged AS-i master in accordance with Specification V3.0, large volumes of project data can be processed in the AS-i network (496 inputs and outputs in each case, up to 62 analog slaves).
- Long-term investment security:
  - Integration in PROFIBUS networks as with DP/AS-i Links Advanced or 20E
  - Backward compatibility to spec. V2
  - Open for state-of-the-art automation concepts with AS-i
- Quick commissioning with simple configuration at the touch of a button (code sequences of ASIsafe slaves can also be taught in at the touch of a button).
- User-friendly configuration of all Siemens slaves via the slave catalog in HW Config (STEP 7) helps reduce engineering work, especially for the ASIsafe slaves modeled on PROFIsafe slaves.

- Safety logic programming with the familiar, powerful commands of the Distributed Safety package from the failsafe SIMATIC PLC in F-FUP or F-FOP (incl. TÜV-certified function blocks for standard safety applications) helps cut costs.
- Can also be used in machine tools with SINUMERIK 840 D SL in conjunction with the Profibus type file (GSD).
- User-friendly diagnosis via the display and easy replacement of modules (only a few settings need to be made via the operator input keys; configuration tool not required) help reduce downtime and service times.

Network integration

DP/AS-i F-Link can be used in a number of different configurations:

- Integration in PROFIBUS networks under SIMATIC F-PLC

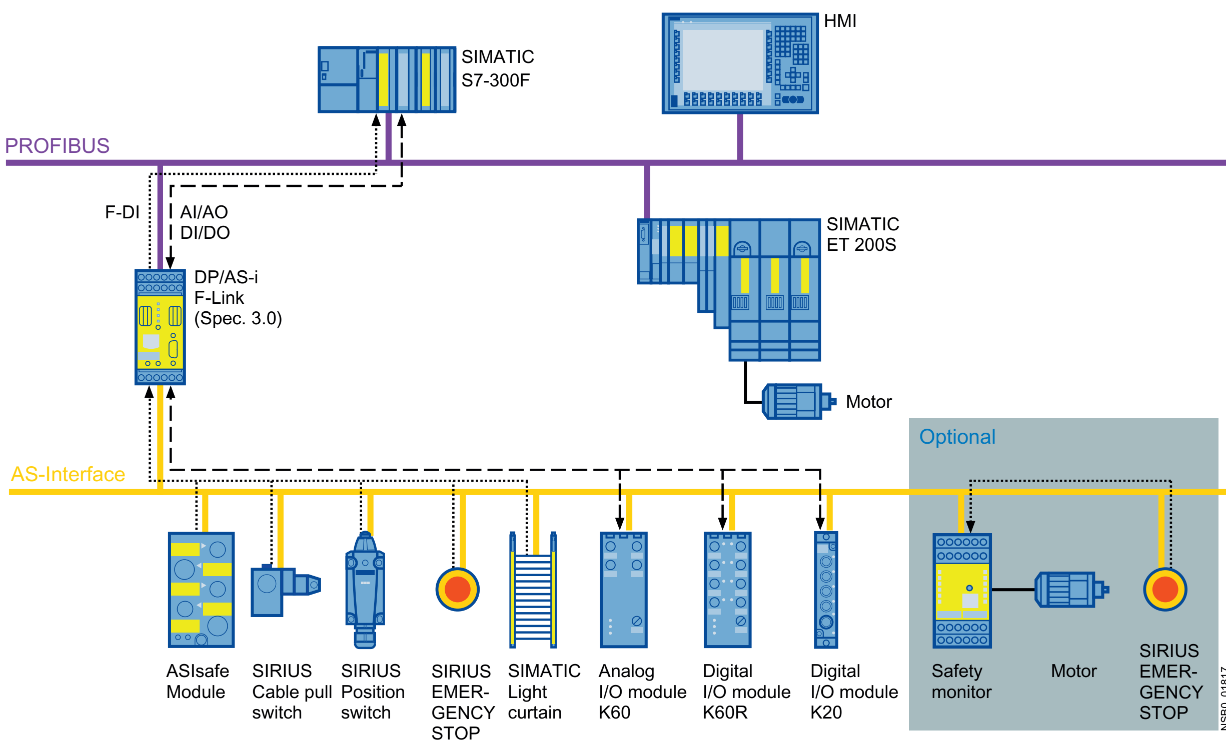


Figure 6-15 Configuration 1: Integration in PROFIBUS networks under SIMATIC F-PLC

- Integration in PROFINET networks under SIMATIC F-PLC
(SIMATIC S7-315 F PN/DP, S7-317 F PN/DP, or S7-416F-3 PN/DP)

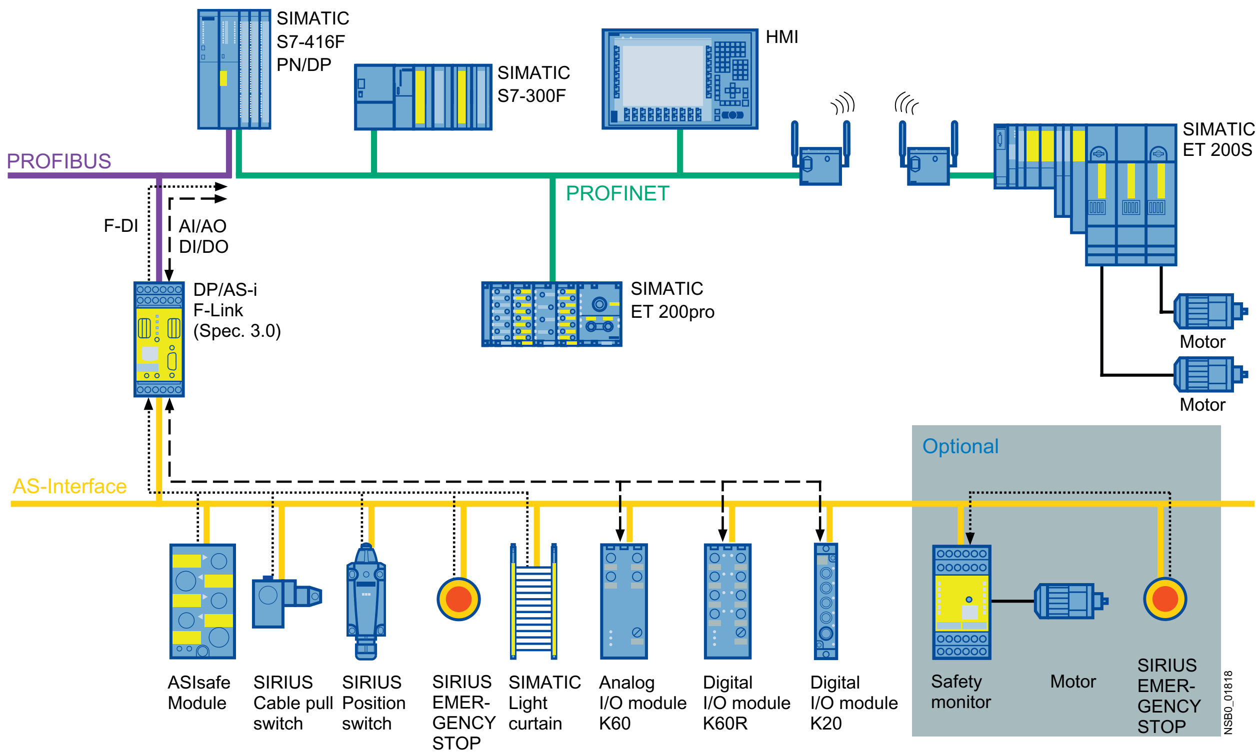


Figure 6-16 Configuration 2: Integration in PROFIBUS networks under SIMATIC F-PLC (SIMATIC S7-315 F PN/DP, SIMATIC S7-317 F PN/DP, SIMATIC S7-416 F PN/DP)

- Alternative integration in PROFINET networks under SIMATIC F-PLC via IE/PB Link

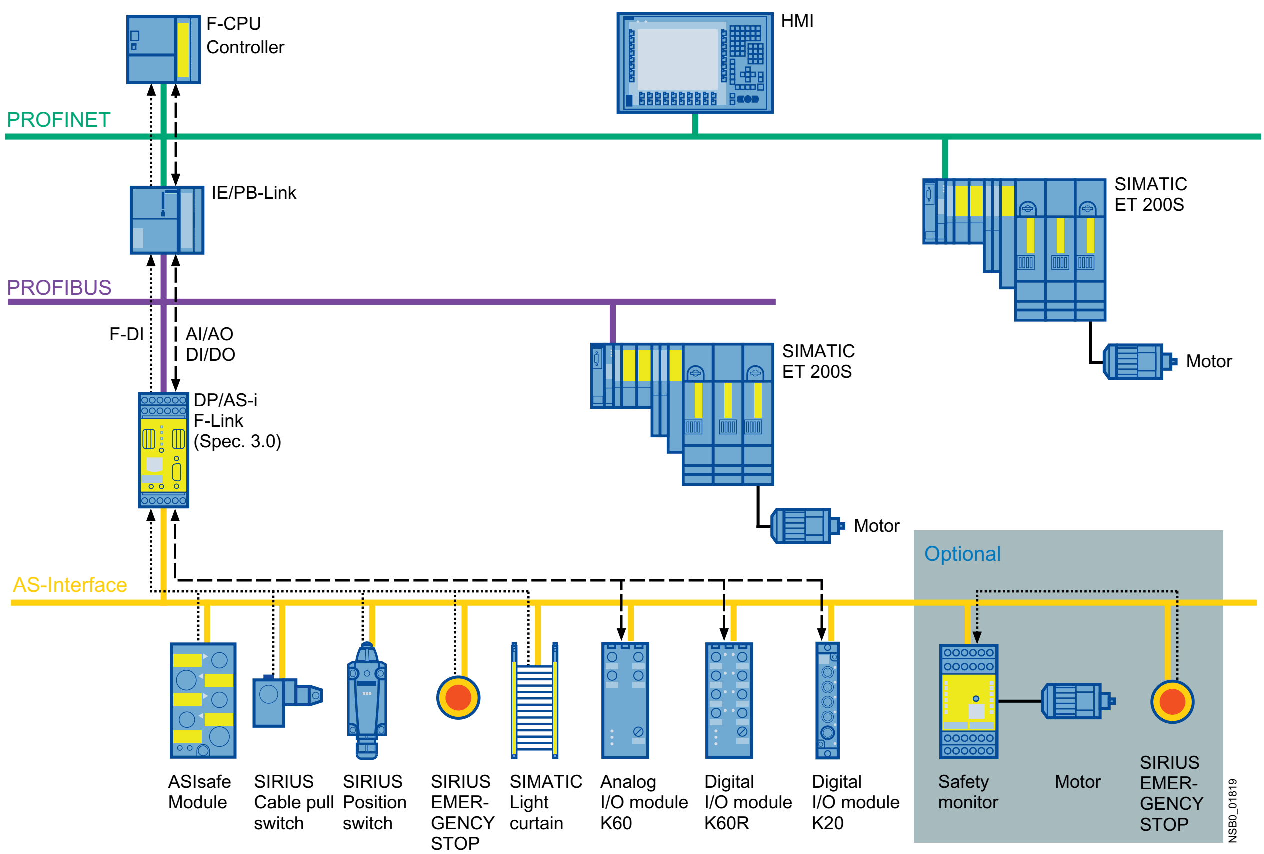


Figure 6-17 Configuration 3: Alternative integration in PROFINET networks under SIMATIC F-PLC via IE/PB Link

- Integration under SINUMERIK Power Line and Solution Line by means of PROFIBUS type file (GSD) (available soon).
- Integration under failsafe controllers from third-party vendors, by means of the PROFIBUS type file (GSD).

Scope of application

DP/AS-i F-Link is a PROFIBUS DP-V1 slave (to EN 50170) and AS-i master (in accordance with AS-Interface Specification V3.0 to EN 50295) and enables transparent data access to AS-Interface from the PROFIBUS DP. DP/AS-i F-Link is also the only AS-i master with which safety-oriented input data can be transferred from ASIsafe slaves to a failsafe CPU with the PROFIBUS DP master via the PROFIsafe protocol. Additional safety-oriented cabling or monitoring is not required (in particular, no AS-Interface safety monitor is required). Depending on the slave type, binary or analog values can be transferred. All slaves that comply with AS-Interface Specification V3.0 can be operated as AS-i slaves.

PROFIBUS DP masters to DP-V0 or DP-V1 can exchange I/O data with lower-level AS-i slaves cyclically. PROFIBUS DP masters with acyclic services to DP-V1 can also carry out AS-i master calls (parameters, diagnosis). In addition to the digital I/O data, analog data is also stored in a high-performance memory in the cyclic I/O area (during configuration with

Object Manager in STEP 7) of a failsafe S7-300/416 F-CPU (communication modules do not need to be called separately).

In configuration mode, DP/AS-i F-Link reads the configuration data of the I/O devices on the AS-Interface. Slave addresses can be set and code sequences of secure AS-i slaves taught in via the display and operator input keys.

During operation, four LEDs and the display provide detailed diagnostic information which, if necessary, can be used to localize faults immediately. A user program enables diagnosis data sets to be read and made available to a higher-level operator control and monitoring system (e.g. WinCC).

Design

- Stable, tried-and-tested plastic housing with degree of protection IP20 for DIN rail or wall mounting.
- Compact design
  - Display on the front for indicating the operating state and operational readiness of all the connected and activated AS-Interface slaves.
  - Two buttons on the front for commissioning and retrieving diagnostic data.
  - Four LEDs for indicating the operating state of the device, PROFIBUS DP, and the AS-Interface network.
  - Front PROFIBUS DP connection with SUB D connector.
  - Removable terminal blocks for connecting the AS-i +/- and power supply (by 24 V DC PELV power supply unit); low width (45 mm).
- Simple installation on a DIN rail or on the wall.
- Operation without fan or battery.
- Rapid replacement of devices in the event of a fault.

Communications principle

The PROFIBUS DP master communicates with the AS-i slaves via DP/AS-i F-Link. The AS-i communication objects are mapped to a contiguous data area for input and output data in the PROFIBUS DP master. DP/AS-i F-Link manages two interfaces here:

- Interface with the PROFIBUS DP master: PROFIBUS DP
- Interface with the AS-i slaves: AS-Interface

Configuration

DP/AS-i F-Link can be configured with STEP 7 as of version V5.4 SP1 or simply by copying the actual configuration on the display.

Alternatively, DP/AS-i F-Link can be integrated by means of the PROFIBUS type file (GSD) in the engineering tool.

When DP/AS-i F-Link is configured with STEP 7, the AS-Interface configuration can be uploaded to STEP 7 as of V5.4 SP1.

Siemens AS-Interface slaves can also be easily configured in HW Config (slave catalog).

Programming

Unlike the AS-Interface safety monitor, DP/AS-i F-Link is simply a gateway with no separate safety logic.

The safety function is programmed at the level of the higher-level failsafe DP master, e.g.:

- With Distributed Safety as of version V5.4 SP1 for SIMATIC S7-300F/416F
- With SAFETY INTEGRATED "SI-Basic" or "SI-COMFORT" NCU software for SINUMERIK 840D SL.

6.2.3.2 Order numbers

Type	Order no.
DP/AS-i F-Link router PROFIBUS DP/AS-i For safety-oriented data transmission from ASISafe to PROFIBUS DP - PROFISAFE Master profile M3/M4 in acc. with extended AS-I Spec. 3.0 Degree of protection IP20 Screw terminals	3RK3141-1CD10
DP/AS-i F-Link router PROFIBUS DP/AS-i For safety-oriented data transmission from ASISafe to PROFIBUS DP - PROFISAFE Master profile M3/M4 in acc. with extended AS-I Spec. 3.0 Degree of protection IP20 Spring-loaded terminals	3RK3141-2CD10
DP/AS-i F-Link manual German	Can be downloaded from the Internet

6.2.3.3 Connection

CAUTION

Switch off the supply voltage

Before starting work, disconnect the device from the supply.

NOTICE

Cable cross-sections and tightening torques

Note the maximum cable cross-sections and tightening torques:

What do I need?	Specification and value for removable terminal blocks with screw terminals	Specification and value for removable terminal blocks with spring-loaded terminals
Screwdriver	Cross-tip screwdriver Size: PZ 2 (⌀ 5 … 6 mm) Torque: 0.8 … 1.2 Nm	Flat-bladed screwdriver Size: 0 or 1 (width to 3 mm) for raising the terminal springs
Rigid cable	Maximum number of cables x cable cross-section: 1 x 0.5 … 4.0 mm² or 2 x 0.5 … 2.5 mm²	Max. no. of cables x cable cross-section: 2 x 0.25 … 1.5 mm²
Flexible cable with end sleeve/cable lug	Max. no. of cables x cable cross-section: 1 x 0.5 … 2.5 mm² or 2 x 0.5 … 1.5 mm²	Max. no. of cables x cable cross-section: 2 x 0.25 … 1.5 mm²
Flexible cable	Not permitted	Max. no. of cables x cable cross-section: 2 x 0.25 … 1.5 mm²

Note

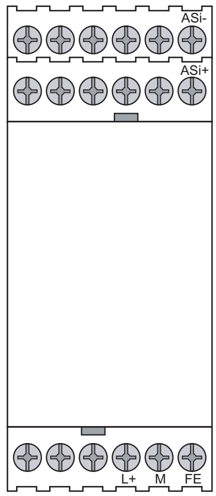
Functional ground - PE

Functional ground (FE) must be connected to the protective ground conductor PE with as little resistance as possible.

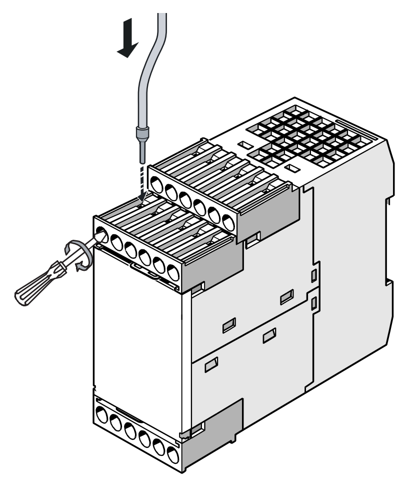
Requirements

- The connection cables from the PELV power supply unit and AS-i cables are correctly stripped to a length of 10 mm.
- Flexible cables with end sleeves or cable lugs are provided for connections to screw terminal blocks.

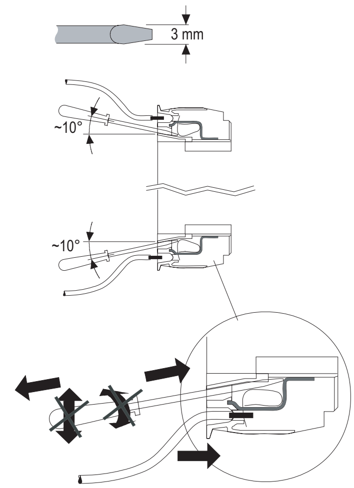
Assignment of terminal blocks

Image	Description	Description
	ASi-	AS-i terminal for blue wire in AS-i cable
	ASi+	AS-i terminal for brown wire in AS-i cable
	L+	24 V DC
	M	Ground to 24 V DC
	FE	Functional ground

Connection for screw terminal blocks (MLFB: 3RK3141-1CD10)

Step	Instructions	Image
1	Insert the relevant cable into the square opening of the screw terminal as far as it will go.	
2	Hold the cable in the screw terminal.	
3	Tighten the screw of the terminal in which the cable in inserted.	
4	Pull the cable to ensure it is secure.	

Connection for spring-loaded terminal blocks (MLFB: 3RK3141-2CD10)

Step	Instructions	Image
1	Insert the 3 mm flat-bladed screwdriver for loosening the terminal springs until it engages in the square opening of the spring-loaded terminal. Observe a 10° horizontal angular deviation of the screwdriver to the oval opening.	
2	Insert the cable into the oval opening until it engages.	
3	Hold the cable in the spring-loaded terminal.	
4	Remove the screwdriver.	
5	Pull the cable to ensure it is secure.	

6.2.3.4 Diagnostics

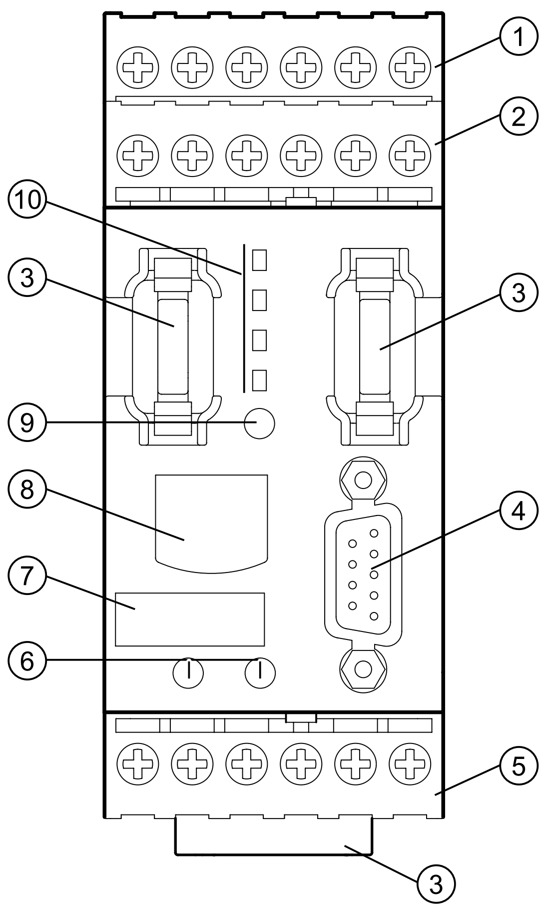


Figure 6-18 Front view of DP/AS-i F-Link

1	Removable terminal block ASi-: connection for ASi - (blue wire in yellow AS-i cable)
2	Removable terminal block ASi+: connection for ASi- (brown wire in yellow AS-i cable)
3	Cover for service and system interface (factory side)
4	PROFIBUS DP interface (SUB D 9-pin)
5	Removable terminal block L+: 24 V DC M: Ground to 24 V DC FE: Functional ground
6	SET button: Confirm MODE button: Selection
7	Labeling strip
8	Display: Two lines, red dot matrix display
9	RESET button: Factory setting (via coded operation)
10	DEVICE LED AS-i LED BF LED SF LED

Meaning of the LEDs

DP/AS-i F-Link features the following four LEDs for indicating the current status and any error messages:

LED	Meaning
DEVICE	Device status
ASi	AS-i voltage / status
BF	Bus fault (PROFIBUS DP)
SF	Group fault

When the device is restarted, it carries out a self-test of the LEDs:

- All LEDs light up for 3 s.
- The two-colored DEVICE and ASi LEDs light up yellow.

Note

Defective device

If neither the LEDs nor the display light up when the power supply and AS-i voltage are switched on, the device is defective.

LED display DEVICE

Display	Possible cause	Possible remedial measures
OFF	No 24 V DC power supply	Check the 24 V DC power supply of the DP / AS-i F-Link.
Green	Device OK	—
Flashing green	Device in power up (self-test, configuration and teaching of code sequences)	—
Yellow	PROFIsafe address invalid or incorrect	Enter the correct PROFIsafe address of the DP / AS-i F-Link via the menu on the display.
Flashing yellow	Factory settings not yet complete	Switch the 24 V DC power supply of the DP / AS-i F-Link off and then on again.
Flickering yellow	Procedure for making factory settings	—
Red	Device defective	Replace the defective DP / AS-i F-Link.
Flashing red/green	Device defective	Replace the defective DP / AS-i F-Link.
Flickering red	Procedure for making factory settings	—

LED display ASi

Display	Possible cause	Possible remedial measures
OFF	AS-i voltage is too low or has failed	Check the power supply for the AS-i slaves.
Green	Device is in "protected" mode	—
Flashing green	AS-i configuration error	Reconfigure the AS-i slave specified on the display.
Yellow	Device is in "configuration" mode	—
Red	No AS-i slave connected to AS-Interface.	Connect an AS-i slave to AS-Interface. This display does not appear in "Config" mode (ASi LED yellow).

LED display BF

Display	Possible cause	Possible remedial measures
OFF	PROFIBUS DP OK	—
Red	PROFIBUS DP connector not plugged in during power up	Plug in the PROFIBUS DP connector during power up.
Flashing red	PROFIBUS DP parameterization/configuration error	• Check the PROFIBUS DP connectors and terminating resistors. • Reconfigure the PROFIBUS DP node specified in the display.

LED display SF

Display	Possible cause	Possible remedial measures
OFF	No group fault	—
Red	Group fault, including the AS-i slaves	Read out data record 92.

Buttons

The buttons on the front of DP/AS-i F-Link have the following function:

Button	Meaning
MODE	• Scroll down through messages and menu options by pressing it once. • Jump back one entry with double-click. • Increase the switching speed by pressing and holding it (> 1 s).
SET	• Confirm a menu option or call up a further range of options. • Change from status mode to menu mode.
MODE + SET	• Return to the menu option "EXIT" by pressing both buttons at the same time in menu mode.
RESET	• Restore the factory settings in accordance with a predefined scheme.

Operating state of the display

The display has two operating states:

- Status mode (standard mode) with error and status messages for DP/AS-i F-Link and the connected buses.
- Menu mode with the display menu.
  In this mode, you can query and change settings as well as call up specific error messages.

You can switch from menu mode to status mode in two different ways:

- Wait 30 s and the operating state switches automatically.
- Press the "MODE" and "SET" buttons at the same time and then press "SET" to confirm "EXIT".

Display on screen (no menu in standard mode)

1st row	2nd row	Meaning
Status message	- / Parameter	No fault, status display.
Fault message flashing	-	No fault present
	Parameter	A fault with parameter is present.
	Parameters, continuous underscore	A fault with more than one parameter is present (e.g. AS-i addresses 0, 1, 1A, 1B, 2, 2A, 2B, etc.).
Fault message flashing, continuous underscore	-	More than one type of fault is present, arranged according to priority.
	Parameter	More than one type of fault is present; a parameter for the current fault type exists; the last parameter of a fault type is shown.
	Parameters, continuous underscore	More than one type of fault is present; more than one parameter for the current fault type exists.

Querying the fault messages

The following options are available for querying fault messages:

- Scroll through all the parameters and fault messages with the "MODE" button.
- If you do not press anything, the display will automatically jump back to the fault with the highest priority after 30 seconds.
- An outgoing fault disappears from the display immediately and the next pending fault message appears.

Meaning of the fault and status messages

Display	Possible cause	Possible remedial measures
RUN▫ ▫▫▫▫▫	No fault, everything is OK and DP / AS-i F-Link is in "protected" mode.	-
RUNc CFG▫▫	No fault, everything is OK and DP / AS-i F-Link is in "configuration" mode	-
APF▫ ▫▫▫▫▫	AS-i voltage is too low or has failed (AS-i Power Fail) Can occur in parallel with "BF▫▫" or "BF▫c" messages.	Check the power supply. Permissible values between ASi+ and ASi- are 26.5 DC to 31.5 V DC
OFFL ▫▫▫▫▫	DP / AS-i F-Link is in offline mode (no data traffic on the AS-i bus) Can occur in parallel with "BF▫▫" or "BF▫c" messages Not displayed in "APF▫" message.	Switch DP / AS-i F-Link to online mode (e.g. with the command "set_offline_mode").
WAIT ▫▫▫▫▫	DP / AS-i F-Link in detection phase (ramp-up) Can occur in parallel with "BF▫▫" or "BF▫c" messages.	Wait until ramp-up is complete. Connect an AS-i slave to the AS-i bus if this has not already been done.

<table>
<tr><th>Display</th><th colspan="2">Possible cause</th><th colspan="2">Possible remedial measures</th></tr>
<tr><td rowspan="8">CER▫
f▫▫31[1)]</td><td colspan="2">AS-i configuration error, deviation from TARGET configuration (automatic address programming switched off or more than one fault is present)
Can occur in parallel with "BF▫▫", "BF▫c", "CODE", "PFF▫", or "PFFc" messages.</td><td colspan="2">• Error type "f"
Remove the slave from the configuration or connect the configured slave to the AS-i bus.
• Error type "E"
Modify the configured slave profile in accordance with the available slave.
• Error type "D"
Reconfigure the specified slave.</td></tr>
<tr><td colspan="4">Re 1) Example display; 2nd row structured as follows:</td></tr>
<tr><td colspan="2">Character for fault type, left-justified</td><td colspan="2">AS-i address, right justified, e.g.</td></tr>
<tr><td>f</td><td>Address configured but not found</td><td>0</td><td>Standard module with address 0</td></tr>
<tr><td>D</td><td>Address found but not configured</td><td>0AB</td><td>A / B module with address 0</td></tr>
<tr><td rowspan="3">E</td><td rowspan="3">Address found and configured, but configured profile (IO-ID-ID1-ID2) does not correspond to the available module.</td><td>1</td><td>Standard module with address 1</td></tr>
<tr><td>1A</td><td>A / B module with address 1A</td></tr>
<tr><td>31B</td><td>A / B module with address 31B</td></tr>
<tr><td rowspan="6">AUP▫
f▫▫31[2)]</td><td colspan="2">AS-i configuration error (automatic address programming activated).
Can occur in parallel with "BF▫▫", "BF▫c", "CODE", "PFF▫", or "PFFc" messages.</td><td colspan="2">Connect the specified AS-i slave to the AS-i bus.</td></tr>
<tr><td colspan="4">Re 2) Example display; 2nd row structured as follows:</td></tr>
<tr><td colspan="2">Character for fault type, left-justified</td><td colspan="2">AS-i address, right justified, e.g.</td></tr>
<tr><td>f</td><td>Address configured but not found.</td><td>1</td><td>Standard module with address 1</td></tr>
<tr><td>D</td><td>Address found but not configured.</td><td>1A</td><td>A / B module with address 1A</td></tr>
<tr><td>E</td><td>Address found and configured, but configured profile (IO-ID-ID1-ID2) does not correspond to the available module.</td><td>31B</td><td>A / B module with address 31B</td></tr>
<tr><td rowspan="7">CODE
c▫▫31[3)]</td><td colspan="2">Code sequence error and DP / AS-i F-Link in "safety" mode.
Can occur in parallel with "BF▫▫" or "PFF▫" messages.</td><td colspan="2">• Check the wiring of the AS-i slave.
• Start teach-in for the code sequences.
• Replace the AS-i slave.</td></tr>
<tr><td colspan="4">As soon as a configuration error occurs ("CER▫", "AUP▫"), the safety component of DP / AS-i F-Link no longer monitors the AS-i bus, which means that code sequence errors are no longer detected or reported.</td></tr>
<tr><td colspan="4">Re 3) Example display; 2nd row structured as follows:</td></tr>
<tr><td colspan="2">Character for fault type, left-justified</td><td colspan="2">AS-i address, right justified, e.g.</td></tr>
<tr><td rowspan="2">c</td><td rowspan="2">Address sends code sequence that does not correspond to the taught sequence.</td><td>1</td><td>Standard module with address 1</td></tr>
<tr><td>31</td><td>Standard module with address 31</td></tr>
<tr><td colspan="4">Conditions for displaying code sequence errors:
• DP / AS-i F-Link is in protected mode.
• The module is configured as an active safety module.
• The module sends a code sequence that DP / AS-i F-Link does not expect.
No display for code sequences 0000, 00xx, or xx00 because they represent the standard operating state when the contacts are open.</td></tr>
<tr><td>PFF▫
p▫▫31[4)]</td><td colspan="2">I/O fault and DP / AS-i F-Link is in "protected" mode
Can occur in parallel with "BF▫▫", "CER▫", "AUP▫", or "CODE" messages.</td><td colspan="2">Rectify the cause of the I/O fault on the AS-i slave.</td></tr>
</table>

Display	Possible cause	Possible remedial measures
	Re 4) Example display; 2nd row structured as follows:	
	Character for fault type, left-justified	AS-i address, right justified, e.g.
	p — Address signals I/O (periphery) fault flag (PFF).	1 — Standard module with address 1 1A — A / B module with address 1A 31B — A / B module with address 31B
PFFc p▫▫31[4)]	I/O fault and DP / AS-i F-Link in "configuration" mode. Can occur in parallel with "BF▫c" messages.	Rectify the cause of the I/O fault on the AS-i slave.
BF▫▫ DP▫28[5)]	PROFIBUS DP fault and DP / AS-i F-Link is in "protected" mode. Can occur in parallel with CER▫", "AUP▫", "CODE", "PFF▫", or other messages.	Reconfigure the specified PROFIBUS DP node.
	Re 5) Example display; 2nd row structured as follows:	
	"DP", left-justified	PROFIBUS DP address (0 ... 126), right justified
BF▫c DP▫28[5)]	PROFIBUS DP fault and DP / AS-i F-Link is in "configuration" mode. Can occur in parallel with "PFF▫" or other messages.	Reconfigure the specified PROFIBUS DP node.
BF▫▫ F-PAR	Invalid parameters for PROFIsafe and DP / AS-i F-Link in "protected" mode. Can occur in parallel with "CER▫" and "AUP▫" messages.	Check that the "F_Dest_Add" parameter on the PROFIsafe tab matches the set PROFIsafe address.
BF▫c F-PAR	Invalid parameters for PROFIsafe and DP / AS-i F-Link in "configuration" mode. Can occur in parallel with "PFFc" or other messages.	Check that the "F_Dest_Add" parameter on the PROFIsafe tab matches the set PROFIsafe address.
CT▫▫ NOK▫▫	Fault detected at ramp-up, or ramp-up not successfully completed. For example, PROFIBUS DP connector not plugged in before switching on supply voltage	Connect the PROFIBUS DP connector to the PROFIBUS DP interface.
	DP / AS-i F-Link is in "configuration" mode.	Change to protected mode.
	Configuration fault pending (planned <> actual)	Eliminate the configuration fault.
	Can occur in parallel with "BF▫▫", "CER▫", or "CFG▫▫" messages.	
CTER c▫▫31[6)]	Invalid code sequence and DP / AS-i F-Link in "protected" mode Can occur in parallel with "CER▫", "AUP▫", or "PFF▫" messages.	• Check the wiring of the AS-i slave. • Replace the AS-i slave.
	Re 6) Example display; 2nd row structured as follows:	
	Character for fault type, left-justified	AS-i address, right justified, e.g.
	c — Address sends code sequence that does not correspond to the guidelines on permissible code sequences.	1 — Standard module with address 1 31 — Standard module with address 31
	Conditions for displaying "CTER": • DP / AS-i F-Link is in protected mode. • The module is configured as an active safety module. • The module sends an invalid code sequence to DP / AS-i F-Link that violates at least one requirement regarding the validity of code sequences.	

Display	Possible cause	Possible remedial measures
CT▫▫ c▫▫31[6)]	A valid code sequence cannot be taught in for the ASIsafe slave displayed.	Close the input contacts of the ASIsafe slave displayed.
MENU	Display in "menu mode".	Status message, switch to normal mode: • Automatic switchover after 30 s • Press "MODE" + "SET" simultaneously. Confirm the display "EXIT" by pressing "SET".

Key: "▫" = space

6.2.3.5 Technical specifications

Technical specifications	
Transfer rates on each AS-Interface line	
• AS-Interface bus cycle time	5 ms for 31 slaves; 10 ms for 62 slaves or in acc. with the Complete AS-Interface Specification V3.0
• PROFIBUS transfer rate	Max. 12 Mbit/s
Interfaces	
• AS-Interface connection	Via removable terminal blocks (with screw or spring-loaded terminals)
• Connection to PROFIBUS-DP	1 x 9-pin SUB D socket
• Connection to Ethernet	1 x RJ45 socket
• 24 V DC power supply (PELV)	3-pin terminal contacts incl. functional earth, via removable terminal blocks (with screw-type or spring-loaded terminals)
Display	2 lines of 4 characters (red LED dot matrix)
Operation	Via three keys (Set / Mode / Reset)
Power supply	
• From AS-Interface	In accordance with AS-Interface Specification EN 50 295
• 24 V DC (PELV)	24 V DC, protective conductor
Current consumption	
• From 24 V DC	Max. 110 mA
Degree of protection	IP20
Permissible ambient conditions	
• Operating temperature	-20°C to +50°C
Transport/storage temperature	-40°C to +85°C
Relative humidity	Max. 95% at +25°C
Operating altitude	2000 m above sea level

Technical specifications	
Design	
• Assembly	On DIN rail
• Dimensions (W x H x D) in mm	45 x 104 x 120
• Weight	Approx. 300 g
Supported AS-Interface master profiles	M1, M2, M3, and M4 (in accordance with complete AS-Interface Specification V3.0)
AS-Interface configuration	Via keys on front plate, with STEP 7 as of version V5.4 SP1 for SIMATIC S7-300F/416F
Safety function programming	With Distributed Safety as of version V5.4 SP1 for SIMATIC S7-300F/416F with SAFETY INTEGRATED "SI-Basic" or "SI-COMFORT" NCU software for SINUMERIK 840D SL
Approvals	CE, TÜV, UL (requested), AS-Interface certificate

6.2.4 IE/AS-i LINK PN IO

6.2.4.1 Overview

Transparent data access to AS-Interface from Industrial Ethernet

- Compact router between Industrial Ethernet (PROFINET IO device) and AS-Interface
- Single and double AS-Interface master (to AS-Interface Specification V3.0) for connecting 62 AS-Interface slaves in each case and integrated analog value transfer
- High-performance, integrated analog value transmission
- Integrated ground-fault monitoring for the AS-Interface cable
- User-friendly on-site diagnosis and commissioning functions via a graphical display and controls or via a Web interface with a standard browser.
- Optimum TIA integration via STEP 7, integration in engineering tools from third-party vendors via the PROFINET type file (GSDML)
- Vertical integration (standard Web interface (Page 72)) via Industrial Ethernet
- Power supplied via the AS-Interface cable or with 24 V DC (optional).
- Modules can be exchanged without the PG by means of C-PLUG (optional).

Benefits

- Quick commissioning by means of simple configuration at the touch of a button and testing the AS-Interface line via the display or Web interface.
- User-friendly diagnosis via the display or Web interface help reduce downtime and service times if a slave fails.
- Reduced installation costs because the power is supplied entirely via the AS-Interface cable, which means that no additional power supply is required.
- User-friendly configuration of Siemens slaves by dragging/dropping them to HW Config (STEP 7) helps reduce engineering work.

Scope of application

IE/AS-i LINK PN IO is a PROFINET IO device (to IEC 61158) and AS-Interface master (in accordance with AS-Interface Specification V3.0 to EN 50 295) and enables transparent data access to the AS-Interface from Industrial Ethernet.

PROFINET IO controllers can exchange I/O data with the AS-Interface cyclically. Acyclic services also enable AS-i master calls to be carried out (parameters, diagnosis). IE/AS-i LINK PN IO is, therefore, suitable for distributed configurations and for integrating a lower-level AS-Interface network.

The AS-i single master version of IE/AS-i LINK PN IO is suitable for applications with typical volumes of data.

The AS-i double master version of IE/AS-i LINK PN IO is suitable for applications with large volumes of data. In this case, the double data volumes can be processed on two separate AS-i lines.

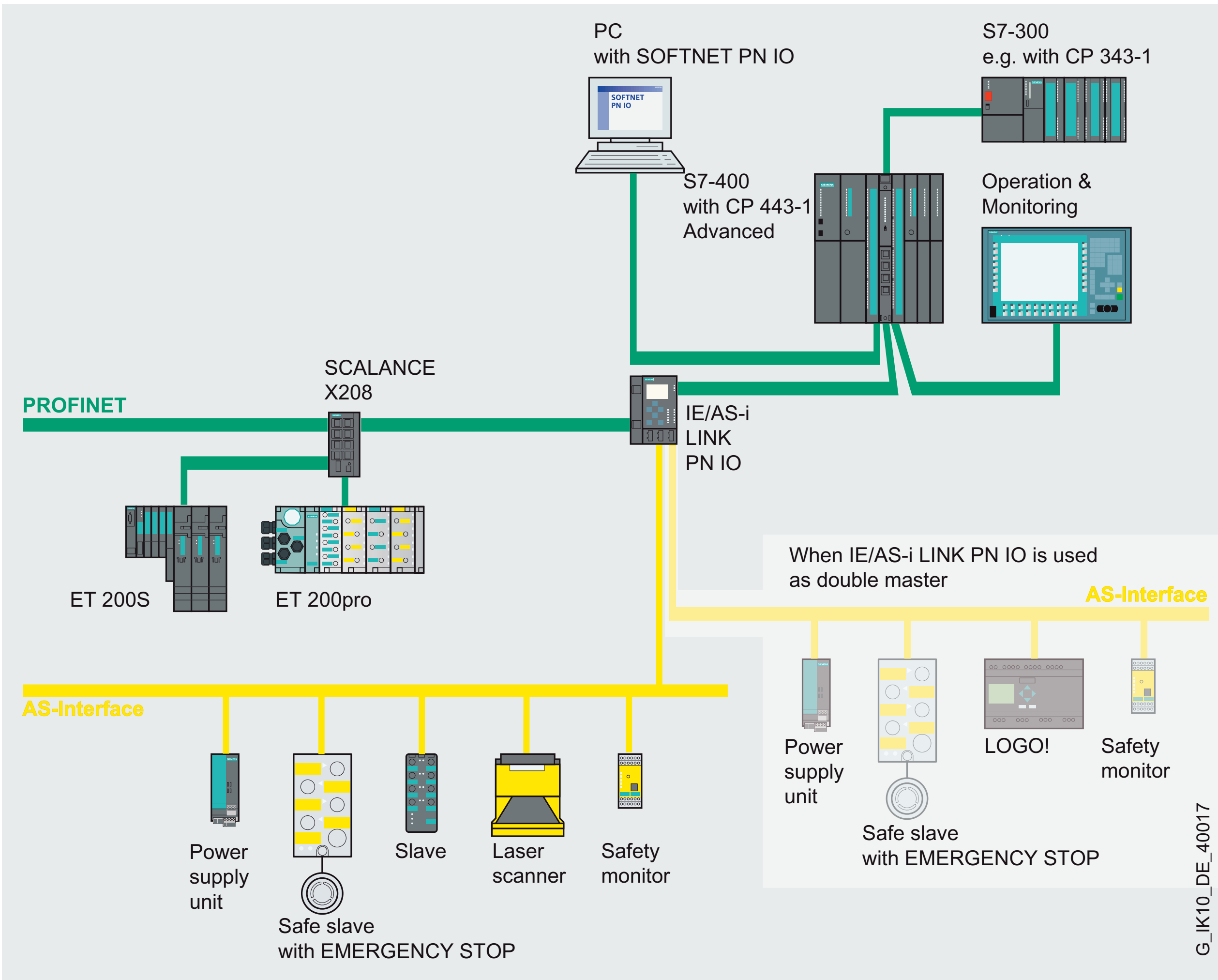


Figure 6-19 Integration of AS-Interface in PROFINET via IE/AS-i LINK PN IO as single/double master

An upstream IWLAN client module (e.g. SCALANCE W746-1PRO) can be used for the wireless integration of an AS-Interface line in the PROFINET environment. Examples of applications here include those that were previously implemented with fault-prone ground cables or contact conductors. This helps cut maintenance costs.

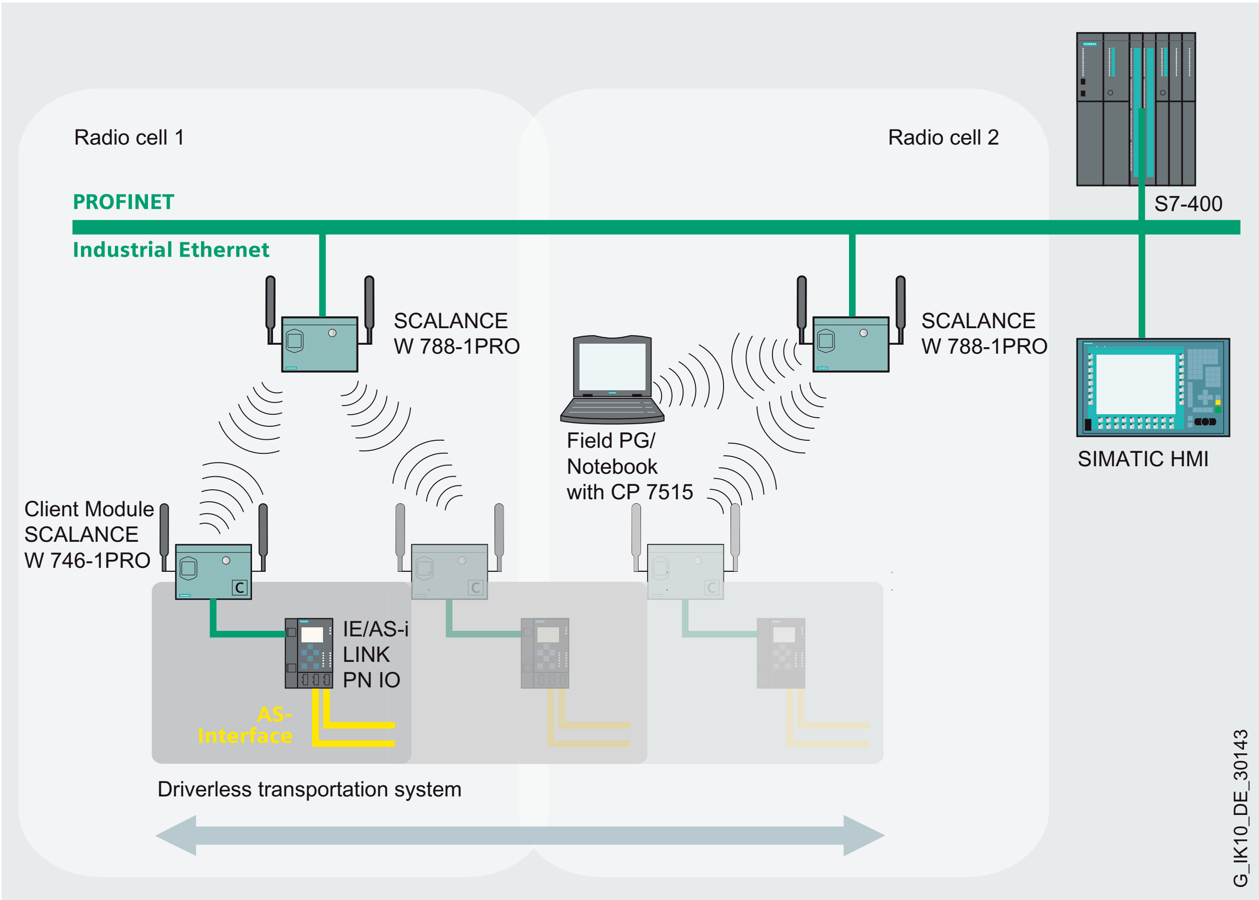


Figure 6-20 Wireless communication between Industrial Ethernet and As-Interface components

Design

- Robust plastic housing with degree of protection IP20 for mounting on DIN rails.
- Compact design
  - Display on the front plate for accurately indicating the operating state and operational readiness of all the connected and activated AS-Interface slaves.
  - Buttons for commissioning and testing the AS-Interface line directly on IE/AS-i LINK PN IO
  - LEDs for indicating the operating state of PROFINET IO and AS-Interface.
  - Integrated two-port switch (RJ45 socket) for the connection to Industrial Ethernet supports the line topology without an external switch.
  - User-friendly commissioning, diagnosis, and testing of IE/AS-i LINK PN IO via a Web interface with a standard browser.
  - Power supplied via the AS-Interface shaped cable or with 24 V DC (optional).
  - Low installation depth due to lowered plug fitting.
- Easy installation on standard DIN rail.

- Operation without fan or battery.
- Rapid replacement of devices by means of the exchange medium C-PLUG (not supplied).

Function

IE/AS-i LINK PN IO provides the PROFINET IO master with cyclic access to the I/O data for all slaves in a lower-level AS-Interface segment. According to the extended AS-Interface Specification (V3.0), up to 62 slaves each with four inputs and four outputs as well as analog slaves on each AS-Interface line can be connected.

In the IO controller, IE/AS-i LINK PN IO is normally assigned 62 input and 62 output bytes in which the I/O data for the connected AS-Interface slaves is stored. The input/output buffer can be compressed so that only the required I/O memory in the IO controller system is used. The integrated function for analyzing analog signals is just as simple to use as the function for accessing digital values.

PROFINET IO controllers can also trigger AS-Interface master calls via the acyclic PROFINET services (e.g.: write parameters, change addresses, read diagnostic values).

An operator display in AS-Interface Link allows you to commission the lower-level AS-i line. IE/AS-i LINK PN IO is equipped with two switched Ethernet ports that allow you to leverage the benefits of the integrated Web server, thereby making it even easier to use the operator display. The firmware can also be upgraded.

The optional C-PLUG allows you to replace modules without a PG, thereby minimizing downtime if a fault occurs.

Diagnostics

A comprehensive range of diagnostic functions are available via displays, controls, a Web interface, or STEP 7. These include:

- Operating state of the link
- State of the link as a PROFINET IO device
- Diagnosis of the AS-Interface network
- Telegram statistics
- Standard diagnosis pages for rapid access to diagnostic data by means of a standard browser

Configuration

IE/AS-i LINK PN IO can be configured with STEP 7 as of version V5.4 SP2 or simply by copying the actual configuration on the display.

Alternatively, IE/AS-i LINK IO can be integrated by means of the PROFINET type file (GSD) in the engineering tool:

- STEP 7 versions older than V5.5 SP2
- Engineering tools from third-party vendors

When configuration is carried out with STEP 7, the AS-Interface configuration can be uploaded to STEP 7 as of V5.4 SP2. Siemens AS-i slaves can also be easily configured in HW Config (slave catalog).

6.2.4.2 Order numbers

Type	Order no.
IE/AS-i LINK PN IO Router between Industrial Ethernet and AS-Interface; Master profiles M3 and M4, extended AS-Interface Specification V3.0; degree of protection IP20; Manual available on CD-ROM, German, English, French, Spanish, Italian Single master with display	6GK1 411-2AB10
IE/AS-i LINK PN IO Router between Industrial Ethernet and AS-Interface; Master profiles M3 and M4, extended AS-Interface Specification V3.0; degree of protection IP20; Manual available on CD-ROM, German, English, French, Spanish, Italian Double master with display	6GK1 411-2AB20
Accessories	
C-Plug Exchange medium for replacing the devices quickly and easily if a fault occurs; for recording configuration and application data, can be used in SIMATIC Net products with C-PLUG slot	6GK1 900-0AB00
IE FC RJ45 Plug 90 RJ45 connector for Industrial Ethernet with a robust metal housing and integrated insulation displacement/terminal contacts for connecting the Industrial Ethernet FC installation cables; with 90° cable outlet (e.g. for ET 200S)	6GK1 901-1BB20-2AA0 (1 package with 1 piece) 6GK1 901-1BB20-2AB0 (1 package with 10 pieces) 6GK1 901-1BB20-2AE0 (1 package with 50 pieces)

6.2.4.3 Connection

Connections

IE/AS-i LINK features the following connections:

Two separate connections to the AS-i cable (with double master)

One connection for an alternative 24 V DC power supply (optional) and functional ground

Two LAN RJ45 connections as independent switch ports (one on PROFINET IO and one, for example, for the WBM configuration)

Connections to the AS-i cable(s) and power supply

IE/AS-i LINK has two connections for AS-i cables (lines 1 and 2). They are each connected via a 4-pin connector each with two + and two - terminals (jumpered internally).

This allows IE/AS-i LINK to be "looped in" to the AS-i cable.

CAUTION

Maximum load-carrying capacity

The maximum load-carrying capacity of the AS-i connection contacts is 3 A. If this value is exceeded on the AS-i cable, IE/AS-INTERFACE LINK PN IO must not be "looped in" to the AS-i cable but must instead be connected via a spur line (one connection pair only occupied by IE/AS-i LINK).

IE/AS-i LINK can receive its entire power supply from the AS-Interface (AS-i line 1 only). The current consumption from the AS-Interface here is 320 mA at 30 V.

Alternatively, IE/AS-i LINK can be supplied via a separate power supply unit (24 V DC).

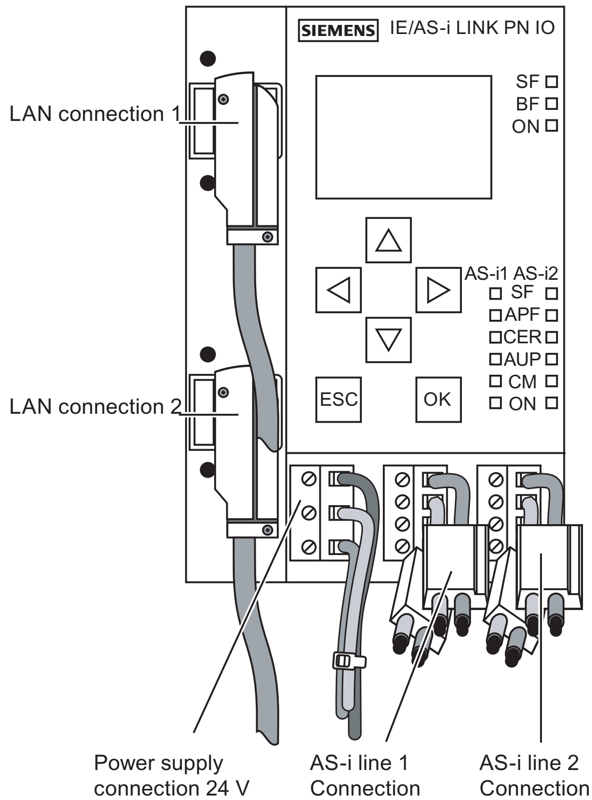


Figure 6-21 Connecting the AS-i cable(s) and power supply

Connector assignment for the AS-i line

PIN no. line 1	Signal
1	AS-i 1 +
2	AS-i 1 -
3	AS-i 1 +
4	AS-i 1 -

PIN no. line 2	Signal
1	AS-i 2 +
2	AS-i 2 -
3	AS-i 2 +
4	AS-i 2 -

PIN 1 and 3 as well as PIN 2 and 4 are jumpered internally with each other.

Connector assignment for the power supply

PIN no. line 1	Signal
1	Power +
2	Power -
3	PE

Note

Functional ground - PE

IE/AS-INTERFACE LINK PN IO features a connection for functional ground. This connection is required if the integrated ground-fault monitoring function is used. It must be connected to the protective conductor with as little resistance as possible.

LAN connections (PROFINET IO, PC with WBM)

The connections to PROFINET and a PC (or network) are established via two RJ45 sockets (recommended: 90° FC connector).

A LAN connection is provided for the PROFINET system. The second LAN connection for IE/AS-i LINK is used for configurations via Web-based management and for diagnostic purposes, for example. Both LAN connections are identical.

IE/AS-i LINK supports autocrossing (i.e. crossed and uncrossed cables can be used).

Connector assignment for the LAN connection

PIN no.	Signal
1	RXP
2	RXN
3	TXP
4	n.c.
5	n.c.
6	TXN
7	n.c.
8	n.c.

n.c. = not used

6.2.4.4 Diagnostics

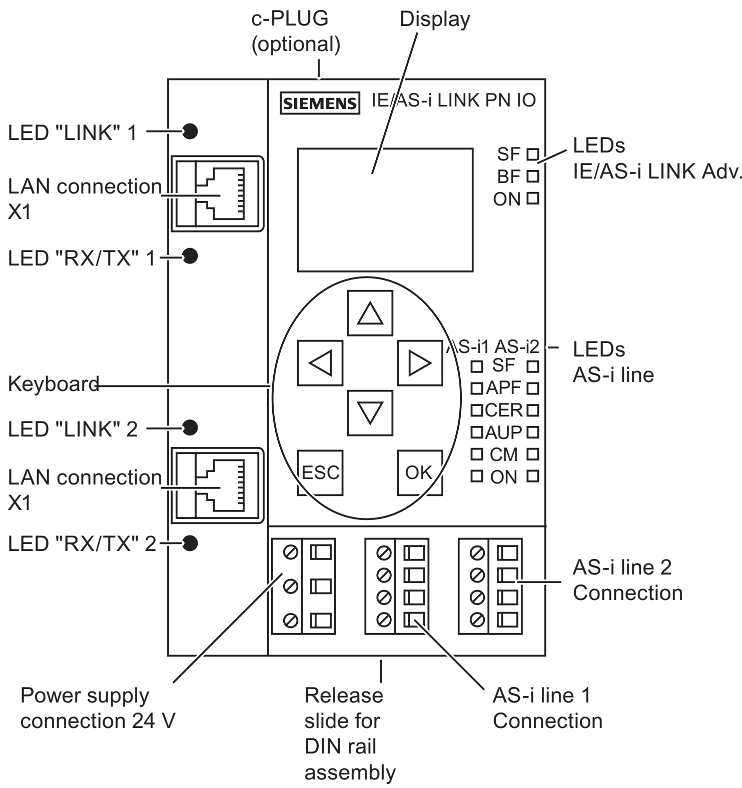


Figure 6-22 Front view of IE/AS-i LINK PN IO (double master)

The following LEDs are located on the front of IE/AS-i LINK:

- Indicators for the LAN connections (for X1 and X2 in each case)
  - LINK: connection to the Ethernet partner
  - RX/TX: Data traffic
- Indicators for IE/AS-i LINK
  - SF: System error
  - BF: Bus fault
  - ON: IE/AS-i LINK power supply
- Indicators for the AS-i line
  - SF: AS-i system error
  - APF: AS-i power failure
  - CER: Configuration error
  - AUP: Automatic address programming
  - CM: Configuration mode
  - ON: AS-i line power supply

Meaning of the IE/AS-i LINK LEDs

LED	Color	Status	Meaning
SF	Red	System error (link)	This LED lights up in the following cases: • In protected mode: a diagnostic alarm (incoming) was triggered in the PROFINET IO controller. • IE/AS-i LINK has detected an internal fault (e.g. EEPROM is defective).
BF	Red	Bus fault	This LED flashes in the following cases: • The connection between the PROFINET IO controller and IE/AS-i LINK is interrupted or the PROFINET IO controller is not active. • IE/AS-i LINK has been incorrectly parameterized/configured by the PROFINET IO controller.
ON	Green	—	This LED lights up when IE/AS-i LINK is supplied with voltage.

Meaning of the AS-i line LEDs

LED	Color	Status	Meaning
SF	Red	System error (line)	In protected mode: a diagnostic alarm (incoming) was triggered in the PROFINET IO controller.
APF	Red	AS-i power failure	Indicates that the voltage supplied by the AS-i power supply unit on the AS-i cable is too low or is faulty.
CER	Yellow	Configuration error	This LED indicates whether the slave configuration detected on the AS-i cable matches the target configuration in IE/AS-i LINK. If any discrepancies are detected, the CER LED lights up. The CER LED lights up in the following cases: • A configured AS-i slave is not detected on the AS-i cable (e.g. the slave has failed). • An AS-i slave that has not yet been configured is detected on the AS-i cable. • A connected AS-i slave has different configuration data (I/O configuration, ID code) to the AS-i slave configured in IE/AS-i LINK. • IE/AS-i LINK is in offline mode.
AUP	Green	Autoprog available	When IE/AS-i LINK is in protected mode, this LED indicates that the address of an AS-i slave can be programmed automatically. Automatic address programming makes it easier to replace a defective AS-i slave on the AS-i cable.
CM	Yellow	Configuration mode	This display indicates the IE/AS-i LINK operating mode. • Display ON: Configuration mode • Display OFF: Protected mode Configuration mode is only required for commissioning IE/AS-i LINK. In configuration mode, IE/AS-i LINK activates all the connected AS-i slaves and exchanges data with them.
ON	Green	—	This LED lights up when IE/AS-i LINK is supplied with voltage.

Keyboard

You can use the operator input keys to switch operating mode. The lower-level AS-i line can also be configured using the operator input keys and display.

Display

The graphical display has a resolution of 128 x 64 pixels.

The lower-level AS-i line is configured with the display/WBM together with the keyboard, display/wbm (Page 72) which means that commissioning and diagnosis can be carried out locally.

The following display appears when the device is switched on or if no user inputs are made over a long period:

Figure 6-23 Logo on the display

Note

Error message during operation

If a fault occurs during operation, an error message is output even if the logo was displayed beforehand.

As soon as any keyboard input is made, the main menu appears in which you can navigate in the menu structure.

If an entry in the list is selected (inverse display), a ticker text automatically appears after a short period with further information (not in the main menu).

6.2.4.5 Technical specifications

Technical specifications	
Transmission rates on each AS-Interface line	
• AS-Interface bus cycle time	5 ms for 31 slaves; 10 ms for 62 slaves
• Ethernet transmission rate	10/100 Mbit/s, autosensing
Interfaces	
• AS-Interface connection	1 x 4-pin terminal contacts (plug-in type)
• Single master	1 x 4-pin terminal contacts (plug-in type)
• Double master (2 AS-i lines)	2 x 4-pin terminal contacts (plug-in type)
• Connection to Ethernet	2 x RJ45 sockets (switchports)
• Optional: 24 V DC power supply	3-pin terminal contacts (connectable) incl. functional earth for internal earth-fault monitoring
Display	128 x 64 pixels with backlighting
Keys	Membrane keyboard
Power supply	
• From the AS-Interface shaped cable	In accordance with AS-Interface Specification EN 50 295
• Optional	24 V DC
Current consumption	
• From the AS-Interface shaped cable	Max. 250 mA
Load-carrying capacity	max. 3A
• Power loss	7.5 W
Degree of protection	IP20
Permissible ambient conditions	
• Operating temperature	
• Horizontal installation	0°C to +60°C
• Vertical installation	0°C to +45°C
Transport/storage temperature	-30°C to +70°C
Relative humidity	Max. 95% at +25°C
Operating altitude	3000 m above sea level
Design	
• Installation	On DIN rail
• Dimensions (W x H x D) in mm	90 x 132 x 88.5
• Weight	Approx. 380 g
Supported AS-Interface master profiles	M1, M2, M3, and M4 (in accordance with AS-Interface Specification V3.0)
AS-Interface configuration	By means of buttons on the front plate, with STEP 7 as of version V5.4 SP2 via Web interface

Power supply units 7

7.1 Overview

Space-saving power supply units and data decoupling

AS-Interface power supply units are among the most important components of an AS-Interface network. They supply the electronic network components (AS-Interface modules and AS-Interface masters) as well as the connected sensors. Integrated data decoupling in the AS-Interface power supply units ensure that data and energy are kept separate but that AS-Interface can transfer data and energy along the same cable.

- Compact design saves space in the cabinet/field.
- Increased output power allows additional AS-Interface nodes to be connected.
- Integrated ground-fault and overload detection functions make the application more reliable, which does away with the need for additional components.
- Diagnostic memory, remote indication, and remote reset allow faults in the system to be quickly detected, thereby reducing downtimes.
- Spring-loaded connection system allow the devices to be installed quickly and securely.
- Terminal blocks can be quickly replaced, thereby reducing downtimes.
- The ultra-wide range input of the 8 A version allows single and dual-phase operation, which means that a neutral conductor is not required.
- UL/CSA ensures that the device can be used worldwide.

Structure

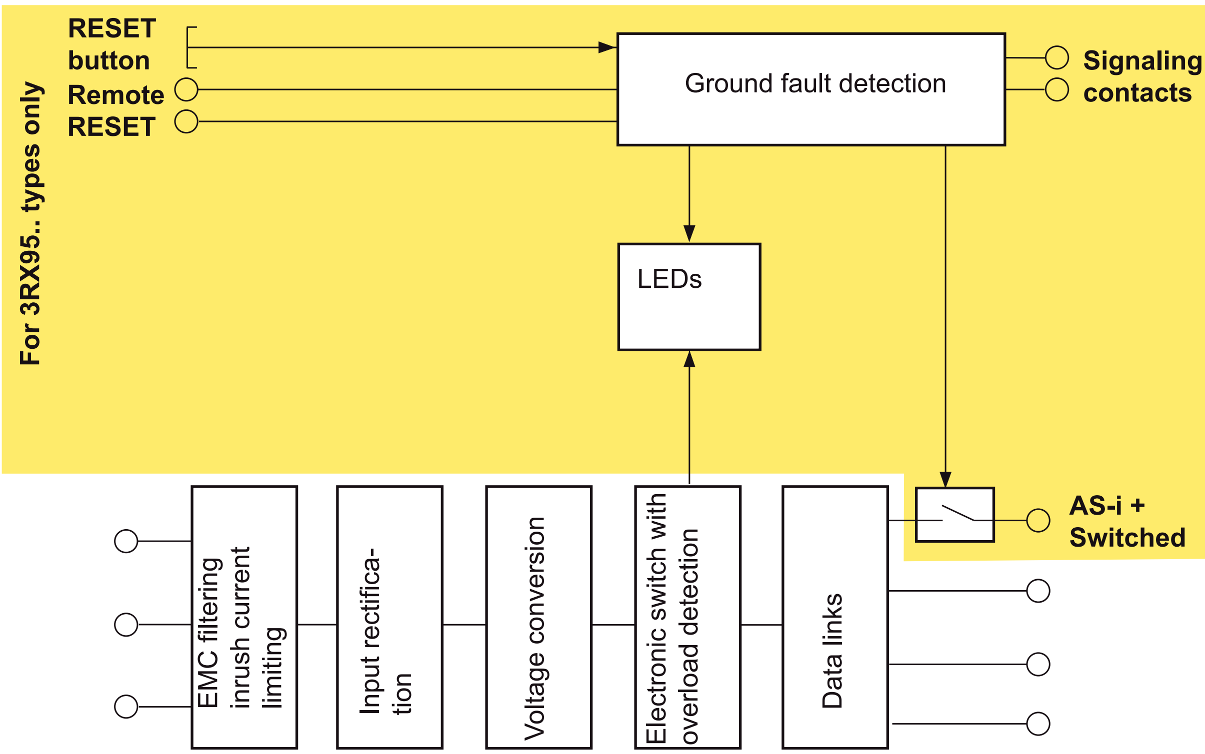


Figure 7-1 Basic structure of the AS-Interface power supply units

AS-Interface power supply units are primary-side regulated DC power supply units. The primary switched-mode regulators generate a regulated DC voltage of 30 V DC with high control stability and low residual ripple.

The AS-Interface two-wire cable transfers data and energy simultaneously. For this reason, AS-Interface power supply units must ensure that the AS-Interface network is supplied with power while the data is decoupled.

Standard power supply units are not suitable here, which is why standard power supply units must not be used for supplying an AS-Interface network. AS-Interface power supply units supply the network electronics (AS-Interface masters and AS-Interface modules) as well as all the connected sensors. Graded power supply units from 2 to 8 A are available depending on the power requirements of the AS-Interface network.

As shown in the block diagram, the new generation of AS-Interface power supply units (3RX95...) with IP20 also features integrated ground-fault and overload detection.

Function: features of the latest generation of power supply units 3RX95..:

- Compact design

  Available in widths of 50/70/120 mm, the latest devices are among the most compact AS-Interface power supply units available offering a very high degree of power density. Thanks to the small surface area of these devices, other devices can be mounted on the DIN rail next to the power supply unit. As a result, they can be installed directly next to other devices (unlike other compact power supply units).

- Increased power

  The new devices have an output current of 3 / 5 / 8 A.

- Integrated ground-fault detection

  Ground-fault detection to EN 60204-1 is obligatory for AS-Interface. The new generation of AS-Interface power supply units all feature integrated ground-fault detection that reliably detects and reports ground faults. Additional contacts also allow users to determine whether the AS-Interface voltage is to be switched off directly if a ground fault occurs, thereby preventing the machines from starting unintentionally and, in turn, preventing the system from being damaged if a fault occurs.

- Remote reset and remote indication

  The detected ground fault can be signaled and evaluated on a central controller via brought-out signal contacts. The stored diagnostic data can be reset locally using the reset button. It can also be reset, however, by a controller via a reset input.

- Integrated overload detection

  An output-side overload is detected and signaled via a diagnostics LED.

- Diagnostic memory

  A ground fault and output-side overload are stored in a diagnostic memory until the system is reset and signaled via the appropriate LEDs. This makes it easier to diagnose faults in an AS-Interface network because the service personnel can immediately identify the potential source of system faults (even after a fault has occurred).

- Diagnostic LEDs

  The status of the AS-Interface power supply unit can be determined locally on the power supply unit via three differently-colored LEDs:

  – Overload LED, red

  – Ground-fault detection LED, yellow

  – OK status LED, green (output voltage ≥ 26.5 V)

- Ultra-wide range input with 8 A

  The ultra-wide range input from 120 to 500 V with the 8 A variant means that the device can be used in virtually any network in the world. In addition, this variant does not require a neutral conductor because the device can be connected directly between 2 phases in a network.

- Removable terminal blocks with spring-loaded connection

  The power supply unit is equipped with three terminal blocks: one block for the input side, one for the output side, and one for the information terminals. These can be removed if required, thereby enabling the power supply unit to be quickly and easily replaced if a fault occurs. The spring-loaded connection system used for the terminals also enables the cable strands to be quickly and securely connected.

7.2 Order numbers

Type		Order no.
AS-Interface power supply unit IP20 • Single output IP20 • With integrated ground-fault detection		6GK7142-2AH00-0XA0
Output current	Input voltage	
3 A	115 / 230 V AC (switchable)	3RX9 501-0BA00
3 A	24 V DC	3RX9 501-1BA00
5 A	115 / 230 V AC (switchable)	3RX9 502-0BA00
8 A	115 / 230 ... 500 V AC (switchable)	3RX9 503-0BA00

7.3 Connection

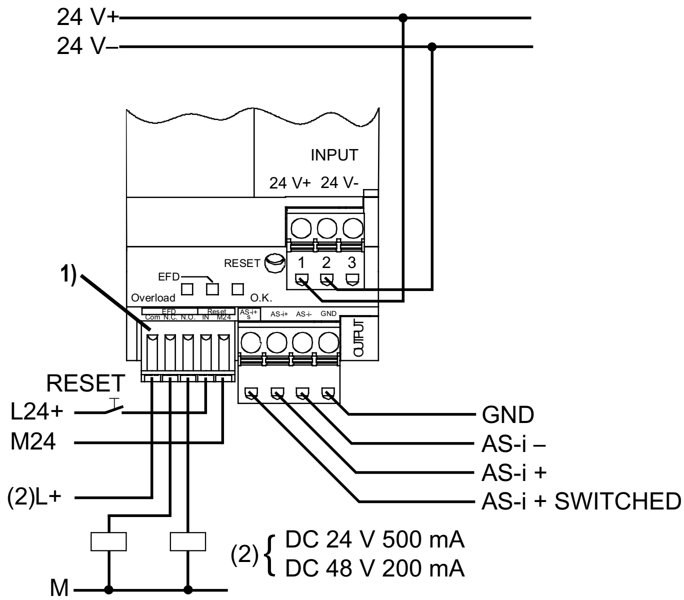
Selecting the installation location

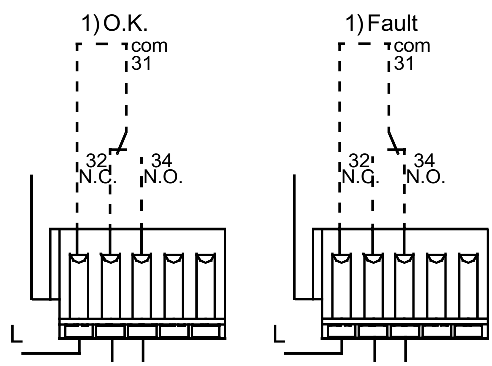
- The power supply unit must be installed vertically to ensure sufficient heat dissipation.
- A clearance of at least 50 mm should be maintained above and below the device.
- The device is clipped on to a 35 mm DIN rail.

Connecting a 3 A / 24 V DC IN power supply unit (3RX9 501-1BA00)

To implement the ground-fault monitoring function, the device must be connected to GND. The device is equipped with a primary-side internal fuse.

All terminals can be removed if required.

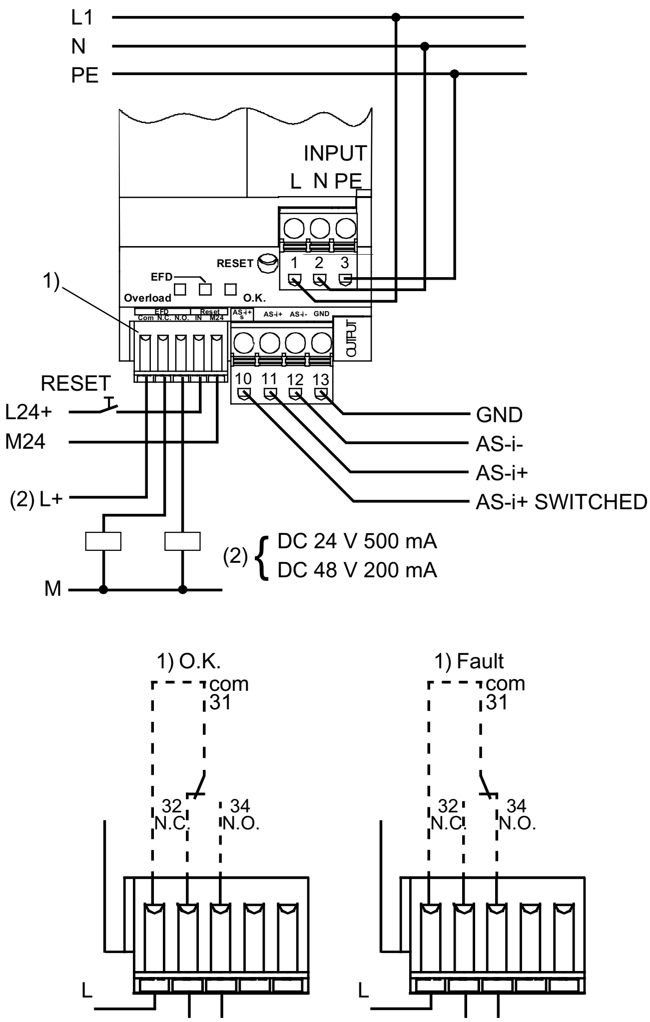

24 V+
24 V–
INPUT
24 V+ 24 V-
1 2 3
RESET
EFD
Overload
O.K.
OUTPUT
1)
RESET
L24+
M24
(2)L+
M
GND
AS-i –
AS-i +
AS-i + SWITCHED
(2) { DC 24 V 500 mA
DC 48 V 200 mA


1) O.K.
com
31
32
N.C.
34
N.O.
L
1) Fault
com
31
32
N.C.
34
N.O.
L

Connecting 3 A (3RX9 501-0BA00), 5 A (3RX9 502-0BA00), and 8 A (3RX9 503-0BA00) power supply units

The power supply (120 / 130 V AC) must be connected in accordance with VDE 0100 and VDE 0160. The network must be fused with max. 20 A (USA) or 16 A (IEC). The device is equipped with a primary-side internal fuse.

All terminals can be removed if required.



7.4 Diagnostics

Status display via LEDs

You can determine the status of the AS-Interface power supply units via the three LEDs at the bottom of the devices.

The following table provides an overview of the status displays:

"OK" LED	"Overload" LED	"EFD" LED	Operating status
ON, green	OFF	OFF	Status OK (with 3RX9 501 / 2 / 3-0BA00: output voltage ≥ 26.5 V)
OFF	OFF	OFF	No voltage on the device
ON, green	Flashing, red	OFF	Overload detected
ON, green	OFF	ON, yellow	Ground fault detected

7.5 Technical specifications

	AS-Interface power supply unit Single output IP20			
	Output current 3 A	Output current 3 A	Output current 5 A	Output current 8 A
	3RX9 501-0BA00	3RX9 501-1BA00	3RX9 502-0BA00	3RX9 503-0BA00
Input data				
• Primary voltage U_e	120 / 230 V AC	24 V DC	120 / 230 V AC	120 / 230 ... 500 V AC
• Working voltage range	85 ... 132 / 176 ... 253 V AC	20 ... 29 V DC	85 ... 132 / 176 ... 253 V AC	85 ... 132 / 176 ... 550 V AC
• Line frequency range	47 ... 63 Hz	-	47 ... 63 Hz	47 ... 63 Hz
• Mains buffering at I_{aNenn}	> 20 ms	> 10 ms	> 20 ms	> 20 ms
• Primary rated current	1.6 / 0.9 A	4.5 A	2.7 / 1.5 A	4.4 / 2.4 A
Output data				
• Rated output voltage $U_{a\ rated30}$	30 V DC	30 V DC	30 V DC	30 V DC
• Residual ripple / spikes	< 50 mVpp (10 ... 500 kHz) < 300 mVpp (0 ... 10 kHz)	< 50 mVpp (10 ... 500 kHz) < 300 mVpp (0 ... 10 kHz)	< 50 mVpp (10 ... 500 kHz) < 300 mVpp (0 ... 10 kHz)	< 50 mVpp (10 ... 500 kHz) < 300 mVpp (0 ... 10 kHz)
• Rated output current $I_{a\ rated}$	3 A	3 A	5 A	8 A
• Current limitation activation point	typ. 3.5 A	typ. 3.5 A	typ. 5.5 A	typ. 8.5 A

	AS-Interface power supply unit Single output IP20			
• Efficiency at full load	typ. 84%	typ. 84%	typ. 87%	typ. 87%
Ambient conditions				
• Storage/transport temperature	-25 ... +80 °C	-25 ... +80 °C	-25 ... +80 °C	-25 ... +80 °C
• Ambient temperature during operation	-10 ... +70 °C	-10 ... +70 °C	-10 ... +70 °C	-10 ... +70 °C
• Degree of protection	IP20	IP20	IP20	IP20
• Degree of pollution	2	2	2	2
• Humidity class	Climate class DIN 50010, max. relative humidity 100 %, without condensation			
• EMC noise emissions Class B	IEC 61000-6-3	IEC 61000-6-3	IEC 61000-6-3	IEC 61000-6-3
• EMC noise immunity	EN 61000-6-2, EN 61000-4-2/-3/-4/-5/-6/-11			

7.6 Dimension drawings

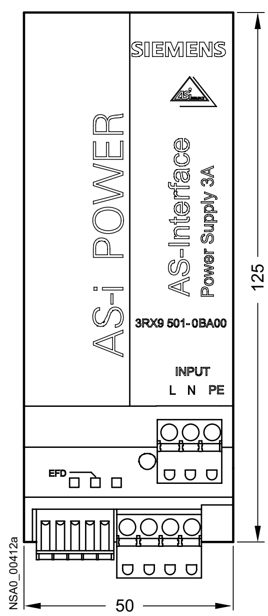


Figure 7-2 Front view of 3RX9 501-0BA00, 3RX9 501-1BA00

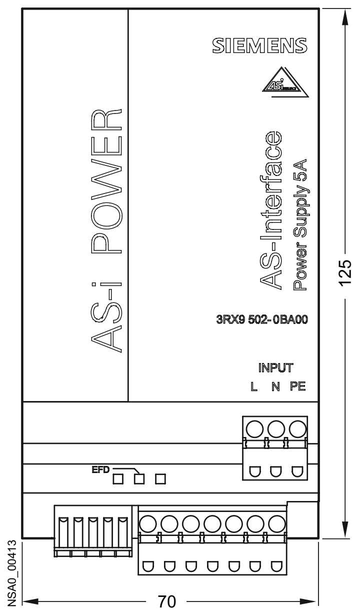


Figure 7-3 Front view of 3RX9 502-0BA00

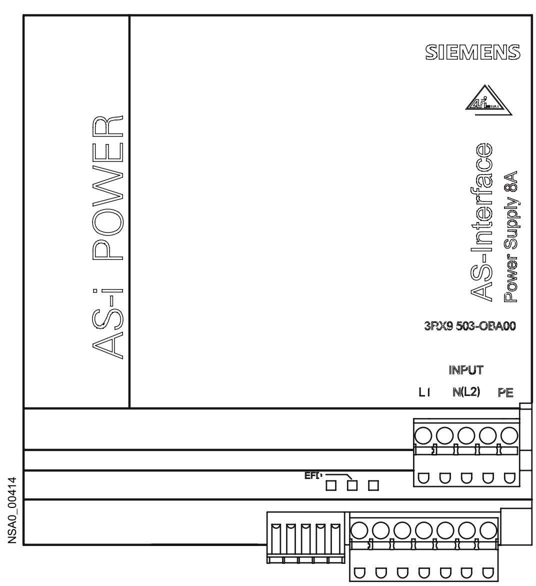


Figure 7-4 Front view of 3RX9 503-0BA00

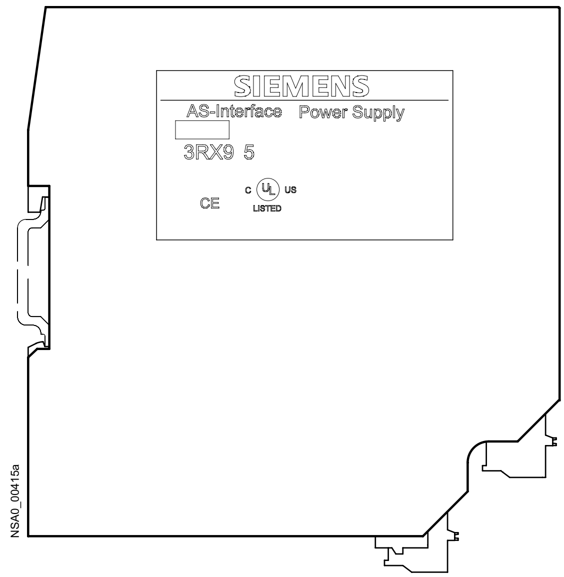


Figure 7-5 Side view of 3RX9 501-0BA00

8 Slaves

Overview of the I/O modules

The following I/O modules are available for AS-Interface:

Digital I/O modules for use in the field

- Degree of protection IP67
  - I/O modules - K60
  - I/O modules - K45
  - I/O modules - K20
- Degree of protection IP68 / IP69K
  - I/O modules - K60R

Analog I/O modules for use in the field

- Degree of protection IP67
  - I/O modules - K60

Digital I/O modules for use in the cabinet

- Degree of protection IP20
  - SlimLine modules of the S22.5 and S45 series
  - F90 module
  - Flat module

Digital I/O modules as specific integration solutions

- Degree of protection IP00 or with housing
  - Communication modules for PCB installation

Modules with special functions

- Counter modules

Housing and front panel module for AS-Interface

- AS-Interface housing with standard components
- Customized AS-Interface housing
- AS-Interface front panel module

8WD4 signaling columns

AS-Interface connection for LOGO!

Contactor with AS-Interface

8.1 Setting the AS-i address

Unique addressing

In the as-delivered condition, an I/O module (slave) has the address 0. It is detected by the master as a new slave that has not yet been addressed and, in this condition, has not yet been integrated in standard communication/data exchange.

To enable data to be exchanged between the master and slaves, you have to assign a **unique** address for each slave (i.e. each slave address must be different) when commissioning the AS-Interface network.

You can choose the addresses as required:

- In address range 1 to 31, for slaves with standard addressing mode
- In address range 1A to 31A and 1B to 31B, for slaves with extended addressing mode (A/B slaves, as of AS-i Spec. 2.1)

Addresses can also be assigned once the devices have been installed.

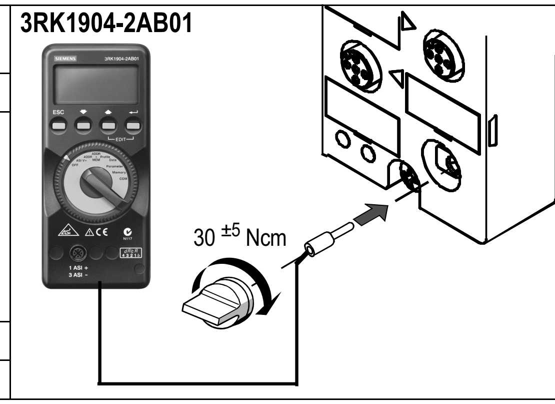
Addressing the slaves

You can set the slave address in different ways:

- Offline with the addressing unit via the addressing socket or at the AS-i connection.
  Recommended when assigning addresses for the entire system. The direct connection between the slave and addressing unit ensures that the slave modules are not mixed up.
- Online by the AS-i master and in the PLC configuration software.
  Recommended for assigning addresses to individual slaves if an addressing unit is not available. Before assigning addresses, you must ensure that each address exists only once in the AS-i network, that is, several new, additional modules (with address 0 in as-delivered condition) must not be connected to the AS-i cable.

> **CAUTION**
>
> As soon as you have assigned a valid address, the master can start cyclic data communication, that is, outputs can be set or inputs read that result in follow-up switching operations. Make sure that the system does not enter a hazardous state (e.g. switch off the AS-i voltage as a precaution).

Offline addressing with the addressing unit using a K45 module as an example

1	Unscrew the cover cap for the addressing socket on the module.	
2	Connect the module to the addressing unit (3RK1904 2AB0).	
3	Assign an address to the module. • Switch the selector switch to ADDR. • Press ↵. The address of the connected module is read and displayed. • Select the address by choosing ▼▲. • To transfer the address to the module, choose ↵.	
4	Remove the addressing cable.	
5	Seal the addressing socket with the cover cap.	

8.2 Connection

AS-Interface bus and auxiliary voltage (AUX POWER)

Depending on the design of the I/O module, the following options are available for connecting the AS-i bus and AUX POWER.

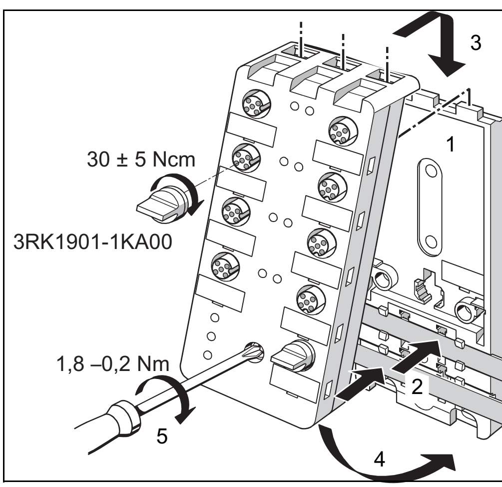
- With the shaped cable for AS-i (yellow) and AUX POWER (black) by means of the insulation displacement method (piercing)
- With round cables and standard M12 connectors
- Wiring as required to screw-type or spring-loaded terminals

Actuators and sensors

- Connection via standard M12 or M8 connectors for modules for use in the field (degree of protection ≥ IP67, compact modules K20, K45, and K60).
- Connection via screw or spring-loaded terminals for modules for use in the cabinet (degree of protection IP20, SlimLine modules, F90 module and flat module)

8.2.1 Connecting the shaped cable for AS-i and AUX POWER

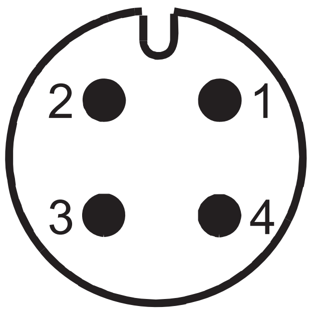
Proceed as follows:



1	Secure the module on a flat surface.
2	Insert the yellow AS-i shaped cable and, if necessary, the black shaped cable for AUX POWER into the cutouts on the mounting plate of the compact modules (K60 and K45).
3	Hook the module onto the holding studs on the mounting plate.
4	Secure the compact module to the mounting plate. This also ensures that contact is established with the shaped cables by means of the insulation displacement method.
5	

8.2.2 AS-i connection via M12 connector

When round cables are used, AS-Interface is connected to an M12 connector.

	1 = UAS-i + 2 = AUX power – 3 = UAS-i – 4 = AUX power +

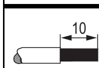
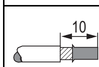
M12 sockets that are not required must be sealed with screw caps (3RK1901-1KA00) to ensure that the required degree of protection is maintained.

8.2.3 Connection via terminals

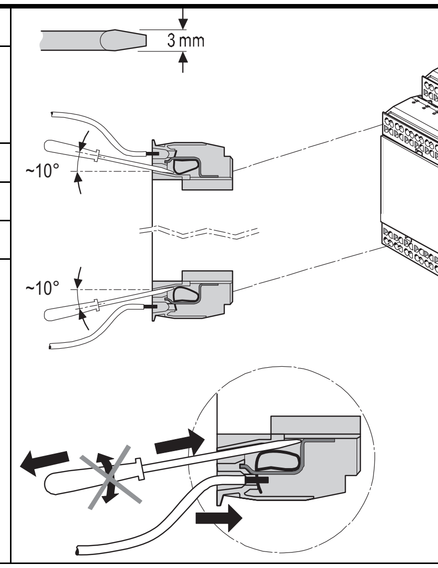
Screw terminals

To screw/unscrew the screw terminals, you need a PZ2 screwdriver. The tightening torque should be between 0.8 and 1.2 Nm.

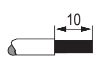
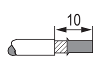
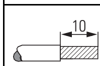
For the connection cross-sections and stripping lengths, see the table.

Connection type	Connection cross-sections
	1 x 0.5 ... 4.0 mm² / 2 x 0.5 ... 2.5 mm²
	1 x 0.5 ... 2.5 mm² / 2 x 0.5 ... 1.5 mm²

Spring-loaded terminals

Step	Explanation	
1	You need a 3 mm flat-bladed screwdriver.	
2	To release the clamping springs, insert the screwdriver as far as it will go into the square opening of the spring-loaded terminal. Position the screwdriver at an angle of 10° with respect to the oval opening.	
3	Insert the cable into the oval opening as far as it will go.	
4	Hold the cable in the spring-loaded terminal.	
5	Remove the screwdriver.	
6	Pull the cable to ensure it is secure.	

For the connection cross-sections and stripping lengths, see the table.

Connection type	Connection cross-sections
	2 x 0.25 ... 1.5 mm²
	2 x 0.25 ... 1.5 mm²
	2 x 0.25 ... 1.5 mm²

Removable terminals

The SlimLine modules are equipped with removable terminals, which makes it easier to replace the device if required. The terminals are coded to prevent confusion.

⚠ CAUTION
Before replacing the terminals, you must disconnect the system and device from the power supply.

Replacing the removable terminals

Step	Description
a	Undo the interlock.
b	Remove the terminal.
c	Insert the new terminal.
d	Push the terminal into the device until the interlock audibly engages.

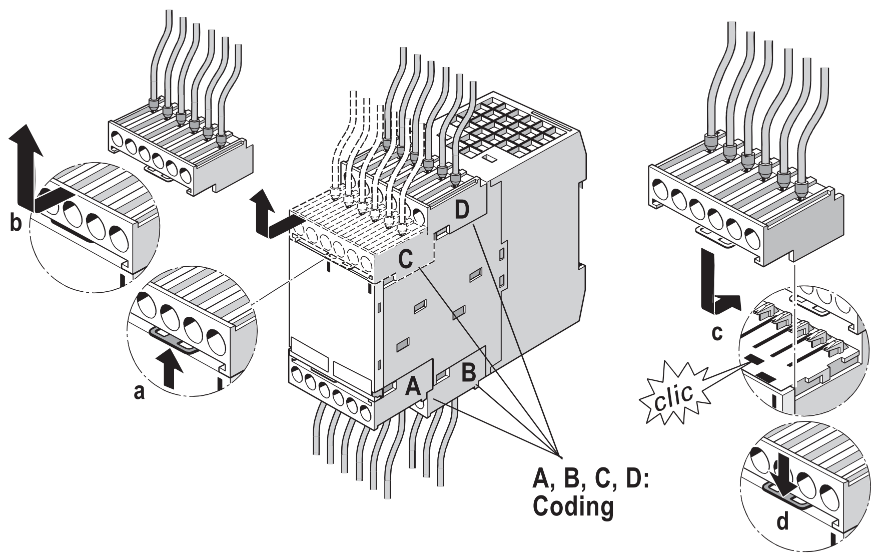
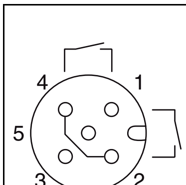
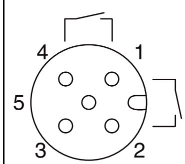


Figure 8-1 Replacing the removable terminals

8.2.4 M12 - standard assignment - digital inputs

	1	Supply L+
	2	Input signal (jumpered with pin 4)
	3	Supply L–
	4	Input signal (jumpered with pin 2)
	5	Ground connection

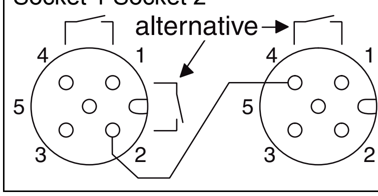
8.2.5 M12 - Y assignment - digital inputs



1	Supply L+
2	Input signal 2
3	Supply L–
4	Input signal 1
5	Ground connection

8.2.6 M12 - Y/II assignment - digital inputs

Socket 1 Socket 2

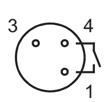


1	Supply L+	Supply L+
2	Input signal 2	Unassigned
3	Supply L–	Supply L–
4	Input signal 1	Input signal 2
5	Ground connection	Ground connection

Note

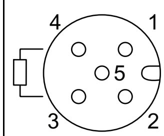
Input signal 2 can be wired to either socket 1 only or socket 2 only.

8.2.7 M8 - assignment - digital inputs

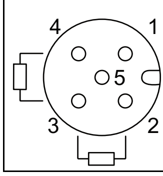


1	Supply L+
3	Supply L–
4	Input signal

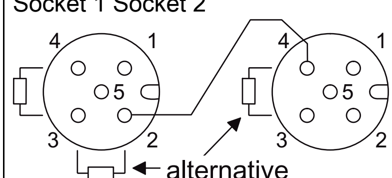
8.2.8 M12 - standard assignment - digital outputs

Circuit diagram	Pin	Assignment
	1	Unassigned
	2	Unassigned
	3	Supply L–
	4	Output signal
	5	Ground connection

8.2.9 M12 - Y assignment - digital outputs

	1	Unassigned
	2	Output signal 2
	3	Supply L–
	4	Output signal 1
	5	Ground connection

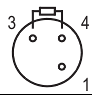
8.2.10 M12 - Y/II assignment - digital outputs

Socket 1 Socket 2 	1	Unassigned	Unassigned
	2	**Output signal 2**	Unassigned
	3	Supply L–	Supply L–
	4	**Output signal 1**	Output signal 2
	5	Ground connection	Ground connection

Note

Output signal 2 can be wired to either socket 1 only or socket 2 only.

8.2.11 M8 - assignment - digital outputs

	1	Unassigned
	3	Supply L–
	4	Output signal

8.3 Diagnostics

Status display

The status of a module is indicated by the LEDs by either a continuous or flashing light, which enables the module to be diagnosed at a glance:

- For AS-i communication
  depending on the design, via two LEDs or via a dual LED
- For the auxiliary voltage U_{AUX}
  with a green LED
- For the switching state of the inputs and outputs
  with yellow LEDs

The following section provides an overview of the LED status displays for the input/output modules.

8.3.1 LED status displays for modules with two LEDs for AS-i and FAULT

AS-i	FAULT	Possible cause	Possible remedial measures
Green	OFF	Normal operation, AS-i communication OK	-
Green	Red	No AS-i communication: • The master is switched off or offline. • The slave is not configured in the master. • The incorrect slave type is connected. • The slave has the wrong address.	Ensure AS-i communication: • Switch on the master or switch it to online mode. • Reconfigure the master. • Connect the correct module. • Check/correct the slave address.
Green	Flashing red	Sensor supply overload (Slave is in RESET mode and switches off completely)	Unplug the sensor cables from the input sockets, user sensors with a lower overall current consumption, check the sensors/cables.
Flashing green	Red	The slave has the address 0 (as-delivered condition)	Assign an address that is not 0.
Flashing green (alternating flashing)	Flashing red	Output overload (the slave switches off all the outputs)	Unplug the actuator cables from the output sockets, check the actuators and cables.
OFF	OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

With SlimLine modules, the FAULT LED is not labeled. It is located directly under the AS-i LED.

The status "output overload" (green/red alternate flashing) is not displayed by all modules.

With analog modules, the following assignment applies:

AS-i	FAULT	Possible cause	Possible remedial measures
Flashing green	Flashing red	No analog data exchange (triple exchange) on AS-i	Use AS-i master to AS-i Spec. 2.1 or more
(alternating flashing)			
		The AS-i master is waiting for analog output data from the PLC (with analog output modules only)	Set CPU to RUN, send data set with analog output data to the AS-i master (CP 343-2, CP 343-2P, Link 20E).
		Sensor supply overload (with analog input modules only)	Unplug the sensor cables from the input sockets, user sensors with a lower overall current consumption, check the sensors and cables.

8.3.2 LED status displays for modules with a dual LED for AS-i/FAULT

AS-i/FAULT	Possible cause	Possible remedial measures
Green	Normal operation, AS-i communication OK	—
Red	No AS-i communication: • The master is switched off or offline. • The slave is not configured in the master. • The incorrect slave type is connected. • The slave has the wrong address.	Ensure AS-i communication: • Switch on the master or switch it to online mode. • Reconfigure the master. • Connect the correct module. • Check/correct the slave address.
Flashing red	Sensor supply overload (Slave is in RESET mode and switches off completely)	Unplug the sensor cables from the input sockets, user sensors with a lower overall current consumption, check the sensors/cables.
Yellow/red flashing	The slave has the address 0 (as-delivered condition)	Assign an address that is not 0.
Green/red flashing	Output overload (the slave switches off all the outputs)	Unplug the actuator cables from the output sockets, check the actuators and cables.
OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

The status "output overload" (green/red flashing) is not displayed by all modules.

8.3.3 LED status display AUX POWER for modules with auxiliary voltage

AUX POWER	Possible cause	Possible remedial measures
Green	Normal operation, 24 V DC auxiliary voltage OK	—
OFF	• No auxiliary voltage • Auxiliary voltage connected with incorrect polarity • Auxiliary voltage too low	• Auxiliary supply 24 V DC • Connect it properly • Measure the auxiliary voltage (approx. 24 V DC)

Modules that are not equipped with an auxiliary voltage connection do not have an AUX POWER LED (e.g. pure input modules, modules with relay outputs).

SlimLine modules with a width of 22.5 mm do not have an AUX POWER LED.

8.3.4 LED status display for the switching state (yellow)

IN x (F-IN x) / OUT x	Meaning
Yellow	Signal activated
OFF	Signal deactivated

8.4 Input/output modules

8.4.1 Digital K60 input/output modules - panel IP67

8.4.1.1 Overview

Standard K60 compact modules

- K60 compact modules with max. four digital inputs and four digital outputs.
  These compact modules contain the communications electronics and the standard M12 connections for inputs and outputs. Up to four sensors and four actuators can be connected to the compact module.
- K60 compact modules with max. eight digital inputs and two digital outputs.
  These modules have eight digital inputs with an M12 connector.
  The module requires two AS-Interface addresses for processing all the inputs and outputs. Addresses are assigned here using a double addressing socket.
- K60 compact modules with four digital inputs and outputs in accordance with AS-i Specification 3.0.
  AS-i Specification 3.0 extends the AS-Interface bus system to include a range of new features.
  Extended address mode (A/B addresses) allows 62 nodes to be connected to an AS-i network. This means that, even in the case of A/B slaves, four outputs can now be used (instead of just three outputs as defined in Specification 2.1). In the maximum configuration of an AS-i network, therefore, this means that 248 inputs and 248 outputs are available.
  Note, however, that these modules can only be operated with a new master in accordance with AS-i Specification 3.0 (e.g. new DP/AS-i LINK Advanced or IE/AS-i LINK PN IO) and that the cycle times for the outputs in this case can be a maximum of 20 ms.
- K60 compact modules for use in potentially explosive areas (ATEX).
  Two versions of the K60 modules are available for use in potentially explosive areas (zone 22) in accordance with classification II 3D (dust in the air, non-conductive dust).
  The version with four inputs and four outputs has the ID (Ex) II 3D T75 °C IP65X, the version with four inputs has the ID (Ex) II 3D T60 °C IP65X.
  Certain factors must be taken into account to ensure that these devices function safely and reliably. In particular, suitable measures must be taken to protect the module against mechanical damage. For further conditions for ensuring safe and reliable operation, see Technical specifications (Page 178).

8.4.1.2 Connection

For information on connecting the AS-i bus and auxiliary voltage U_{AUX} as well as the actuators and sensors, see Connection (Page 166).

8.4.1.3 Order numbers

K60 compact modules

Inputs/outputs	Type	Assignment	Current-carrying capacity per output	Order no.
8 inputs / 2 outputs	A/B slave	Special assignment	2 A	3RK2400–1HQ00–0AA3
8 inputs	Standard slave	Y-II assignment	—	3RK1200–0DQ00–0AA3
8 inputs	A/B slave	Y-II assignment	—	3RK2200–0DQ00–0AA3
4 inputs / 4 outputs	Standard slave	Y-II assignment	2 A	3RK1400–1DQ00–0AA3
4 inputs / 4 outputs	Standard slave	Standard assignment	2 A	3RK1400–1CQ00–0AA3
4 inputs / 4 outputs	Standard slave	Y-II assignment	1 A	3RK1400–1DQ01–0AA3
4 inputs / 4 outputs	Standard slave	Standard assignment	1 A	3RK1400–1DQ03–0AA3
4 inputs / 4 outputs	A/B slave (Spec 3.0).	Y-II assignment	2 A	3RK2400–1DQ00–0AA3
4 inputs / 3 outputs	A/B slave	Y-II assignment	2 A	3RK2400–1FQ03–0AA3
4 inputs / 2 outputs	Standard slave	Y-II assignment	2 A	3RK1400–1MQ00–0AA3
4 inputs	Standard slave	Y-II assignment	—	3RK1200–0CQ00–0AA3
2 x 2 inputs / 2 x 2 outputs	Standard slave	Y-II assignment	1 A	3RK1400–1DQ02–0AA3
4 outputs	Standard slave	Y-II assignment	2 A	3RK1100–1CQ00–0AA3
4 Ein- /4 Ausgänge Ausf. ATEX (Ex) II 3D X	Standard slave	Y-II assignment	2 A	3RK1400–1DQ05–0AA3
4 inputs version ATEX (Ex) II 3D X	Standard slave	Y-II assignment	—	3RK1200–0CQ05–0AA3

Accessories

Description	Comments	Order numbers
K60 mounting plate	For wall mounting	3RK1901-0CA00
K60 mounting plate	For DIN rail mounting	3RK1901-0CB01

8.4.1.4 Diagnostics

LEDs for AS-i and FAULT

The module has two LEDs for AS-i and FAULT for diagnostic purposes; see LED status displays for modules with two LEDs for AS-i and FAULT (Page 173) .

LED display AUX POWER

The module also has an LED for AUX POWER; for a description, see LED status display AUX POWER for modules with auxiliary voltage (Page 175).

Status display for the switching state

The switching state of the AS-i inputs and outputs is indicated by a yellow LED; see LED status display for the switching state (yellow) (Page 175).

8.4.1.5 Technical specifications

Operating voltage in acc. with AS-Interface Specification	26.5 to 31.6 V
Input circuit	PNP
Inputs	
Sensor supply via AS-Interface	Short circuit and overload proof
Sensors	2 and 3 conductors
Voltage range	20 to 30 V
Switching level - high	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 6 mA
Outputs	
Output type	Electronics
Short-circuit protection	Integrated
Inductive interference protection	Integrated
External 24 V DC power supply	Via black AS-Interface flat cable
Watchdog	Integrated
AS-Interface certificate	Awarded (or planned for new devices)
Approvals	UL, CSA, shipbuilding (or planned for new devices)
Degree of protection	IP67
Ground connection	PIN5 of each M12 socket is connected to the ground clamp in the mounting plate by means of a pin.
Ambient temperature	–25 to +85°C
Storage temperature	–40 to +85°C
Connection	Via the mounting plate for compact module K60

Note

An external additional power supply (AUX POWER) of between 20 and 30 V DC is required for supplying the output circuits. The additional power supply must comply with VDE 0106 (PELV), protection class III.

Order no.	3RK2400–1HQ00–0AA3	3RK1200–0DQ00–0AA3	3RK2200–0DQ00–0AA3
Slave type	A/B slave	Standard slave	A/B slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.1	AS-i Spec. 2.0	AS-i Spec. 2.1
No. of inputs/outputs	8 inputs / 2 outputs	8 inputs	8 inputs
Socket assignment	Special assignment	Y-II assignment	Y-II assignment
AS-i slave profile IO.ID.ID2	0.A.E (addr. 1) 7.A.E (addr. 2)	0.1.F (addr. 1) 0.1.F (addr. 2)	0.A.E (addr. 1) 0.A.E (addr. 2)
ID1 code (factory setting)	7 (addr. 1 and 2)	F (addr. 1 and 2)	7 (addr. 1 and 2)
Total power consumption	≤ 300 mA	≤ 270 mA	≤ 270 mA
Inputs			
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA	200 mA	200 mA
Outputs			
Typ. current-carrying capacity per output: 12/13 DC	2 A	—	—
Max. total current per module	4 A	—	—
Data bit assignments			
Socket 1	PIN 4 = IN1(D0) (addr. 1) PIN 2 = IN2(D1) (addr. 1)		
Socket 2	PIN 4 = IN2(D1) (addr. 1)		
Socket 3	PIN 4 = IN3(D2) (addr. 1) PIN 2 = IN4(D3) (addr. 1)		
Socket 4	PIN 4 = IN4(D3) (addr. 1)		
Socket 5	PIN 4 = IN1(D0) (addr. 2) PIN 2 = IN2(D1) (addr. 2)		
Socket 6	PIN 4 = IN2(D1) (addr. 2)		
Socket 7	PIN 4 = OUT1(D0) (addr. 2) PIN 2 = IN3(D2) (addr. 2)		
Socket 8	PIN 4 = OUT2(D1) (addr. 2) PIN 2 = IN4(D3) (addr. 2)		
No. of I/O sockets	8 x M12		
Note	The modules require two addresses.		

Order no.	3RK1400–1DQ00–0AA3	3RK1400–1CQ00–0AA3	3RK1400–1DQ01–0AA3
Slave type	Standard slave	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs / 4 outputs	4 inputs / 4 outputs	4 inputs / 4 outputs
Socket assignment	Y-II assignment	Standard assignment	Y-II assignment
AS-i slave profile IO.ID.ID2	7.F.F	7.0.F	7.F.F
ID1 code (factory setting)	F	F	F
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 270 mA
Inputs			
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA	200 mA	200 mA
Outputs			
Typ. current-carrying capacity per output: 12/13 DC	2 A	2 A	1 A
Max. total current per module	4 A	4 A	4 A
Data bit assignments			
Socket 1	PIN4 = IN1(D0) PIN2 = IN2(D1)	PIN2/4 = IN1(D0)	PIN4 = IN1(D0) PIN2 = IN2(D1)
Socket 2	PIN4 = IN2(D1)	PIN2/4 = IN2(D1)	PIN4 = IN2(D1)
Socket 3	PIN4 = IN3(D2) PIN2 = IN4(D3)	PIN2/4 = IN3(D2)	PIN4 = IN3(D2) PIN2 = IN4(D3)
Socket 4	PIN4 = IN4(D3)	PIN2/4 = IN4(D3)	PIN4 = IN4(D3)
Socket 5	PIN4 = OUT1(D0) PIN2 = OUT2(D1)	PIN4 = OUT1(D0)	PIN4 = OUT1(D0) PIN2 = OUT2(D1)
Socket 6	PIN4 = OUT2(D1)	PIN4 = OUT2(D1)	PIN4 = OUT2(D1)
Socket 7	PIN4 = OUT3(D2) PIN2 = OUT4(D3)	PIN4 = OUT3(D2)	PIN4 = OUT3(D2) PIN2 = OUT4(D3)
Socket 8	PIN4 = OUT4(D3)	PIN4 = OUT4(D3)	PIN4 = OUT4(D3)
No. of I/O sockets	8 x M12	8 x M12	8 x M12

Order no.	3RK1400–1DQ03–0AA3	3RK2400–1DQ00–0AA3	3RK2400–1FQ03–0AA3	3RK1400–1MQ00–0AA3
Slave type	Standard slave	A/B slave (Spec. 3.0)	A/B slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 3.0	AS-i Spec. 2.1	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs/ 4 outputs	4 inputs/ 4 outputs	4 inputs/ 3 outputs	4 inputs/ 2 outputs
Socket assignment	Standard	Y-II assignment	Y-II assignment	Y-II assignment
AS-i slave profile IO.ID.ID2	7.0.F	7.A.7	7.A.2	7.F.F
ID1 code (factory setting)	F	7	7	F
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 270 mA	≤ 270 mA
Inputs				
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA	200 mA	200 mA	200 mA
Outputs				
Typ. current-carrying capacity per output: 12/13 DC	1 A	2 A	2 A	2 A
Max. total current per module	4 A	4 A	4 A	4 A
Data bit assignments				
Socket 1	PIN2/4 = IN1(D0)	PIN4 = IN1(D0) PIN2 = IN2(D1)	PIN4 = IN1(D0) PIN2 = IN2(D1)	PIN4 = IN1(D0) PIN2 = IN2(D1)
Socket 2	PIN2/4 = IN2(D1)	PIN4 = IN2(D1)	PIN4 = IN2(D1)	PIN4 = IN2(D1)
Socket 3	PIN2/4 = IN3(D2)	PIN4 = IN3(D2) PIN2 = IN4(D3)	PIN4 = IN3(D2) PIN2 = IN4(D3)	PIN4 = IN3(D2) PIN2 = IN4(D3)
Socket 4	PIN2/4 = IN4(D3)	PIN4 = IN4(D3)	PIN4 = IN4(D3)	PIN4 = IN4(D3)
Socket 5	PIN4 = OUT1(D0)	PIN4 = OUT1(D0) PIN2 = OUT2(D1)	PIN4 = OUT1(D0) PIN2 = OUT2(D1)	PIN4 = OUT1(D0) PIN2 = OUT2(D1)
Socket 6	PIN4 = OUT2(D1)	PIN4 = OUT2(D1)	PIN4 = OUT2(D1)	PIN4 = OUT2(D1)
Socket 7	PIN4 = OUT3(D2)	PIN4 = OUT3(D2) PIN2 = OUT4(D3)	PIN4 = OUT3(D2)	Not assigned (sealed)
Socket 8	PIN4 = OUT4(D3)	PIN4 = OUT3(D2)	Not assigned (sealed)	Not assigned (sealed)
No. of I/O sockets	8 x M12	8 x M12	7 x M12	6 x M12

Order no.	3RK1200–0CQ00–0AA3	3RK1400–1DQ02–0AA3	3RK1100–1CQ00–0AA3
Slave type	Standard slave	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs	2 x 2 inputs / 2 x 2 outputs	4 outputs
Socket assignment	Y-II assignment	Y-II assignment	Y-II assignment
AS-i slave profile IO.ID.ID2	0.1.F	7.F.F	8.1.F
ID1 code (factory setting)	F	F	F
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 270 mA
Inputs			
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA	200 mA	200 mA
Outputs			
Typ. current-carrying capacity per output: 12/13 DC	—	1 A	2 A
Max. total current per module	—	4 A	4 A
Data bit assignments			
Socket 1	PIN4 = IN1(D0) PIN2 = IN2(D1)	PIN4 = IN1(D0) PIN2 = IN2(D1)	—
Socket 2	PIN4 = IN2(D1)	Not assigned (sealed)	—
Socket 3	PIN4 = IN3(D2) PIN2 = IN4(D3)	PIN4 = IN3(D2) PIN2 = IN4(D3)	—
Socket 4	PIN4 = IN4(D3)	Not assigned (sealed)	—
Socket 5	Not assigned (sealed)	PIN4 = OUT1(D0) PIN2 = OUT2(D1)	PIN4 = OUT1(D0) PIN2 = OUT2(D1)
Socket 6	Not assigned (sealed)	Not assigned (sealed)	PIN4 = OUT2(D1)
Socket 7	Not assigned (sealed)	PIN4 = OUT3(D2) PIN2 = OUT4(D3)	PIN4 = OUT3(D2) PIN2 = OUT4(D3)
Socket 8	Not assigned (sealed)	Not assigned (sealed)	PIN4 = OUT4(D3)
No. of I/O sockets	4 x M12	4 x M12	4 x M12

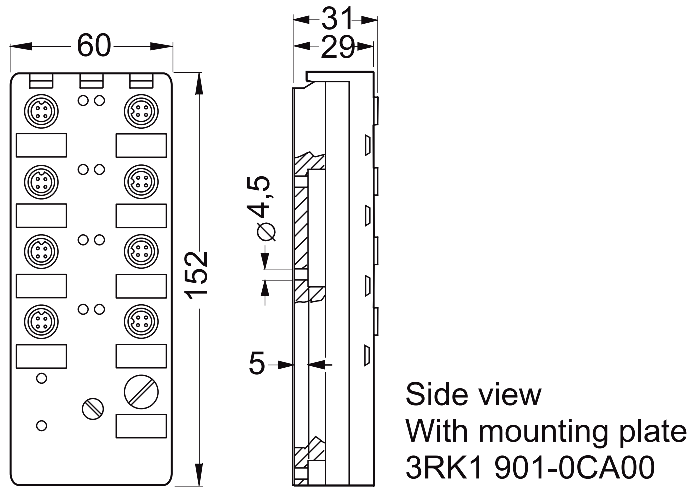
Version ATEX (Ex) II 3D X

Order no.	3RK1400–1DQ05–0AA3	3RK1200–0CQ05–0AA3
Slave type	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs / 4 outputs	4 inputs
Socket assignment	Y-II assignment	Y-II assignment
AS-i slave profile IO.ID.ID2	7.F.F	0.1.F
ID1 code (factory setting)	F	F
Total power consumption	≤ 270 mA	≤ 270 mA
Inputs		
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA	200 mA
Outputs		
Typ. current-carrying capacity per output: 12/13 DC	2 A	—
Max. total current per module	4 A	—
Data bit assignments		
Socket 1	PIN4 = IN1(D0) PIN2 = IN2(D1)	
Socket 2	PIN4 = IN2(D1)	
Socket 3	PIN4 = IN3(D2) PIN2 = IN4(D3)	
Socket 4	PIN4 = IN4(D3)	
Socket 5	PIN4 = OUT1(D0) PIN2 = OUT2(D1)	Not assigned (sealed)
Socket 6	PIN4 = OUT2(D1)	Not assigned (sealed)
Socket 7	PIN4 = OUT3(D2) PIN2 = OUT4(D3)	Not assigned (sealed)
Socket 8	PIN4 = OUT4(D3)	Not assigned (sealed)
No. of I/O sockets	8 x M12	4 x M12
Proper usage	In potentially explosive are zone 22 according to classification II 3D (dust atmosphere, non-conductive dust), shock resistance: 1 Joule; compliance with Guideline 94/9/EG (ATEX) is verified by compliance with standards EN 50281-1-1 and EN 60947-5-2	
Identification	(Ex) II 3D T75°C IP65X	(Ex) II 3D T60°C IP65X

Restrictions for safe operation	Suitable measures must be taken to protect the module against mechanical damage. All M12 connectors are protected against unauthorized removal by means of a safety clip, whereby the connectors can only be removed by destroying the safety clip. A suitable safety clip is available from Binder GmbH + Co., Elektrische Bauelemente KG, P.O. Box 1152, 74148 Neckarsulm, Tel. 07132/325-0, Fax 07132/325-150, info@binder-connector.de, article no. 16-0977-000. All unassigned M12 sockets must be sealed using screw caps 3RK1 901-1KA01 (tamper-proof version) in such a way that they cannot be removed by hand. The module can only be addressed using addressing unit 3RK1 904-2AB01 outside potentially explosive zone 22. Once the module has been addressed, the addressing socket must be sealed using the screw cap provided (3RK1 901-1KA01 (tamper-proof version)) in such a way that it cannot be removed by hand. If an additional power supply (AUX POWER) is required, it must comply with VDE 0106 (PELV), protection class III.
Installation and commissioning	The devices are permitted for use in temperatures of between –25 and +85°C. The devices must only be set up, connected, and commissioned by qualified specialists. Improper conduct can result in serious personal and/or material damage. Knowledge of the classification assignments to the permitted potentially explosive areas is essential. Plug-in connections and AS-Interface cables must not be connected/disconnected when the system is live. The devices are maintenance free. No modifications or repairs must be made to the devices. All the relevant points outlined in this document must be observed when the devices are replaced. See also installation regulations EN 60079-14 / EN 50281-1-2.

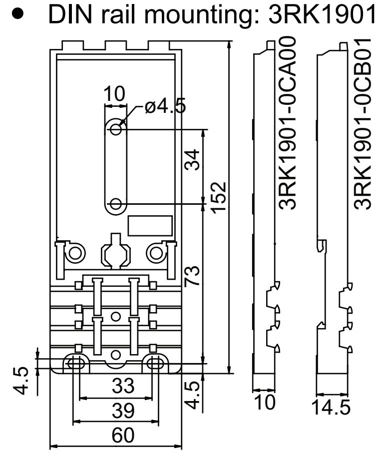
8.4.1.6 Dimension drawings

K60 compact module



K60 mounting plates

- Wall mounting: 3RK1901-0CA00
- DIN rail mounting: 3RK1901-0CB01



8.4.2 Digital input/output modules K60R - panel IP68 / IP69K

8.4.2.1 Overview

Modules with a degree of protection IP67 are not suitable for use in areas subject to continuously high levels of humidity (e.g. when drilling emulsions, cutting oils, or high-pressure cleaners are used). Instead, the K60R compact module with degree of protection IP68/IP69K is the ideal solution here.

IP68/IP69K tests

The K60R modules are subject to the following tests:

- More stringent test than IP67:
  90 min at a depth of 1.8 m in water (IP67: 30 min at a depth of 1 m in water)
- Salt water test:
  immersed in salt water for five months, at a depth of 20 cm at room temperature
- Test with oil highly prone to creep:
  five months fully immersed in oil at room temperature
- Test with drilling emulsion:
  five months at room temperature (constituents of drilling emulsion: anionic and non-ionic emulsifiers, paraffined, low-aroma mineral oil, boric acid alkanolamines, corrosion inhibitors, oil content: 40 %)
- Test in oil bath (oil: Excelence 416) with fluctuating temperature of the oil bath:
  130 cycles at 15 to 55°C, two months
- Cleaning with high-pressure cleaner to IP69K:
  80 to 100 bar, distance of 10 to 15 cm, time per side > 30 sec, water temperature: 80°C

To simulate requirements as realistically as possible, the modules were artificially aged by subjecting them to 15 temperature cycles at -25/+85°C prior to the tests. During the tests, the modules were connected with 3RX1 connection cables. Unassigned connections were sealed with screw caps (3RK1 901-1KA00).

8.4.2.2 Order numbers

K60R compact modules

Inputs/outputs	Type	Assignment	Order no.
4 inputs / 4 outputs	Standard slave	Standard assignment	3RK1400-1CR00-0AA3

Accessories

Name	Comments	Order no.
K60 mounting plate	For wall mounting	3RK1901-0CA00
K60 mounting plate	For DIN rail mounting	3RK1901-0CB01
Screw cap M12	For IP67 modules	3RK1901-1KA00
4 x M12 branch AS-i and U_{AUX}	4 x M12 socket IP67 (delivery incl. coupling module)	3RK1901-1NR00
M12 branch AS-i and U_{AUX}	With M12 socket IP67/68/69K, max. 4 A	3RK1901-1NR20
M12 branch AS-i and U_{AUX}	1 m cable with M12 angle plug IP67/68/69K, max. 4 A	3RK1901-1NR21
M12 branch AS-i and U_{AUX}	2 m cable with M12 angle plug IP67/68/69K, max. 4 A	3RK1901-1NR22
Addresing cable M12	For addressing unit 3RK1904-2AB00	3RK1901-3RA00
IP68 T-distributor AS-i + 24 V DC	For M12 round cable 1 X M12 connector , 2 X M12 box	3RK1901-1TR00

8.4.2.3 Connection

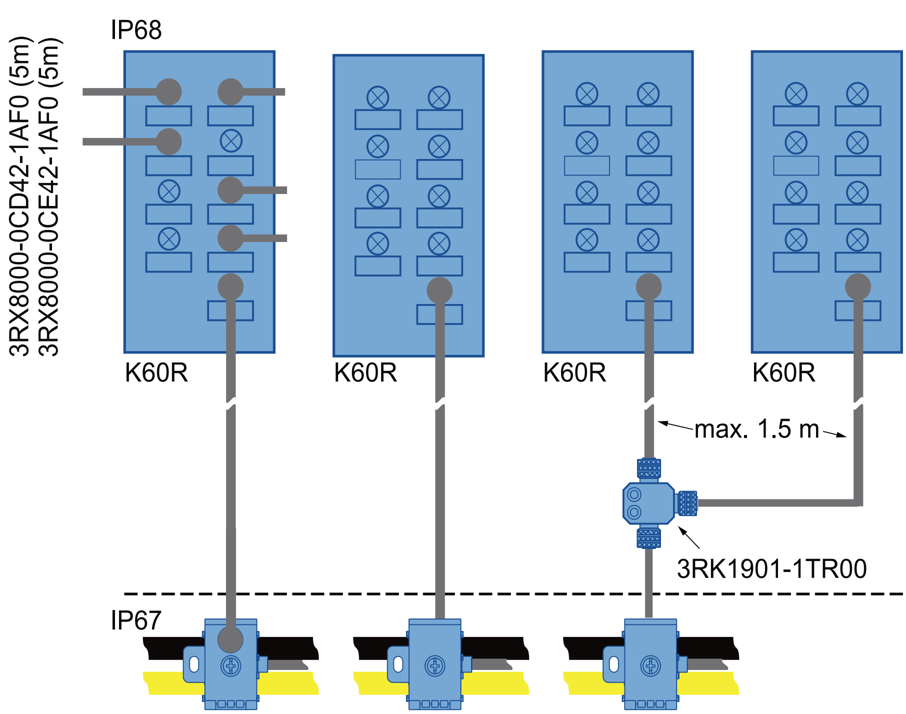


Figure 8-2 K60R connection variants

In the IP67 environment, the standard components are connected by means of flat ribbon cables. Spur lines are branched to the IP68 environment via an AS-Interface M12 branch (3RK1901-1NR..). The module is connected by means of round cables with an M12 cable plug. Instead of an addressing socket, the module is now equipped with an M12 bus connection for this purpose. The AS-Interface bus cable and 24 V DC auxiliary voltage are both routed in a 4-pole round cable, which must not contain a grounding conductor. The ground connection is established via the mounting plate.

Only cables with integral M12 connectors can be used in the IP68 environment. Prefabricated versions of these cables are available as M12 cable connectors/plugs:

- 3RX8000-0GF42-1AA6: 0.5 m long
- 3RX8000-0GF42-1AB0: 1.0 m long
- 3RX8000-0GF42-1AB5: 1.5 m long

The maximum length of the cable between the IP68 T-distributor and the module must not exceed 1.5 m.

When longer cables are required to connect the distributor and K60R module, cables that can be cut as required and have an M12 cable plug and open cable end can be used, fitted with an M12 connector (straight: 3RX8000-0CD45; angle: 3RX8000-0CE45) and connected to the distributor. Two different versions of this cable are available:

- 3RX8000-0CB42-1AF0: 5 m long, with M12 cable plug
- 3RX8000-0CC42-1AF0: 5 m long, with M12 angle cable plug

If more than one K60R module is to be connected to a spur line, they can be distributed further by means of a T-distributor (3RK1901-1TR00) with degree of protection IP68.

The following general conditions must be taken into account:

- The installation guidelines for AS-Interface must always be observed. The max. permissible current for all M12 connection cables is restricted to 4 A. The cross-section of these cables is only 0.34 mm². To connect the K60R modules, the M12 connection cables mentioned above can be used for the spur lines. The voltage drop induced by the ohmic resistance (approx. 0.11 Ω/m) must be taken into account.
- The following maximum lengths apply to round cable connections whereby AS-i and U_{AUX} are routed in the same cable:
  - For each spur line from the branch to the module: max. 5 m
  - Total of round cable components in one AS-Interface network: max. 20 m

Note

Screw caps and M12 connections must be tightened with the correct torque.

8.4.2.4 Diagnostics

LEDs for AS-i and FAULT

The module has two LEDs for AS-i and FAULT for diagnostic purposes; see LED status displays for modules with two LEDs for AS-i and FAULT (Page 173) .

LED display AUX POWER

The module also has an LED for AUX POWER; for a description, see LED status display AUX POWER for modules with auxiliary voltage (Page 175).

Status display for the switching state

The switching state of the AS-i inputs and outputs is indicated by a yellow LED; see LED status display for the switching state (yellow) (Page 175).

8.4.2.5 Technical specifications

K60R compact module

Order no.	3RK1400-1CR00-0AA3
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs / 4 outputs
Socket assignment	Standard assignment
AS-i slave profile IO.ID.ID2	7.0.F
ID1 code (factory setting)	F
Operating voltage in acc. with AS-Interface Specification	26.5 to 31.6 V
Total power consumption	≤ 270 mA
Inputs	
Input circuit	PNP
Sensor supply via AS-Interface	Short circuit and overload proof
Sensors	2 and 3 conductors
Voltage range	20 to 30 V
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA
Switching level - high	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 6 mA
Outputs	
Output type	Electronic

Order no.		3RK1400-1CR00-0AA3
Current-carrying capacity on each output 12/13 DC		Typ. 2 A
Max. total current for each module		4 A
Short-circuit protection		Integrated
Inductive interference protection		Integrated
External 24 V DC power supply		Joint round cable connection with AS-Interface connection via M12 socket contact
Watchdog		Integrated
Assignment of the data bits		
Socket 1 Socket 2 Socket 3 Socket 4 Socket 5 Socket 6 Socket 7 Socket 8		PIN2/4 = IN1(D0) PIN2/4 = IN2(D1) PIN2/4 = IN3(D2) PIN2/4 = IN4(D3) PIN4 = OUT1(D0) PIN4 = OUT2(D1) PIN4 = OUT3(D2) PIN4 = OUT4(D3)
AS-Interface certificate		Available
Approvals		UL, CSA, shipbuilding
Degree of protection		IP68/IP69K with mounting plate 3RK1901-0CA00 IP68 test conditions: see "IP68/IP69K tests" (Page 186). The degree of protection is only achieved when all of the M12 connections are tightened with the correct torque. I/O sockets that are not required must be sealed with screw caps (3RK1 901-1KA00).
Ground connection		PIN5 of each M12 socket is connected to the earthing clamp in the mounting plate by means of a pin.
Ambient temperature	°C	–25 to +85
Storage temperature	°C	–40 to +85
No. of I/O sockets		8 x M12
Status displays		
I/O display		LED yellow
Display U_{AUX}		LED green
AS-Interface/diagnostics display		LED green/red

Note

An external additional power supply (AUX POWER) of between 20 and 30 V DC is required for supplying the output circuits. The additional power supply must comply with VDE 0106 (PELV), protection class III.

8.4.2.6 Dimension drawings

K60R compact module

The dimensions of the K60R compact modules are the same as those of the standard K60 compact modules.

The mounting plates for the K60 modules can also be used for the K60R modules.

8.4.3 K60 compact module data coupler - panel IP67

8.4.3.1 Overview

This module is equipped with two AS-i slaves that are connected to two different AS-i networks. Each of the two integrated slaves has four virtual inputs and four virtual outputs. This is the easiest and most cost-effective way of enabling the bidirectional transfer of four data bits between two AS-i networks. The data coupler requires an address in each AS-i network.

Depending on the number of nodes, each AS-i network functions with a different cycle time, which means that the two AS-i networks are never synchronous. For this reason, only standard data and not safety-oriented data (ASIsafe) can be transferred via the AS-i data coupler.

The two AS-i networks are electrically isolated in the device.

The output bits from AS-i network 1 are read as input bits in AS-i network 2 (and vice versa). The statuses of the outputs are indicated by LEDs.

NOTICE
Two AS-i networks **must not be** electrically connected.

8.4.3.2 Order numbers

K60 compact module data coupler

MLFB	Inputs/outputs	Type	Assignment
3RK408–8SQ00–0AA3	4 inputs / 4 outputs (virtual)	Standard slave	—

Accessories

MLFB	Name	Comments
3RK1 901-0CA00	K60 mounting plate	For wall mounting
3RK1 901-0CB01	K60 mounting plate	For DIN rail mounting

8.4.3.3 Connection

The device is connected via the AS-i cables for the two AS-i networks.

The yellow shaped cable from AS-i network 1 is fed into the upper cutout ("AS-i") on the mounting plate.

The yellow shaped cable from AS-i network 2 is fed into the lower cutout (reserved for "AUX POWER" on other K60 modules) on the mounting plate.

A black shaped cable (24 V DC) is not required.

No actuators or sensors are connected to the data coupler.

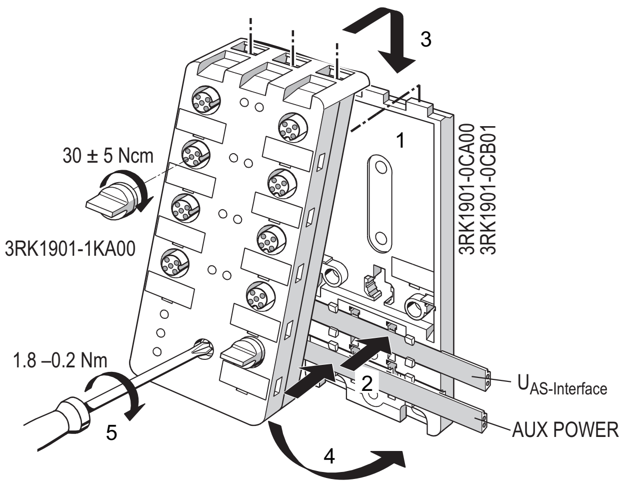


Figure 8-3 K60 data coupler: connecting the AS-i shaped cable

See the table below for the data bit assignments:

Slave in AS-i network 1	Slave in AS-i network 2
D0 (OUT)	D0 (IN)
D1 (OUT)	D1 (IN)
D2 (OUT)	D2 (IN)
D3 (OUT)	D3 (IN)
D0 (IN)	D0 (OUT)
D1 (IN)	D1 (OUT)
D2 (IN)	D2 (OUT)
D3 (IN)	D3 (OUT)

8.4.3.4 Diagnostics

LEDs for AS-i/FAULT1 and AS-i/FAULT2

For diagnostic purposes, the module has two dual LEDs for AS-i/FAULT, which indicate the status of the two AS-i buses; see LED status displays for modules with a dual LED for AS-i/FAULT (Page 174) .

Status display for the switching state

The switching state of the AS-i inputs and outputs is indicated by a yellow LED; see LED status display for the switching state (yellow) (Page 175).

8.4.3.5 Technical specifications

K60 compact module data coupler

Each of the two integrated slaves has the following technical specifications:

Order no.	3RK1408-8SQ00-0AA3
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs/ 4 outputs (virtual)
Socket assignment	—
AS-i slave profile IO.ID.ID2	7.F.F
ID1 code (factory setting)	F
Total power consumption	≤ 70 mA

8.4.3.6 Dimension drawings

K60 compact module data coupler

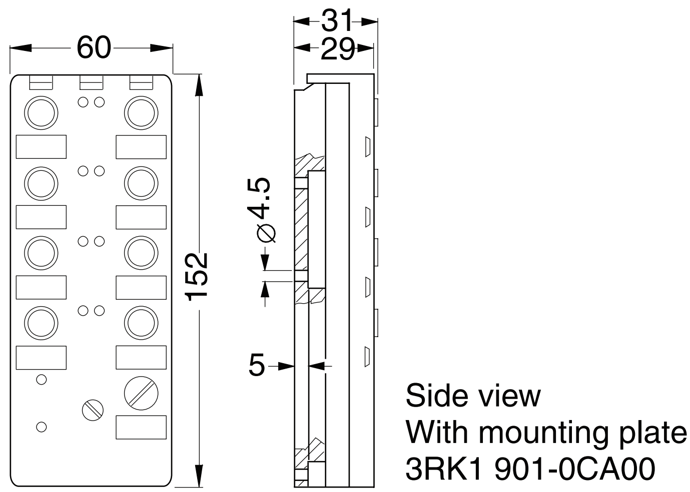


Figure 8-4 K60 compact module data coupler

K60 mounting plates

- Wall mounting: 3RK1901-0CA00
- DIN rail mounting 3RK1901-0CB01

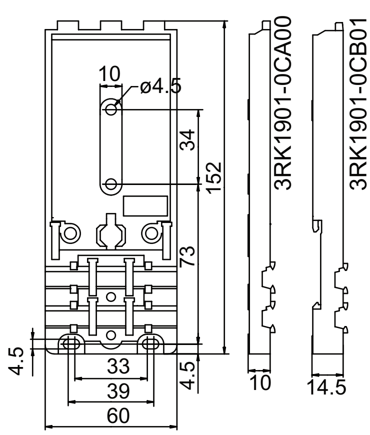


Figure 8-5 K60 mounting plates

8.4.4 Digital K45 input/output modules - field IP67

8.4.4.1 Overview

The range of 'large' K60 compact modules now includes the K45 compact module series to extend the lower end of the product range.

The K45 modules, which are significantly smaller, offer all the existing benefits of the K60 compact modules. They have the same surface area as the user modules. The installation depth, however, is just 2/3 of that of the user module, which makes it the perfect complement to the range of compact modules.

Despite its small size, however, all the modules feature easy-to-read labeling strips and an integrated addressing socket.

- K45 compact modules with four digital inputs.
  These compact modules house the communications electronics and standard M12 connections or M8 screw-type or snap-on connections for the inputs. Up to four sensors can be connected to the compact module.
- K45 compact modules with max. four digital outputs.
  These modules have up to four digital outputs with an M12 connector.
- K45 compact modules with two digital inputs and outputs.
  These modules each have two digital inputs and outputs with an M12 connector.

K45 compact modules are available as standard or A/B slaves.

8.4.4.2 Order numbers

K45 compact modules

Inputs/outputs	Type	Assignment	Connection	MLFB
4 inputs	Standard slave	Standard assignment	M12	3RK1200-0CQ20-0AA3
4 inputs	Standard slave	Standard assignment	M8 screw	3RK1200-0CT20-0AA3
4 inputs	Standard slave	Standard assignment	M8 snap-on	3RK1200-0CU20-0AA3
4 inputs	A/B slave	Standard assignment	M12	3RK2200-0CQ20-0AA3
4 inputs	A/B slave	Standard assignment	M8 screw	3RK2200-0CT20-0AA3
4 inputs	A/B slave	Standard assignment	M8 snap-on	3RK2200-0CU20-0AA3
2x2 inputs	A/B slave	Y assignment	M12	3RK2200-0CQ22-0AA3
2 inputs / 2 outputs	Standard slave	Standard assignment	M12	3RK1400-1BQ20-0AA3
2 x (1 input / 1 output)	Standard slave	Y assignment	M12	3RK1400-0GQ20-0AA3
4 outputs	Standard slave	Standard assignment	M12	3RK1100-1CQ20-0AA3
3 outputs	A/B slave	Standard assignment	M12	3RK2100-1EQ20-0AA3
2 outputs / 2 inputs	A/B slave	Standard assignment	M12	3RK2400-1BQ20-0AA3

Accessories

MLFB	Designation	Comments
3RK1901-2EA00	K45 mounting plate	Wall mounting
3RK1901-2DA00	K45 mounting plate	DIN rail mounting:

8.4.4.3 Connection

For information on connecting the AS-i bus and auxiliary voltage U_{AUX} as well as the actuators and sensors, see Connection (Page 166).

8.4.4.4 Diagnostics

LED for AS-i/FAULT

The module has one dual LED for AS-i/FAULT for diagnostic purposes; see LED status displays for modules with a dual LED for AS-i/FAULT (Page 174) .

LED display AUX POWER

The module also has an LED for AUX POWER; for a description, see LED status display AUX POWER for modules with auxiliary voltage (Page 175).

Status display for the switching state

The switching state of the AS-i inputs and outputs is indicated by a yellow LED; see LED status display for the switching state (yellow) (Page 175).

8.4.4.5 Technical specifications

K45 compact modules

Joint technical specifications of the digital I/O modules IP67 – K45	
Operating voltage in acc. with AS-Interface Specification	26.5 to 31.6 V
Reverse polarity protection U_{AS-i}	Integrated
Input circuit	PNP
Inputs	
Sensor supply via AS-Interface	Short circuit and overload proof
Sensors	2 and 3 conductors
Voltage range	20 to 30 V [1)]
Switching level - high	≥ 1 V
Input current low/high	≤ 1.5 / ≥ 6 mA
Outputs	
Output type	Electronics
Short-circuit protection	Integrated
Inductive interference protection	Integrated
External 24 V DC power supply	Via black AS-Interface flat cable
Watchdog	Integrated
AS-Interface certificate	Available (or planned for new devices)
Approvals	UL, CSA, shipbuilding (or planned for new devices)
Degree of protection	IP67 (IP65 with M8 snap-on connection)
Ground connection	Via PIN5 on M12 sockets and outgoing feeder via 2.8 mm flat connector (no ground connection on M8 sockets)
Ambient temperature	–25 to +85 °C
Storage temperature	–40 to +85 °C
Connection	Via the mounting plate for compact module K45
1) For 3RK2 400-1BQ20-0AA3 Umin = 16.5 V	

Note

An external additional power supply (AUX POWER) of between 20 and 30 V DC is required for supplying the output circuits. The additional power supply must comply with VDE 0106 (PELV), protection class III.

Order no.	3RK1200-0CQ20-0AA3	3RK1200-0CT20-0AA3	3RK1200-0CU20-0AA3
Slave type	Standard slave	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs	4 inputs	4 inputs
Socket assignment	Standard assignment	Standard assignment	Standard assignment
AS-i slave profile IO.ID.ID2	0.0.F	0.0.F	0.0.F
ID1 code (factory setting)	F	F	F
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 270 mA
Inputs			
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA	200 mA	200 mA
Assignment of the data bits			
Socket 1	PIN4/2 = IN1(D0)	PIN4 = IN1(D0)	PIN4 = IN1(D0)
Socket 2	PIN4/2 = IN2(D1)	PIN4 = IN2(D1)	PIN4 = IN2(D1)
Socket 3	PIN4/2 = IN3(D2)	PIN4 = IN3(D2)	PIN4 = IN3(D2)
Socket 4	PIN4/2 = IN4(D3)	PIN4 = IN4(D3)	PIN4 = IN4(D3)
No. of I/O sockets	4 x M12	4 x M8 screw locking	4 x M8 snap locking

Order no.	3RK2200-0CQ20-0AA3	3RK2200-0CT20-0AA3	3RK2200-0CU20-0AA3
Slave type	A/B slave	A/B slave	A/B slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.1	AS-i Spec. 2.1	AS-i Spec. 2.1
No. of inputs/outputs	4 inputs	4 inputs	4 inputs
Socket assignment	Standard assignment	Standard assignment	Standard assignment
AS-i slave profile IO.ID.ID2	0.A.0	0.A.F	0.A.0
ID1 code (factory setting)	7	7	7
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 270 mA
Inputs			
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA	200 mA	200 mA
Assignment of the data bits			
Socket 1	PIN4/2 = IN1(D0)	PIN4 = IN1(D0)	PIN4 = IN1(D0)
Socket 2	PIN4/2 = IN2(D1)	PIN4 = IN2(D1)	PIN4 = IN2(D1)
Socket 3	PIN4/2 = IN3(D2)	PIN4 = IN3(D2)	PIN4 = IN3(D2)
Socket 4	PIN4/2 = IN4(D3)	PIN4 = IN4(D3)	PIN4 = IN4(D3)
No. of I/O sockets	4 x M12	4 x M8 screw locking	4 x M8 snap locking

Order no.	3RK2200-0CQ22-0AA3	3RK1400-1BQ20-0AA3	3RK1400-0GQ20-0AA3
Slave type	A/B slave	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.1	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	2 x 2 inputs	2 inputs / 2 outputs	2 x (1 input / 1 output)
Socket assignment	Y assignment	Standard assignment	Y assignment
AS-i slave profile IO.ID.ID2	0.A.2	3.0.F	3.F.F
ID1 code (factory setting)	7	F	F
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 270 mA
Inputs			
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA	200 mA	200 mA 2)
Outputs			
Typ. current-carrying capacity per output: 12/13 DC	—	2 A 1)	0.2 A 2)
Max. total current for each module	—	3 A	0.2 A 2)
Reverse polarity protection U_{AUX}	N/A	By means of coding	U_{AUX} not required
Assignment of the data bits			
Socket 1	PIN4 = IN1(D0) PIN2 = IN2(D1)	PIN4/2 = IN1(D0)	PIN4 = IN1(D0) PIN2 = OUT3(D2)
Socket 2	—	PIN4/2 = IN2(D1)	—
Socket 3	—	PIN4 = OUT3(D2)	—
Socket 4	PIN4 = IN3(D2) PIN2 = IN4(D3)	PIN4 = OUT4(D3)	PIN4 = IN2(D1) PIN2 = OUT4(D3)
No. of I/O sockets	2 x M12	4 x M12	2 x M12

1) With version "E12", the typical current-carrying capacity per output increases from 1.5 to 2 A
2) Aggregate current for all inputs and outputs: max. 200 mA.

Order no.	3RK1100-1CQ20-0AA3	3RK2100-1EQ20-0AA3	3RK2400-1BQ20-0AA3
Slave type	Standard slave	A/B slave	A/B slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.1	AS-i Spec. 2.1
No. of inputs/outputs	4 outputs	3 outputs	2 outputs / 2 inputs
Socket assignment	Standard assignment	Standard assignment	Standard assignment
AS-i slave profile IO.ID.ID2	8.0.F	8.A.0	B.A.0
ID1 code (factory setting)	F	7	7
Total power consumption	≤ 45 mA	≤ 45 mA	≤ 270 mA
Inputs			
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA	200 mA	200 mA
Outputs			
Typ. current-carrying capacity per output: 12/13 DC	1 A	1 A	2 A
Max. total current for each module	3 A	3 A	3 A
Reverse polarity protection U_{AUX}	By means of coding	By means of coding	By means of coding
Assignment of the data bits			
Socket 1	PIN4 = OUT1(D0)	PIN4 = OUT1(D0)	PIN4/2 = IN3(D2)
Socket 2	PIN4 = OUT2(D1)	PIN4 = OUT2(D1)	PIN4/2 = IN4(D3)
Socket 3	PIN4 = OUT3(D2)	PIN4 = OUT3(D2)	PIN4 = OUT1(D0)
Socket 4	PIN4 = OUT4(D3)	Not available	PIN4 = OUT2(D1)
No. of I/O sockets	4 x M12	3 x M12	4 x M12

8.4.4.6 Dimension drawings

K45 compact modules

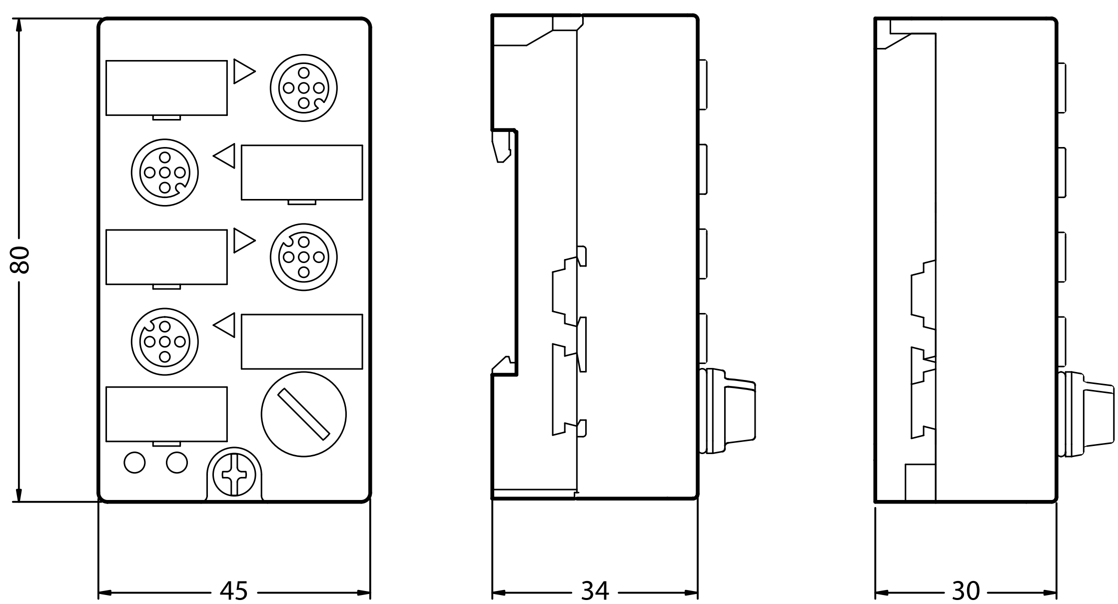


Figure 8-6 Dimensions of the K45 compact module

K45 mounting plates

- DIN rail mounting:
- Wall mounting

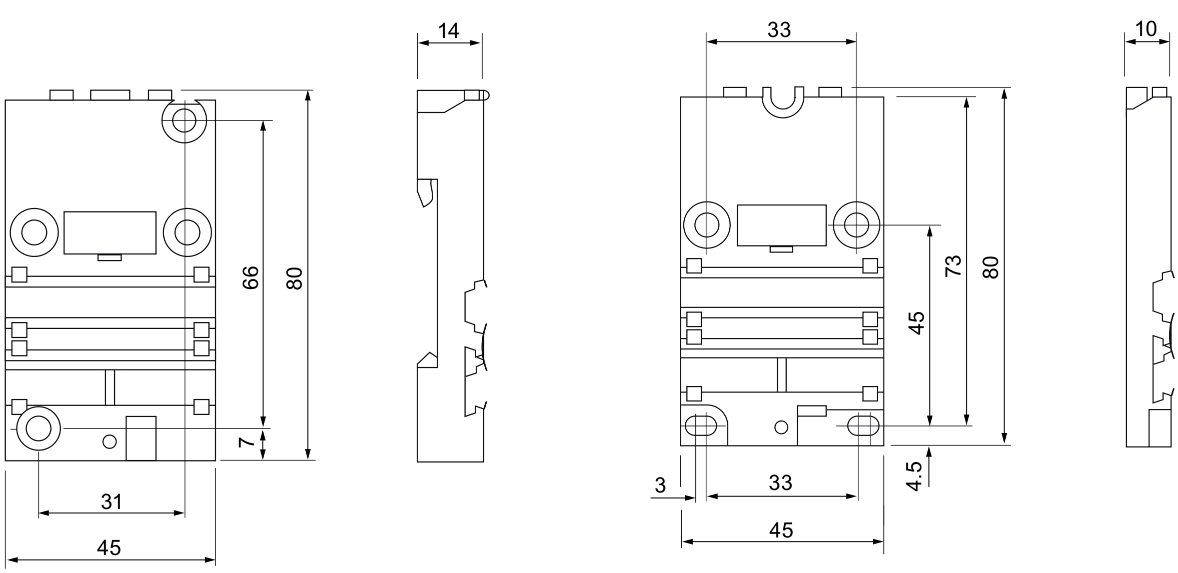


Figure 8-7 K45 mounting plates (DIN rail mounting on left, wall mounting on right)

8.4.5 Digital K20 input/output modules - field IP67

8.4.5.1 Overview

K20 compact modules

The range of AS-Interface compact modules has now been extended to include the K20 compact modules which, with a width of just 20 mm, are characterized by their slimline design. Due to their small dimensions, these modules are particularly suitable for applications involving industrial robots in production engineering where space for the modules is extremely limited.

The K20 modules are connected to AS-Interface using a round cable with an M12 cable plug instead of the AS-Interface flat ribbon cable. The AS-Interface bus cable and 24 V DC auxiliary supply are routed in a joint round cable, which allows for an extremely compact design.

Since the round cable is so flexible, the modules can also be easily installed on moving machine parts, an application for which they are particularly suitable because their non-encapsulated design makes them extremely light.

When ground cables are used, many users choose to lay the AS-Interface bus cable in a round cable. In this case, K20 modules can be connected directly to the round cable. An adapter from the flat ribbon cable to the round cable is not required.

The range of K20 compact modules comprises not only standard AS-Interface modules but also an ASIsafe version for connecting safety-oriented sensors (e.g. EMERGENCY STOP buttons or protective door monitoring). As far as is technically feasible, all AS-Interface K20 modules support the extended address mode (A/B addresses) in accordance with AS-Interface Specification 2.1, which allows 62 nodes to be connected to an AS-Interface network. In extended address mode, the K20 module with four inputs and four outputs operates in accordance with AS-Interface Specification 3.0 which, for the first time, also permits four outputs for an A/B slave and, in turn, 248 inputs and 248 outputs in the maximum configuration of an AS-i network.

To save even more space, the sensors and actuators can be connected via M8 connectors. Alternatively, an M12 connection with a Y assignment is also available.

Installation

The K20 modules are secured with two screws. A mounting plate is not required. The modules can be installed not only on the front but also on the side, which saves space and provides them with additional protection (e.g. on DIN rails).

8.4.5.2 Order numbers

K20 compact modules

Inputs/outputs	Type	Assignment	Connection	Order no.
4 inputs / 4 outputs	Standard slave	Standard assignment	8 x M8	3RK1400-1CT30-0AA3
4 inputs	A/B slave	Y assignment	2 x M12	3RK2200-0CQ30-0AA3
4 inputs	A/B slave	Standard assignment	4 x M8	3RK2200-0CT30-0AA3
2 inputs / 2 outputs	A/B slave	Y assignment	2 x M12	3RK2400-1BQ30-0AA3
2 inputs / 2 outputs	A/B slave	Standard assignment	4 x M8	3RK2400-1BT30-0AA3
4 inputs / 4 outputs	A/B slave (Spec. 3.0)	Standard assignment	8 x M8	3RK2400-1CT30-0AA3

Accessories

Name	Comments	Order no.
M12 screw cap for IP67 modules	AS-Interface accessories	3RK1901-1KA00
M8 screw cap for IP67 modules	AS-Interface accessories	3RK1901-1PN00
AS-Interface distributor (standard) for AS-I shaped cable	Distribution function, isolating function, sealing function (M.SEP. seal) IP67, max. 7 A incl. mounting plate	3RK1901-1NN00
AS-Interface distributor (compact) for AS-I shaped cable	Distribution function, isolating function, IP 67/68/69K, max. 6 A	3RK1901-1NN10
AS-Interface 4 x M12 branch AS-i and U_{AUX}	4 x M12 socket IP67 (delivery incl. coupling module)	3RK1901-1NR00
AS-Interface M12 branch AS-i without U_{AUX}	With M12 socket IP67/68/69K, max. 4 A	3RK1901-1NR10
AS-Interface M12 branch AS-i without U_{AUX}	1 m cable with M12 angle plug IP67/68/69K, max. 4 A	3RK1901-1NR11
AS-Interface M12 branch AS-i without U_{AUX}	2 m cable with M12 angle plug IP67/68/69K, max. 4 A	3RK1901-1NR12
AS-Interface M12 branch AS-i and U_{AUX}	With M12 socket IP67/68/69K, max. 4 A	3RK1901-1NR20
AS-Interface M12 branch AS-i and U_{AUX}	1 m cable with M12 angle plug IP67/68/69K, max. 4 A	3RK1901-1NR21
AS-Interface M12 branch AS-i and U_{AUX}	2 m cable with M12 angle plug IP67/68/69K, max. 4 A	3RK1901-1NR22
IP68 T-distributor AS-i + 24 V DC for M12 round cable 1 x M12 connector	AS-Interface accessories, 2 x M12 box	3RK1901-1TR00
Addressing cable M12 for addressing unit 3RK1904-2AB00	AS-Interface accessories	3RK1901-3RA00
AS-Interface transition from AS-i cable to M12 socket	—	3RX9801-0AA00
SIMATIC DP, Y connector for distr. I/O ET 200X	For double connection of I/O by means of single cable to ET 200X 5-pin M12	6ES7194-1KA01-0XA0

8.4.5.3 Setting the AS-i address

The K20 modules are addressed via the same socket as for the bus connection. The module is addressed by connecting it to the addressing unit (e.g. 3RK1 904-2AB01) with a standard M12 connection cable (2 or 3-pin) (e.g. 3RX8 000-0GF32-1AB5). If the older version of the addressing unit (3RK1 904-2AB00) is used, a special addressing cable (3RK1 901-3RA00) is required to connect the module to the addressing unit. Once the address has been set, the addressing cable is unplugged and the module is connected to the bus cable. Four or five-pin connection cables must not be used for addressing purposes.

As far as technically possible, all K20 modules (not ASIsafe versions) support extended address mode and can be addressed with an A or a B address. In this way, up to 62 slaves can be connected to an AS-Interface network. The version with four inputs and four outputs (3RK2 400-1CT30-0AA3) functions in accordance with the new AS-Interface Specification 3.0, which means that A/B slaves can use four outputs (instead of just three as is the case with Specification 2.1). Note, however, that this module can only be operated with a new master in accordance with AS-Interface Specification 3.0 (e.g. new DP/AS-i LINK Advanced) and the cycle times for the outputs in this case can reach a maximum of 20 ms.

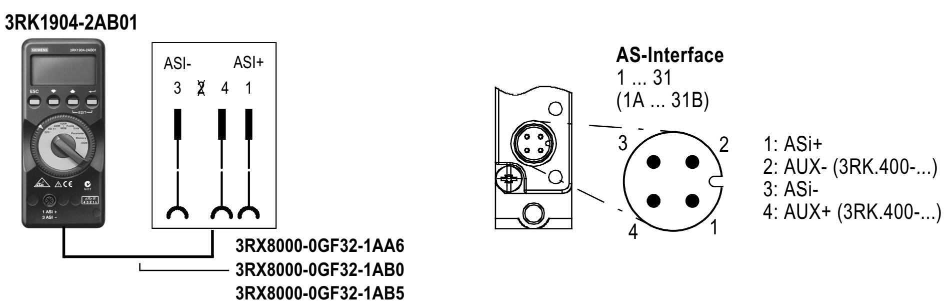
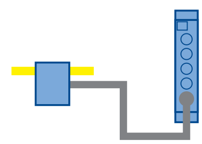
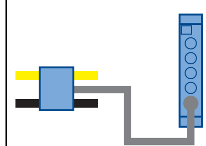
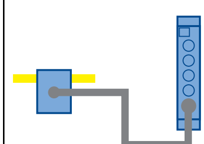
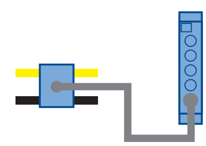
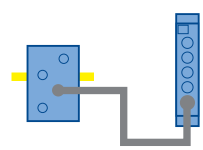
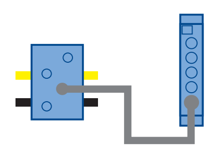


Figure 8-8 K20 addressing

8.4.5.4 Connection

The different methods of connecting the K20 modules to the AS-Interface bus cable and the 24 V DC auxiliary voltage are shown in the following table:

K20 module	Digital I/O modules IP67 – K20	
	AS-i without Uaux	AS-i with Uaux
Plus M12 branch with integral cable	 3RK1901-1NR11 (1 m) 3RK1901-1NR12 (2 m)	 3RK1 901-1NR11 (1 m) 3RK1 901-1NR12 (2 m)
Plus M12 branch with socket Plus separate M12 cable [1)]	 3RX9 801-0AA00 3RK1 901-1NR10	 3RK1 901-1NR20
Plus 4 x M12 branch Plus separate M12 cable [1)]	 3RK1 901-1NR00	 3RK1 901-1NR00

1) Prefabricated versions of these cables are available as M12 cable connectors/plugs:

3RX8000-0GF42-1AA6: 0.5 m long

3RX8000-0GF42-1AB0: 1.0 m long

3RX8000-0GF42-1AB5: 1.5 m long

When longer cables are required to connect the distributor and module, cables that can be cut as required and have an M12 cable plug and open cable end can be used, fitted with an M12 connector (straight: 3RX8000-0CD45; angle: 3RX8000-0CE45) and connected to the distributor. Two different versions of this cable are available:

3RX8000-0CB42-1AF0: 5 m long, with M12 cable plug

3RX8000-0CC42-1AF0: 5 m long, with M12 angle cable plug

Connection examples for K20 modules

The following general conditions must be taken into account:

- The installation guidelines for AS-Interface must always be observed. The max. permissible current for all M12 connection cables is restricted to 4 A. The cross-section of these cables is only 0.34 mm². To connect the K20 modules, the M12 connection cables mentioned above can be used for the spur lines. The voltage drop induced by the ohmic resistance (approx. 0.11 Ω/m) must be taken into account.
- The following maximum lengths apply to round cable connections whereby AS-i and UAUX are carried in the same cable:
  - For each spur line from the branch to the module: max. 5 m
  - Total of round cable components in one AS-Interface network: max. 20 m

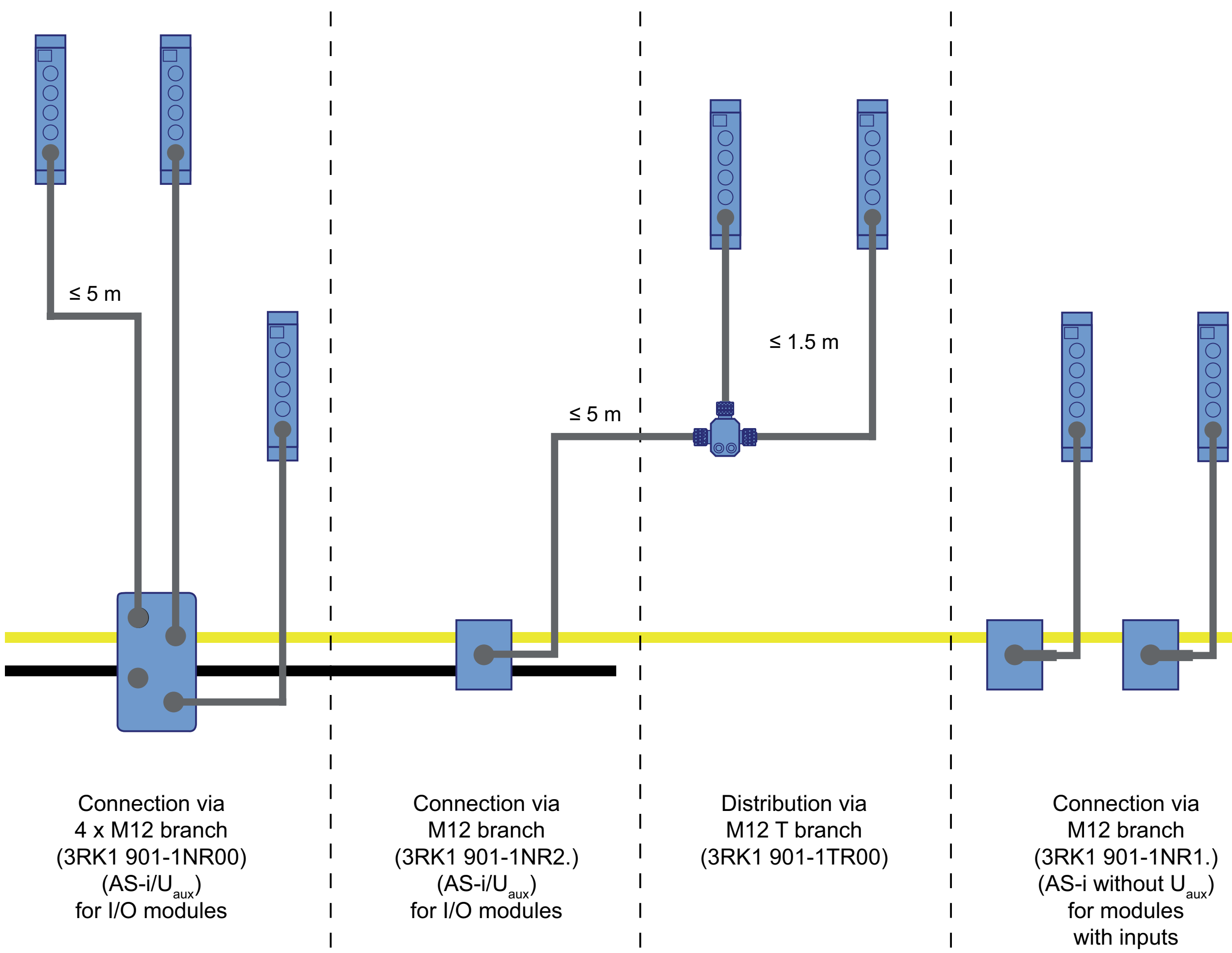


Figure 8-9 K20 connection examples

Figure 8-10 AS-Interface M12 branches and distributor (closed)

Figure 8-11 AS-Interface M12 branches and distributor (open)

8.4.5.5 Diagnostics

LED for AS-i/FAULT

The module has one dual LED for AS-i/FAULT for diagnostic purposes; see LED status displays for modules with a dual LED for AS-i/FAULT (Page 174)

LED display AUX POWER

The module also has an LED for AUX POWER; for a description, see LED status display AUX POWER for modules with auxiliary voltage (Page 175).

Status display for the switching state

The switching state of the AS-i inputs and outputs is indicated by a yellow LED; see LED status display for the switching state (yellow) (Page 175).

8.4.5.6 Technical specifications

Order no.	3RK2200-0CT30-0AA3	3RK2200-0CQ30-0AA3	3RK2400-1BT30-0AA3
Slave type	A/B slave	A/B slave	A/B slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.1	AS-i Spec. 2.1	AS-i Spec. 2.1
No. of inputs/outputs	4 inputs	4 inputs	2 inputs / 2 outputs
AS-i slave profile IO.ID.ID2	0.A.0	0.A.2	B.A.0
ID1 code (factory setting)	7	7	7
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 270 mA
Inputs			
Input circuit	PNP	PNP	PNP
Current-carrying capacity for all inputs (T_U ≤ 40°C)	200 mA	200 mA	150 mA
Current-carrying capacity for all inputs (T_U ≤ 55 °C)	150 mA	150 mA	70 mA
Switching level - high	≥ 10 V	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 6 mA	≤ 1.5 / ≥ 6 mA	≤ 1.5 / ≥ 6 mA
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof	Short circuit and overload proof
Sensors	2 and 3 conductors	2 and 3 conductors	2 and 3 conductors
Voltage range	16.5 to 30 V	16.5 to 30 V	16.5 to 30 V
Outputs			
Output type	—	—	Electronic
Typ. current-carrying capacity per output: 12/13 DC	—	—	1 A

Order no.	3RK2200-0CT30-0AA3	3RK2200-0CQ30-0AA3	3RK2400-1BT30-0AA3
Max. total current for each module	—	—	1 A
Short-circuit protection	—	—	Integrated
Inductive interference protection	—	—	Integrated
External 24 V DC power supply	—	—	Joint round cable connection with AS-Interface connection via M12 socket contact
Watchdog	—	—	Integrated
Assignment of the data bits			
Socket 1	PIN4 = IN1(D0)	PIN4 = IN1(D0) PIN2 = IN2(D1)	PIN4 = IN3(D2)
Socket 2	PIN4 = IN2(D1)	PIN4 = IN3(D2) PIN2 = IN4(D3)	PIN4 = IN4(D3)
Socket 3	PIN4 = IN3(D2)	Not available	PIN4 = OUT1(D0)
Socket 4	PIN4 = IN4(D3)	Not available	PIN4 = OUT2(D1)
Socket 5	Not available	Not available	Not available
Socket 6	Not available	Not available	Not available
Socket 7	Not available	Not available	Not available
Socket 8	Not available	Not available	Not available
No. of I/O sockets	4 x M8	2 x M12	4 x M8
AS-Interface certificate	Available	Available	Available
Approvals	UL/CSA available soon	UL/CSA available soon	UL/CSA available soon
Degree of protection	IP65/67	IP65/67	IP65/67
Ground connection	Not available	Not available	Not available
Ambient temperature	–25 to +70 °C	–25 to +70 °C	–25 to +70 °C
Storage temperature	–40 to +85 °C	–40 to +85 °C	–40 to +85 °C

Note

An external additional power supply (AUX POWER) of between 20 and 30 V DC is required for supplying the output circuits of the compact module (3RK2400-1BT30-0AA3). The additional power supply must comply with VDE 0106 (PELV), protection class III.

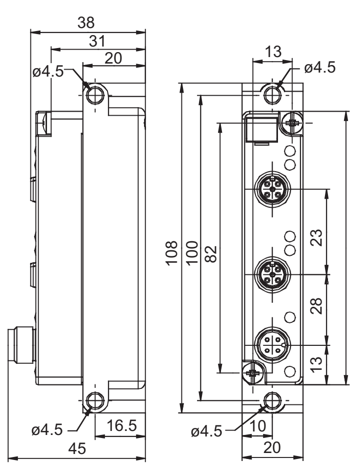
Order no.	3RK2400-1BQ30-0AA3	3RK1400-1CT30-0AA3	3RK2400-1CT30-0AA3
Slave type	A/B slave	Standard slave	A/B slave (Spec. 3.0)
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.1	AS-i Spec. 2.0	AS-i Spec. 3.0
No. of inputs/outputs	2 inputs / 2 outputs	4 inputs / 4 outputs	4 inputs / 4 outputs
No. of I/O sockets	2 x M12	8 x M8	8 x M8
AS-i slave profile IO.ID.ID2	B.A.2	7.0.E	7.A.7
ID1 code (factory setting)	7	F	7
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 270 mA
Inputs			
Input circuit	PNP	PNP	PNP
Current-carrying capacity for all inputs (T_U ≤ 40°C)	150 mA	200 mA	200 mA
Current-carrying capacity for all inputs (T_U ≤ 55 °C)	70 mA	150 mA	150 mA
Switching level - high	≥ 10 V	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 6 mA	≤ 1.5 / ≥ 6 mA	≤ 1.5 / ≥ 6 mA
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof	Short circuit and overload proof
Sensors	2 and 3 conductors	2 and 3 conductors	2 and 3 conductors
Voltage range	16.5 to 30 V	16.5 to 30 V	16.5 to 30 V
Outputs			
Output type	Electronic	Electronic	Electronic
Typ. current-carrying capacity per output: 12/13 DC	1 A	1 A	1 A
Max. total current for each module	1 A	2 A at T = 40°C	2 A at T = 40°C
Short-circuit protection	Integrated	Integrated	Integrated
Inductive interference protection	Integrated	Integrated	Integrated
External 24 V DC power supply	Joint round cable connection with AS-Interface connection via M12 socket contact	Joint round cable connection with AS-Interface connection via M12 socket contact	Joint round cable connection with AS-Interface connection via M12 socket contact
Watchdog	Integrated	Integrated	Integrated
Assignment of the data bits			
Socket 1	PIN4 = IN3(D2) PIN2 = IN4(D3)	PIN4 = IN1(D0)	PIN4 = IN1(D0)
Socket 2	PIN4 = OUT1(D0) PIN2 = OUT2(D1)	PIN4 = IN2(D1)	PIN4 = IN2(D1)
Socket 3	Not available	PIN4 = IN3(D2)	PIN4 = IN3(D2)
Socket 4	Not available	PIN4 = IN4(D3)	PIN4 = IN4(D3)
Socket 5	Not available	PIN4 = OUT1(D0)	PIN4 = OUT1(D0)
Socket 6	Not available	PIN4 = OUT2(D1)	PIN4 = OUT2(D1)

Order no.	3RK2400-1BQ30-0AA3	3RK1400-1CT30-0AA3	3RK2400-1CT30-0AA3
Socket 7	Not available	PIN4 = OUT3(D2)	PIN4 = OUT3(D2)
Socket 8	Not available	PIN4 = OUT4(D3)	PIN4 = OUT4(D3)
AS-Interface certificate	Available	Available soon	Available soon
Approvals	UL/CSA available soon	UL/CSA available soon	UL/CSA available soon
Degree of protection	IP65/67	IP65/67	IP65/67
Ground connection	Not available	Not available	Not available
Ambient temperature	–25 to +70 °C	–25 to +70 °C	–25 to +70 °C
Storage temperature	–40 to +85 °C	–40 to +85 °C	–40 to +85 °C

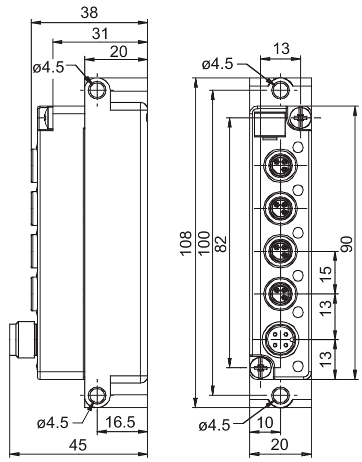
Note

An external additional power supply (AUX POWER) of between 20 and 30 V DC is required for supplying the output circuits for compact modules 3RK2400-1BQ30-0AA3, 3RK1400-1CT30-0AA3, and 3RK2400-1CT30-0AA3. The additional power supply must comply with VDE 0106 (PELV), protection class III.

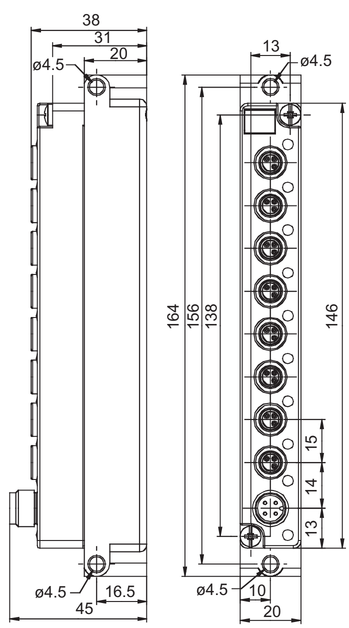
8.4.5.7 Dimension drawings



K20 compact module with 2 M12 sockets



K20 compact module with 4 M8 sockets



K20 compact module with 8 M8 sockets

8.4.6 Analog K60 input/output modules - panel IP67

8.4.6.1 Properties

The most important properties of the K60 analog modules

- Analog modules can be integrated in AS-Interface just as easily as digital modules.
- Analog values can be easily recorded and output locally.
- Preprocessing the analog value transmission in the master allows the analog values to be evaluated quickly and easily.
- Up to four values can be recorded via an analog module.

Specification 3.0 with fast analog modules (to profile 7.A.9) also offers the following features:

- A/B technology (i.e. up to 62 analog modules can each be connected to one AS-i master).
- Variable operation: 12-bit or 14-bit resolution, single or double channel, can be selected via the ID1 code.
- Transfer times twice as fast on average (three or four cycles only depending on the selected resolution).
- Simplified analog value processing with masters that comply with Specification 3.0 (DP/AS-i LINK Advanced).

8.4.6.2 Overview

AS-Interface analog modules in the K60 compact series record or supply analog signals locally. These modules are connected to the higher-level controller via an AS-Interface master in accordance with Specification 2.1 or 3.0.

Measured variable	Signal range	Inputs			Outputs
		A/B1)	Standard 2)		Standard
		1 / 2 channel	2 channel	4 channels	2 channel
Current	± 20 mA	X	X	X	X
	4 - 20 mA	X	X	X	X
	0 - 20 mA	X	X	X	X
Voltage	± 10 V	X	X	X	X
	1 - 5 V	X	X	X	X
	0 - 10 V	—	—	—	X
Temperature / resistance	PT100	—	X	X	—
	Ni100	—	X	X	—
	0 - 600 Ω	—	X	X	—
1) AS-i Spec. 3.0 (faster transfer, switch between 1 / 2 channels, switch between 12 / 14 Bit) 2) AS-i Spec. 2.1 2.1					

The input modules to profile 7.3/7.4 are available with two or four input channels. The two-channel module can also be switched for use with just one input channel, which means that the analog value is available more quickly. To switch the module, a jumper is connected to socket 3. Analog modules to profile 7.A.9 achieve transfer times twice as fast as those to profile 7.3/7.4. Among other things, you can use the ID1 code to select whether the module is operated with one channel or two.

The output modules are available as two-channel modules as standard.

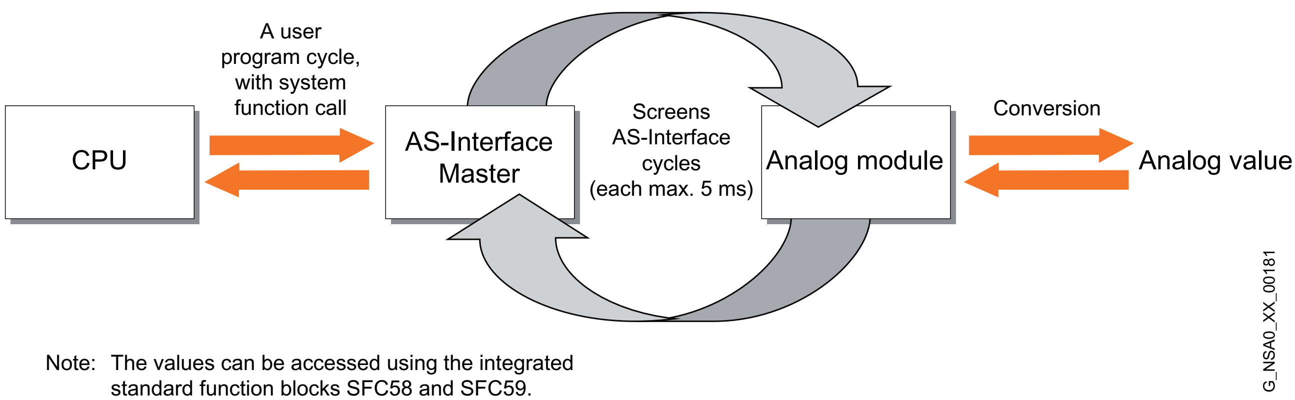
The input and output channels are electrically isolated vis-à-vis the AS-Interface network.

If sensors with increased power requirements (total ≥ 46 mA) are to be connected when analog input modules are used, additional power must be supplied via the auxiliary voltage rather than via the internal supply (flat cable, black). When the auxiliary power is connected, the sensor supply is short-circuit proof (max. 500 mA). No auxiliary power is required for output and resistor/thermoresistor modules. The auxiliary power cable can be "looped in" for other modules, however.

The "AS-Interface Analog Modules Profile 7.3, Profile 7.A.9" manual contains extensive descriptions of the modules along with their technical specifications and detailed information about operation.

Function

Data transfer to analog profile 7.3/7.4



With analog profile 7.3/7.4, at least seven AS-Interface cycles are required to transfer all the data. In this case, a master that complies with extended Specification V2.1 (or higher) must be used.

When input modules are used, the complete analog value is available in the AS-Interface master. Preprocessing is then carried out in the master.

The next time this system function is called up, the user program copies the analog value as a value to the user program.

The same sequence in reverse applies to analog value transfer for the output modules.

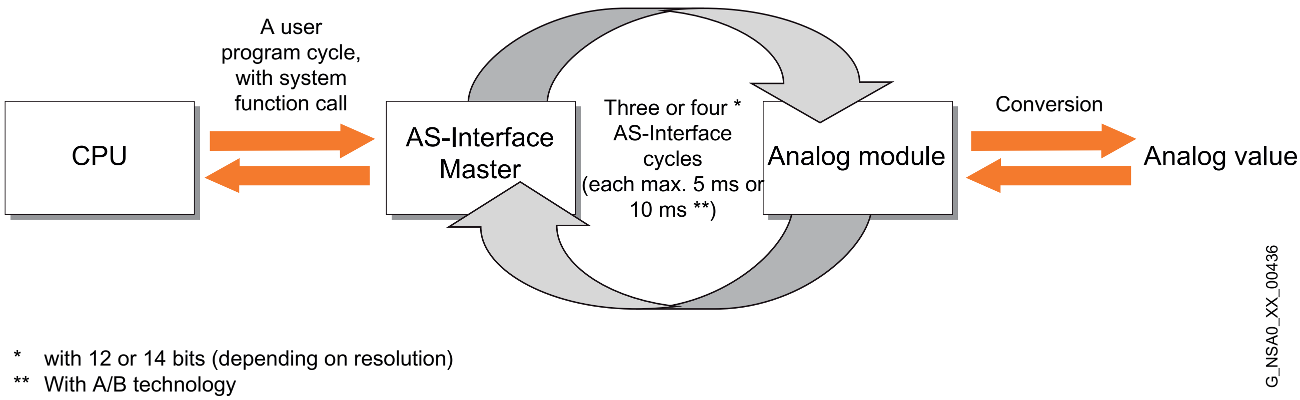
The total processing time (t_{total}) for the complete transfer process from 1/2 inputs is calculated as follows:

- Conversion time t_c
- AS-i transfer time $t_{transfer}$ (with cycle times of 5 ms / 10 ms)
- PLC transfer time t_{PLC}

This results in the following maximum times until the analog value with profile 7.3/7.4 is available:

	1 channel	2 channels	4 channels
Total transfer time	Max. 95 ms	Max. 235 ms	Max. 435 ms

Data transfer to analog profile 7.A.9



* with 12 or 14 bits (depending on resolution)
** With A/B technology

With analog profile 7.A.9, just three or four AS-Interface cycles are required for transferring the data. In this case, a master that complies with Specification 3.0 must be used.

	1 channel				2 channels			
	Standard		A/B		Standard		A/B	
	12 bits	14 bits	12 bits	14 bits	12 bits	14 bits	12 bits	14 bits
Total transfer time	~ 55 ms	~ 65 ms	~ 85 ms	~ 105 ms	~ 145 ms	~ 160 ms	~ 190 ms	~ 220 ms

The maximum times that elapse before the analog value is available with profile 7.A.9 depend on the selections made (resolution, no. of channels, A/B technology).

Coding

The resolution and channel are selected with the ID1 code.

I/O code: 7_{hex}
ID code: A_{hex}
ID2 code: 9_{hex}
ID1 code: see table:

ID1	IN 1	IN 2	14 bits	12 bits
0	X	—	X	—
1	X	—	—	X
2	X	—	X	—
3	X	—	X	—
4	X	X	X	—
5	X	X	X	—
6	X	X	—	X
7	X	X	X	—

Profile overview of the input modules

Measurement type	No. of inputs	Order no.	Slave profile
Current measurement	1, 2	3RK1207-1BQ40-0AA3	S7.3
	4	3RK1207-1BQ44-0AA3	S7.3
	1, 2	3RK2207-1BQ50-0AA3	7.A.9
Voltage measurement	1, 2	3RK1207-2BQ40-0AA3	S7.3
	4	3RK1207-2BQ44-0AA3	S7.3
	1, 2	3RK2207-2BQ50-0AA3	7.A.9
Resistance/thermoresistance measurement	1, 2	3RK1207-3BQ40-0AA3	S7.3
	4	3RK1207-3BQ44-0AA3	S7.3

Module overview: input modules

Profile overview of output modules

Output	No. of outputs	Order no.	
Current output	2	3RK1107-1BQ40-0AA3	S7.3
Voltage output	2	3RK1107-2BQ40-0AA3	S7.3

Module overview: output modules

8.4.6.3 Order numbers

Input modules (Each module has two coding elements)

Inputs/outputs	Type	Application	Code setting	Order no.
4 inputs	Analog slave	Current measurement	B1	3RK1207-1BQ44-0AA3
4 inputs	Analog slave	Voltage measurement	B2	3RK1207-2BQ44-0AA3
4 inputs	Analog slave	Thermoresistance	B3	3RK1207-3BQ44-0AA3
1, 2 inputs	Analog slave	Current measurement	B1	3RK1207-1BQ40-0AA3 1)
1, 2 inputs	Analog slave	Current measurement	B1	3RK2207-1BQ50-0AA3 2)
1, 2 inputs	Analog slave	Voltage measurement	B2	3RK1207-2BQ40-0AA3 1)
1, 2 inputs	Analog slave	Voltage measurement	B2	3RK2207-2BQ50-0AA3 2)
1, 2 inputs	Analog slave	Thermoresistance	B3	3RK1207-3BQ40-0AA3 1)
1) Operation with 1 input only with jumper (Page 226) 3RK1901-1AA00 possible 2) OPeration with 1, 2 inputs can be configured via ID1 code				

Output modules (Each module has two coding elements)

Type	Module variant	Code setting	Order no.
Analog slave	Current output	B4	3RK1107-1BQ40-0AA3
Analog slave	Voltage output	B5	3RK1107-2BQ40-0AA3

Accessories

Name	Order no.
K60 mounting plate for screw fixing	3RK1901-0CA00
K60 mounting plate for DIN rail installation	3RK1901-0CB00
Jumper for operation with 1 input (for the following modules only: 3RK1207-1BQ40-0AA3, 3RK1207-2BQ40-0AA3, 3RK1207-3BQ40-0AA3)	3RK1901-1AA00

8.4.6.4 Parameterization

For a detailed description of how to set parameters with AS-i, see Parameterization (Page 619).

The parameters are sent to the AS-i master via the CPU. Function block FC "ASI_3422" (FC 7) is required for the S7-300 controller.

FC 7 is available on a disk supplied with the manual for CP-343-2 and Link 20 E. When the CPU is booted, FC 7 should execute the command "write_extended_parameter_list" (3CH), for example.

(This is integrated in HW Config as of SIMATIC STEP 7, V 5.4.)

Modules that comply with slave profile 7.A.9 require a "V3 Extended Master" profile M4.

Parameter settings for input modules

The following table shows the individual parameter settings for the analog input modules. Default value for new modules: 1 1 1 1

Parameter bit 1) P3 P2 P1 P0	Current input	Voltage input	Resistance 3)
X X 1 1	4 ... 20 mA, 4 wires	±10 V, 4 wires	Pt 100 standard, 4 wires
X X 1 0	4 ... 20 mA, 2 wires	1 ... 5 V, 4 wires	0 ... 600 Ω, 4 wires
X X 0 1	±20 mA, 4 wires	Reserved 2)	Pt 100 climate, 4 wires
X X 0 0	Reserved 2)	Reserved 2)	Ni 100 standard, 4 wires
X 1 X X	Without smoothing		
X 0 X X	With smoothing		
1 X X X	Filter 50 Hz 1)		
0 X X X	Filter 60 Hz 1)		
1) For modules with order number 3RK2207 and fast analog modules to spec. 3.0, parameter bit P3 is not used; the modules are set permanently to filter 50 Hz. 2) With this parameter combination, the default range is the same as that for X X 1 1. 3) 2 and 3-wire connection: see Connection (Page 226).			

Current measurement range ±20 mA

(Parameter setting XX01)

Measured value		Units		Range
± 20 mA	in %	Dec.	Hex.	
> 23.52 mA	>117.589	32767	7FFF	Overflow
23.52 mA	117.589	32511 27649	7EFF 6C01	Overrange
20 mA 723.4 nA 0 mA -723.4 nA -20 mA	100 0.003617 0 -0.003617 -100	27648 1 0 -1 -27648	6C00 0001 0000 FFFF 9400	Nominal range
-23.51 mA	-117.593	-27649 -32512	93FF 8100	Underrange
< -23.51 mA	<-117.593	-32768 (+32767)	8000 (7FFF)	Underflow (for certain AS-i masters)

Current measurement range 4 to 20 mA

(Parameter setting XX11 for 4-wire connection)
(Parameter setting XX10 for 2-wire connection)

Measured value		Units		Range
4 to 20 mA	in %	Dec.	Hex.	
> 22.81 mA	>117.589	32767	7FFF	Overflow
22.81 mA	117.589	32511 27649	7EFF 6C01	Overrange
20 mA 4 mA + 578.7 nA 4 mA	100 0.003617 0	27648 1 0	6C00 0001 0000	Nominal range
1.185 mA	-17.593	-1 -4864	FFFF ED00	Underrange
< 1.185 mA	<-17.593	32767	7FFF	Wire breakage

Voltage measurement range ±10 V

(Parameter setting XX11)

Range		Units		Range
± 10 V	in %	Dec.	Hex.	> 11.759 V
>117.589	32767	7FFF	Overflow	
11,759 V	117.589	32511 27649	7EFF 6C01	Overrange
10 V 361.7 µV 0 V -361.7 µV -10 V	100 0.003617 0 -0.003617 -100	27648 1 0 -1 -27648	6C00 0001 0000 FFFF 9400	Nominal range
-11.759 V	-117.593	-27649 -32512	93FF 8100	Underrange
< -11.759 V	<-117.593	-32768 (+32767)	8000 (7FFF)	Underflow (for certain AS-i masters)

Voltage measurement range 1 to 5 V

(Parameter setting XX10)

Range		Units		Range
1 to 5 V	in %	Dec.	Hex.	
> 5.704 V	>117.589	32767	7FFF	Overflow
5,704 V	117.589	32511 27649	7EFF 6C01	Overrange
5 V 1 V + 144.7 µV 1 V	100 0.003617 0	27648 1 0	6C00 0001 0000	Nominal range
0.296 V	-17.593	-1 -4864	FFFF ED00	Underrange
< 0.296 V	<-17.593	32767	7FFF	Wire breakage

Thermoresistor Pt 100

Standard range (linear) -200 to +850°C (Parameter setting XX11)

Range -200 to +850°C	Units		Range
	Dec.	Hex.	
> 1000°C	32767	7FFF	Overflow
1000°C 1)	8501	2135	Overrange
850 °C ... 0.1 °C 0 °C -0.1 °C ... -200 °C	8500 1 0 -1 -2000	2134 0001 0000 FFFF F830	Nominal range
-243°C 1)	-2001	F82F	Underrange
< -243°C	-32768 (+32767)	8000 (7FFF)	Underflow (for certain AS-i masters)
1) In the overrange/underrange, the gradient of the characteristic is maintained when the linear nominal range is exited.			

Climatic range (linear) -120 to +130°C (Parameter setting XX01)

Range -120 to +130°C	Units		Range
	Dec.	Hex.	
> 155°C	32767	7FFF	Overflow
155°C 1)	13001	32C9	Overrange
130 °C ... 0.01 °C 0 °C -0.01 °C ... -120 °C	13000 1 0 -1 -12000	32C8 0001 0000 FFFF D120	Nominal range
-145°C 1)	-12001	D11F	Underrange
< -145°C	-32768 (+32767)	8000 (7FFF)	Underflow (for certain AS-i masters)
1) In the overrange/underrange, the gradient of the characteristic is maintained when the linear nominal range is exited.			

Thermoresistor Ni 100

Standard range (linear) -60 to +250 °C (Parameter setting XX00)

Range -60 to +250 °C	Units		Range
	Dec	Hex.	
> 295°C	32767	7FFF	Overflow
295°C 1)	2501	9C5	Overrange
250 °C ... 0.1 °C 0 °C -0.1 °C ... -60 °C	2500 1 0 -1 -600	9C4 0001 0000 FFFF FDA8	Nominal range
-105°C 1)	-601	FDA7	Underrange
< -105°C	-32768 (+32767)	8000 (7FFF)	Underflow (for certain AS-i masters)
1) In the overrange/underrange, the gradient of the characteristic is maintained when the linear nominal range is exited.			

Resistance measurement

Range 0 ... 600 Ω (Parameter setting XX10)

Range		Units		Range
0 to 600 Ω	in %	Dec.	Hex.	
> 705.53 Ω	>117.589	32767	7FFF	Overflow
705.53 Ω	117.589	32511 27649	7EFF 6C01	Overrange
600 Ω ... 21.7 mΩ 0 Ω	100 0.003617 0	27648 1 0	6C00 0001 0000	Nominal range
1) 1)	 -17.593	-1 -4864	FFFF ED00	Underrange
1)	<-17.593	-32768 (+32767)	8000 (7FFF)	Underflow (for certain AS-i masters)
1) Reverse polarity of constant current IC+, IC-				

Parameter settings for output modules

The following table shows the individual parameter settings for the analog output modules.

Parameter bit P3 P2 P1 P0	Current output	Voltage output
1 1 1 1	4 ... 20 mA	± 10 V
1 1 1 0	± 20 mA	0 ... 10 V
1 1 0 1	0 ... 20 mA	Reserved 1)
1 1 0 0	Reserved 1)	1 ... 5 V
1) With this parameter combination, the default range is the same as that for 1 1 1 1.		

Current output ranges

Range ±20 mA (parameter setting 1110)

Output value		Units		Range
± 20 mA	in %	Dec	Hex.	
0 mA	118.5149 117.593	32767 32512	7FFF 7F00	Overflow
23.52 mA	117.589	32511 27649	7EFF 6C01	Overrange
20 mA 723.4 nA 0 mA -723.4 nA -20 mA	100 0.003617 0 -0.003617 -100	27648 1 0 -1 -27648	6C00 0001 0000 FFFF 9400	Nominal range
-23.52 mA	-117.593	-27649 -32512	93FF 8100	Underrange
0 mA	-117.596 -118.519	-32513 -32768	80FF 8000	Underflow

Range 0 to 20 mA (parameter setting 1101)

Output value		Units		Range
0 to 20 mA	in %	Dec	Hex.	
0 mA	118.5149 117.593	32767 32512	7FFF 7F00	Overflow
23.52 mA	117.589	32511 27649	7EFF 6C01	Overrange
20 mA 723.4 nA 0 mA	100 0.003617 0	27648 1 0	6C00 0001 0000	Nominal range
0 mA	-117.593	-1 -32512	FFFF 8100	Impermissible range, underflow
0 mA	-117.596 -118.519	-32513 -32768	80FF 8000	

Range 4 to 20 mA (parameter setting 1111)

Output value		Units		Range
4 to 20 mA	in %	Dec.	Hex.	
0 mA	118.5149 117.593	32767 32512	7FFF 7F00	Overflow
22.81 mA	117.589	32511 27649	7EFF 6C01	Overrange
20 mA 4 mA + 578.7 nA 4 mA	100 0.003617 0	27648 1 0	6C00 0001 0000	Nominal range
4 mA - 578.7 nA 0 mA	-25	-1 -6912	FFFF E500	Underrange
0 mA	-117.593	-6913 -32512	E4FF 8100	Impermissible range, underflow
0 mA	-117.596 -118.519	-32513 -32768	80FF 8000	

Note

The lowest possible resolution for the D/A converter is 11.57 μA. The current resulting from the units received, therefore, only changes in steps of 11,57 μA.

Voltage output ranges

Range ±10 V(parameter setting 1111)

Output value		Units		Range
± 10 V	in %	Dec.	Hex.	
0 V	118.5149 117.593	32767 32512	7FFF 7F00	Overflow
11.76 V	117.589	32511 27649	7EFF 6C01	Overrange
10 V 361.7 μV 0 V -361.7 μV -10 V	100 0.003617 0 -0.003617 -100	27648 1 0 -1 -27648	6C00 0001 0000 FFFF 9400	Nominal range
-11.76 V	-117.593	-27649 -32512	93FF 8100	Underrange
0 V	-117.596 -118.519	-32513 -32768	80FF 8000	Underflow

Range 0 to 10 V (parameter setting 1110)

Output value		Units		Range
0 to 10 V	in %	Dec.	Hex.	
0 V	118.5149 117.593	32767 32512	7FFF 7F00	Overflow
11,76 V	117.589	32511 27649	7EFF 6C01	Overrange
10 V 361.7 µV 0 V	100 0.003617 0	27648 1 0	6C00 0001 0000	Nominal range
0 V	-117.593	-1 -32512	FFFF 8100	Impermissible range, underflow
0 V	-117.596 -118.519	-32513 -32768	80FF 8000	

Range 1 to 5 V (parameter setting 1100)

Output value		Units		Range
1 to 5 V	in %	Dec.	Hex.	
0 V	118.5149 117.593	32767 32512	7FFF 7F00	Overflow
5,7 V	117.589	32511 27649	7EFF 6C01	Overrange
5 V 1 V +144.7 µV 1 V	100 0.003617 0	27648 1 0	6C00 0001 0000	Nominal range
1 V -144.7 µV 0 V	-25	-1 -6912	FFFF E500	Underrange
0 V	-117.593	-6913 -32512	E4FF 8100	Impermissible range, underflow
0 V	-117.596 -118.519	-32513 -32768	80FF 8000	

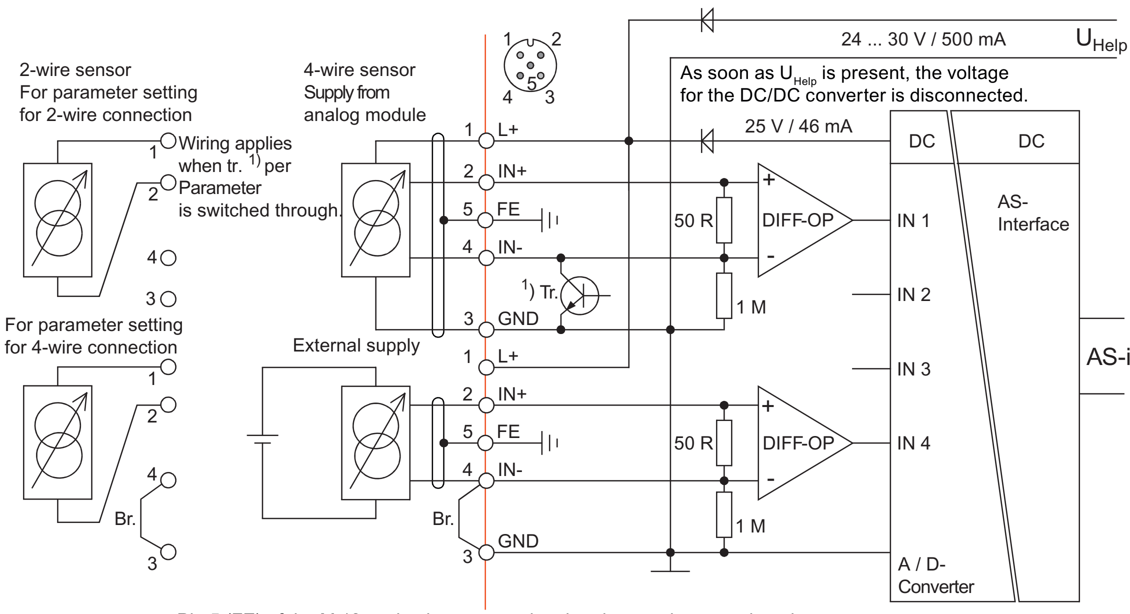
Note

The lowest possible resolution for the D/A converter is 5.787 mV.
The voltage resulting from the units received, therefore, only changes within 5.787 mV.

8.4.6.5 Connection

Block diagrams

Structure of input module for current measurement



Pin 5 (FE) of the M 12 socket is connected to the plate on the mounting plate.
The internal transistor (tr.) is switched through for parameter setting XX10 (for 2-wire connection) (for input IN 1 and 2 only).
1) Tr. for input IN 1 and 2 only; jumper must be set for input IN 3 and 4

Figure 8-12 Block diagram: current measurement

Structure of input module for voltage measurement

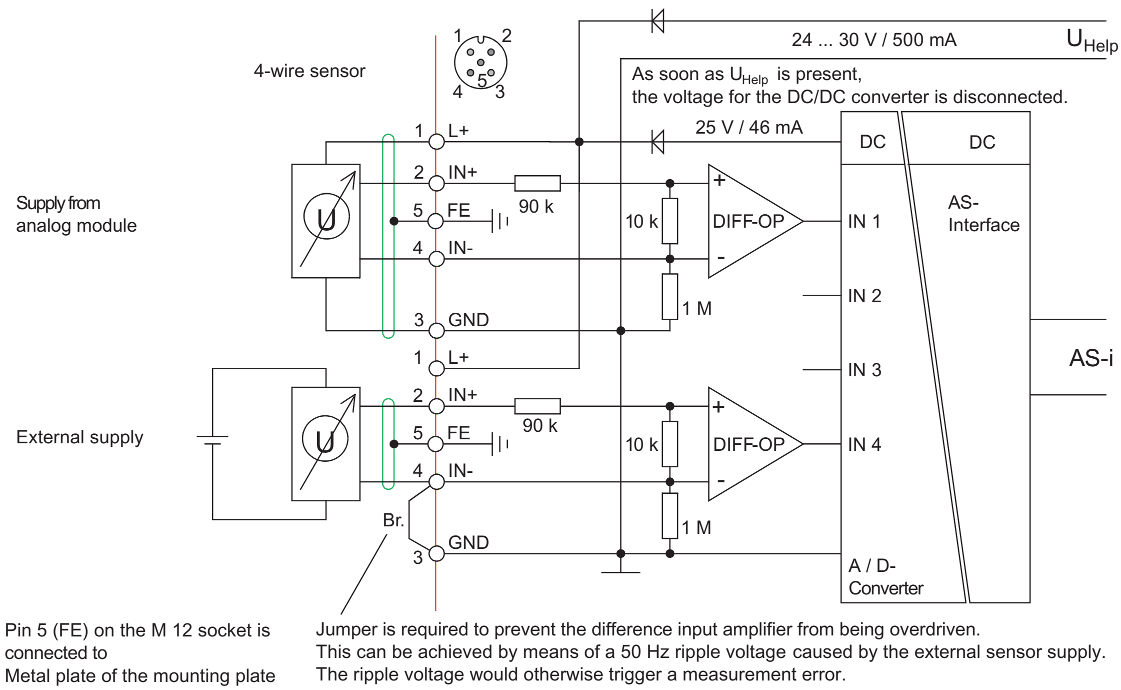


Figure 8-13 Block diagram: voltage measurement

Structure of input module for resistance measurement

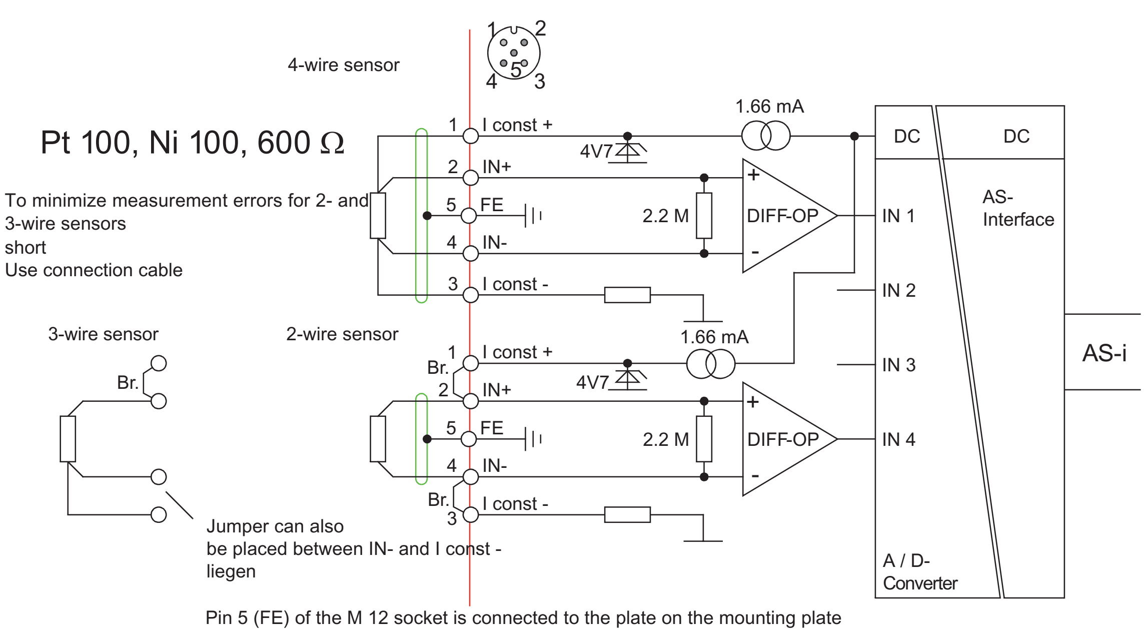


Figure 8-14 Block diagram: resistance measurement

Structure of input module for current output

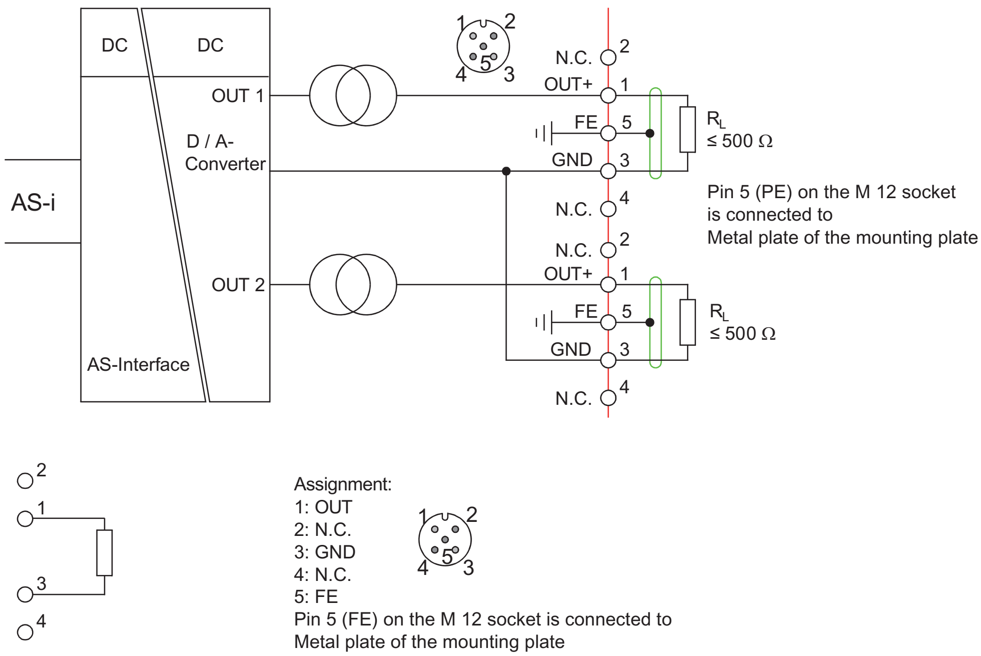


Figure 8-15 Block diagram: current output

Structure of input module for voltage output

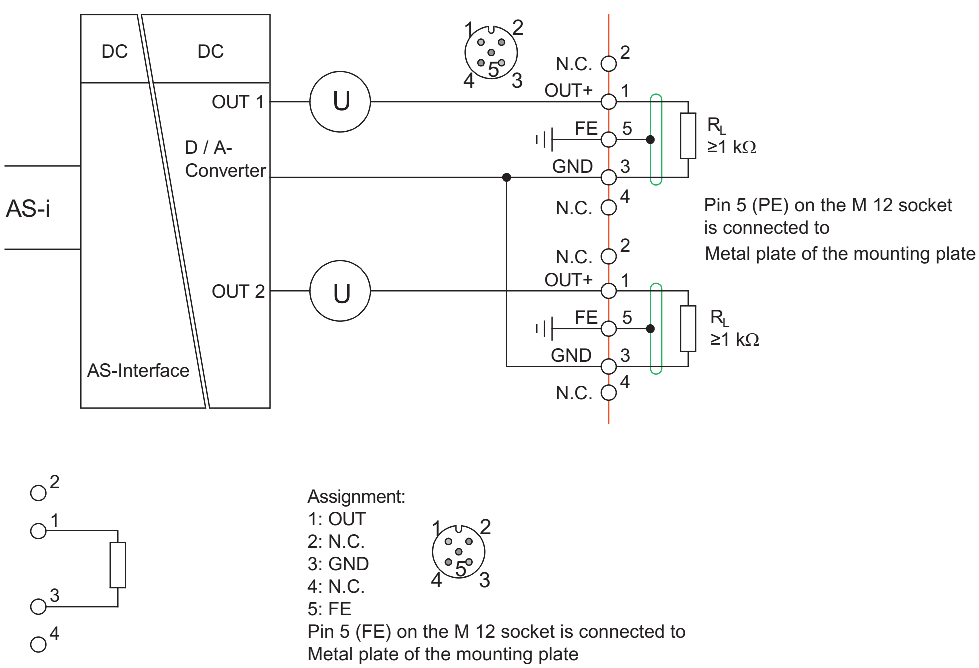
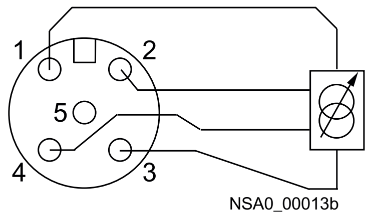


Figure 8-16 Block diagram: voltage output

Pin assignment for inputs/outputs

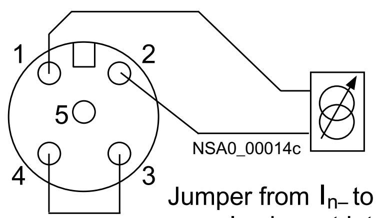
Input modules



Pole 1: Supply L+ (24 V DC)
Pin 2: IN+
Pole 3: Supply M (ground)
Pin 4: IN–
Pole 5: Cable shielding /
FE (functional ground)

All pin assignments without an external sensor supply.

Figure 8-17 Current input: 4-wire sensor

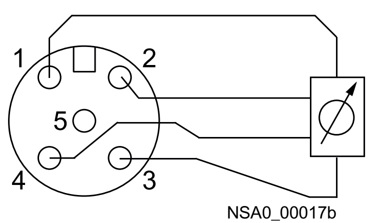


Jumper from I_{n-} to M(3) can also be set internally by means of parameters.

Pole 1: Supply L+ (24 V DC)
Pin 2: IN+
Pole 3: Supply M (ground)
Pin 4: IN–
Pole 5: Cable shielding /
FE (functional ground)

All pin assignments without an external sensor supply.

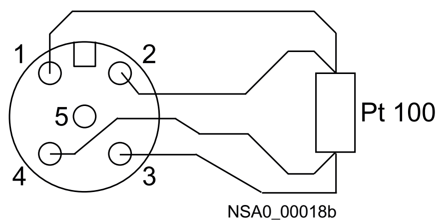
Figure 8-18 Current input: 2-wire sensor



Pole 1: Supply L+ (24 V DC)
Pin 2: IN+
Pole 3: Supply M (ground)
Pin 4: IN–
Pole 5: Cable shielding /
FE (functional ground)

All pin assignments without an external sensor supply.

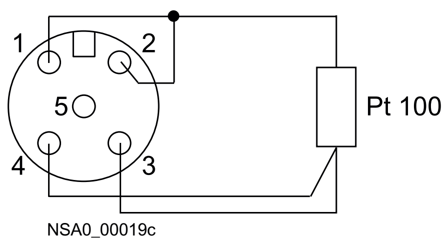
Figure 8-19 Voltage input: 4-wire sensor



Pin 1: I_{const+}
Pin 2: IN+
Pin 3: $I_{const–}$
Pin 4: IN–
Pole 5: Cable shielding

All pin assignments without an external sensor supply.

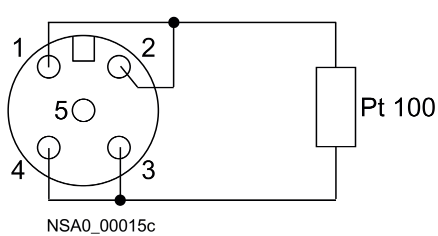
Figure 8-20 Thermoresistor: 4-wire sensor



Pin 1: I_{const+}
Pin 2: IN+
Pin 3: $I_{const–}$
Pin 4: IN–
Pole 5: Cable shielding

All pin assignments without an external sensor supply.

Figure 8-21 Thermoresistor: 3-wire sensor

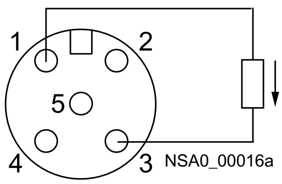


Pin 1: I_{const+}
Pin 2: IN+
Pin 3: $I_{const–}$
Pin 4: IN–
Pole 5: Cable shielding

All pin assignments without an external sensor supply.

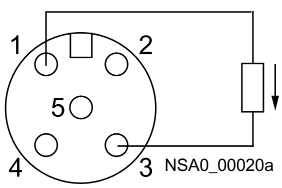
Figure 8-22 Thermoresistor: 2-wire sensor

Output modules



Pole 5: Cable shielding
All pin assignments without an external sensor supply.

Figure 8-23 Analog current output



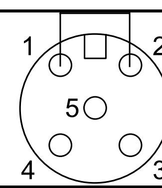
Pole 5: Cable shielding
All pin assignments without an external sensor supply.

Figure 8-24 Analog voltage output

Wiring the two-channel input modules with one input

The modules with order numbers 3RK1207-.BQ40-0AA3 with two inputs can also be operated with one input. This increases the speed at which the input signal is transferred.

To do so, pin 1 and pin 2 must be connected to each other at socket 3. A jumper (3RK1901-1AA00) can also be used for this purpose.



Socket 2 (IN2), which is not used, must be sealed with a screw cap.

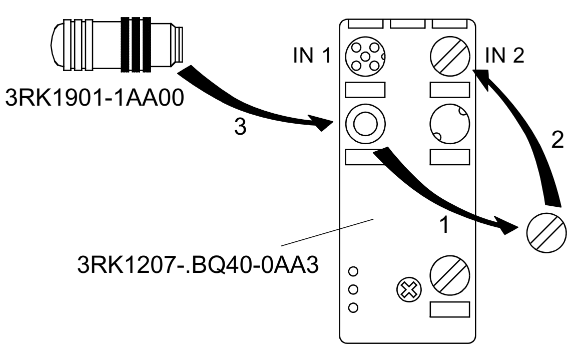


Figure 8-25 Operation with one input

8.4.6.6 Diagnostics

LEDs for AS-i and FAULT

The module has two LEDs for AS-i and FAULT for diagnostic purposes; see LED status displays for modules with two LEDs for AS-i and FAULT (Page 173) .

LED display AUX POWER

The module also has an LED for AUX POWER; for a description, see LED status display AUX POWER for modules with auxiliary voltage (Page 175).

Status display for the switching state

The switching state of the AS-i inputs and outputs is indicated by a yellow LED; see LED status display for the switching state (yellow) (Page 175).

8.4.6.7 Technical specifications

Order no.			
Current measurement	3RK1207-1BQ44-0AA3	3RK1207-1BQ40-0AA3	3RK2207-1BQ50-0AA3
Voltage measurement	3RK1207-2BQ44-0AA3	3RK1207-2BQ40-0AA3	3RK2207-2BQ50-0AA3
Temperature / resistance measurement	3RK1207-3BQ44-0AA3	3RK1207-3BQ40-0AA3	—
Slave type	Standard slave	Standard slave	A/B slave (Spec. 3.0)
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.1	AS-i Spec. 2.1	AS-i Spec. 3.0
No. of inputs	4	2	2
AS-i slave profile IO.ID.ID2	7.3.E	7.3.D	7.A.9
ID1 code (factory setting)	F	F	7
Number format	SIMATIC S7	SIMATIC S7	SIMATIC S7
Operating voltage in acc. with AS-Interface Specification	26.5 to 31.6 V		
Optional supply for sensors via U_{AUX} (for current/voltage measurement only)	24 to 30 V		
Total power consumption of module from AS-i, including connection of sensors	150 mA		
Current-carrying capacity for all inputs (without U_{AUX} supply)	Max. 46 mA		
Current-carrying capacity for all inputs (with U_{AUX} supply) (for current/voltage measurement only)	Max. 500 mA		
Approvals	UL/CSA/shipbuilding		

Order no.			
Current measurement	3RK1207-1BQ44-0AA3	3RK1207-1BQ40-0AA3	3RK2207-1BQ50-0AA3
Voltage measurement	3RK1207-2BQ44-0AA3	3RK1207-2BQ40-0AA3	3RK2207-2BQ50-0AA3
Temperature / resistance measurement	3RK1207-3BQ44-0AA3	3RK1207-3BQ40-0AA3	—
Degree of protection	IP67		
Ambient temperature	–20 to +60 °C		
Storage temperature	–40 to +85 °C		
Connection	Via the mounting plate for compact module K60		

Measurement ranges (variable) for current measurement: 4 to 20 mA, +/– 20 mA

Measurement ranges (variable) for voltage measurement: +/– 10 V, 1 to 5 V

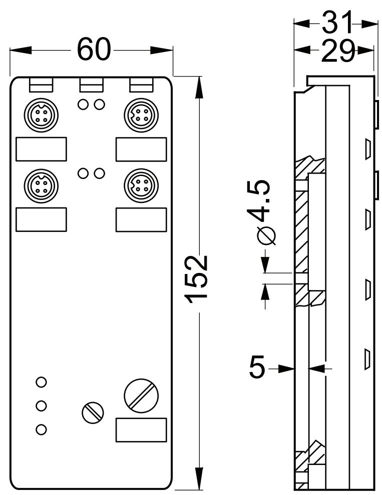
Measurement ranges (variable) for temperature/resistance measurement:
Pt100 standard range (–200.0 to +850.0°C),
Pt100 climatic range (–120.00 to +130.00°C),
Ni100 standard range (–60.0 to +250.0°C),
Resistance measurement (0 to 600 Ω)

Order no.	
Current output	3RK1107-1BQ40-0AA3
Voltage output	3RK1107-2BQ40-0AA3
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.1
No. of outputs	2
AS-i slave profile IO.ID.ID2	7.3.5
ID1 code (factory setting)	F
Number format	SIMATIC S7
Operating voltage in acc. with AS-Interface Specification	26.5 to 31.6 V
Total power consumption of module from AS-i	150 mA
Approvals	UL/CSA/shipbuilding
Degree of protection	IP67
Ambient temperature	–20 to +60 °C
Storage temperature	–40 to +85 °C
Connection	Via the mounting plate for compact module K60

Output ranges (variable) for current output: +/– 20 mA, 0 to 20 mA, 4 to 20 mA

Output ranges (variable) for voltage output: +/– 10 V, 0 to 10 V, 1 to 5 V

8.4.6.8 Dimension drawings



Side view
With mounting plate
3RK1901-0CA00

8.4.7 SlimLine digital input/output module - cabinet IP20

SlimLine modules of the S22.5 and S45 series

The AS-Interface module series for the SlimLine cabinet with degree of protection IP20 saves space in cabinets or in distributed on-site boxes. The main feature of these modules is that they are extremely slim (width of between 22.5 and 45 mm).

Screw or spring-loaded terminals can be used to connect standard sensors/actuators and the AS-Interface cable.

All modules are equipped with LEDs on the front, which indicate the status of the module.

An addressing socket on the front also allows the module to be addressed once it has been installed.

In addition to the digital input/output modules, S22.5 modules are available with special functions. These include:

- Counter module
- Ground fault detection module

The new AS-Interface Specification 3.0 extends the AS-Interface bus system to include a range of new features. Extended address mode (A/B addresses) allows 62 nodes to be connected to an AS-Interface network. With extended address mode to Specification 3.0, A/B slaves can now, for the first time, support four outputs (instead of just three outputs as defined in Specification 2.1). In the maximum configuration of an AS-Interface network, therefore, this means that 248 inputs and 248 outputs are available in an AS-Interface network.

Modules with four inputs and four outputs as A/B slaves in accordance with Specification 3.0 are also available for the cabinet as SlimLine module S45.

Note

Note that the modules to spec. 3.0 can only be operated with a new master to AS-Interface specification 3.0 (e.g. a new DP/AS-i LINK Advanced or IE/AS-i LINK PN IO) and that the cycle times for the outputs in this case must not exceed 20 ms.

8.4.7.1 Order numbers

SlimLine Module S22.5

Inputs/outputs	Type	Connection type	Sensors	Output	MLFB
4 outputs	Standard slave	Screw terminals	—	Transistor PNP (1 A)	3RK1100-1CE00-0AA2
4 outputs	Standard slave	Spring-loaded terminal	—	Transistor PNP (1 A)	3RK1100-1CG00-0AA2
4 inputs	Standard slave	Screw terminals	2 conductors	—	3RK1200-0CE00-0AA2
4 inputs	Standard slave	Screw terminals	2 and 3 conductors	—	3RK1200-0CE02-0AA2
4 inputs	Standard slave	Spring-loaded terminal	2 conductors	—	3RK1200-0CG00-0AA2
4 inputs	Standard slave	Spring-loaded terminal	2 and 3 conductors	—	3RK1200-0CG02-0AA2
2 inputs / 2 outputs	Standard slave	Screw terminals	2 conductors	Transistor PNP	3RK1400-0BE00-0AA2
2 inputs / 2 outputs	Standard slave	Spring-loaded terminal	2 conductors	Transistor PNP	3RK1400-0BG00-0AA2
2 inputs / 2 outputs	Standard slave	Screw terminals	2 conductors	Relay	3RK1402-0BE00-0AA2
2 inputs / 2 outputs	Standard slave	Spring-loaded terminal	2 conductors	Relay	3RK1402-0BG00-0AA2
4 inputs	A/B slave	Screw terminals	2 and 3 conductors	—	3RK2200-0CE02-0AA2
4 inputs	A/B slave	Spring-loaded terminal	2 and 3 conductors	—	3RK2200-0CG02-0AA2

SlimLine modules S45

Inputs/outputs	Type	Connection type	Sensors	Output	MLFB
4 inputs / 4 outputs	Standard slave	Screw terminals	2 and 3 conductors	Transistor PNP (1 A)	3RK1400-1CE00-0AA2
4 inputs / 4 outputs	Standard slave	Screw terminals	2 and 3 conductors	Transistor PNP (2 A)	3RK1400-1CE01-0AA2
4 inputs / 4 outputs	Standard slave	Spring-loaded terminal	2 and 3 conductors	Transistor PNP (1 A)	3RK1400-1CG00-0AA2
4 inputs / 4 outputs	Standard slave	Spring-loaded terminal	2 and 3 conductors	Transistor PNP (2 A)	3RK1400-1CG01-0AA2
4 inputs / 4 outputs	Standard slave	Screw terminals	2 and 3 conductors	Relay	3RK1402-3CE00-0AA2
4 inputs / 4 outputs	Standard slave	Screw terminals	2 and 3 conductors floating	Transistor PNP (1 A) floating	3RK1402-3CE01-0AA2

4 inputs / 4 outputs	Standard slave	Spring-loaded terminal	2 and 3 conductors	Relay	3RK1402-3CG00-0AA2
4 inputs / 4 outputs	Standard slave	Spring-loaded terminal	2 and 3 conductors floating	Transistor PNP (1 A) floating	3RK1402-3CG01-0AA2
4 inputs / 4 outputs	A/B slave	Screw terminals	2 and 3 conductors	Transistor PNP (2 A)	3RK2400-1CE01-0AA2
4 inputs / 4 outputs	A/B slave	Spring-loaded terminal	2 and 3 conductors	Transistor PNP (2 A)	3RK2400-1CG01-0AA2
4 inputs / 3 outputs	A/B slave	Screw terminals	2 and 3 conductors	Transistor PNP (2 A)	3RK2400-1FE00-0AA2
4 inputs / 3 outputs	A/B slave	Spring-loaded terminal	2 and 3 conductors	Transistor PNP (2 A)	3RK2400-1FG00-0AA2

Accessories

MLFB	Description	Comments
3RP1902	Sealable cover	For devices with 1 or 2 changeover contacts
3RP1902	Adapter for screw fixing	For devices with 1 or 2 changeover contacts
8WA2807	Screwdriver	Blade 2.5 x 0.5 mm, green

8.4.7.2 Connection

SlimLine module S22.5

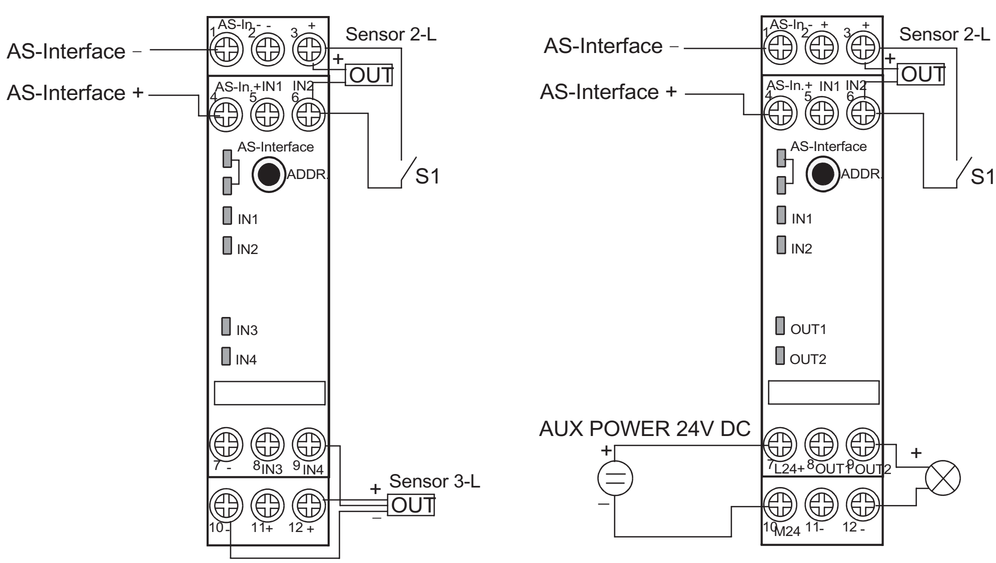


Figure 8-26 S22.5 connection

SlimLine modules S45

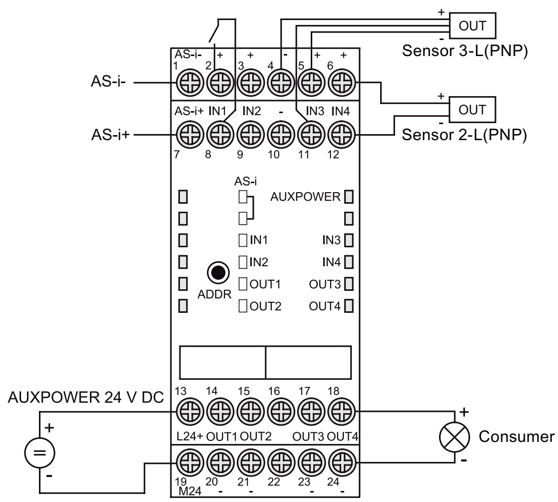


Figure 8-27 S45 connection

8.4.7.3 Diagnostics

LED for AS-i/FAULT

The module has one dual LED for AS-i/FAULT for diagnostic purposes; see LED status displays for modules with a dual LED for AS-i/FAULT (Page 174)

LED display AUX POWER

The module also has an LED for AUX POWER; for a description, see LED status display AUX POWER for modules with auxiliary voltage (Page 175).

Status display for the switching state

The switching state of the AS-i inputs and outputs is indicated by a yellow LED; see LED status display for the switching state (yellow) (Page 175).

8.4.7.4 Technical specifications

General technical specifications

Operating voltage in acc. with AS-Interface Specification	26.5 to 31.6 V
Input circuit	PNP
AS-Interface certificate	Available (or planned for new devices)
Approvals	UL, CSA, shipbuilding (or planned for new devices)
Degree of protection	IP20
Ambient temperature	–25 to +70 °C
Storage temperature	–40 to +85 °C

Note

An external additional power supply (AUX POWER) of between 20 and 30 V DC is required for supplying the output circuits. The additional power supply must comply with VDE 0106 (PELV), protection class III.

SlimLine module S22.5

Order no.	3RK1200-0CE00-0AA2	3RK1200-0CE02-0AA2	3RK2200-0CE02-0AA2
Slave type	Standard slave	Standard slave	A/B slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs	4 inputs	4 inputs
Connection type	Screw connection	Screw connection	Screw connection
Connection for sensors	2 conductors	2 and 3 conductors	2 and 3 conductors
AS-i slave profile IO.ID.ID2	0.0.F	0.0.F	0.A.0
ID1 code (factory setting)	F	F	7
Total power consumption	≤ 50 mA	≤ 270 mA	≤ 270 mA
Inputs			
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	—	200 mA	200 mA
Switching level - high	≥ 10 V	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA
Assignment of the data bits			
Data bit D0	IN1	IN1	IN1
Data bit D1	IN2	IN2	IN2
Data bit D2	IN3	IN3	IN3
Data bit D3	IN4	IN4	IN4

SlimLine module S22.5

Order no.	3RK1200-0CG00-0AA2	3RK1200-0CG02-0AA2	3RK2200-0CG02-0AA2
Slave type	Standard slave	Standard slave	A/B slave
No. of inputs/outputs	4 inputs	4 inputs	4 inputs
Connection type	Spring-loaded terminals	Spring-loaded terminals	Spring-loaded terminals
Connection for sensors	2 conductors	2 and 3 conductors	2 and 3 conductors
AS-i slave profile IO.ID.ID2	0.0.F	0.0.F	0.A.0
ID1 code (factory setting)	F	F	7
Total power consumption	≤ 50 mA	≤ 270 mA	≤ 270 mA
Inputs			
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	—	200 mA	200 mA
Switching level - high	≥ 10 V	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA
Assignment of the data bits			
Data bit D0	IN1	IN1	IN1
Data bit D1	IN2	IN2	IN2
Data bit D2	IN3	IN3	IN3
Data bit D3	IN4	IN4	IN4

SlimLine module S22.5

Order no.	3RK1400-0BE00-0AA2	3RK1402-0BE00-0AA2	3RK1400-0BG00-0AA2
Slave type	Standard slave	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	2 inputs / 2 outputs	2 inputs / 2 outputs	2 inputs / 2 outputs
Connection type	Screw connection	Screw connection	Spring-loaded connection
AS-i slave profile IO.ID.ID2	3.0.F	3.0.F	3.0.F
ID1 code (factory setting)	F	F	F
Connection for sensors	2 conductors	2 conductors	2 conductors
Output type	Transistor PNP (2 A)	Relay	Transistor PNP (2 A)
Total power consumption	≤ 50 mA	≤ 50 mA	≤ 50 mA
Inputs			
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	—	—	—
Switching level - high	≥ 10 V	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA

Order no.	3RK1400-0BE00-0AA2	3RK1402-0BE00-0AA2	3RK1400-0BG00-0AA2
Outputs			
Typ. current-carrying capacity per output: 12/13 DC	2 A	—	2 A
Max. total current for each module	4 A	—	4 A
Short-circuit protection	Integrated	External back-up fuse	Integrated
Inductive interference protection	Integrated	N/A	Integrated
Reverse polarity protection	Not integrated	N/A	Not integrated
External 24 V DC power supply	Via terminals: Terminal 7 = "+" Terminal 10 = "–"	N/A	Via terminals: Terminal 7 = "+" Terminal 10 = "–"
I_{th}	—	6 A	—
AC-15	—	3 A	—
13, 24 V DC	—	1 A	—
13, 110 V DC	—	0.2 A	—
13, 230 V DC	—	0.1 A	—
Watchdog	Integrated	Integrated	Integrated
Assignment of the data bits			
Data bit D0	IN1	IN1	IN1
Data bit D1	IN2	IN2	IN2
Data bit D2	OUT1	OUT1	OUT1
Data bit D3	OUT2	OUT2	OUT2
Connection	Screw connection	Screw connection	Spring-loaded terminals

SlimLine module S22.5

Order no.	3RK1402-0BG00-0AA2	3RK1100-1CE00-0AA2	3RK1100-1CG00-0AA2
Slave type	Standard slave	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	2 inputs / 2 outputs	4 outputs	4 outputs
Connection type	Spring-loaded terminals	Screw connection	Spring-loaded terminals
Connection for sensors	2 conductors	—	—
Output type	Relais changeover contact, floating	Transistor PNP (1 A)	Transistor PNP (1 A)
AS-i slave profile IO.ID.ID2	3.0.F	8.0.F	8.0.F
ID1 code (factory setting)	F	F	F
Total power consumption	≤ 50 mA	≤ 40 mA	≤ 40 mA

Order no.	3RK1402-0BG00-0AA2	3RK1100-1CE00-0AA2	3RK1100-1CG00-0AA2
Inputs			
Sensor supply via AS-Interface	Short circuit and overload proof	—	—
Voltage range	20 to 30 V	—	—
Current-carrying capacity for sensor supply	—	—	—
Switching level - high	≥ 10 V	—	—
Input current low/high	≤ 1.5 / ≥ 5 mA	—	—
Outputs			
Typ. current-carrying capacity per output: 12/13 DC	—	1 A	1 A
Max. total current for each module	—	2 A	2 A
Short-circuit protection	External back-up fuse required	Integrated	Integrated
Inductive interference protection	N/A	Integrated	Integrated
Reverse polarity protection	N/A	Integrated	Integrated
External 24 V DC power supply	N/A	Screw connection: Terminal 7 = "+" Terminal 10 = M	Screw connection: Terminal 7 = "+" Terminal 10 = M
I_{th}	6 A	—	—
AC-15	3 A	—	—
13, 24 V DC	1 A	—	—
13, 110 V DC	0.2 A	—	—
13, 230 V DC	0.1 A	—	—
Watchdog	Integrated	Integrated	Integrated
Assignment of the data bits			
Data bit D0	IN1	OUT1	OUT1
Data bit D1	IN2	OUT2	OUT2
Data bit D2	OUT1	OUT3	OUT3
Data bit D3	OUT2	OUT4	OUT4

SlimLine modules S45

Order no.	3RK1400-1CE00-0AA2	3RK1400-1CE01-0AA2	3RK1402-3CE01-0AA2
Slave type	Standard slave	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs / 4 outputs	4 inputs / 4 outputs	4 inputs / 4 outputs
Connection type	Screw connection	Screw connection	Screw connection
Connection for sensors	2 and 3 conductors	2 and 3 conductors	2 and 3 conductors (floating)
Output type	Transistor PNP (1 A)	Transistor PNP (2 A)	Transistor PNP (1 A) floating
AS-i slave profile IO.ID.ID2	7.0.F	7.0.F	7.0.F
ID1 code (factory setting)	F	F	F
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 40 mA
Inputs			
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	200 mA	200 mA	200 mA
Switching level - high	≥ 10 V	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA
Outputs			
Typ. current-carrying capacity per output: 12/13 DC	1 A	2 A	1 A
Max. total current for each module	4 A	4 A	4 A
Short-circuit protection	Integrated	Integrated	Integrated
Inductive interference protection	Integrated	Integrated	Integrated
Reverse polarity protection	Integrated	Integrated	Integrated
External 24 V DC power supply	Terminal 13 = L24+ Terminal 19 = M24	Terminal 13 = L24+ Terminal 19 = M24	Sensor supply: Terminal 13 = U_s+ Terminal 19 = U_s– Actuator supply: Terminal 14 = L+ Terminals 20 to 24 = M
Watchdog	Integrated	Integrated	Integrated
Assignment of the data bits			
Data bit D0	IN1/OUT1	IN1/OUT1	IN1/OUT1
Data bit D1	IN2/OUT2	IN2/OUT2	IN2/OUT2
Data bit D2	IN3/OUT3	IN3/OUT3	IN3/OUT3
Data bit D3	IN4/OUT4	IN4/OUT4	IN4/OUT4
The module "3RK1 402-3CE01-0AA2" is equipped with four floating inputs and four floating switching outputs. An external additional supply of 20 to 30 V to VDE 0106 (PELV) protection class III is required for the input and output circuits.			

SlimLine modules S45

Order no.	3RK1402-3CE00-0AA2	3RK1400-1CG00-0AA2	3RK1400-1CG01-0AA2
Slave type	Standard slave	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs / 4 outputs	4 inputs / 4 outputs	4 inputs / 4 outputs
Connection type	Screw connection	Spring-loaded terminals	Spring-loaded terminals
Connection for sensors	2 and 3 conductors	2 and 3 conductors	2 and 3 conductors
Output type	Relay	Transistor PNP (1 A)	Transistor PNP (2 A)
AS-i slave profile IO.ID.ID2	7.0.F	7.0.F	7.0.F
ID1 code (factory setting)	F	F	F
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 270 mA
Inputs			
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	200 mA	200 mA	200 mA
Switching level - high	≥ 10 V	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA
Outputs			
Typ. current-carrying capacity per output: 12/13 DC	—	1 A	2 A
Max. total current for each module	—	4 A	4 A
Short-circuit protection	External back-up fuse 6 A gL/gG	Integrated	Integrated
Inductive interference protection	N/A	Integrated	Integrated
Reverse polarity protection	—	Integrated	Integrated
External 24 V DC power supply	N/A	Terminal 13 = L24+ Terminal 19 = M24	Terminal 13 = L24+ Terminal 19 = M24
I_{th}	5 A	—	—
AC-15	3 A	—	—
13, 24 V DC	1 A	—	—
13, 110 V DC	0.2 A	—	—
13, 230 V DC	0.1 A	—	—
Watchdog	Integrated	Integrated	Integrated
Assignment of the data bits			
Data bit D0	IN1/OUT1	IN1/OUT1	IN1/OUT1
Data bit D1	IN2/OUT2	IN2/OUT2	IN2/OUT2
Data bit D2	IN3/OUT3	IN3/OUT3	IN3/OUT3
Data bit D3	IN4/OUT4	IN4/OUT4	IN4/OUT4

SlimLine modules S45

Order no.	3RK1402-3CG01-0AA2	3RK1402-3CG00-0AA2
Slave type	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs / 4 outputs	4 inputs / 4 outputs
Connection type	Spring-loaded terminals	Spring-loaded terminals
Connection for sensors	2 and 3 conductors	2 and 3 conductors
Output type	Transistor PNP (1 A)	Relay
AS-i slave profile IO.ID.ID2	7.0.F	7.0.F
ID1 code (factory setting)	F	F
Total power consumption	≤ 40 mA	≤ 270 mA
Inputs		
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	200 mA	200 mA
Switching level - high	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA
Outputs		
Typ. current-carrying capacity per output: 12/13 DC	1 A	—
Max. total current for each module	4 A	—
Short-circuit protection	Integrated	External back-up fuse 6 A gL/gG
Inductive interference protection	Integrated	N/A
Reverse polarity protection	Integrated	Integrated
External 24 V DC power supply	Sensor supply: Terminal 13 = U_s+ Terminal 19 = U_s– Actuator supply: Terminal 14 = L+ Terminals 20 to 24 = M	N/A
I_{th}	—	5
AC-15	—	3
13, 24 V DC	—	1
13, 110 V DC	—	0.2
13, 230 V DC	—	0.1
Watchdog	Integrated	Integrated

Order no.	3RK1402-3CG01-0AA2	3RK1402-3CG00-0AA2
Assignment of the data bits		
Data bit D0	IN1/OUT1	IN1/OUT1
Data bit D1	IN2/OUT2	IN2/OUT2
Data bit D2	IN3/OUT3	IN3/OUT3
Data bit D3	IN4/OUT4	IN4/OUT4
The module "3RK1 402-3CG01-0AA2" is equipped with four floating inputs and four floating switching outputs. An external additional supply of 20 to 30 V to VDE 0106 (PELV) protection class III is required for the input and output circuits.		

SlimLine modules S45

Order no.	3RK2400-1FE00-0AA2	3RK2400-1FG00-0AA2
Slave type	A/B slave	A/B slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.1	AS-i Spec. 2.1
No. of inputs/outputs	4 inputs / 3 outputs	4 inputs / 3 outputs
Connection type	Screw connection	Spring-loaded terminals
Connection for sensors	2 and 3 conductors	2 and 3 conductors
Output type	Transistor PNP (2 A)	Transistor PNP (2 A)
AS-i slave profile IO.ID.ID2	7.A.0	7.A.0
ID1 code (factory setting)	7	7
Total power consumption	≤ 270 mA	≤ 270 mA
Inputs		
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	200 mA	200 mA
Switching level - high	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA
Outputs		
Typ. current-carrying capacity per output: 12/13 DC	2 A	2 A
Max. total current for each module	4 A	4 A
Short-circuit protection	Integrated	Integrated
Inductive interference protection	Integrated	Integrated
Reverse polarity protection	Integrated	Integrated
External 24 V DC power supply	Terminal 13 = L24+ Terminal 19 = M24	Terminal 13 = L24+ Terminal 19 = M24

Order no.	3RK2400-1FE00-0AA2	3RK2400-1FG00-0AA2
I_{th}	—	—
AC-15	—	—
13, 24 V DC	—	—
13, 110 V DC	—	—
13, 230 V DC	—	—
Watchdog	Integrated	Integrated
Assignment of the data bits		
Data bit D0	IN1/OUT1	IN1/OUT1
Data bit D1	IN2/OUT2	IN2/OUT2
Data bit D2	IN3/OUT3	IN3/OUT3
Data bit D3	IN4	IN4

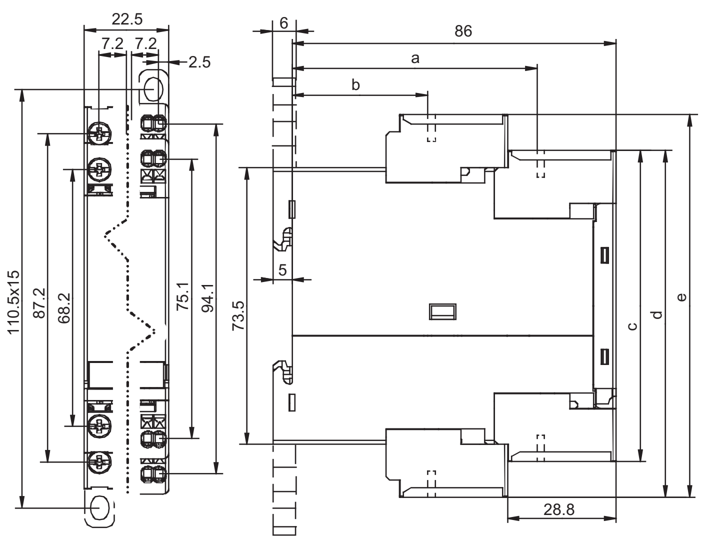
SlimLine modules S45

Order no.	2400-1CE01-0AA2	2400-1CG01-0AA2
Slave type	A/B slave (Spec. 3.0)	A/B slave (Spec. 3.0)
No. of inputs/outputs	4 inputs / 4 outputs	4 inputs / 4 outputs
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 3.0	AS-i Spec. 3.0
Connection type	Screw connection	Spring-loaded terminals
Connection for sensors	2 and 3 conductors	2 and 3 conductors
Output type	Transistor PNP (2 A)	Transistor PNP (2 A)
AS-i slave profile IO.ID.ID2	7.A.7	7.A.7
ID1 code (factory setting)	7	7
Total power consumption	≤ 270 mA	≤ 270 mA
Inputs		
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	200 mA	200 mA
Switching level - high	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA
Outputs		
Typ. current-carrying capacity per output: 12/13 DC	2 A	2 A
Max. total current for each module	4 A	4 A
Short-circuit protection	Integrated	Integrated
Inductive interference protection	Integrated	Integrated
Reverse polarity protection	Integrated	Integrated
External 24 V DC power supply	Terminal 13 = L24+ Terminal 19 = M24	Terminal 13 = L24+ Terminal 19 = M24

Order no.	2400-1CE01-0AA2	2400-1CG01-0AA2
I_{th}	—	—
AC-15	—	—
13, 24 V DC	—	—
13, 110 V DC	—	—
13, 230 V DC	—	—
Watchdog	Integrated	Integrated
Assignment of the data bits		
Data bit D0	IN1/OUT1	IN1/OUT1
Data bit D1	IN2/OUT2	IN2/OUT2
Data bit D2	IN3/OUT3	IN3/OUT3
Data bit D3	IN4/OUT4	IN4/OUT4

8.4.7.5 Dimension drawings

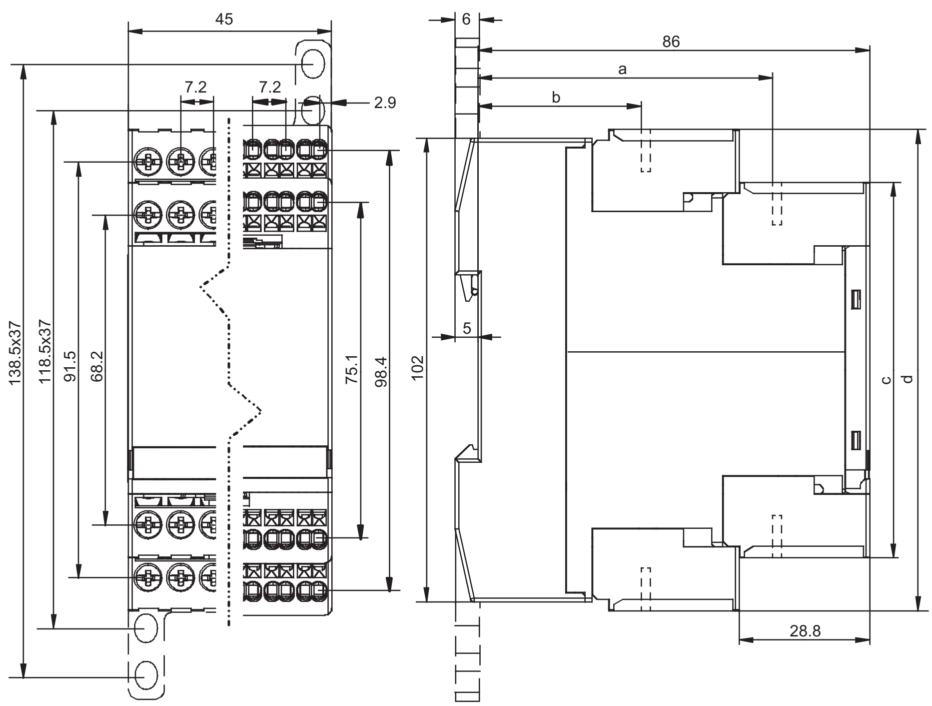
Module S22.5



	a	b	c	d	e
3RK....-..E.	65	36	82.6	92.2	101.6
3RK....-..G.	—	—	84.4	93.9	103.4

Figure 8-28 Dimensions of the SlimLine module S22.5

Module S45



	a	b	c	d
3RK....-..E.	65	36	82.6	105.9
3RK....-..G.	—	—	84.4	107.7

Figure 8-29 Dimensions of the SlimLine module S45

8.4.8 F90 digital input/output module - cabinet IP20

8.4.8.1 Overview

F90 module

The F90 module is available in the following versions:

- 4 inputs / 4 outputs
  - Current-carrying capacity 1 A
  - Current-carrying capacity 2 A
- 4 inputs / 4 outputs 2 A, floating
- 16 inputs

With either screw terminals or Combicon connector.

Operating principle of the F90 module with 16 inputs

The 16 inputs are divided into four groups each comprising four inputs.

Only one group at a time can be active. The PLC activates each group one after the other and reads the four items of input data to the process image for the inputs (PII). The user program assigns the input data to the relevant groups, that is, the output image (POI) of the PLC must match the set output on the module otherwise input data will be read by the wrong group.

If the AS-Interface transfer procedure is not functioning properly, it can take up to three AS-Interface cycles (15 ms) before the output image (OI) of the slave matches the output image of the master and, in turn, the PLC. It can also take up to three AS-Interface cycles to transfer the input image of the slave. If more than three consecutive AS-Interface cycles are required to send telegrams to the relevant slave, a "configuration error" is output on the master. The input image in the master is set to "zero" and the error bit in the PLC is set.

Example: Behavior of the OI and II in the master and slave when AS-Interface transfer is faulty

AS-Interface-Cycle	PLC		Master		Module		Comments
	PAA	PAE	AA		AA	EA	
	1000	xxxx					
1	1000	xxxx	0111	xxxx	xxxx	xxxx	MA or SA faulty
2	1000	xxxx	0111	xxxx	xxxx	xxxx	MA or SA faulty
3	1000	xxxx	0111	~~EEEE~~	1000	~~EEEE~~	E invalid due to switchover time in module
4	1000	xxxx	0111	xxxx	1000	EEEE	MA or SA faulty
5	1000	xxxx	0111	xxxx	1000	EEEE	MA or SA faulty
6	1000	xxxx	0111	EEEE	1000	EEEE	MA or SA not faulty
	1000	EEEE	0111				

Key:
AA Output image
EA Input image
MA Master call
PAA Process image of outputs
PA Process image of inputs
SA Slave response
PLC Programmable logic controller

Figure 8-30 F90 cycle

In this example, the OI and II in the master and slave do not match until after six AS-Interface cycles. The PLC cycle is asynchronous vis-à-vis the AS-Interface cycle, which is why the time required for the OI and II of the master and PLC to match increases by one AS-Interface cycle and one PLC cycle.

Formula for the cycle time:

4 x ((6 x 5 ms) + 5 ms + 10 ms) =180 ms

Note

The following function blocks (FB) are available for the flow sequence:

- FB 21 (E16-2433) for the AS-Interface master CP2433 (AG S5-95 U)
- FB 22 (E16-2430) for the AS-Interface master CP2430 (AG S5-115 U)
- FC 22 for S7

The time between two calls of the FB for a module must be at least 30 ms in order to ensure that the switching statuses of the inputs are read reliably.

Note

If you require programming examples, contact the Technical Assistance team (tel. (0911) 895-5900) or visit the following Web page:

http://www.siemens.de/as-interface

8.4.8.2 Order numbers

F90 module

Type	Order no.
AS-Interface F90 module, digital, 4I/4O, 2/3 conductors, 4 x 1 input, max. 200 mA, PNP, 4 x 1 output, electr., 2 A, 24 V DC connection via screw terminals	3RG9002-0DA00
AS-Interface F90 module, digital, 4I/4O, 2/3 conductors, 4 x 1 input, max. 200 mA, PNP, 4 x 1 output, electr., 1 A, 24 V DC connection via screw terminals	3RG9002-0DB00
AS-Interface F90 module, digital, 4I/4O, 2/3 conductors, floating, 4 x 1 input, max. 200 mA, PNP, 4 x 1 output, electr., 2 A, 24 V DC connection via screw terminals	3RG9002-0DC00
AS-Interface F90 module, digital, 16I (multiplexing) 16 x 1 input, 2 conductors, connection via screw terminals, function block required	3RG9002-0DE00
AS-Interface F90 module, digital, 4I/4O, 2/3 conductors, 4 x 1 input, max. 200 mA, PNP, 4 x 1 output, electr., 2 A, 24 V DC connection via COMBICON	3RG9004-0DA00
AS-Interface F90 module, digital, 4I/4O, 2/3 conductors, 4 x 1 input, max. 200 mA, PNP, 4 x 1 output, electr., 1 A, 24 V DC connection via COMBICON	3RG9004-0DB00
AS-Interface F90 module, digital, 4I/4O, 2/3 conductors, floating, 4 x 1 input, max. 200 mA, PNP, 4 x 1 output, electr., 2 A, 24 V DC connection via COMBICON	3RG9004-0DC00
AS-Interface F90 module, digital, 16I (multiplexing) 16 x 1 input, 2 conductors, connection via COMBICON, function block required	3RG9004-0DE00

Accessories

Type	Order no.
COMBICON connector set for 4I/4O modules with COMBICON connection. 4 x 5-pin connector for connecting standard sensors/actuators 2 x 4 pin connector for AS-i and external auxiliary power supply	3RX9810-0AA00

8.4.8.3 Connection

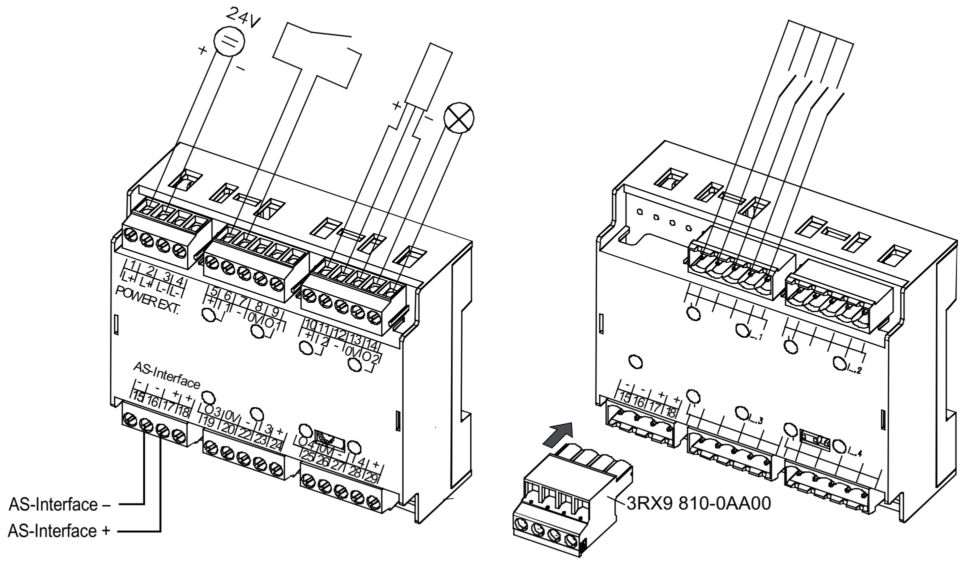


Figure 8-31 Connecting the F90 module, 4I/4O screw connection (left), 16I COMBICON connection (right)

1	2	3	4
L+	L+	L-	L-
U_{HI}			

5	6	7	8	9
+	E	–	0	A
IN1			OUT1	

10	11	12	13	14
+	E	–	0	A
IN2			OUT2	

AS-i			
–	–	+	+
15	16	17	18

OUT3		IN3		
A	0	–	E	+
19	20	21	22	23

OUT4		IN4		
A	0	–	E	+
24	25	26	27	28

Figure 8-32 Terminal assignment for F90 4I-4O

5	6	7	8	9
G1	I1.1	I1.2	I1.3	I1.4

10	11	12	13	14
G2	I2.1	I2.2	I2.3	I2.4

15	16	17	18
–	–	+	+
AS-i			

19	20	21	22	23
G3	I3.1	I3.2	I3.3	I3.4

24	25	26	27	28
G4	I4.1	I4.2	I4.3	I4.4

Figure 8-33 Terminal assignment for F90 16I

8.4.8.4 Diagnostics

LED for AS-i/FAULT

The module has one dual LED for AS-i/FAULT for diagnostic purposes; see LED status displays for modules with a dual LED for AS-i/FAULT (Page 174)

8.4.8.5 Technical specifications

Order no.	3RG9002-0DB00	3RG9002-0DA00	3RG9004-0DB00	3RG9004-0DA00
Slave type	Standard slave	Standard slave	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs / 4 outputs	4 inputs / 4 outputs	4 inputs / 4 outputs	4 inputs / 4 outputs
Connection type	Screw terminals	Screw terminals	Combicon connection	Combicon connection
AS-i slave profile IO.ID.ID2	7.0.F	7.0.F	7.0.F	7.0.F
ID1 code (factory setting)	F	F	F	F
Connection for sensors	2 and 3 conductors	2 and 3 conductors	2 and 3 conductors	2 and 3 conductors
Input circuit	PNP	PNP	PNP	PNP
Total power consumption	≤ 270 mA	≤ 270 mA	≤ 270 mA	≤ 270 mA
Inputs				
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	200 mA	200 mA	200 mA	200 mA
Switching level - high	≥ 10 V	≥ 10 V	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA
Outputs				
Output type	Electronics	Electronics	Electronics	Electronics
Typ. current-carrying capacity per output: 12/13 DC	1 A	2 A	1 A	2 A
Max. total current for each module	4 A	6 A	4 A	6 A
Short-circuit protection	Integrated	External back-up fuse	Integrated	
Inductive interference protection	Integrated	Integrated	Integrated	Integrated
Reverse polarity protection	Integrated	Integrated	Integrated	Integrated
Watchdog	Integrated	Integrated	Integrated	Integrated
External 24 V DC power supply	Via terminals	Via terminals	Via plug connector	Via plug connector

Order no.	3RG9002-0DB00	3RG9002-0DA00	3RG9004-0DB00	3RG9004-0DA00
Assignment of the data bits				
Data bit D0	IN1/OUT1	IN1/OUT1	IN1/OUT1	IN1/OUT1
Data bit D1	IN2/OUT2	IN2/OUT2	IN2/OUT2	IN2/OUT2
Data bit D2	IN3/OUT3	IN3/OUT3	IN3/OUT3	IN3/OUT3
Data bit D3	IN4/OUT4	IN4/OUT4	IN4/OUT4	IN4/OUT4
AS-Interface certificate	Available			
Approvals	UL, CSA, shipbuilding			
Degree of protection	IP20			
Ambient temperature	-25 ... +70 °C			
Storage temperature	-40 ... +85 °C			
Indicators				
Inputs/outputs	Yellow LEDs			
AS-i voltage	LED green			

Order no.	3RG9002-0DC00	3RG9004-0DC00
Slave type	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs / 4 outputs	4 inputs / 4 outputs
Connection type	Screw terminals	Combicon connection
AS-i slave profile IO.ID.ID2	7.0.F	7.0.F
ID1 code (factory setting)	F	F
Connection for sensors	2 and 3 conductors	2 and 3 conductors
Input circuit	PNP	PNP
Total power consumption	≤ 30 mA	≤ 30 mA
Inputs		
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	200 mA	200 mA
Switching level - high	≥ 10 V	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA	≤ 1.5 / ≥ 5 mA
Outputs		
Output type	Electronics	Electronics
Typ. current-carrying capacity per output: 12/13 DC	2 A, floating	2 A, floating
Max. total current for each module	4 A	6 A
Short-circuit protection	Integrated	Integrated
Inductive interference protection	Integrated	Integrated
Watchdog	Integrated	Integrated

Order no.	3RG9002-0DC00	3RG9004-0DC00
External 24 V DC power supply	Via terminals	Via plug connector
Assignment of the data bits		
Data bit D0	IN1/OUT1	IN1/OUT1
Data bit D1	IN2/OUT2	IN2/OUT2
Data bit D2	IN3/OUT3	IN3/OUT3
Data bit D3	IN4/OUT4	IN4/OUT4
AS-Interface certificate	Available	
Approvals	UL, CSA, shipbuilding	
Degree of protection	IP20	
Ambient temperature	-25 ... +70 °C	
Storage temperature	-40 ... +85 °C	
Displays		
Inputs/outputs	Yellow LEDs	
AS-i voltage	LED green	
Note: The module is equipped with four floating inputs and four floating switching outputs. An external additional supply of 20 to 30 V to VDE 0106 (PELV) protection class III is required for the input and output circuits.		

Order no.	3RG9002-0DE00	3RG9004-0DE00
Slave type	Standard slave	Standard slave
Geeignet für AS-i Master nach Spec. ... (oder höher)	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	16 inputs	16 inputs
Connection type	Screw terminals	Combicon connection
AS-i slave profile IO.ID.ID2	7.F.F	7.F.F
ID1 code (factory setting)	F	F
Connection for sensors	Mechanical contacts	Mechanical contacts
Input circuit	PNP	PNP
Total power consumption	≤ 70 mA	≤ 70 mA
Inputs		
Sensor supply via AS-Interface	Short circuit and overload proof	Short circuit and overload proof
Voltage range	20 to 30 V	20 to 30 V
Current-carrying capacity for sensor supply	200 mA	200 mA
Signal 1 U_{in}	20 ... 30 V ≥ 3 mA	20 ... 30 V ≥ 3 mA
Group signal		
Current-carrying capacity I_{out}	≤ 25 mA	≤ 25 mA
Output voltage U_{out}	20 ... 30 V	20 ... 30 V
Watchdog	Integrated	Integrated

Order no.	3RG9002-0DE00	3RG9004-0DE00
Assignment of the data bits		
Data bit D0	Data bit D0 group signal G1 (D0) inputs I 1.1 to I 1.4 (D0 to D3)	
Data bit D1	Data bit D1 group signal G2 (D1) inputs I 2.1 to I 2.4 (D0 to D3)	
Data bit D2	Data bit D2 group signal G3 (D2) inputs I 3.1 to I 3.4 (D0 to D3)	
Data bit D3	Data bit D3 group signal G4 (D3) inputs I 4.1 to I 4.4 (D0 to D3)	
AS-Interface certificate	Available	
Approvals	UL, CSA, shipbuilding	
Degree of protection	IP20	
Ambient temperature	-25 ... +70 °C	
Storage temperature	-40 ... +85 °C	
Displays		
Inputs/outputs	Yellow LEDs	
AS-i voltage	LED green	
Note: 1. The module is equipped with four input groups. Each input group has four inputs and one group signal for supplying the inputs with power. The input groups are activated separately when the controller sets the relevant group signal. The switching statuses of the assigned inputs are then read. 2. Function block required.		

Note

An external additional power supply (AUX POWER) of between 20 and 30 V DC is required for supplying the output circuits. The additional power supply must comply with VDE 0106 (PELV), protection class III.

Setting the AS-i address

The address can be assigned via the integrated addressing socket.

8.4.8.6 Dimension drawings

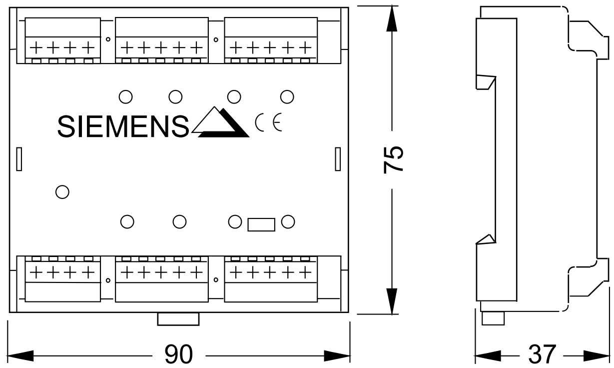
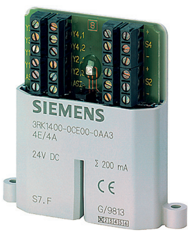


Figure 8-34 F90 module dimensions

8.4.9 Flat digital input/output module - cabinet IP20

8.4.9.1 Overview



The flat module for cabinets with degree of protection IP20 is equipped with four inputs and four outputs.

The module is fitted with LEDs on the front, which indicate the status of the module.

Installation

The modules can be secured using the integrated lugs.

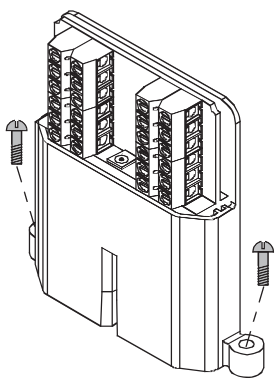


Figure 8-35 Installing the flat modules

Setting the AS-i address

An integrated addressing socket allows the module to be addressed once it has been installed.

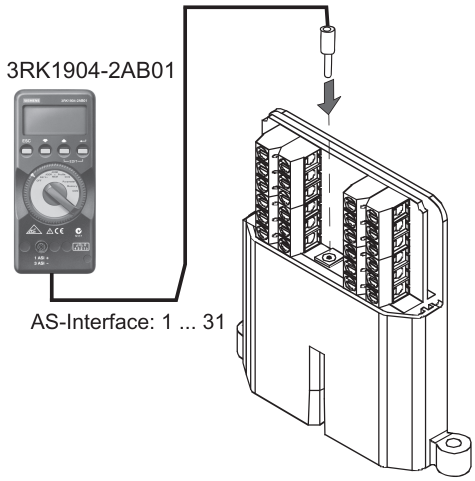


Figure 8-36 Addressing the flat modules

8.4.9.2 Order numbers

Type	Order no.
AS-Interface flat module, 4I/4O, with screw connection, 4 X 1 input, PNP, 4 X outputs 45 mA, 24 V DC supply of outputs via AS-i cable	3RK1400-0CE00-0AA3

8.4.9.3 Connection

Connecting the flat modules for installation in cabinets

Screw terminals can be used to connect standard sensors/actuators and the AS-Interface cable.

8.4.9.4 Diagnostics

LED for AS-i/FAULT

The module has one dual LED for AS-i/FAULT for diagnostic purposes; see LED status displays for modules with a dual LED for AS-i/FAULT (Page 174)

8.4.9.5 Technical specifications

Order no.	3RK1400-0CE00-0AA3
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs / 4 outputs
Connection type	Screw terminals
AS-i slave profile IO.ID	7.F
ID2, ID1 code	not available (substitute values: F, F)
Connection for sensors	2 and 3 conductors
Input circuit	PNP
Total power consumption	≤ 270 mA
Inputs	
Sensor supply via AS-Interface	Short circuit and overload proof
Voltage range	20 to 30 V
Current-carrying capacity for sensor supply	200 mA (total current for all inputs and outputs: max. 200 mA)
Switching level - high	≥ 10 V
Input current low/high	≤ 1.5 / ≥ 5 mA
Outputs	
Output type	Electronics
Typ. current-carrying capacity per output: 12/13 DC	200 mA (total current for all inputs and outputs: max. 200 mA)
Short-circuit protection	Integrated
Inductive interference protection	Integrated
Watchdog	Integrated
External 24 V DC power supply	Not required (all inputs and outputs are supplied via the AS-Interface cable)
Assignment of the data bits	
Data bit D0	IN1/OUT1
Data bit D1	IN2/OUT2
Data bit D2	IN3/OUT3
Data bit D3	IN4/OUT4
AS-Interface certificate	Available
Degree of protection	IP20
Ambient temperature	-25 ... +85 °C
Storage temperature	-40 ... +85 °C
Displays	
AS-i voltage	LED green
FAULT	LED red

8.4.9.6 Dimension drawings

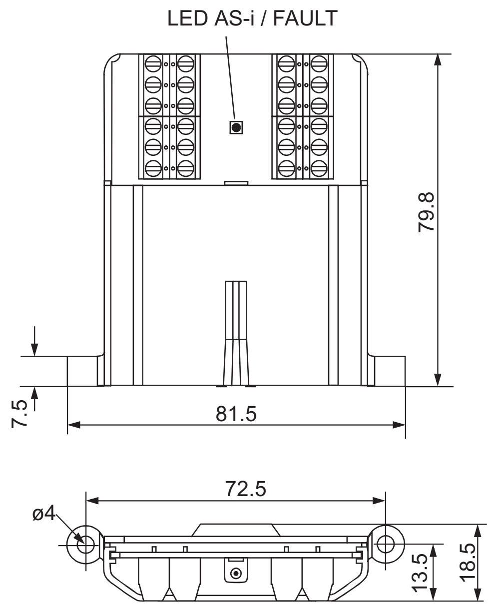


Figure 8-37 Dimensions of the flat module

8.5 Modules with special functions

Overview

The following modules with special functions are available for AS-Interface:

- Counter module:
  counts input pulses.

8.5.1 Counter module

8.5.1.1 Overview

Counter module

This module is used for transferring hexadecimal count values (LSB=D0, MSB=D3) to a higher-level controller, whereby the count value is incremented by one every time a valid count pulse is received at terminal 8. The module counts from 0 to 15 and then starts again at 0. The controller adopts the current value and determines the pulse count between two host calls by calculating the difference from the previous value. The difference is added together to yield the total number of count pulses.

To transfer unique values, no more than 15 count values must be present between two host calls or AS-Interface master calls at terminal 8. The maximum permissible transfer frequency is calculated from these times:

$f_{Trmax} = 15 / T_{max}$

T_{max}: max. possible transfer time from slave to host

A further condition for the maximum frequency is the required pulse shape. To ensure that the counter adopts a pulse as being "valid", a low must be applied for at least 300 µs and a high for at least 1 ms at the input. This results in a controller-independent maximum frequency of:

f_{Zmax} = 1 / 1.3 ms = 769 Hz for the counter module (see the following diagram).

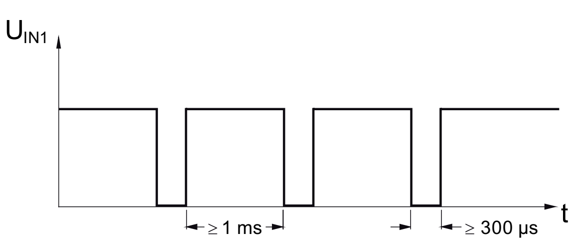


Figure 8-38 Time criteria for the counter module

If the time criteria specified in the diagram is violated, the count value is rejected.

The counter is only active for the reset parameter P2 (default). When P2 is set, the counter is deleted and the incoming count pulses are not registered until P2 is reset.

Setting the AS-i address

The AS-i address can be set with the addressing unit on the addressing socket.

8.5.1.2 Order numbers

Type	Order no.
Counter module, screw terminal connection	3RK1200-0CE03-0AA2
Counter module, spring-loaded terminal	3RK1200-0CG03-0AA2

8.5.1.3 Connection

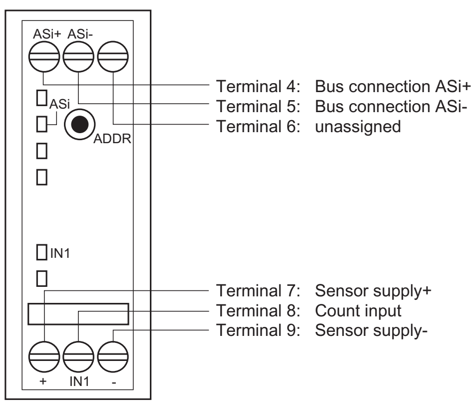


Figure 8-39 Counter module terminals

Connection cross-sections

Cable	Screw terminals	Spring-loaded terminals
Single-core:	1 x 0.5 ... 4.0 mm² 2 x 0.5 ... 2.5 mm²	2 x 0.25 ... 1.5 mm²
Finely stranded with wire end ferrule	1 x 0.5 ... 2.5 mm² 2 x 0.5 ... 1.5 mm²	2 x 0.25 ... 1.5 mm²
Finely stranded without wire end ferrule	—	2 x 0.25 ... 1.5 mm²
AWG cables, single or multi-core	2 x 20 to 14	2 x 24 to 16

8.5.1.4 Diagnostics

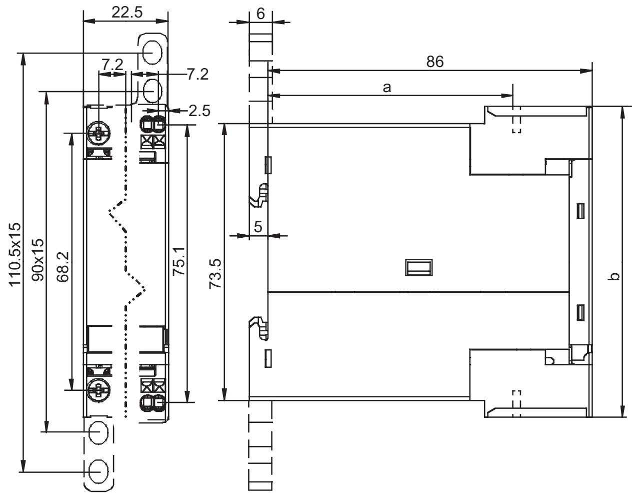
LED for AS-i/FAULT

The module has one dual LED for AS-i/FAULT for diagnostic purposes; see LED status displays for modules with a dual LED for AS-i/FAULT (Page 174)

8.5.1.5 Technical specifications

Order no.	Screw terminals	Spring-loaded terminals
Connection type	3RK1200-0CE03-0AA2	3RK1200-0CG03-0AA2
Slave type	Standard slave	
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	
No. of inputs/outputs	1 input	
Operating voltage in acc. with AS-Interface Specification	26.5 ... 31.6 V	
Rated operating voltage	—	
AS-i slave profile IO.ID	0.F	
ID2, ID1 code	not available (substitute values: F, F)	
Total power consumption from AS-Interface	≤ 170 mA	
AS-Interface certificate	Available	
Approvals	UL, CSA, shipbuilding	
Degree of protection	IP20	
Ambient temperature	-25 ... +70 °C	
Storage temperature	-40 ... +85 °C	
Sensor supply via AS-Interface	Short circuit and overload proof	
Voltage range	20 ... 30 V	
Current-carrying capacity for sensor supply	90 mA	
Switching level - high	≥ 10 V	
Switching level - low	≤ 5 V	
Input current - high	≥ 10 mA	
Input current - low	≤ 2 mA	
Assignment of the terminals	7: = + 9: = – 8: = IN1	

8.5.1.6 Dimension drawings



	a	b
3RK1200-..E.	65	82.6
3RK1200-..G.	—	84.4

Figure 8-40 Counter module dimensions

8.6 Switching devices with integrated AS-i connection

Switching devices with integrated AS-i connection

The functionality of the AS-Interface is not restricted to I/O modules only.

AS-Interface can be integrated directly for switching devices:

AS-Interface motor starter

- Electromechanical compact starters DS and RS
- Electronic compact starters EDS and ERS

Motor starter and load feeders IP65/67

- Motor starter (24 V DC)
  - Single direct-on-line starter (without brake or connectable quick-stop function)
  - Double direct-on-line starter (with brake and connectable quick-stop function)
  - Reversing starter (with brake and connectable quick-stop function)

ECOFAST starters

- ECOFAST starter RS (electromechanical)
- ECOFAST starter ERSS (reversing soft starter, electronic)
- ECOFAST starter R2SS (duo reversing starter, electronic)

8.6.1 AS-Interface motor starter (400 V / 600 V, IP65)

8.6.1.1 Overview

Compact starter

The AS-Interface compact starter is a fully pre-wired (internally) load feeder with degree of protection IP65 designed for switching and protecting all types of three-phase loads up to 5.5 kW at 400/500 V AC (electromechanical compact starters DS and RS) and up to 2.2 kW (electronic compact starters EDS and ERS), usually standard induction motors with direct operation mode or reversing duty. It comprises either an electromechanical switchgear assembly or an electronic overload protection system and motor starter protector unit. The overload/short-circuit protection device is located under a sealable, transparent cover and can be diagnosed here. Two LEDs located to the left of the cover are used for diagnosing AS-Interface and the auxiliary power.

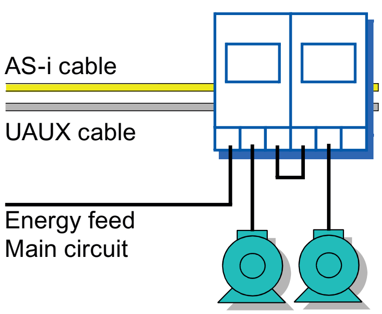
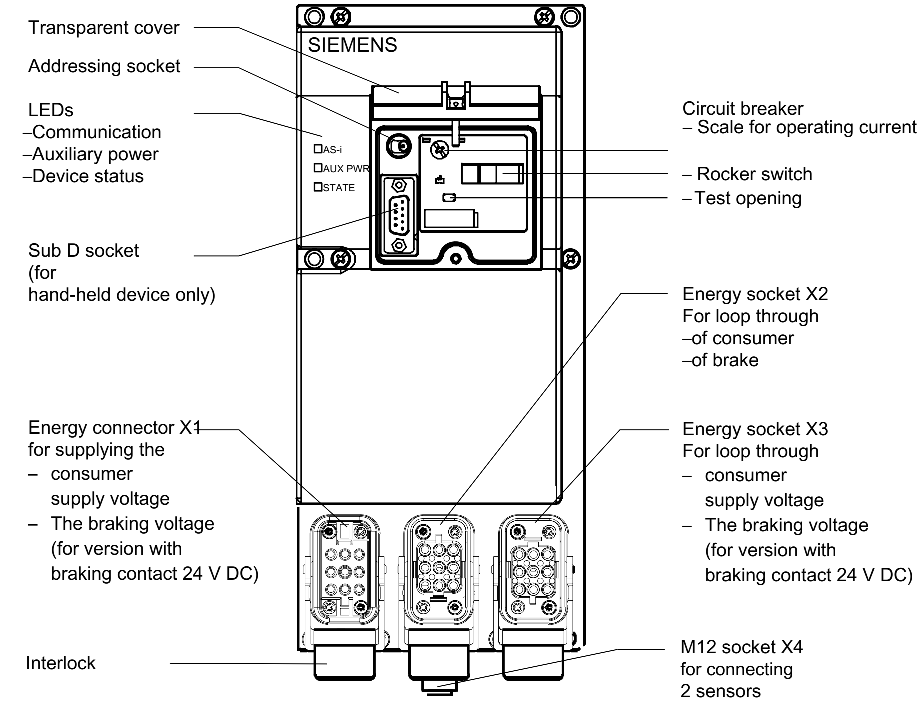


Figure 8-41 Sample configuration with two compact starters

Three power connectors (-X1, -X2, -X3) are used for supplying (-X1) and routing (-X3) the load power supply (energy bus) as well as for connecting the load itself (-X2). Prefabricated power connection cables can be used to connect compact starters that are directly adjacent to each other. The maximum number of starters that can be supplied via one power cable depends on the maximum permissible aggregate current (max. 4 mm^2 = approx. 35 A).

Compact starters DS/RS



Compact starters EDS/ERS

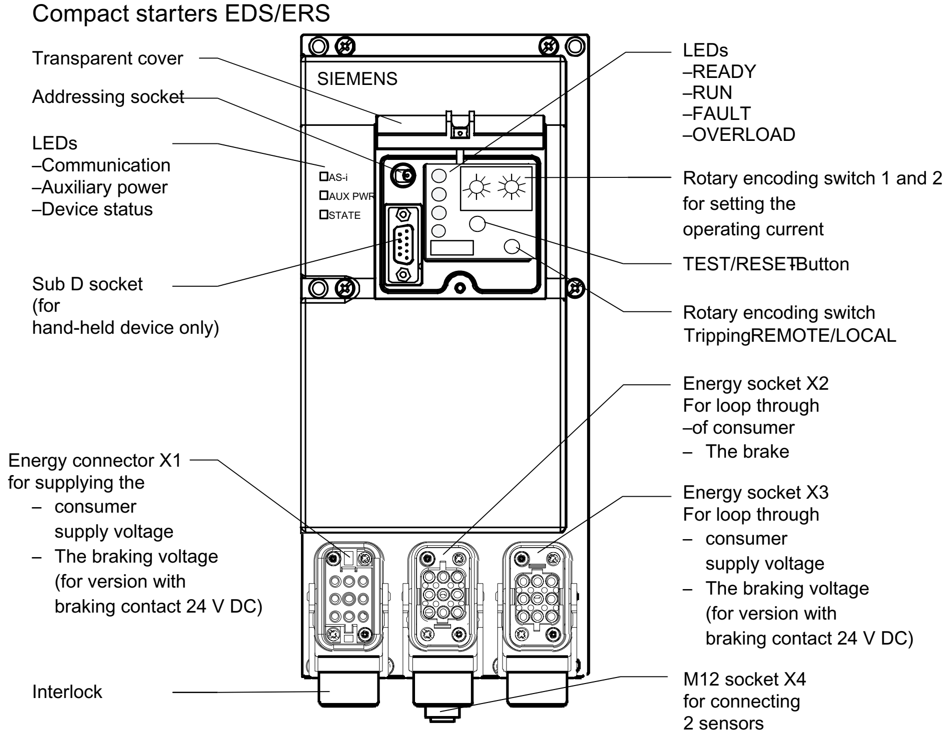


Figure 8-42 DS/RS and EDS/ERS compact starters

DS/RS compact starters (electromechanical)

Electromechanical compact starters comprise a standard switchgear assembly with SIRIUS circuit breakers for short-circuit/overload protection and SIRIUS contactor(s) for switching under normal operating conditions. Electromechancal starters not only offer a number of benefits including safe, electrical isolation during switch-off or in the event of a trip and integrated, non-fused short-circuit protection, but are also reasonably priced. The electromechanical versions can also be used to switch direct currents.

Configuration note: in temperature-critical applications, you are advised to operate circuit-breakers in the lower setting range.

EDS/ERS compact starters (electronic)

Electronic compact starters EDS (direct-on-line starters) and ERS (reversing starters) comprise an electronic overload protection system and an electronic motor starter protector unit.

The benefits of these electronic compact starters include a broad setting range for overload protection (just two variants cover a power range of up to 2.2 kW at 400/500 V AC), a highly wear resistant motor starter protector unit, a current detector (for monitoring the power connectors), emergency operation in the event of overload, and a remote reset function via AS-Interface after an overload trip.

The ERS compact starter is designed for direct startup in reversing duty. The electronic overload protection system and the tripping behavior in the event of an overload are set directly on the device.

Version with brake contact

All compact starters are available with an optional, separately-controlled brake contact for electrically-operated motor brakes. For motor brakes supplied externally, the 24 V DC is supplied together with the load voltage via the power connector at -X1. The power is routed via -X3 to supply the next compact starter at -X1. The 24 V DC for the brakes is only jumpered in the devices with a brake contact. During configuration, make sure that these starters are positioned next to each other.

All compact starters can be equipped with a brake contact for 500 V DC with a 400 AC brake contact.

Hand-held device

The hand-held device allows the compact starter to be operated locally and completely autonomously when the auxiliary power is present. In addition to standard manual operation, it is, therefore, possible for local switching operations and test runs during pre-commissioning (e.g. for testing the motor direction) to be performed with a functioning automation level if the PLC/bus system fails (emergency operation). A connection cable can be used to connect the hand-held device directly to the socket under the transparent cover on the compact starter.

Free inputs

The compact starters are also equipped with two free inputs. The input signals are forwarded directly to the higher-level controller and not evaluated in the compact starter.

The M12 socket has a Y assignment. The signal inputs are located on PIN 2 and 4. This enables an optical proximity switch to be connected, which supplies a signal and the message "dirty".

An M12 Y coupler plug can be used to divide the signal inputs over two M12 sockets, which means that two separate sensors can be connected.

Setting the AS-i address

As with the input/output modules, the AS-i address of the starter can be assigned via the addressing socket on the front (under the transparent cover).

8.6.1.2 Order numbers

Compact starter

Type		Order no.			
EDS compact starter Electronic direct-on-line starter with two free digital inputs		3RK1322-	xx	S12-0AA	x
ERS compact starter Electronic reversing starter with two free digital inputs		3RK1322-	xx	S12-1AA	x
Order no. extension for:					
AC motor 4-pin at 400 V AC Standard power P	Setting range of overcurrent release				
kW	A				
0.18 ... 0.8	0.6 ... 2.18		0A		
0.75 ... 2.2	2.0 ... 5.95		0B		
DS compact starter Electromechanical direct-on-line starter, with two free digital inputs		3RK1322-	xx	S02-0AA	x
RS compact starter Electromechanical reversing starter, with two free digital inputs		3RK1322-	xx	S02-1AA	x
Order no. extension for:					
AC motor 4-pin at 400 V AC Standard power P	Setting range of overcurrent release				
kW	A				
<0,06	0.14 ... 0.20		0B		
0.06	0.18 ... 0.25		0C		
0.09	0.22 ... 0.32		0D		

Type		Order no.			
0.10	0.28 ... 0.40		0E		
0.12	0.35 ... 0.50		0F		
0.18	0.45 ... 0.63		0G		
0.21	0.55 ... 0.80		0H		
0.25	0.70 ... 1.0		0J		
0.37	0.9 ... 1.25		0K		
0.55	1.1 ... 1.6		1A		
0.75	1.4 ... 2.0		1B		
0.90	1.8 ... 2.5		1C		
1.1	2.2 ... 3.2		1D		
1.5	2.8 ... 4.0		1E		
1.9	3.5 ... 5.0		1F		
2.2	4.5 ... 6.3		1G		
3.0	5.5 ... 8.0		1H		
4.0	7.0 ... 10		1J		
5.5	9.0 ... 12		1K		
Standard version					0
Version with brake contact for 24 V DC / 3 A external supply					1
Version with brake contact for 400 V AC / 0.5 A supply for brake rectifier					3
Version with brake contact for DC-side brake switching with 500 V DC / 0.2 A					4

Accessories

Type	Order no.
M12 coupler plug for connecting actuators or sensors (5-pin)	3RX8000-0CD55
M12 angle coupler plug for connecting actuators or sensors (5-pin)	3RX8000-0CE55
M12 Y coupler plug for double connection of sensors by means of single cable (5-pin)	6ES7194-1KA01-0XA0
M12 screw caps for sealing unassigned input/output sockets (one set contains ten screw caps)	3RX9802-0AA00

8.6.1.3 Connection

Voltages / signals	Connection type
AS-i cable	Insulation displacement method (flat cable)
U_{AUX} cable	Insulation displacement method (flat cable)
Free inputs	M12 socket, Y assignment
Power supply, motor cable (main circuit)	Han Q 8/0 connectors/sockets

Assignment of the inputs DI 0 - DI 3

Input	Status	Meaning	Possible measures
DI 0 "ready"	0	Manual mode Simultaneous activation of CW and CCW rotation For DS / RS only: Overload/short-circuit trip For DS / RS only: Compact starter defective For EDS / ERS only: Tripped signal Note: No automatic shutdown for TRIPPING in REMOTE setting. Shutdown must be initiated by user program. For EDS / ERS only: No current flow despite activation. Device fault	Use hand-held device to switch to automatic mode. Correct user program. Close circuit breaker. Replace compact starter. Briefly press RESET/TEST button (< 2 s) or remote reset via positive pulse on output bit DO3. Check: Motor connector/cable unplugged, auxiliary voltage < 18 V, failure of 2 phases, current asymmetry, carry out self-test, compact starter defective → replace.
	1	Device ready and in automatic mode	—
DI 1 "running"	0	Contactor OFF (DS / RS) No current flow (EDS / ERS)	—
	1	Contactor ON (DS / RS) Current flow present (EDS / ERS)	—
DI 2 "special information 1"	0	No input signal IN1	—
	1	Free input signal IN1 present	—
DI 3 "special information 2"	0	No input signal IN2	—
	1	Free input signal IN2 present	—

Assignment of outputs DO 0 - DO 3

Output	Status	Activation
DO 0 "run forward"	0	CW rotation OFF
	1	CW rotation ON
DO 1 "run reverse"	0	CCW rotation OFF
	1	CCW rotation ON
DO 2 "special command 1"	0	Open brake contact (brake voltage OFF)
	1	Close brake contact (brake voltage ON)
DO 3 "special command 2"	0	Remote reset OFF (EDS / ERS only)
	1	Remote reset ON (EDS / ERS only)

8.6.1.4 Diagnostics

The compact starters are equipped with LEDs for indicating error statuses, which enables comprehensive diagnostic activities to be carried out directly on the device.

Dual LED: AS-i

AS-i	Possible cause	Possible remedial measures
Green	Normal operation, AS-i communication OK	—
Red	No AS-i communication: • The master is switched off or offline. • The slave is not configured in the master. • The incorrect slave type is connected. • The slave has the wrong address.	Ensure AS-i communication: • Switch on the master or switch it to online mode. • Reconfigure the master. • Connect the correct module. • Check/correct the slave address.
Flashing red	Sensor supply overload (AS-i slave is in RESET mode and switches off completely)	Unplug the sensor cables from the input sockets, use sensors with a lower overall current consumption, check the sensors/cables.
Yellow/red flashing	The AS-i slave has the address 0 (on delivery)	Assign an address that is not 0.
OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

LED: AUX PWR (AUX POWER)

AUX PWR	Possible cause	Possible remedial measures
Green	Normal operation, 24 V DC auxiliary voltage OK	—
OFF	No auxiliary voltage, auxiliary voltage connected with incorrect polarity, auxiliary voltage too low	Switch on 24 V DC auxiliary voltage, connect properly, measure auxiliary voltage (approx. 24 V DC)

Note

If the auxiliary voltage has not been switched on, the motor starter shuts down the main circuit.

LED: STATE

STATE	Possible cause	Possible remedial measures
OFF	No activation, no fault	—
Green	Control signal present: CW or CCW, via AS-i master or hand-held device	—
Red	General error, e.g.: • Sensor supply overload • Circuit breaker tripped • Activation of CCW rotation for direct-on-line starter DS • Simultaneous activation of CW and CCW rotation	Rectify fault: • Unplug the sensor cables from the input sockets, use sensors with a lower overall current consumption, check the sensors/cables, switch on master and set to online mode. • Check the motor, close the circuit breaker. • Check/correct activation of CCW/CW rotation.
Flashing yellow	Compact starter switched to manual mode ("local") with hand-held device and hand-held device removed.	Deactivate manual mode: • Connect hand-held device and switch to bus mode ("remote"). • Switch 24 V auxiliary voltage on/off
Depending on the model, the "yellow flashing" status is the same as the "green flashing" status. The "red" status is not indicated for the electronic compact starters EDS/ERS. For EDS/ERS, this status is indicated by additional LEDs on the tripping unit under the transparent cover.		

Additional LEDs for compact starters EDS / ERS

The compact starters EDS / ERS have additional LEDs under the transparent cover on the tripping unit:

LED: READY

READY	Possible cause	Possible remedial measures
OFF	No auxiliary voltage or other fault	Switch on 24 V auxiliary voltage or look at the other LEDs.
Green	Device is ready for operation.	—
The READY (green) LED can also light up when the self-test is triggered. See notes for OVERLOAD.		

LED: RUN

RUN	Possible cause	Possible remedial measures
OFF	Main circuit OFF or current flow < 20 % of rated value.	—
Yellow	Main circuit ON, i.e. current flow > 20 % of rated value.	—

LED: FAULT

FAULT	Possible cause	Possible remedial measures
OFF	Main circuit ready	—
Red	Main circuit OFF, e.g. due to: • Failure of 2 phases • No current flow despite activation (e.g. motor connector unplugged) • Auxiliary voltage too low (< 18 V) • Simultaneous activation of CW and CCW rotation	Rectify fault: • Check power cable. • Check motor cable, motor. • Check auxiliary voltage. • Check/correct activation of CCW/CW rotation.
The FAULT (red) LED can also light up when the self-test is triggered. See notes for OVERLOAD.		

LED: OVERLOAD

OVERLOAD	Possible cause	Possible remedial measures
OFF	No overload in main circuit.	—
Red	Overload trip in main circuit: • When TRIPPING = LOCAL: automatic shutdown • When TRIPPING = REMOTE: shutdown must be performed by user program	• Remove overload (check drive/motor). • Briefly press RESET/TEST button (< 2 s) or carry out remote reset via positive pulse on output bit DO3.
Flashing red	Overcurrent detected but no overload trip yet.	• Shut down motor. • Remove overload (check drive/motor).
The "OVERLOAD red flashing" display can also occur when the self-test trips. (1) Press the RESET/TEST button (> 2 s) when the main circuit has been shut down. Flashing frequency. Bus activation is blocked. (3) When the self-test has finished, "OVERLOAD red flashing" is indicated with a slow flashing frequency. (3a) If "FAULT red" is indicated at the same time, an error occurred during the test. When you have rectified the problem, repeat the procedure as of step (1). (3b) If "READY green" is indicated at the same time, the test was successful. (4) Briefly press the RESET/TEST button (< 2 s) to enable bus activation. "OVERLOAD" extinguishes.		

8.6.1.5 Technical specifications

Control circuit	
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
No. of assigned inputs/outputs of which freely available	4 inputs / 4 outputs 2 inputs
AS-i slave profile IO.ID	7.D (for compact starters DS/RS) 7.E (for compact starters EDS/ERS)
ID2, ID1 code	not available (substitute values: F, F)
Overall current consumption from AS-i without wiring of free inputs	≤ 270 mA typ. 70 mA
Free inputs input circuit	PNP
Current-carrying capacity for all inputs	200 mA
Switching level - high	≥ 10 V
Input current low/high	≤1.5 mA / ≥ 6 mA
Sensor supply via AS-Interface	Short circuit and overload proof
Sensors	2 and 3 conductors
Voltage range	20 – 30 V
Assignment of the data bits	See the table in section Connection (Page 274)
Main circuit	
Rated operating voltage U_e • To DIN VDE 0106, part 1014 • To CSA and UL	 500 V AC, tolerance up to 575 V AC up to 600 V AC
Current ranges	See table for order numbers (Page 272) for the compact starters.
Brake circuit	
Brake voltage • Compact starters DS and RS • Compact starters EDS and ERS	 24 V DC, 500 V DC (depending on the version) 24 V DC, 400 V AC, 500 V DC (depending on the version)

For all the relevant technical specifications, see the "AS-Interface Compact Starter" manual (see Bibliography (Page 627), doc. ID: 6008647).

Note

In the specified documentation, the extension "2I" in the product designation means that the compact starter has two 2 free inputs (e.g. "compact starter DS2I"). In the catalog, however, the short product designation is used (e.g. "compact starter DS"). The two product designations are interchangeable and refer to the same product.

8.6.1.6 Dimension drawings

DS/RS and EDS/ERS compact starters

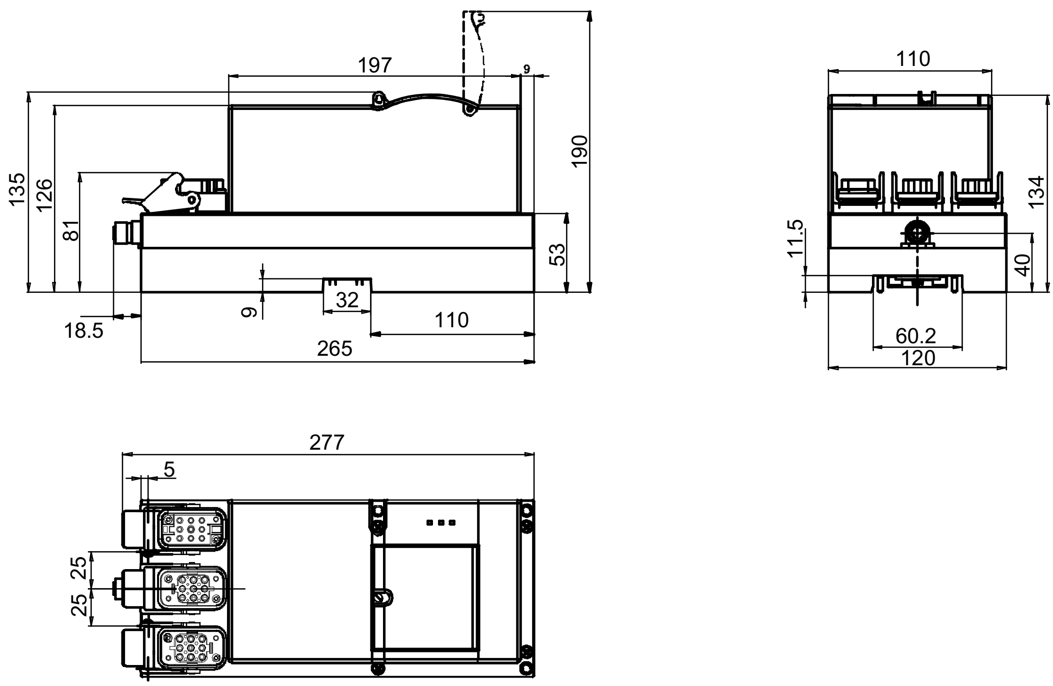


Figure 8-43 Dimensions of compact starter

8.6.2 AS-Interface motor starters (24 V DC, IP65 / IP67)

8.6.2.1 Overview

24 V DC motors and the associated sensors can be be connected quickly and easily on site with the AS-Interface K60 24 V DC motor starters for the lowest power range up to 70 watt.

A total of three different variants are available in the following versions:

- Single direct-on-line starter (without brake, with connectable quick-stop function)
- Double direct-on-line starter (with brake and connectable quick-stop function)
- Reversing starter (with brake and connectable quick-stop function)

M12 connectors are used to connect DC motors to the module. The yellow AS-Interface cable is all that is required for supplying the sensors and electronics in the module. An auxiliary voltage (24 V DC), which is supplied via the black AS-Interface cable, is required for supplying the outputs only.

Quick-stop function

All AS-Interface 24 V DC motor starters are equipped with a quick-stop function, which can be connected/disconnected as required via a switch integrated in the module. Quick stop allows a connected motor to be switched off immediately when the sensor signal (high) is present without the need for a "diversion" via the PLC control program. The switch for the quick-stop function is located next to the input sockets and is protected by an M12 screw cap.

Switch position 0 to 3: quick stop OFF
Switch position 4 to 9: quick stop ON

When quick stop is activated ("ON"), the assigned output OUT1 (OUT2; OUT1 for reversing starters in reversing duty) is switched off without the intervention of the higher-level PLC when signal "1" is present at the associated input IN1 (IN3).

Brake

Double direct-on-line starters and single reversing starters are equipped with an integrated, fixed brake function, that is, as soon as the output signal has been set to "0", the motor is slowed down when the motor connection is short-circuited. This function cannot be used to control mechanical brakes.

Single direct-on-line starters are not equipped with a brake function, which means that the motor coasts to standstill once it has been switched off.

Commissioning via integrated buttons

Buttons integrated in the module (located under the output socket) can be used to switch on the associated motor directly. The buttons are protected by an M12 screw cap.

Note

A motor controlled via the PLC program **cannot** be switched off using this function.

8.6.2.2 Order numbers

IP65/IP67 motor starters

Type	Order no.
Single direct-on-line starter	3RK1400-1NQ01-0AA4
Double direct-on-line starter	3RK1400-1MQ01-0AA4
Single reversing starter	3RK1400-1MQ03-0AA4

Accessories

Type	Order no.
Mounting plate for wall mounting	3RK1901-0CA00
Mounting plate for DIN rail mounting	3RK1901-0CB01

8.6.2.3 Connection

Single direct-on-line starter

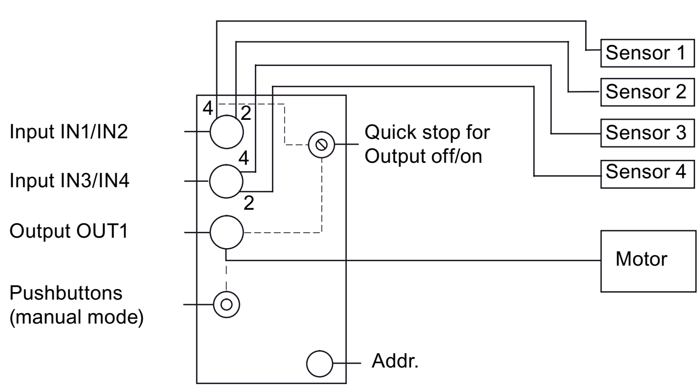


Figure 8-44 Single direct-on-line starter

Double direct-on-line starter

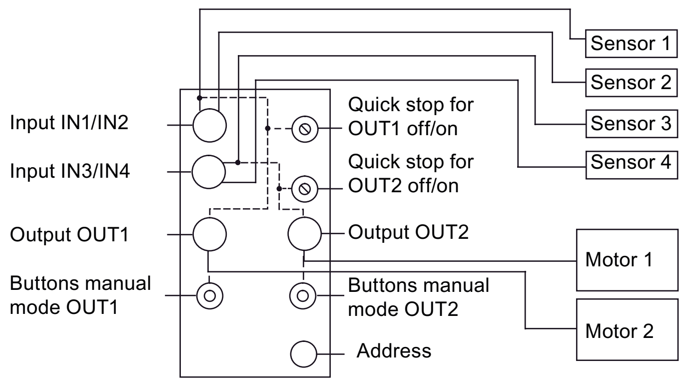


Figure 8-45 Double direct-on-line starter

Single reversing starter

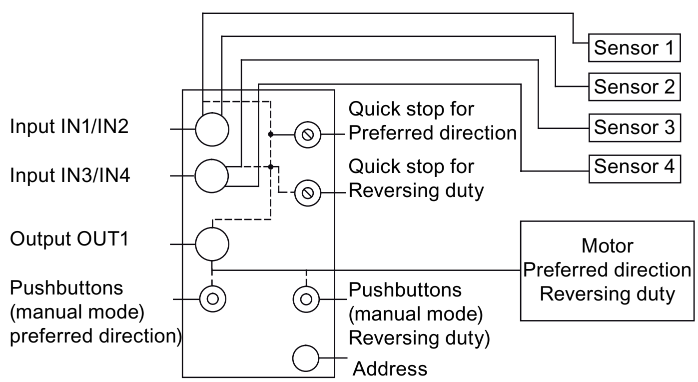


Figure 8-46 Single reversing starter

8.6.2.4 Diagnostics

The LEDs (Page 173) on the DC motor starters are the same as those for the standard K60 compact modules.

If an output short circuits, it is switched off without a feedback message being sent to the master (no display via LEDs). The module is ready for operation again when the affected output is first switched off and then switched to the required operating status.

8.6.2.5 Technical specifications

Order no.	3RK1400-1NQ01-0AA4 Single direct-on-line starter	3RK1400-1MQ01-0AA4 Double direct-on-line starter	3RK1400-1MQ03-0AA4 Single reversing starter
Slave type	Standard slave		
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	4 inputs (for sensors) 1 output (for motor)	4 inputs (for sensors) 2 outputs (for motors)	4 inputs (for sensors) 1 output (for motor, CW/CCW rotation)
Quick-stop function	✓	✓	✓
Integrated brake function	—	✓	✓
Operating voltage in acc. with AS-Interface Specification	26.5 ... 31.6 V		
Reverse polarity protection U_AS-i	Integrated		
AS-i slave profile IO.ID	7.F		
ID2, ID1 code	not available (substitute values: F, F)		
No. of I/O sockets	3 x M12	4 x M12	3 x M12
Total power consumption from AS-Interface	≤ 270 mA		
AS-Interface certificate	Available		
Approvals	UL, CSA		
Degree of protection	IP67		
Ground connection	Available		
Ambient temperature	-25 ... +55 °C		
Storage temperature	-40 ... +85 °C		
Inputs			
Input circuit	PNP		
Sensor supply via AS-Interface	Short circuit and overload proof		
Sensors	3 conductors		
Voltage range	20 ... 30 V		
Current-carrying capacity for sensor supply	200 mA (Tu ≤ 40°C) / 150 mA (Tu ≤ 55°C)		
Switching level - high	≥ 10 V		
Switching level - low	≤ 5 V		
Socket assignment Inputs	Y assignment 1 = sensor supply L+ 2 = data input IN2 (IN4) 3 = sensor supply L– 4 = data input / quick stop IN1 (IN3) 5 = ground connection		

Order no.	3RK1400-1NQ01-0AA4 Single direct-on-line starter	3RK1400-1MQ01-0AA4 Double direct-on-line starter	3RK1400-1MQ03-0AA4 Single reversing starter
Outputs			
Output type		Electronics	
Short-circuit protection		Integrated	
Inductive interference protection		Integrated	
External 24 V DC power supply		Via black AS-Interface flat cable	
Watchdog		Integrated	
Rated current-carrying capacity on each output (typical)	3 A (Tu ≤ 55°C)	1 x 3 A (Tu ≤ 55°C) 2 x 2 A (Tu ≤ 55°C)	2.5 A (Tu ≤ 55°C)
Voltage drop (without supply cable)	0.6 V		1.2 V
Max. ramp time DC motor		80 ms	
Max. motor starting current (restricted within module)		4.5 A	
Motor type		24 V DC motor with brushgear	
Socket assignment Outputs	Special assignment 1 = voltage L+ 2 = unassigned 3 = unassigned 4 = switching output (negative switching) 5 = ground connection For reversing starters, the polarity is reversed in reversing duty.		
Assignment of the data bits			
Socket 1	PIN4 = IN1 (D0 / quick stop1) PIN2 = IN2 (D1)		
Socket 2	PIN4 = IN3(D2) PIN2 = IN4(D3)	PIN4 = IN3 (D2 / quick stop2) PIN2 = IN4 (D3)	
Socket 3	PIN4 = OUT1(D0)	PIN4 = OUT1(D0)	PIN4 = OUT1 (D0 = CW, D1 = CCW)
Socket 4	—	PIN4 = OUT2(D1)	—
Note	Max. switching frequency for controlling one 10 W DC motor, for example (U_{AUX} = 28.8 V/duty cycle = 50%): $T_{u\ max}$: 55°C Max. switching frequency/h: 1500	Max. switching frequency for controlling two 10 W DC motors, for example (U_{AUX} = 28.8 V/duty cycle = 50%): $T_{u\ max}$: 55°C Max. switching frequency/h: 1500	Max. switching frequency for controlling one 10 W DC motor, for example (U_{AUX} = 28.8 V/duty cycle = 50%): $T_{u\ max}$: 55°C Max. switching frequency/h: 1000

8.6.2.6 Dimension drawings

The dimensions of the DC motor starters are the same as those of the standard K60 compact modules.

The mounting plates for the K60 modules can be used for installation purposes.

8.6.3 ECOFAST motor starters

8.6.3.1 Overview

ECOFAST starters

The AS-Interface ECOFAST starter is a fully pre-wired (internally) load feeder with degree of protection IP65 designed for switching and protecting all types of three-phase load up to 4 kW at 400/500 V AC (electromechanical starters), up to 5.5 kW (electronic soft starters or electronically switching starters), and up to 1.5 kW (electronic speed controllers), usually standard three-phase motors in direct operation mode or reversing duty.

All ECOFAST starters support reversing duty.

The starter comprises either an electromechanical switchgear assembly or an electronic overload protection system and motor starter protector unit.

Seven LEDs integrated in the cover are used for diagnosing AS-Interface and the auxiliary power.

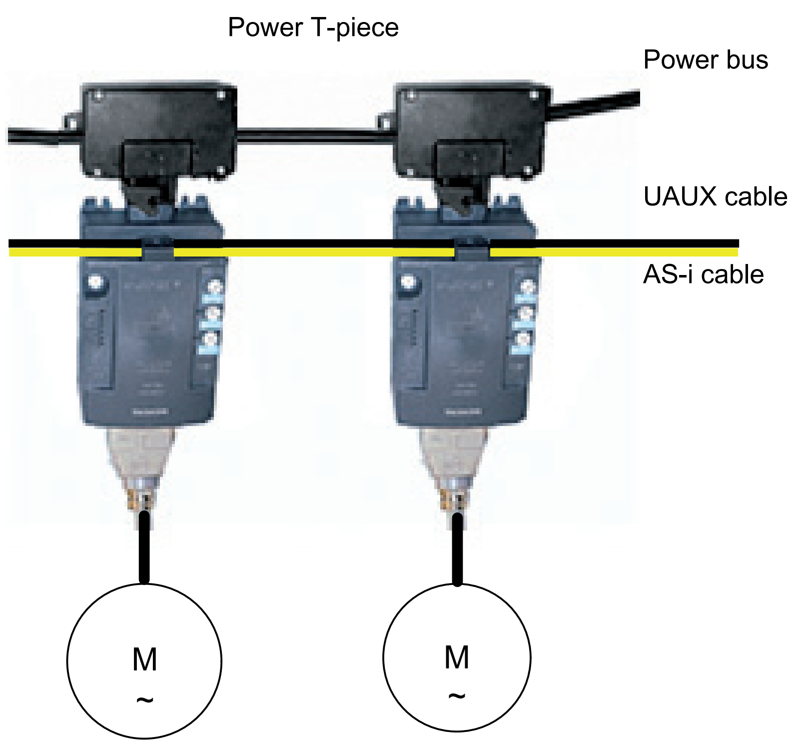
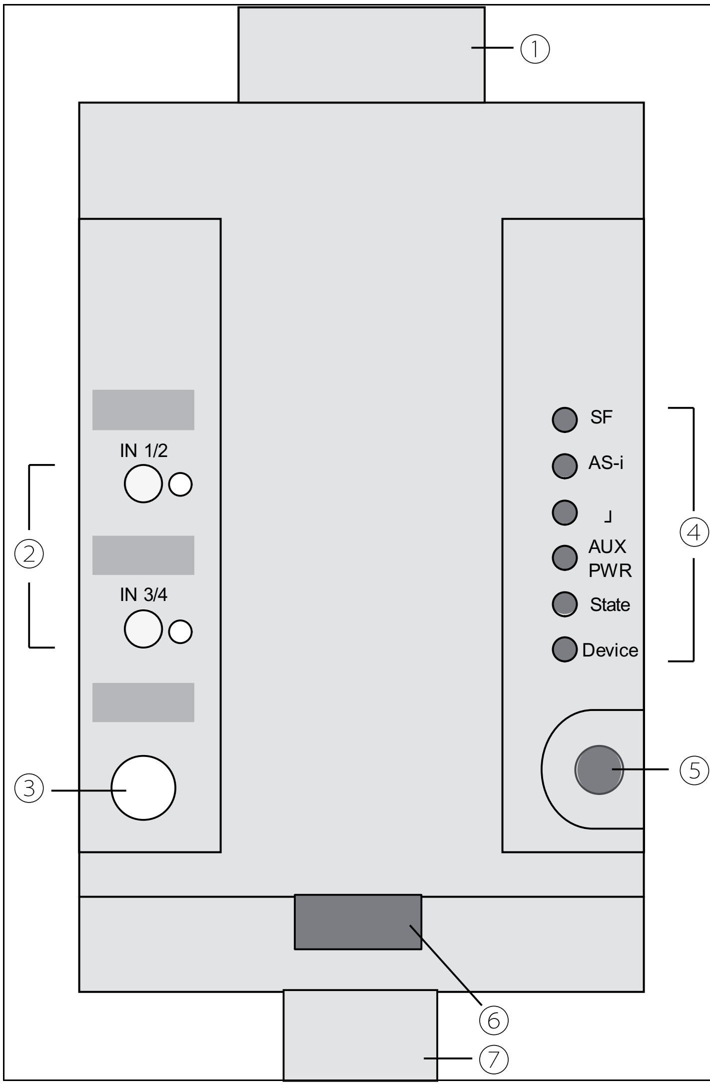


Figure 8-47 Sample configuration with two ECOFAST starters

The Han Q4/2 power connector is used for supplying the consumer power supply (energy bus). Prefabricated power connection cables and a power T unit can be used to connect ECOFAST starters. The maximum number of starters that can be supplied via one power cable depends on the maximum permissible aggregate current (max. 6 mm^2 = approx. 40 A).

ECOFAST starters connections and LEDs



①	Power socket for connecting: • The motor • The brake • The thermistor
②	M12 sockets for connecting two sensors each
③	Addressing socket
④	LEDs
⑤	Local device interface for: • Parameterization • Diagnostics • Hand-held device
⑥	Connection (insulation displacement method) for: • AS-i • AUX power
⑦	Power connector for the supply voltage

Variants

- ECOFAST RS starters (electromechanical)
  Electromechanical starters comprise a standard switchgear assembly with SIRIUS circuit breakers for overload protection and SIRIUS contactor(s) for switching under normal operating conditions. Internal fuses provide short-circuit protection. Benefits of electromechanical starters include safe, electrical isolation during switch-off or in the event of a trip, the broad setting range (just two variants cover a power range up to 4 kW at 400/500 V AC), and remote reset via AS-Interface after an overload trip. They are also reasonably priced.
- ECOFAST ERSS starters (electronic)
  Electronic ERSS starters (reversing soft starters) comprise an electronic overload protection system and an electronic motor starter protector unit.
  The benefits of these electronic ECOFAST starters include a broad setting range for

overload protection (just two variants cover a power range of up to 5.5 kW at 400/500 V AC), a highly wear resistant motor starter protector unit, a current detector (for monitoring the power connectors), and a remote reset function via AS-Interface after an overload trip.
ERSS starters are designed to be started directly in reversing duty and for soft start mode (as well as reversing duty). Electronic overload protection and the switch-off behavior in the event of an overload are set directly on the device via the local interface.

- ECOFAST R2SS starters (electronic)
  Electronic R2SS starters (duo reversing soft starters) comprise an electronic overload protection system and an electronic motor starter protector unit. The R2SS starters can cover a power range of up to 1.5 kW at 400/500 V AC.
  The benefits of these electronic starters include a highly wear resistant motor starter protector unit, a current detector (for monitoring the power connectors), the capability to run at two speeds, and remote reset via AS-Interface after an overload trip.
  The R2SS starter is designed to be started directly in reversing duty as well as with soft start startup/braking. Electronic overload protection and the switch-off behavior in the event of an overload are set directly on the device via the local interface.

Version with brake contact

All ECOFAST starters are available with an optional, separately-controlled brake contact for electrically-operated motor brakes. The output voltage is 400 V AC.

Version with temperature sensor

If required, ECOFAST starters can be equipped with an optional function for evaluating a temperature sensor. Either a thermoclick or type A PTC can be used as a temperature sensor.

Hand-held device

The hand-held device allows ECOFAST starters to be operated locally and completely autonomously when the auxiliary power is present. In addition to standard manual operation, it is, therefore, possible for local switching operations and test runs during pre-commissioning (e.g. for testing the motor direction) to be performed with a functioning automation level if the PLC/bus system fails (emergency operation). A connection cable can be used to connect the hand-held device directly to the local interface on the ECOFAST starter.

Free inputs

ECOFAST starters are also equipped with two free inputs. The input signals are forwarded directly to the higher-level controller, and can also be evaluated directly in the ECOFAST starter.

The M12 socket has a Y assignment. The signal inputs are located on PIN 2 and 4. This enables an optical proximity switch to be connected, which supplies a signal and the message "contamination".

An M12 Y coupler plug can be used to divide the signal inputs over two M12 sockets, which means that two separate sensors can be connected.

Parameterizing the ECOFAST starter

The "Motor Starter ES 2006" (or more recent version) or "Switch ES Motorstarter" (name of the predecessor version) software is required for parameterizing the ECOFAST starters.

The motor starters are set to the maximum rated current (factory setting).

8.6.3.2 Order numbers

ECOFAST motor starters

Setting range	Motor protection / switching	Brake	Order no.
0.3 A - 9 A (4 kW)	Temperature sensor / mechanical	—	3RK1323-2AS54-1AA0
		400 V AC	3RK1323-2AS54-1AA3

ECOFAST motor starters, high feature

Setting range	Motor protection / switching	Brake	Order no.
0.3 A - 3 A (1.1 kW)	Thermal motor model / mechanical	—	3RK1323-5BS44-3AA0
2.4 A - 9 A (4 kW)		—	3RK1323-5CS44-3AA0
0.3 A - 3 A (1.1 kW)		400 V AC	3RK1323-5BS44-3AA3
2.4 A - 9 A (4 kW)		400 V AC	3RK1323-5CS44-3AA3
0.3 A - 3 A (1.1 kW)	Full motor protection / Electronic, soft	—	3RK1323-6BS74-3AA0
2.4 A - 12 A (5.5 kW)		—	3RK1323-6DS74-3AA0
0.3 A - 3 A (1.1 kW)		400 V AC	3RK1323-6BS74-3AA3
2.4 A - 12 A (5.5 kW)		400 V AC	3RK1323-6DS74-3AA3
0.6 A - 4 A (1.5 kW)	Full motor protection / Electronic, soft (duo reversing soft starter)	400 V AC	3RK1323-6ES84-3AA3

8.6.3.3 Connection

Voltages / signals	Connection type
AS-i cable	Insulation displacement method (flat cable)
U_{AUX} cable	Insulation displacement method (flat cable)
Free inputs	M12 socket, Y assignment
Power supply (main circuit)	Han Q 4/2 connectors/sockets
Motor cable	Han 10E socket

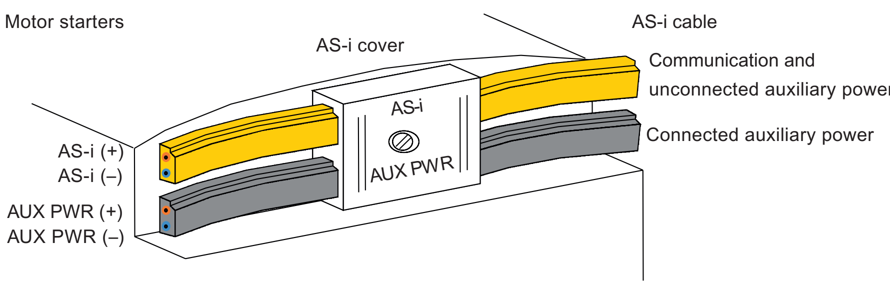


Figure 8-48 ECOFAST starters, ASI connection

Assignment of the inputs DI 0 - DI 3

Input	Process image	Status	Signal
DI 0	Ready (automatic)	0	NO
		1	YES
DI 1	Motor on	0	NO
		1	YES
DI 2	IN1 (input 1)	0	OPEN
		1	24 V is present
DI 3	IN2 (input 2)	0	OPEN
		1	24 V is present

Assignment of outputs DO 0 - DO 3

Output	Process image	Status	Signal
DO 0	Motor CW	0	OFF
		1	ON
DO 1	Motor CCW	0	OFF
		1	ON
DO 2	Brake	0	OFF
		1	ON
DO 3	Trip reset / creep feed [1)]	0 ➜ 1	ACTIVE (trip reset)
		0	OFF (creep feed)
		1	ON (creep feed)
1) Double assignment DO.3 with trip reset and creep feed. Trip reset: Edge controlled with rising edge from [0] ➜ [1] Creep feed: Level controlled [0] and [1] when D 0.0 or D 0.1 are triggered at the same time.			

8.6.3.4 Diagnostics

The ECOFAST starters are equipped with LEDs to indicate error statuses, which enables comprehensive diagnostic activities to be carried out directly on the device.

AS-i	Possible cause	Possible remedial measures
Green	Normal operation, AS-i communication OK	—
Red	No AS-i communication: • The master is switched off or offline. • The slave is not configured in the master. • The incorrect slave type is connected. • The slave has the wrong address.	Ensure AS-i communication: • Switch on the master or switch it to online mode. • Reconfigure the master. • Connect the correct module. • Check/correct the slave address.
Yellow/red flashing	The AS-i slave has the address 0 (on delivery)	Assign an address that is not 0.
OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

LED: AUX PWR (AUX POWER)

AUX PWR	Possible cause	Possible remedial measures
Green	Normal operation, 24 V DC auxiliary voltage OK	—
OFF	No auxiliary voltage, auxiliary voltage connected with incorrect polarity, auxiliary voltage too low	Switch on 24 V DC auxiliary voltage, connect properly, measure auxiliary voltage (approx. 24 V DC)

LED: SF

SF	Possible cause	Possible remedial measures
OFF	No error	—
Red	Group / I/O error, e.g. ➜ motor switched off. Group warning e.g. ➜ motor not switched off.	Cancel the motor CW/CCW control command.

LED: STATE (switching status)

STATE	Meaning
OFF	Switching element OFF
Green	Switching element ON by means of control / operator control and monitoring
Flashing green	Ramp operation
Flickering green	Switching element and brake output ON through input action
Red	Switching status ≠ switching command
Flashing yellow	Manual mode: Connection aborted
Yellow	Switching element and brake output OFF through input action

LED: DEVICE (device status)

DEVICE	Meaning
OFF	Supply voltage not switched on < 18 V DC
Green	Device OK and "normal operation"
Flashing green	Device not initialized (send device for repair)
Yellow	Internal trip
Flashing yellow	General warning (e.g. overload, asymmetry)
Red	Device defective (send device for repair)
Flashing red	Self-test: current flowing or FW download
Flickering red	Self-test: No current flow
Flickering red for approx. 5 s	Factory settings restored

8.6.3.5 Technical specifications

AS-Interface	
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
AS-i slave profile IO.ID.ID2	7.D.0 (for ECOFAST starter RS) 7.E.0 (for ECOFAST starters ERSS, R2SS)
ID1 code (factory setting)	F
Overall current consumption from AS-i without wiring of free inputs	≤ 270 mA typ. 60 mA
Assignment of the data bits	See the table in section Connection (Page 291)
Auxiliary voltage	
Auxiliary power (AUX POWER)	20.4 V DC to 28.8 V DC
Current consumption	15 mA - 110 mA (depending on status)
Polarity protection	Yes (but device does not function)
Short-circuit/overload protection	Yes, multifuse 0.5 A, self-restoring fuse, reset through power OFF
Undervoltage detection	< 17 V DC
Digital Inputs	
Input circuit	PNP
Current-carrying capacity for all inputs	200 mA
Switching level - high	≥ 10 V
Input current low/high	≤1.5 mA / ≥ 7 mA
Sensor supply via AS-Interface	Short circuit and overload proof
Sensors	2 and 3 conductors
Voltage range	20 – 30 V
Brake output 400 V AC	
Voltage range	200 V AC (-10%) to 460 V AC (+10%)
Current-carrying capacity	AC 15: 500 mA
Short-circuit protection	Fusible link at 1 A / 500 V AC, at 1 A / 500 V AC, I_{Cu} = 1 kA
Main circuit	
Rated operating voltage	400 V AC
CLASS	Tripping time with 7.2 x I_e: 10: 8 s | 20: 16 s | 30: 24 s
Rated insulation voltage	500 V AC to IEC 60947-1
Rated surge voltage	4 kV to IEC 60947-1
Safe isolation	300 V AC between auxiliary and main power
Frequency	50 Hz (-10%) to 60 Hz (+10%)
ON period (ED)	100%
Utilization category	1 (device destroyed after short-circuit)

AS-Interface	
Current measurement	
Measuring accuracy	± 7.5% of the parameterized rated operational current
Measuring range	10 x the parameterized rated operational current

The technical specifications are available in full in the "ECOFAST Motor Starter" (doc. ID = 21465498 (Page 627)) and "ECOFAST Motor Starter High Feature" (doc. ID = 19065401 (Page 627)) manuals in the bibliography.

Setting the AS-i address

The addressing socket can be used to assign the AS-i address of the starter in the same way as for I/O modules.

Parameterizing the ECOFAST starter

The "Motor Starter ES 2006" (or more recent version) or "Switch ES Motorstarter" (name of the predecessor version) software is required for parameterizing the ECOFAST starters.

The 3RK1323-2xxxx-xxxx starters are equipped with a temperature sensor connection for monitoring the motor and do not process the input signals further internally. This means that these starters do not need to be parameterized.

Factory settings

Parameters	Value	Device
Basic parameters		
Rated operating current	Max. rated current	1), 2), 3)
Rated voltage	400 V AC (50 Hz)	3)
Rated power	1.5 kW	3)
Rated frequency	50 Hz	3)
Rated speed	1400 rpm	3)
Load type	3-pole	1), 2), 3)
Protection against voltage failure	Activated	1), 2), 3)
Motor protection		
Thermal motor model	CLASS 10	1), 2), 3)
Idle time	0	1), 2), 3)
Response to overload	Switch off without restart	1), 2), 3)
Recovery time	1.5 min.	1), 2), 3)
Temperature sensor	Deactivated	1), 2), 3)

Parameters	Value	Device
Current limit values		
Response to no-current detection	Deactivate	1), 2), 3)
Blocking current	800 % of Ie	1), 2), 3)
Response to current limit value violation	Warning	1), 2), 3)
Lower current limit	18,75 % of Ie	1), 2), 3)
Upper current limit	112,5 % of Ie	1), 2), 3)
Asymmetry		
Asymmetry	Deactivate	1), 2), 3)
Asymmetry limit value	30 %	1), 2), 3)
Inputs		
Input delay	10 msec	1), 2), 3)
Input 1 signal	Unlatch	1), 2), 3)
Input 1 level	NO contact	1), 2), 3)
Input 1 action	No action	1), 2), 3)
Input 2 signal	Unlatch	1), 2), 3)
Input 2 level	NO contact	1), 2), 3)
Input 2 action	No action	1), 2), 3)
Input 3 signal	Unlatch	1), 2), 3)
Input 3 level	NO contact	1), 2), 3)
Input 3 action	No action	1), 2), 3)
Input 4 signal	Unlatch	1), 2), 3)
Input 4 level	NO contact	1), 2), 3)
Input 4 action	No action	1), 2), 3)
Reversing starter control function		
Reversing starter lock-out time	0 sec	1), 2), 3)
Mechanical braking		4)
Brake release delay time on starting	0.0 sec	2), 3)
Brake holding time on stopping	0.0 sec	2), 3)
Electrical braking		4)
Brake torque (electrical braking)	40 %	1), 2), 3)
Brake time (electrical braking)	0.0 sec	1), 2), 3)
Control function: soft starter		
Startup mode	Control function: soft starter	2)
Starting voltage	40 %	2)
Current limiting value (control function: soft starter)	450 %	2)
Starting time	5 sec	2)
Coasting down time	0 sec	2)
Stop voltage	40 %	2)

Parameters	Value	Device
Control function: regulating rheostat		
Control techniques	V/f characteristic + 4Q operation	3)
Setpoint fmax	70 Hz	3)
Setpoint f1	50 Hz	3)
Starting time f1	1 sec	3)
Coasting down time f1	1 sec	3)
Setpoint f2	50 Hz	3)
Starting time f2	1 sec	3)
Coasting down time f2	1 sec	3)

1) Order no. 3RK1323-5xxxx-xxxx
2) Order no. 3RK1323-6xx7x-xxxx
3) Order no. 3RK1323-6ES84-3AA3
4) Only starters with brake output

8.6.3.6 Dimension drawings

ECOFAST motor starters (electromechanical)

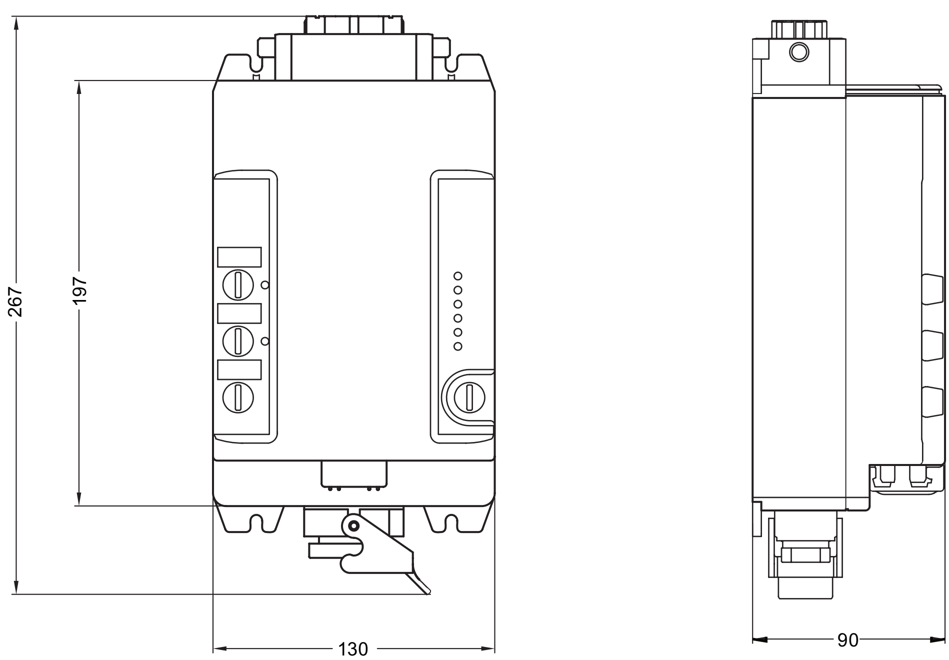


Figure 8-49 ECOFAST starters (electromechanical)

ECOFAST motor starters (electronic)

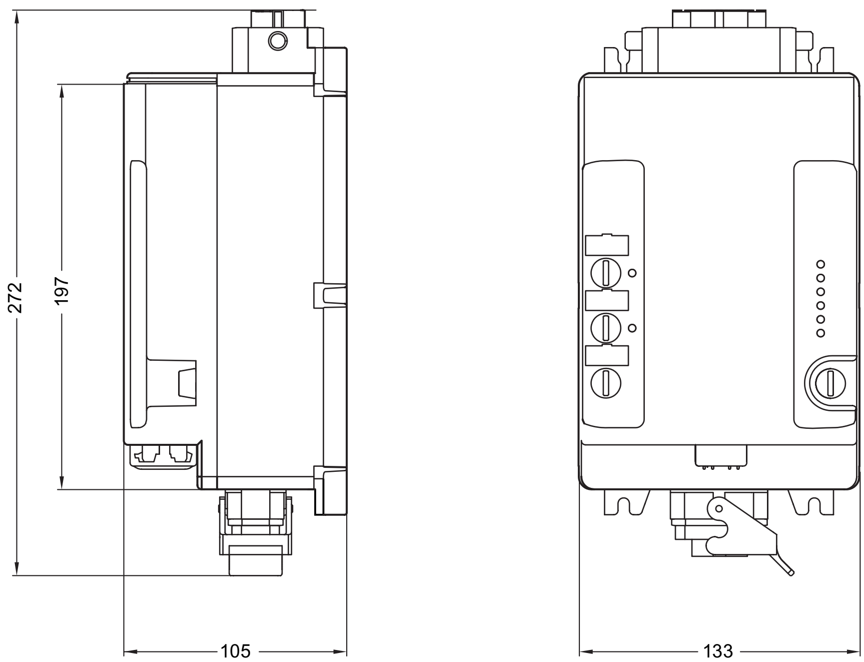


Figure 8-50 ECOFAST starters (electronic)

ECOFAST motor starters (electronic) (duo reversing starters)

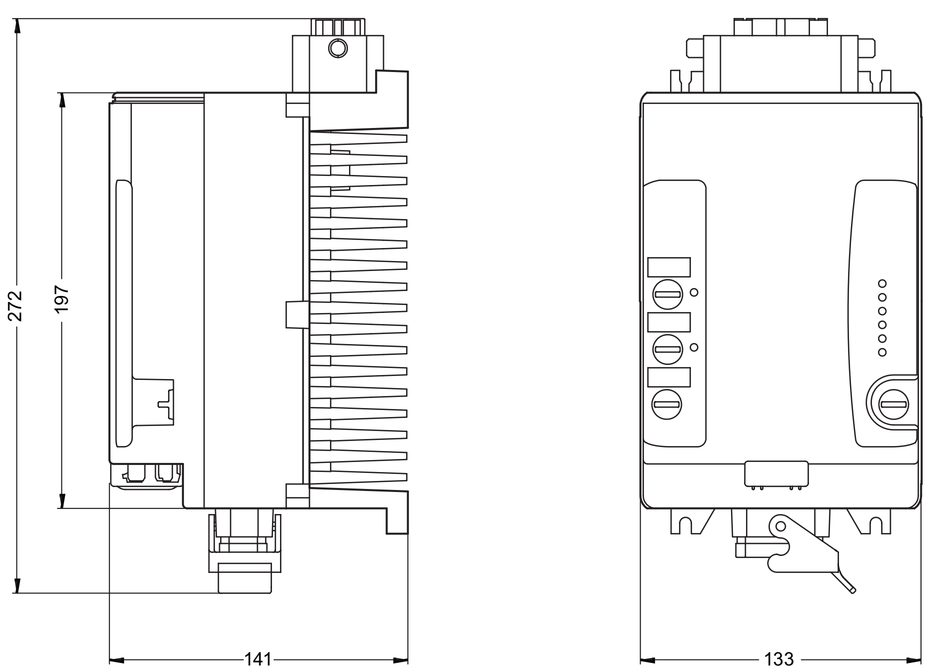


Figure 8-51 ECOFAST starters (electronic) (duo reversing starters)

8.6.4 AS-Interface load feeder modules

8.6.4.1 Overview

Load feeders

AS-Interface load feeders (3RA5) allow circuit-breaker/contactor combinations to be quickly and easily connected to AS-Interface.

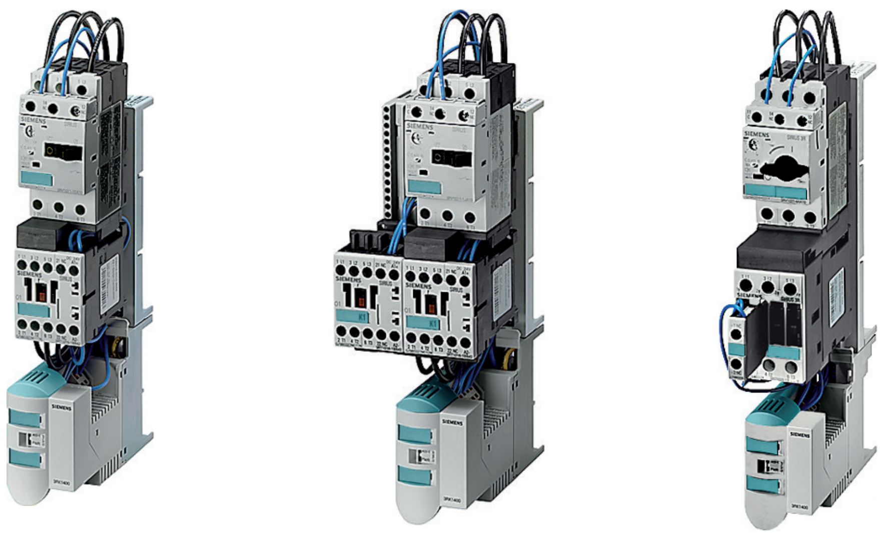


Figure 8-52 Direct-on-line starter 3RA51, reversing starter 3RA52, and fuseless load feeder 3RA5110

Direct-on-line and reversing starters with SIRIUS switching devices of size S00 up to 10 A and size S0 up to 16 A are available. Complete feeders require an auxiliary voltage of 24 V DC.

A complete feeder comprises an AS-i load feeder module, a circuit breaker, one contactor (direct-on-line starter) or two contactors (reversing starters), and a holder for busbar systems (40 mm or 60 mm busbar clearance), including tested pre-wiring.

The components can also be ordered separately if wiring is provided by the customer.

AS-i load feeder modules

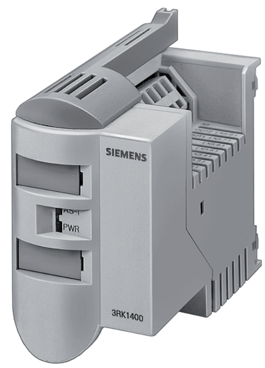


Figure 8-53 AS-Interface load feeder module

The AS-i load feeder modules are available in the following variants:

- With a 24 V DC auxiliary voltage for outputs
  - 2 inputs / 1 output
  - 4 inputs / 2 outputs
- With a 120/230 V AC auxiliary voltage for outputs
  - 2 inputs / 1 relay output
  - 3 inputs / 2 relay outputs

The connection to the higher-level automation system is established via the AS-Interface interface for the load feeder module. A standard, unshielded litz wire can be used as a data cable and for supplying the auxiliary voltage.

Two 2-pin connectors with insulation displacement are used to connect the AS-Interface cable (yellow connector) and auxiliary voltage (black connector for 24 V or red connector for 120 / 230 V). Standard litz wires of between 0.5 mm^2 and 0.75 mm^2 can be used as connection cables.

The feedback messages from the circuit breaker and contactor(s) can be queried with the inputs. The inputs are supplied from the AS-Interface voltage.

The outputs are used for energizing the contactor coils directly. Since the outputs are equipped with integrated overvoltage protection, no additional measures need to be taken with regard to the contactors.

The outputs are supplied via the separate auxiliary voltage, which allows a selective EMERGENCY STOP concept to be easily implemented.

8.6.4.2 Order numbers

Direct starters for busbar systems

Size	Standard three-phase motor 4-pole at 400 V AC		Setting range for thermal overload release	Order no.	
	Rated power	Motor current		For busbar system	
	kW	A	A	40 mm (5-pin)	60 mm (4-pin)
S00	0.06	0.2	0.14 ... 0.2	3RA5110-0BC15-0BB4	3RA5110-0BD15-0BB4
	0.06	0.2	0.18 ... 0.25	3RA5110-0CC15-0BB4	3RA5110-0CD15-0BB4
	0.09	0.3	0.22 ... 0.32	3RA5110-0DC15-0BB4	3RA5110-0DD15-0BB4
	0.09	0.3	0.28 ... 0.4	3RA5110-0EC15-0BB4	3RA5110-0ED15-0BB4
	0.12	0.4	0.35 ... 0.5	3RA5110-0FC15-0BB4	3RA5110-0FD15-0BB4
	0.18	0.6	0.45 ... 0.63	3RA5110-0GC15-0BB4	3RA5110-0GD15-0BB4
	0.25	0.8	0.55 ... 0.8	3RA5110-0HC15-0BB4	3RA5110-0HD15-0BB4
	0.25	0.8	0.7 ... 1	3RA5110-0JC15-0BB4	3RA5110-0JD15-0BB4
	0.37	1.1	0.9 ... 1.25	3RA5110-0KC15-0BB4	3RA5110-0KD15-0BB4
	0.55	1.5	1.1 ... 1.6	3RA5110-1AC15-0BB4	3RA5110-1AD15-0BB4
	0.75	1.9	1.4 ... 2	3RA5110-1BC15-0BB4	3RA5110-1BD15-0BB4
	0.75	1.9	1.8 ... 2.5	3RA5110-1CC15-0BB4	3RA5110-1CD15-0BB4
	1.1	2.7	2.2 ... 3.2	3RA5110-1DC15-0BB4	3RA5110-1DD15-0BB4
	1.5	3.6	2.8 ... 4	3RA5110-1EC15-0BB4	3RA5110-1ED15-0BB4
	1.5	3.6	3.5 ... 5	3RA5110-1FC15-0BB4	3RA5110-1FD15-0BB4
	2.2	5.2	4.5 ... 6.3	3RA5110-1GC15-0BB4	3RA5110-1GD15-0BB4
	3	6.8	5.5 ... 8	3RA5110-1HC15-0BB4	3RA5110-1HD15-0BB4
	4	9	7 ... 10	3RA5110-1JC16-0BB4	3RA5110-1JD16-0BB4
	5.5	11.5	9 ... 12	3RA5110-1KC17-0BB4	3RA5110-1KD17-0BB4
S0	7.5	15.5	11 ... 16	—	3RA51 20-4AD25-0BB4
With one connector each for AS-i and auxiliary voltage (yellow and black). The starting and rated data of the motor to be protected are crucial factors in the selection.					

Reversing starters for busbar systems

Size	Standard three-phase motors 4-pin at 400 V AC		Setting range for thermal overload release	Order no.	
	Rated power	Motor current		For busbar system	
	kW	A	A	40 mm (5-pin)	60 mm (4-pin)
S00	0.06	0.2	0.14 ... 0.2	3RA5210-0BC15-0BB4	3RA5210-0BD15-0BB4
	0.06	0.2	0.18 ... 0.25	3RA5210-0CC15-0BB4	3RA5210-0CD15-0BB4
	0.09	0.3	0.22 ... 0.32	3RA5210-0DC15-0BB4	3RA5210-0DD15-0BB4
	0.09	0.3	0.28 ... 0.4	3RA5210-0EC15-0BB4	3RA5210-0ED15-0BB4
	0.12	0.4	0.35 ... 0.5	3RA5210-0FC15-0BB4	3RA5210-0FD15-0BB4
	0.18	0.6	0.45 ... 0.63	3RA5210-0GC15-0BB4	3RA5210-0GD15-0BB4
	0.25	0.8	0.55 ... 0.8	3RA5210-0HC15-0BB4	3RA5210-0HD15-0BB4
	0.25	0.8	0.7 ... 1	3RA5210-0JC15-0BB4	3RA5210-0JD15-0BB4
	0.37	1.1	0.9 ... 1.25	3RA5210-0KC15-0BB4	3RA5210-0KD15-0BB4
	0.55	1.5	1.1 ... 1.6	3RA5210-1AC15-0BB4	3RA5210-1AD15-0BB4
	0.75	1.9	1.4 ... 2	3RA5210-1BC15-0BB4	3RA5210-1BD15-0BB4
	0.75	1.9	1.8 ... 2.5	3RA5210-1CC15-0BB4	3RA5210-1CD15-0BB4
	1.1	2.7	2.2 ... 3.2	3RA5210-1DC15-0BB4	3RA5210-1DD15-0BB4
	1.5	3.6	2.8 ... 4	3RA5210-1EC15-0BB4	3RA5210-1ED15-0BB4
	1.5	3.6	3.5 ... 5	3RA5210-1FC15-0BB4	3RA5210-1FD15-0BB4
	2.2	5.2	4.5 ... 6.3	3RA5210-1GC15-0BB4	3RA5210-1GD15-0BB4
	3	6.8	5.5 ... 8	3RA5210-1HC15-0BB4	3RA5210-1HD15-0BB4
	4	9	7 ... 10	3RA5210-1JC16-0BB4	3RA5210-1JD16-0BB4
	5.5	11.5	9 ... 12	3RA5210-1KC17-0BB4	3RA5210-1KD17-0BB4
S0	7.5	15.5	11 ... 16	—	3RA51 20-4AD25-0BB4
With one connector each for AS-i and auxiliary voltage (yellow and black). The starting and rated data of the motor to be protected are crucial factors in the selection.					

Accessories (e.g. for customer installation of a load feeder)

Type	Order no.
Holder for AS-Interface load feeder modules Holder extension for installation on standard load feeders (3RA1) or busbar adapter (8US1), for installing an AS-Interface load feeder module	—
For installation on busbar adapter with 40 mm center-to-center clearance, with busbar pick-up for N and PE conductors (two separate busbars), power connector set 3RK1901-0EA00 required 45 mm width 54 mm width	 3RK1901-3AA00 3RK1901-3BA00
For installation on busbar adapter with 60 mm center-to-center clearance, with busbar pick-up for PEN conductor (one busbar), power connector set 3RK1 901-0EA00 required 45 mm width 54 mm width	 3RK1901-3CA00 3RK1901-3DA00
Without PE and N conductor connection, for installation on busbar adapter with 40 mm or 60 mm center-to-center clearance 45 mm width 54 mm width	 3RK1901-3EA00 3RK1901-3FA00
For installation on SIRIUS mounting rail adapter 3RA19 22-1A 45 mm width	 3RK1901-3GA00
Power connector set 5-pin, 2.5 mm^2 (1 set contains 1 connector and 1 coupling)	3RK1901-0EA00
For additional busbar accessories, see catalog LV 1, "SIRIUS - SENTRON - SIVACON".	

Load feeder modules

Type		Order no.
AS-Interface load feeder module		—
Type	**Auxiliary voltage**	—
2 inputs / 1 output	24 V DC	3RK1400-1KG01-0AA1 [1)]
4 inputs / 2 outputs	24 V DC	3RK1400-1MG01-0AA1 [1)]
2 inputs / 1 relay output	120/230 V AC	3RK1402-3KG02-0AA1 [2)]
3 inputs / 2 relay outputs	120/230 V AC	3RK1402-3LG02-0AA1 [2)]
1) Without connector for AS-i and auxiliary voltage (yellow and black). 2) With connector in each case for AS-i and auxiliary voltage (yellow and red).		

Accessories (for load feeder modules)

Type	Order no.
Connector for AS-i and auxiliary voltage with insulation piercing connecting devices for 2 x (0.5 to 0.75 mm^2) standard litz wire yellow black red	 3RK1901-0NA00 3RK1901-0PA00 3RK1901-0QA00

8.6.4.3 Connection

Load feeders with busbar

The devices are fully pre-wired and can be adapted on the busbar. They are available for busbar systems with a busbar center-to-center clearance of 40 mm and 60 mm.

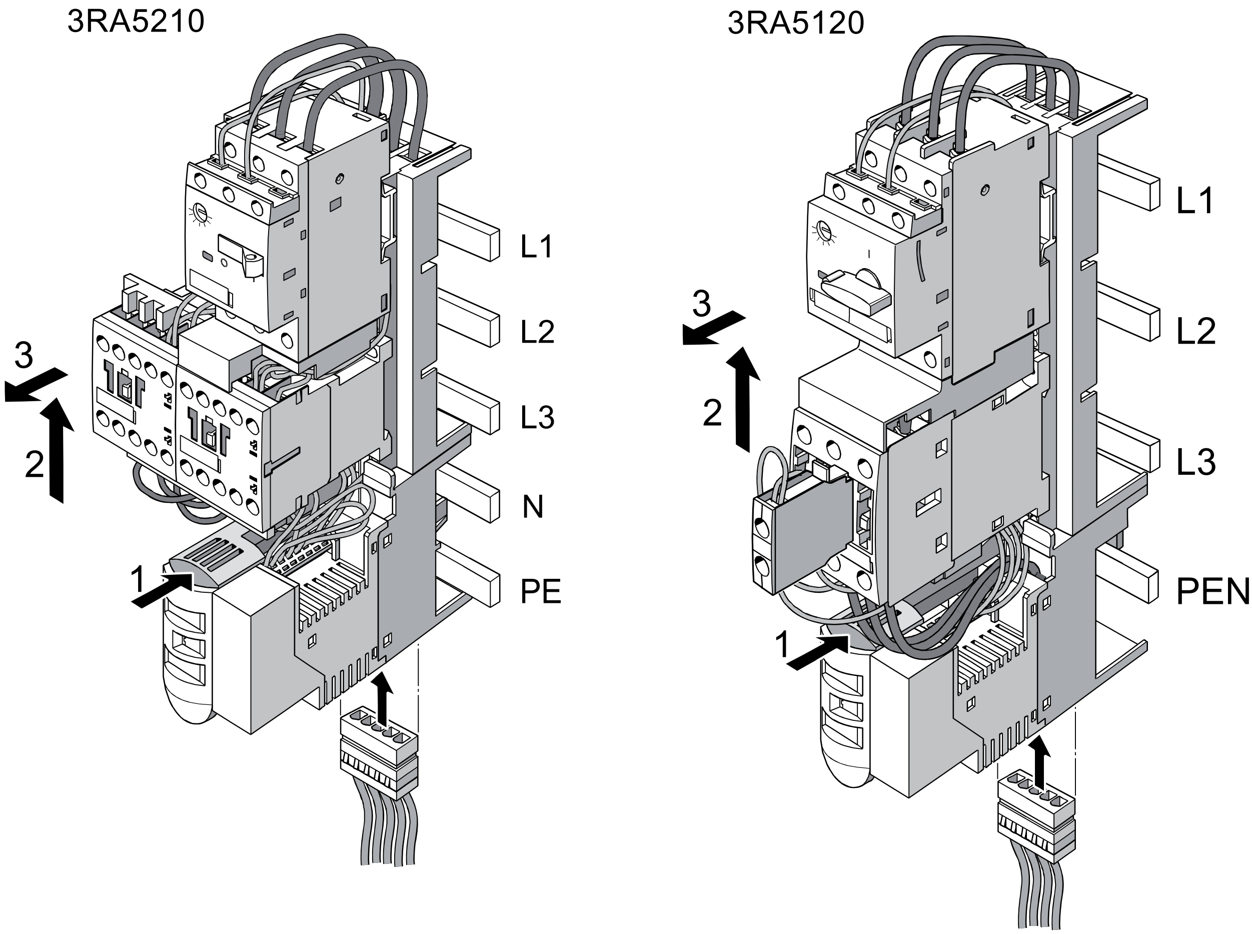


Figure 8-54 Load feeders with busbar

The outgoing side to the load is wired via the power connector, which means that the main conductors L1/L2/L3 and the N or PE conductor have plug-in connections. The power connector is included in the scope of supply.

Power connector

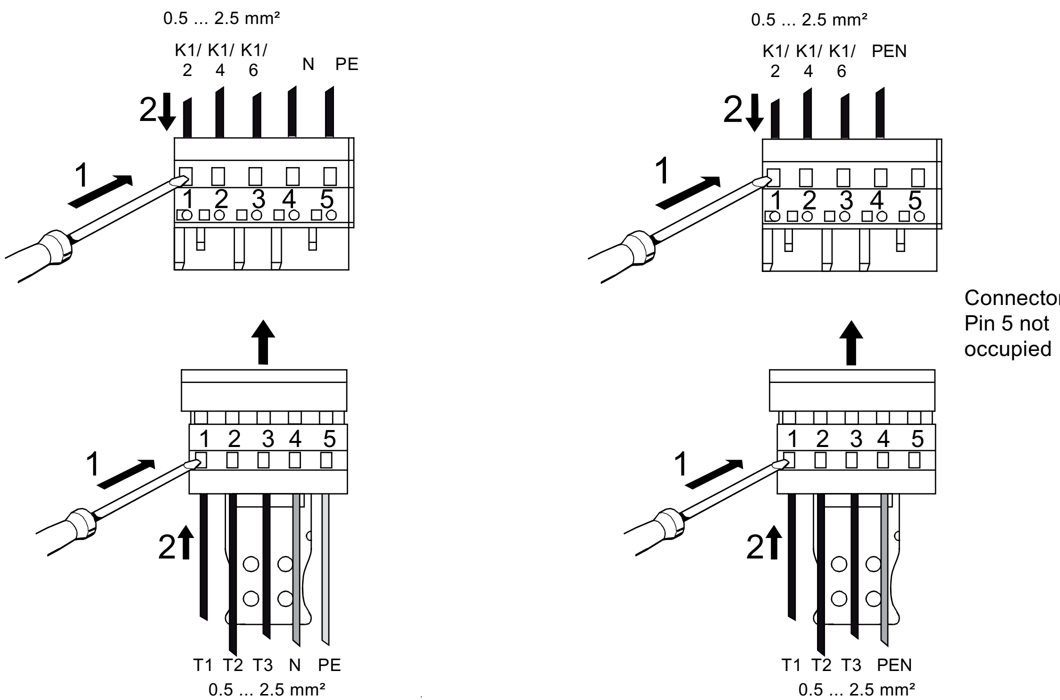


Figure 8-55 Connecting the power connectors

Communications connector

The 24 V DC auxiliary power and the AS-Interface cable are routed via two communications connectors (supplied).

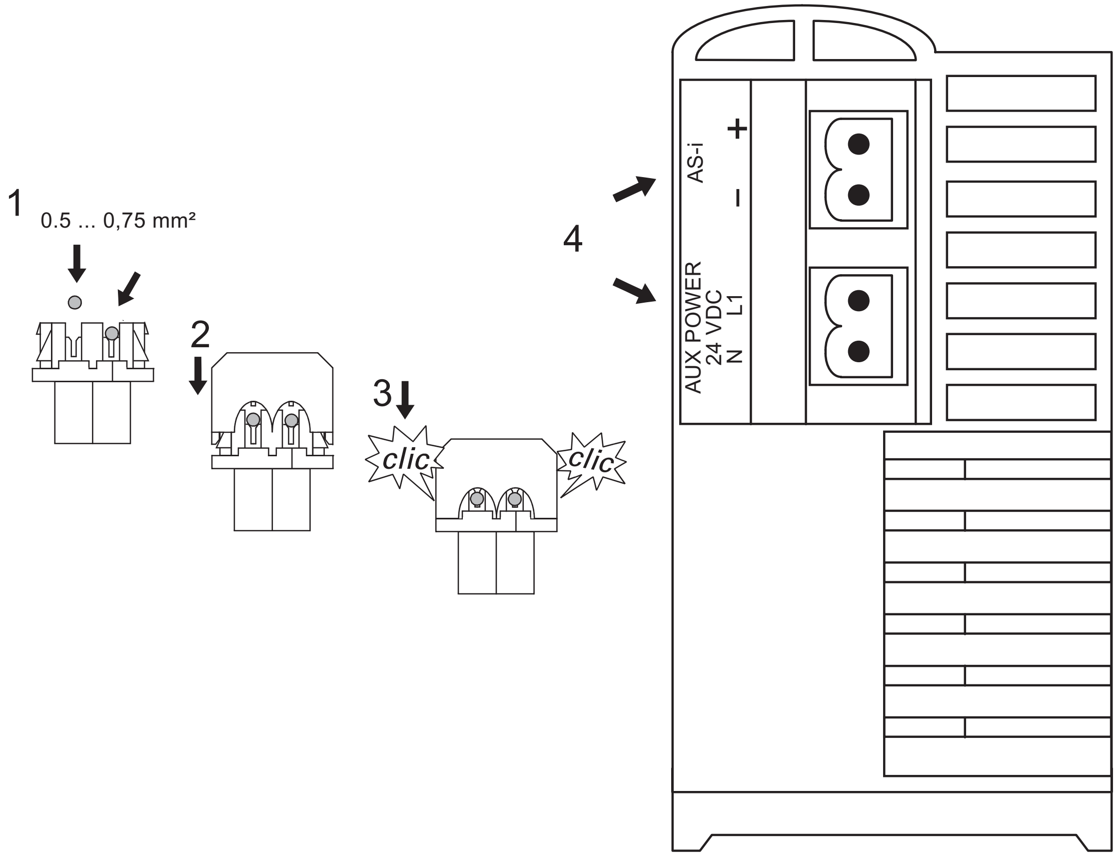


Figure 8-56 Connecting the AS-i and AUX-POWER cable

Internal wiring and data bit assignments

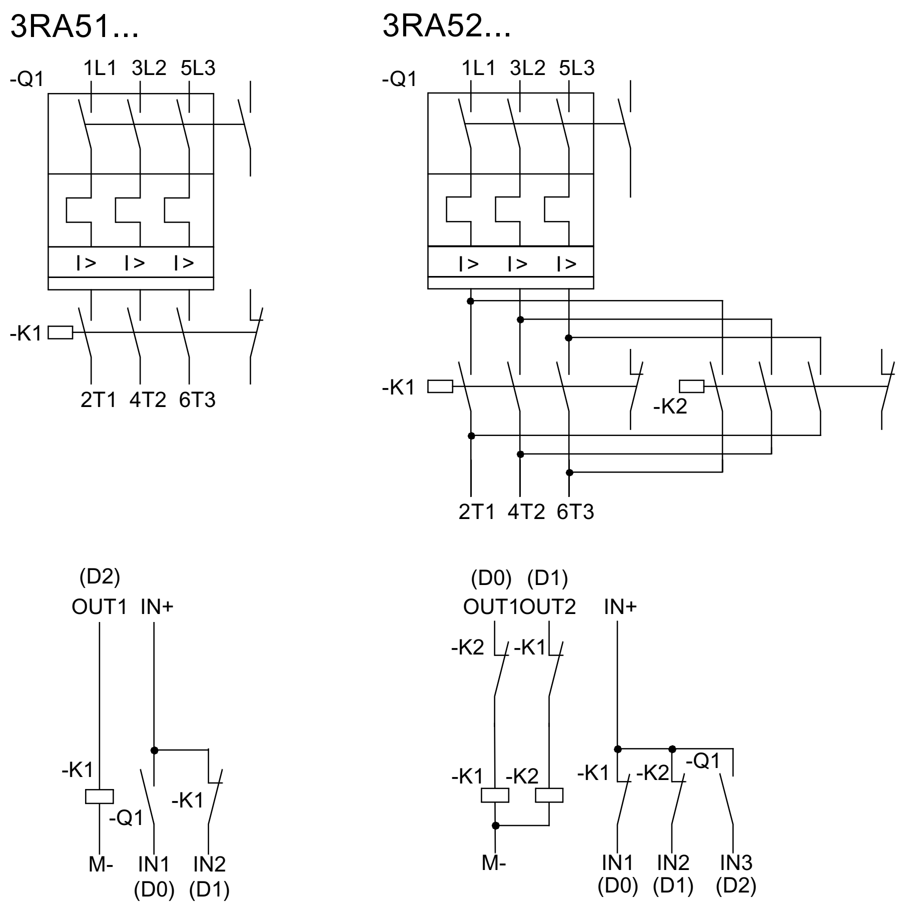


Figure 8-57 Load feeder: internal wiring and data bit assignments

Connections on the load feeder modules

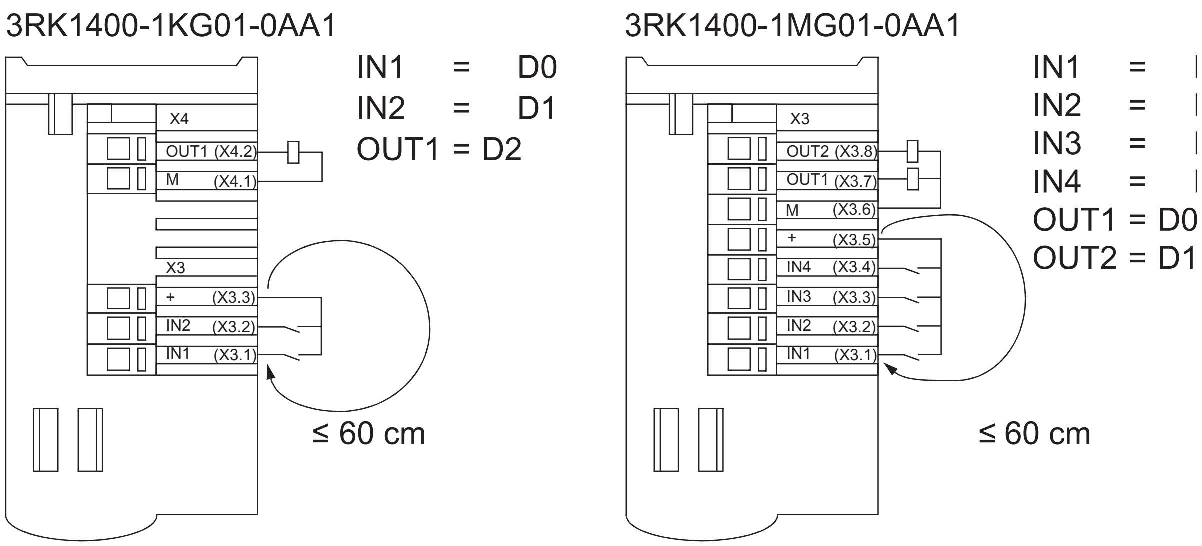


Figure 8-58 Load feeder module for 24 V DC

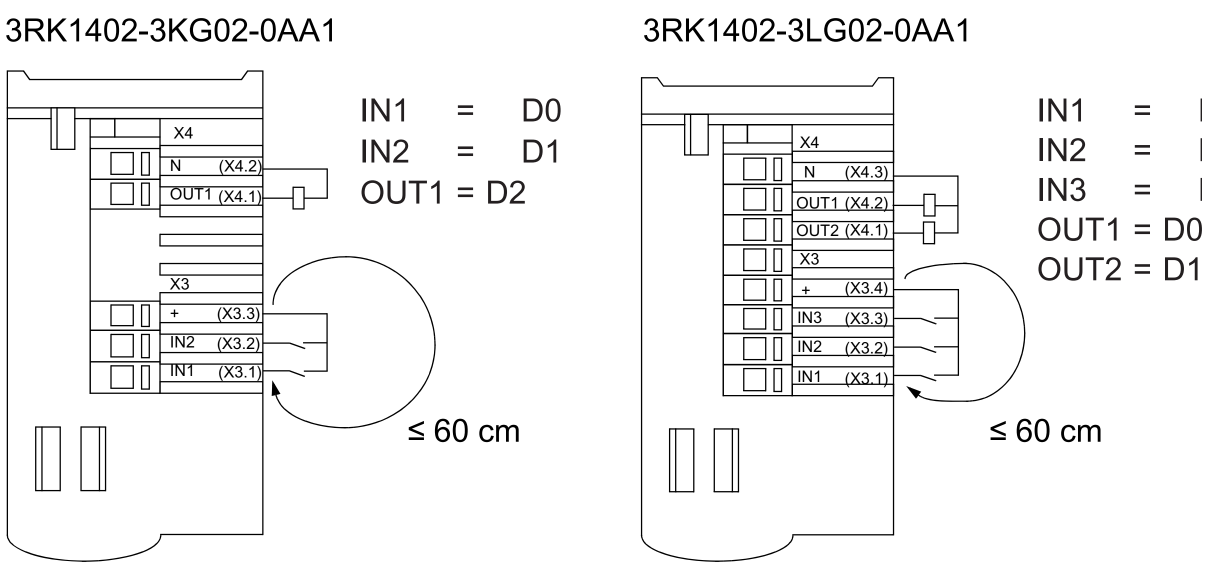


Figure 8-59 Load feeder module for 120/240 V

Note

The sensor connection cables must be no more than 60 cm long.

8.6.4.4 Diagnostics

LED for AS-i/FAULT

The module has one dual LED for AS-i/FAULT for diagnostic purposes; see LED status displays for modules with a dual LED for AS-i/FAULT (Page 174).

LED display AUX POWER

The module also has an LED for AUX POWER; for a description, see LED status display AUX POWER for modules with auxiliary voltage (Page 175).

8.6.4.5 Technical specifications

Load feeders

Note

The load feeders have the same technical specifications as the individual devices (e.g. high short-circuit strength of I_q = 50 kA).

Load feeder modules

Order no.	3RK1400-1KG01-0AA1	3RK1400-1MG01-0AA1	3RK1402-3KG02-0AA1	3RK1402-3LG01-0AA2
Installed in:	3RA5110-*****-0BB4 3RA5120-*****-0BB4	3RA5210-*****-0BB4 3RA5220-*****-0BB4	—	—
Slave type	Standard slave			
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0			
No. of inputs/outputs	2 inputs / 1 output	4 inputs / 2 outputs	2 inputs / 1 relay output	3 inputs / 2 relay outputs
Operating voltage in acc. with AS-Interface Specification	26.5 ... 31.6 V			
Reverse polarity protection U_{AS-i}	Integrated			
AS-i slave profile IO.ID	3.F	7.F	3.F	7.F
ID2, ID1 code	not available (substitute values: F, F)			
Total power consumption from AS-Interface	8 ... 12 mA			
AS-Interface certificate	Available			
Approvals	UL, CSA			

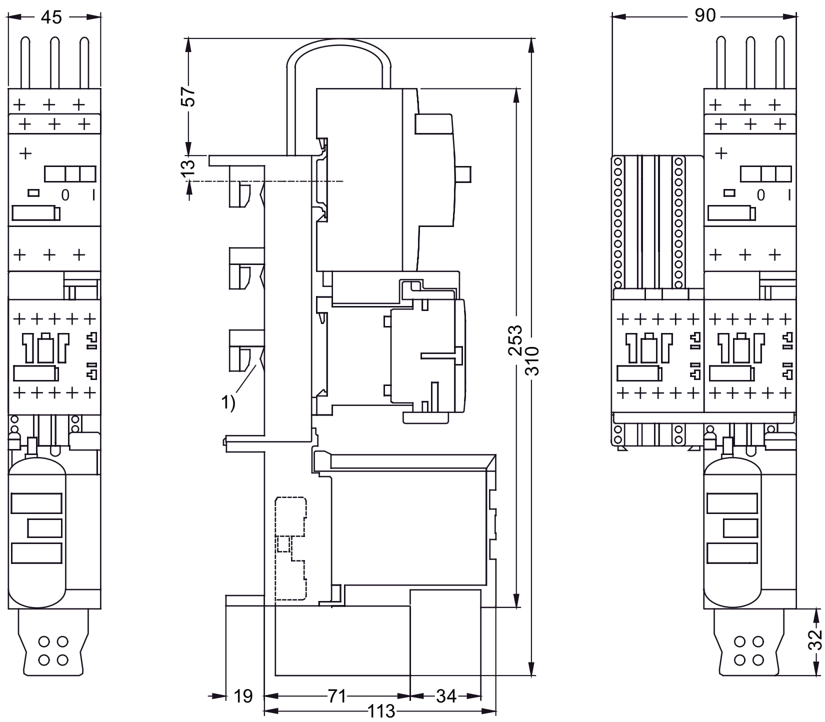
Order no.	3RK1400-1KG01-0AA1	3RK1400-1MG01-0AA1	3RK1402-3KG02-0AA1	3RK1402-3LG01-0AA2
Degree of protection	IP20			
Ambient temperature	0 ... +55 °C			
Storage temperature	-40 ... +85 °C			
Inputs				
Reverse polarity protection	Integrated			
Max. input current	6 mA			
Max. permissible cable length between IN + and an input	0.4 m			
Outputs				
External power supply for outputs (energizing the contactor coils) via auxiliary power	24 V DC		Max. 230 V AC	
Current-carrying capacity I_e	0.5 A (DC-13/DC-14)		3 A (AC-15); 0.1 (DC-13 at 220 V)	
Total current (thermal) I_{th}	2 A		3 A	
Reverse polarity protection	Integrated		Not required	
Short-circuit protection	Integrated		No	
Inductive interference protection	Integrated		Not required	
Watchdog	Integrated			

8.6.4.6 Dimension drawings

Size S00, for 40 mm and 60 mm busbar systems

Direct-on-line starting

Reversing duty



1) Busbar adapter suitable
for busbar thicknesses of 5 and 10 mm
with chamfered edges.

Figure 8-60 Load feeder: size S00

Size S0, for 40 mm and 60 mm busbar systems

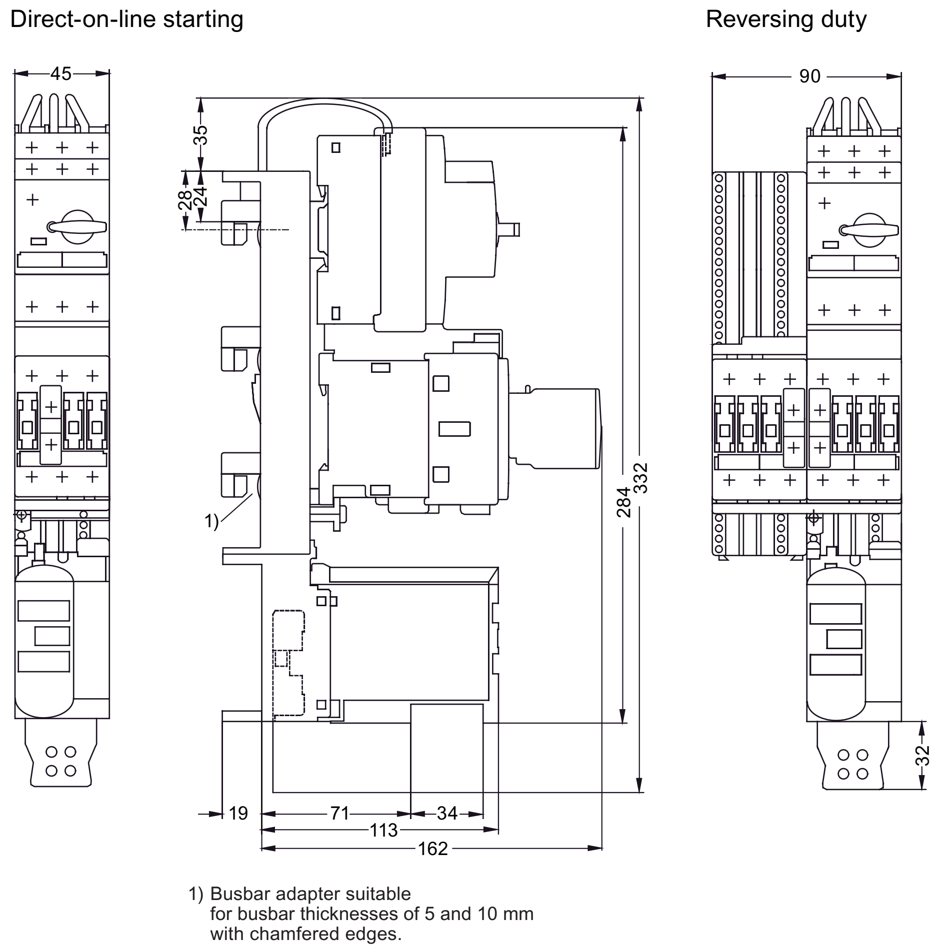


Figure 8-61 Load feeder: size S0

Load feeder module

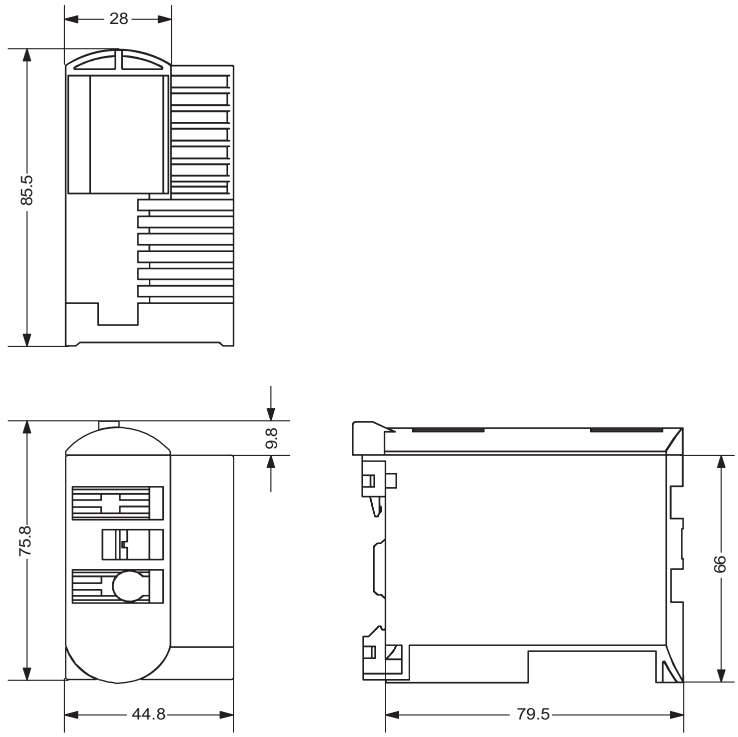


Figure 8-62 Load feeder module

8.7 AS-Interface for control and signaling devices

8.7.1 AS-i F adapter for EMERGENCY STOP control devices 3SB3

8.7.1.1 Overview

AS-i F adapter for EMERGENCY STOP control devices 3SB3

The AS-Interface F adapter is used for connecting an EMERGENCY STOP / EMERGENCY OFF control device (to ISO 13850 or EN 418) from the 3SB3 series to the AS-Interface bus system.

The AS-i F adapter contains an ASIsafe slave and is snapped on to EMERGENCY STOP / EMERGENCY OFF (actuating element only) from the rear.

Depending on the version, it can be connected with a screw connection or spring-loaded terminals.

The AS-Interface F adapter is available:

- Without an additional output
- With an output for controlling an indicator light with an LED

With the adapter, the device fulfills safety category 4 (SIL 3).

Figure 8-63 AS-i F adapter

The version with an output can be used to control the illuminated backing plate for EMERGENCY STOP control devices, for example.

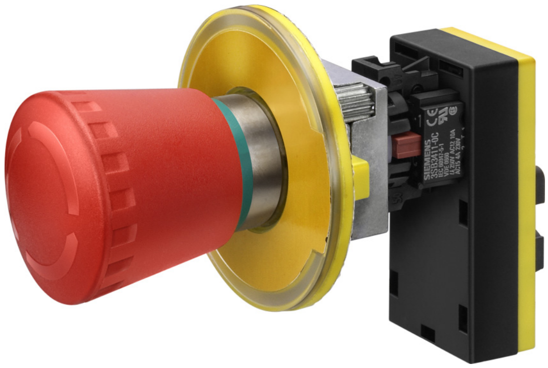


Figure 8-64 AS-i F adapter with EMERGENCY STOP control device and illuminated backing plate

Setting the AS-i address

The addressing socket is located under the AS-i terminals. The address is assigned as usual using the AS-i addressing unit.

8.7.1.2 Order numbers

Type	Order no.
AS-I slave for front plate mounting with screw connection 2F-DI	3SF5402-1AA03
AS-I slave for front plate mounting with spring-mounted terminal 2F-DI	3SF5402-1AA04
AS-I slave for front plate mounting with screw connection; 2F-DI/1DO; output for controlling lamp holder with integrated LED	3SF5402-1AB03
AS-I slave for front plate mounting with spring-loaded terminal; 2F-DI/1DO; output for controlling lamp holder with integrated LED	3SF5402-1AB04

Accessories

Type	Order no.
Yellow backing plate, illuminated, labeling can be added	3SB3921-0DA
Yellow backing plate, illuminated, labeled with "EMERGENCY STOP"	3SB3921-0DD
Yellow backing plate, illuminated, labeled with "NOT-HALT"	3SB3921-0DK

8.7.1.3 Diagnostics

LED for AS-i/FAULT

The module has one dual LED for AS-i/FAULT for diagnostic purposes; see LED status displays for modules with a dual LED for AS-i/FAULT (Page 174) .

8.7.1.4 Technical specifications

AS-i F adapter

Technical specifications	
AS-i slave profile IO.ID.ID2	7.B.F
ID1 code (factory setting)	F
Total current consumption I	≤ 60 mA
Reverse polarity protection	Integrated
Inputs	
Low signal range	Contact open
High signal range	Contact closed
I_{in}	(I_{peak} ≥ 5 mA)
The PFD value does not have any major effect on the PFD of the system as a whole comprising the AS-Interface bus and safety monitor.	

8.7.2 Housing and modules for buttons and indicator lights 3SB3

8.7.2.1 Overview

AS-Interface housing can be used to connect distributed control devices of series 3SB3 quickly and easily to AS-Interface.

Figure 8-65 Housing in different versions

The housing is available in metal or plastic with 1, 2, 3, 4, or 6 control points.
Housing with 1, 2, or 3 control points has cutouts for M20 cable glands.
Housing with 4 or 6 control points has cutouts for M25 cable glands.

The housing with integrated AS-Interface can be:

- supplied in a fully pre-wired condition
- assembled by the customer from individual components or otherwise extended/modified.

The pre-wired housing can be:

- ordered with a fixed range of standard range of components (with 1 to 3 control points) (see order numbers (Page 321)) or
- assembled (with 1 to 6 control points) and ordered by the customer using a configurator

Configurator

You can call up the configurator at the following Internet address:

www.siemens.de/sirius-befehlen

Then choose Online Configurator on the right of the screen.

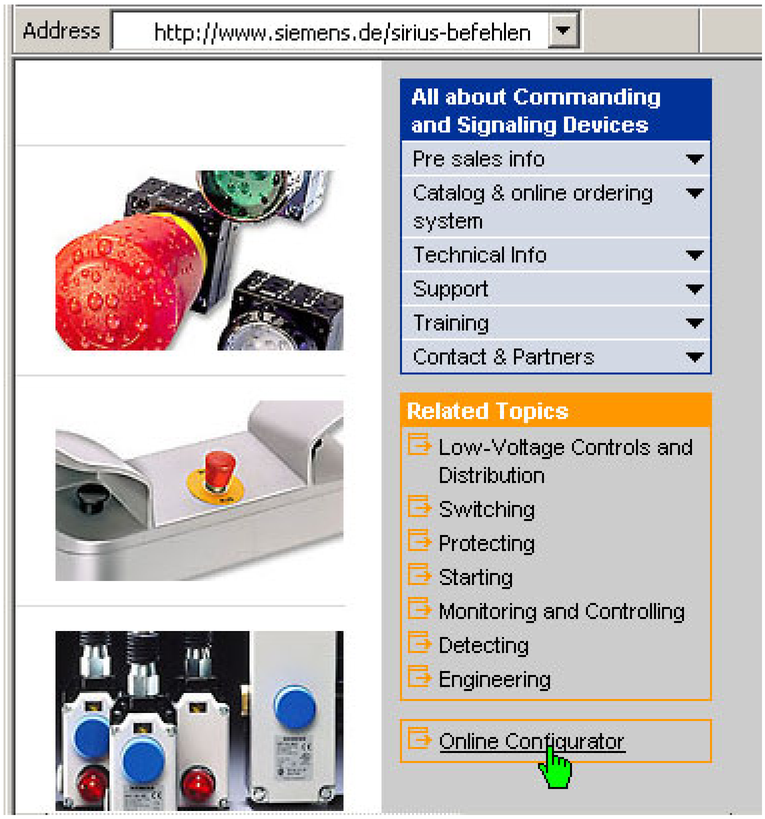


Figure 8-66 Calling up the configurator on the Internet

You can equip the housing with practically all of the available actuators and indicators in the 3SB3 range (22 mm, round version): indicator lights, acoustic signal devices, buttons, knob switches, key-operated switches, mushroom pushbuttons, etc.

AS-Interface slaves

Built-in AS-i modules are available for the housing for integrating AS-i. These slave modules can be snapped in to the base plate of the housing without the need for tools.

Thanks to the integrated busbar adapter, the modules can also be snapped on to a DIN rail outside the 3SB3 housing so that they can be used for other configuration concepts.

The modules are available in the following versions:

- Standard module for connecting four switching elements and four LEDs, in two housing variants
  - For installation in plastic housing (with 2-6 control points)
  - For installation in metal housing (with 2-6 control points)
- A/B module for connecting four switching elements and three LEDs, in two housing variants
  - For installation in plastic housing (with 2-6 control points)
  - For installation in metal housing (with 2-6 control points)
- ASIsafe module for connecting safety-oriented signals with two contacts (e.g. EMERGENCY STOP) in three housing variants
  - For installation in plastic housing without protective collars (with 1-6 control points)
  - For installation in metal housing without protective collars (with 1-6 control points)
  - For installation in plastic or metal housing with protective collars (with 1 control point)

Figure 8-67 Standard or A/B module (left) and ASIsafe module (right)

Scope of application

In a 3SB3 housing, the AS-Interface modules 4DI/4DO and 4DI/3DO can query four contacts. AS-Interface module 4DI/4DO can also control four indicator lights, while module 4DI/3DO can control three indicator lights. The required power is provided by the AS-Interface system. In conjunction with an A/B-capable AS-Interface master, up to 62 4DI/3DO modules can be operated in one AS-Interface network.

Installed in a 3SB3 housing, the **AS-Interface safety module** is used for detecting safety-related switching statuses of one or two-channel EMERGENCY OFF buttons with floating contacts. For this purpose, a code table with 8x4 bits is transferred via the AS-Interface bus and evaluated by the safety monitor.

When operated properly, the system fulfills safety category 4 to EN 954-1. If an EMERGENCY OFF actuator is queried on just one channel (terminals for F-IN2 jumpered by means of wire), the system only fulfills safety category 2.

In accordance with IEC 61508, the module can be used in loops up to SIL 3. The PFD value of the module is insignificant vis-à-vis the PDF value of the evaluation unit (e.g. AS-i monitor).

Always read the notes in the Safety Integrated manual and operating instructions for the safety monitor.

Setting the AS-i address

To assign the AS-i address, you need to open the housing. The addressing socket is located on the side of the built-in AS-i module. The address is assigned as usual using the AS-i addressing unit. If the housing contains more than one AS-i module, you have to assign multiple addresses.

8.7.2.2 Order numbers

Order numbers of the housing and modules

Housing with the standard range of components can be delivered with:

- Vertical mounting type
- Plastic housing with plastic actuators and signaling devices
- Metal housing with metal actuators and signaling devices

The plastic housing versions have a connection for the AS-Interface flat cable (cable is routed externally past the housing); with metal housing versions, the AS-Interface cable is routed into the housing.

Version (A, B, C = code letters for control points)	No. of control points	Order no.	
		For plastic housing	For metal housing
A = EMERGENCY OFF mushroom pushbutton via AS-Interface adapter, top of housing: yellow	1	3SF5811-0AA08	3SF5811-2AA08
A = EMERGENCY OFF mushroom pushbutton via AS-Interface adapter, top of housing: yellow, with protective collar	1	3SF5811-0AB08	3SF5811-2AB08
B = green pushbutton, label "I" A = red pushbutton, label "O"	2	3SF5812-0DA00	3SF5812-2DA00
B = white pushbutton, label "I" A = black pushbutton, label "O"	2	3SF5812-0DB00	3SF5812-2DB00
C = clear indicator light, blank label B = green pushbutton, label "I" A = red pushbutton, label "O"	3	3SF5813-0DA00	3SF5813-2DA00
C = clear indicator light, blank label B = white pushbutton, label "I" A = black pushbutton, label "O"	3	3SF5813-0DC00	3SF5813-2DC00
C = black pushbutton, label "II" B = black pushbutton, label "I" A = red pushbutton, label "O"	3	3SF5813-0DB00	3SF5813-2DB00
Housing with user-defined configuration		See configurator.	

Slave modules

Type	Order no.	
	For plastic housing	For metal housing
ASIsafe slave, 2 safe inputs, for housing without protective collar	3SF5500-0BA	3SF5500-0CA
ASIsafe slave, 2 safe inputs, for housing with protective collar	3SF5500-0DA	
A/B slave, 4 inputs / 3 outputs	3SF5500-0BB	3SF5500-0CB
Standard slave, 4 inputs / 4 outputs	3SF5500-0BC	3SF5500-0CC

Accessories

Type	No. of control points	Order no.	
		For plastic housing	For metal housing
Wiring unit for F slave		3SF5900-0BA	
Wiring unit for standard or A/B slave		3SF5900-0BB	
Connection elements			
For AS-Interface flat cable, connection via insulation displacement method	1 ... 3	3SF5900-0CA	—
	4 ... 6	3SF5900-0CB	—
For AS-Interface connection via M12 connector	1 ... 3	3SF5900-0CC	3SF5900-2CC
	4 ... 6	3SF5900-0CD	3SF5900-2CD
For bringing out unused inputs/outputs via M12 socket	1 ... 3	3SF5900-0CE	3SF5900-2CE
	4 ... 6	3SF5900-0CF	3SF5900-2CF
For AS-Interface flat cable, cable routed into housing	1 ... 3	3SF5900-0CG	
	4 ... 6	3SF5900-0CH	
For round cable, cable routed into housing	1 ... 3	3SF5900-0CJ	
	4 ... 6	3SF5900-0CK	

8.7.2.3 Connection

Housing and modules

Instead of the standard method using multi-core connection cables, the elements are wired directly to one or more AS-Interface slave modules in the housing. Switching elements are connected to inputs and LED elements are connected to outputs. The 2-core AS-i cable is all that is required for establishing a connection with the PLC.

An auxiliary voltage (black 24 V cable) is not required because the outputs/LED elements are supplied with power directly via the AS-i voltage.

The following secure connection options are available for connecting the AS-i cable:

- M12 socket
- Cable gland for AS-i flat cable
- Cable gland for round cable

The following quick-assembly option is also available:

- Connection clip with insulation displacement method for AS-i flat cable

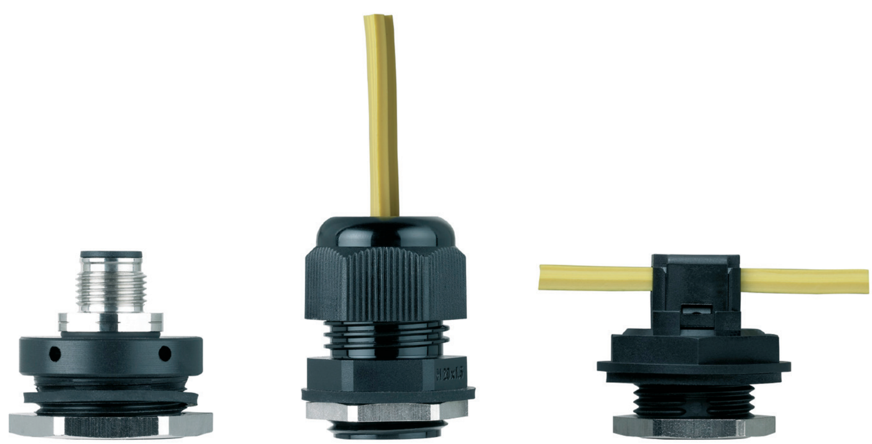


Figure 8-68 Different connection options

Inputs or outputs that are not required for switching elements or LED elements can be routed externally (e.g. to connect external sensors) via an M12 socket through the second cutout in the housing.

Connecting the AS-Interface slave modules to the control and signaling devices

The modules are connected to the control and signaling devices via connecting cables.

Standard or A/B modules require 14-pin connectors while ASIsafe modules require 8-pin connectors.

The connectors are available as complete wiring units.

Wiring / pin assignment

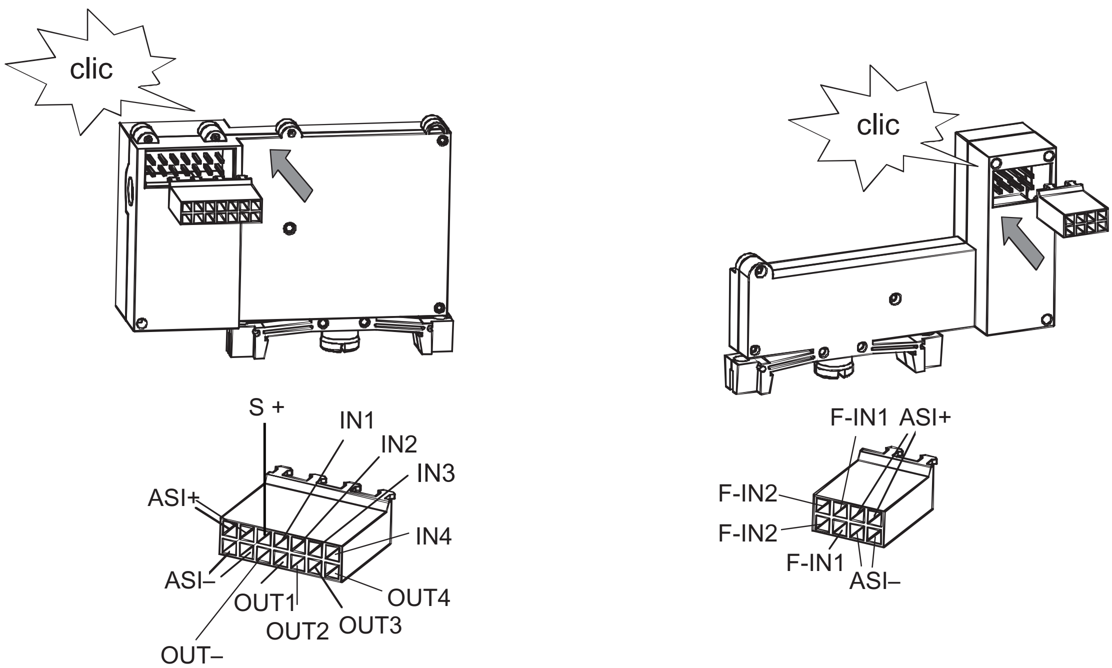


Figure 8-69 Connecting the standard or A/B module (left) and ASIsafe module (right)

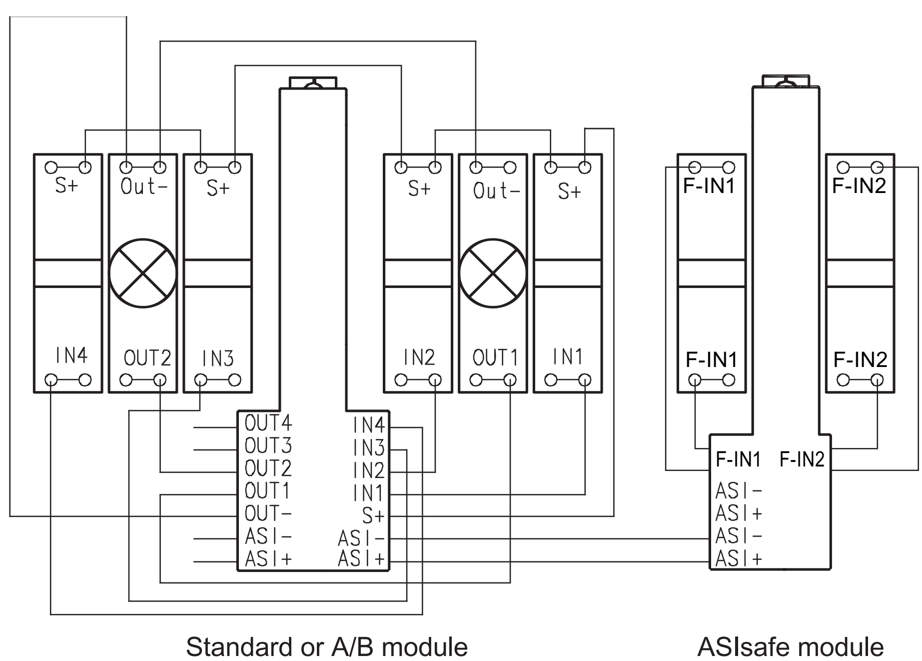


Figure 8-70 Wiring the standard or A/B module (left) and ASIsafe module (right)

Only mechanical contacts can be connected to inputs F-INx and INx.

Cross-connections between two modules (e.g. S+ (module 1) to INx (module 2)) are not permitted.

Signal cables must not be connected to external voltages (e.g. actuator between OUTx and external ground cable) must not be connected nor +24 V wired to INx.

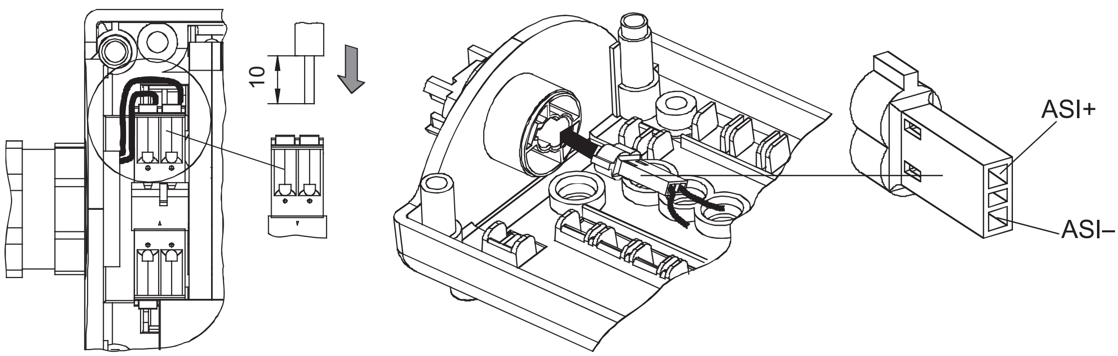


Figure 8-71 Connecting the AS-Interface module to the connection element for AS-Interface

Data assignment of pre-wired (in factory) housing:

The positions of the control points in the housing are labeled with A, B, C, etc. "A" is located at the bottom (or on the left if the device is mounted horizontally).

1. Safety-oriented control points (e.g. EMERGENCY STOP buttons) require one complete ASIsafe module.
2. The inputs and outputs on standard and A/B modules are assigned in ascending order in accordance with the position of the switching elements or LED elements.
3. If more than one standard or A/B modules are installed in the housing:

In the case of illuminated control points (illuminated pushbuttons / knobs), the LED and switching element are wired to the same AS-i module. If the control point has two switching elements (illuminated knob with 3 positions), the LED and the "lower" switching element are wired to the same AS-i module. This means that individual outputs in this consecutive series may remain unused.

Example of data assignment for factory-side assembly: housing with six control points (incl. EMERGENCY STOP)

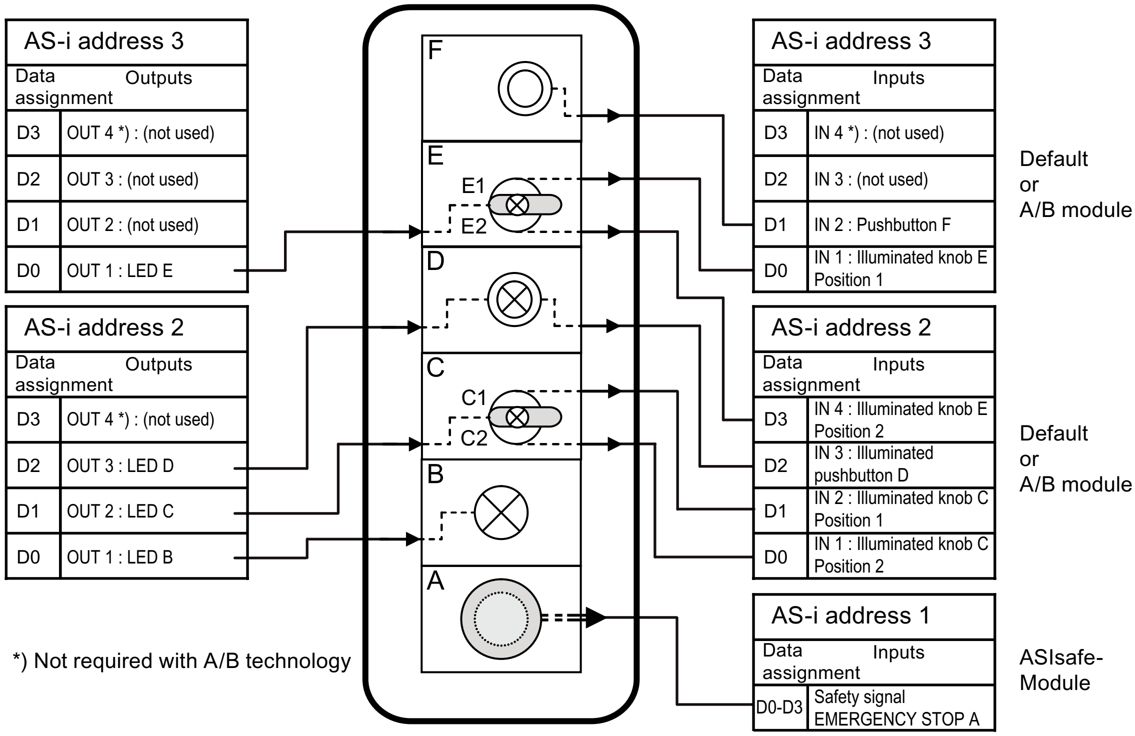


Figure 8-72 Data assignment: element B LED

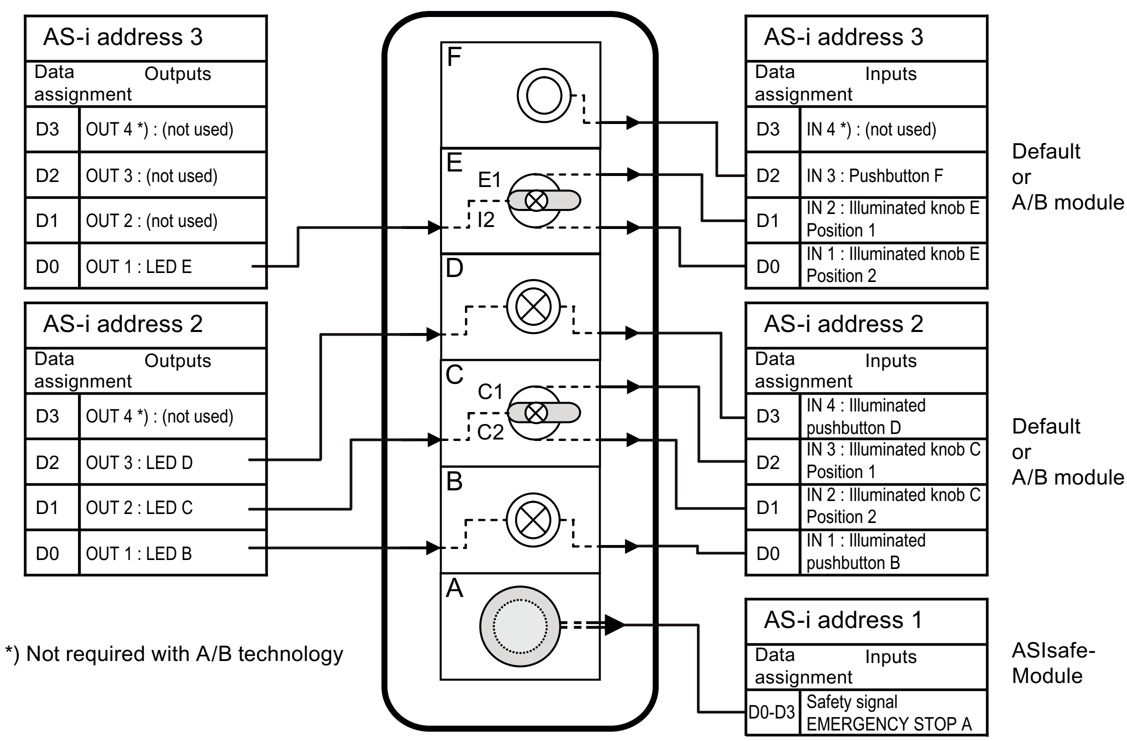


Figure 8-73 Data assignment: element B illuminated pushbuttons

8.7.2.4 Technical specifications

Technical specifications of the AS-Interface slaves

General technical specifications

Immunity to noise (EN 61000, EN 61496-1)	
IEC 61000-4-2	4 kV / 8 kV (encapsulated)
IEC 61000-4-3	10 V/m
IEC 61000-4-4	1 kV (A) / 2 kV (B)
Mechanical data	
Degree of protection with metal housing	IP67
Degree of protection with plastic housing	IP65
Shock load (IEC 60068-2-27)	30 g / 11 ms, half-sine
Vibratory load (IEC 60068-2-6)	10 to 100 Hz, 5 g
Temperature range	
Rated temperature T_u	25°C
Ambient temperature Ta	–25°C to +70°C
Storage temperature Ts	–40°C to +80°C

Power requirements

The following table can be used to calculate the power requirements for the AS-i housing:

Components	Power requirements for each function used/connected
For each ASIsafe module (incl. switching elements)	60 mA
For each standard module or A/B module	40 mA
For each switching element used	6 mA
For each activated LED	20 mA

Standard and A/B module

Technical specifications	Standard module	A/B module
AS-i slave profile IO.ID.ID2	7.0.F	7.A.E
ID1 code (factory setting)	F	7
Total current consumption I	≤ 280 mA	≤ 280 mA
Reverse polarity protection	Integrated	Integrated
Inputs		
Sensor supply (short circuit and overload proof)		

Technical specifications	Standard module	A/B module
Voltage range Uout	20 V to 30 V DC	20 V to 30 V DC
Switching current I	Approx. 5 mA	Approx. 5 mA
Outputs (supplied from AS-Interface)		
Load voltage Uout (depending on current load)	20 V to 30 V DC	20 V to 30 V DC
Max. aggregate current Iout (max. 4 LEDs / 24 V lamps, 1 W)	≤ 180 mA	≤ 180 mA
Switching frequency	100 Hz	100 Hz
Short-circuit protection	Integrated	Integrated

ASIsafe module

Technical specifications	ASIsafe module
AS-i slave profile IO.ID.ID2	7.B.F
ID1 code (factory setting)	F
Total current consumption I	≤ 60 mA
Reverse polarity protection	Integrated
Inputs	
Low signal range	Contact open
High signal range	Contact closed
I_{in}	Dynamic (Ipeak ≥ 5 mA)
The PFD value does not have any major effect on the PFD of the system as a whole comprising the AS-Interface bus and safety monitor.	

Example of AS-i housing with an EMERGENCY STOP button and two illuminated pushbuttons:

Max. overall power requirements (from AS-i cable):	
ASIsafe module	60 mA
Standard or A/B module	40 mA
2 x switching elements, 6 mA each	12 mA
2 x LEDs, 20 mA each	40 mA
Total	152 mA

When realistic simultaneity factors are taken into account, the actual power requirements tend to be lower in practice.

8.7.2.5 Dimension drawings of the housing

Dimension drawings of the housing

Housing without protective collar (plastic)

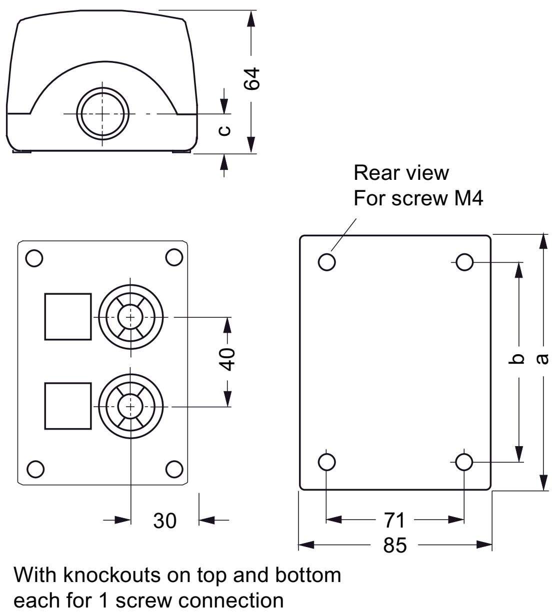


Figure 8-74 Housing without protective collar (plastic)

No. of control points	Length a	Clearance b	Clearance c
1	85	54	17.5
2	114	83	17.5
3	154	123	17.5
4	194	163	17.5
6	280	249	20.5

Housing without protective collar (metal)

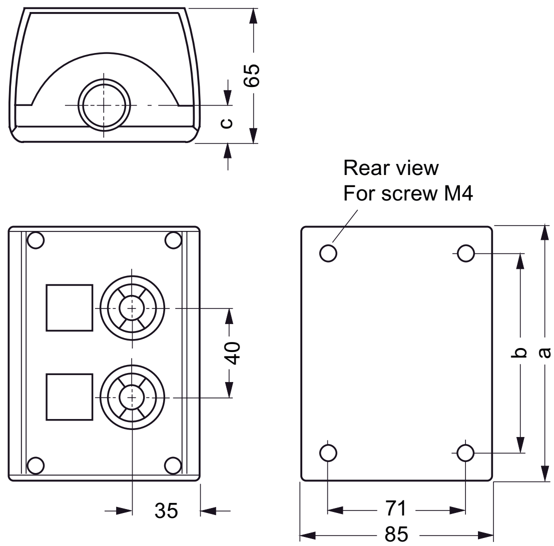


Figure 8-75 Housing without protective collar (metal)

No. of control points	Length a	Clearance b	Clearance c
1	85	54	21
2	114	83	21
3	154	123	21
4	194	163	21
6	280	249	21

8.8 Signaling columns with AS-Interface connection

8.8.1 Overview

On machines or in automatic processes, the 8WD4 signaling columns are used for monitoring complex procedures or provide visual/acoustic warnings in emergencies.

In the case of standard signaling columns, the signaling elements (e.g. lamp elements) are placed vertically on the connection element. In the connection element, a signal cable (and joint ground cable) must be connected for each signaling element.

In the case of AS-Interface signaling columns, an AS-i adapter element is placed on the connection element. The signaling elements are placed vertically on top of this. Only the 2-pin AS-i cable (and auxiliary voltage, if required) needs to be connected in the connection element. The signaling elements are controlled as AS-i outputs. The outputs are connected to the signaling elements automatically in ascending order.

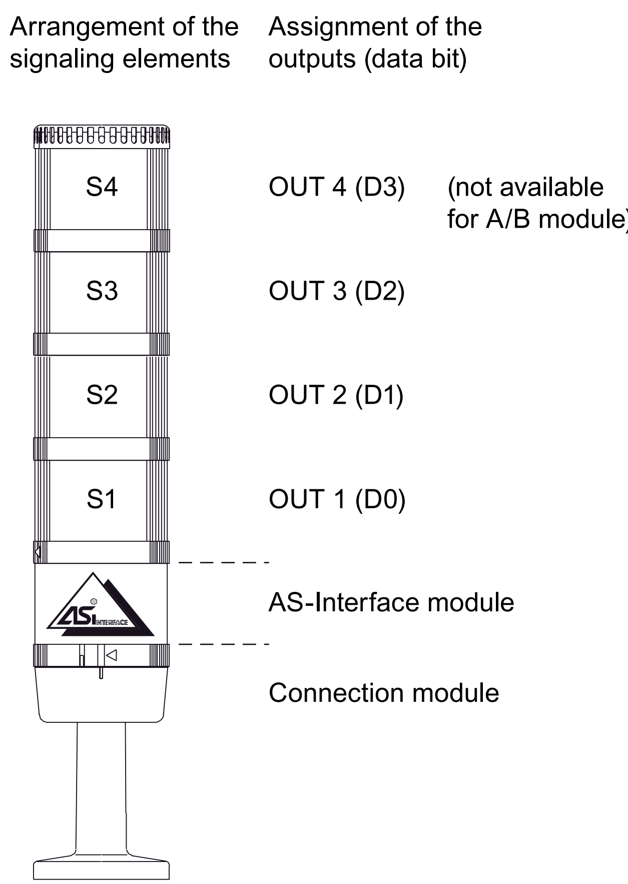


Figure 8-76 Assignment of the signaling elements to the AS-i outputs

Configuring the signaling columns

For a detailed guide to configuring signaling columns, please visit:

www.siemens.com/automation/infocenter

On the left of the screen, choose the product path:

Automation and Drives ➜ Low-Voltage Controls and Distribution ➜ SIRIUS Industrial Controls ➜ Commanding and Signaling Devices ➜ 8WD4 Signaling Columns

In the middle of the screen under the "Brochures" tab, download the PDF file onto your PC in the required language.

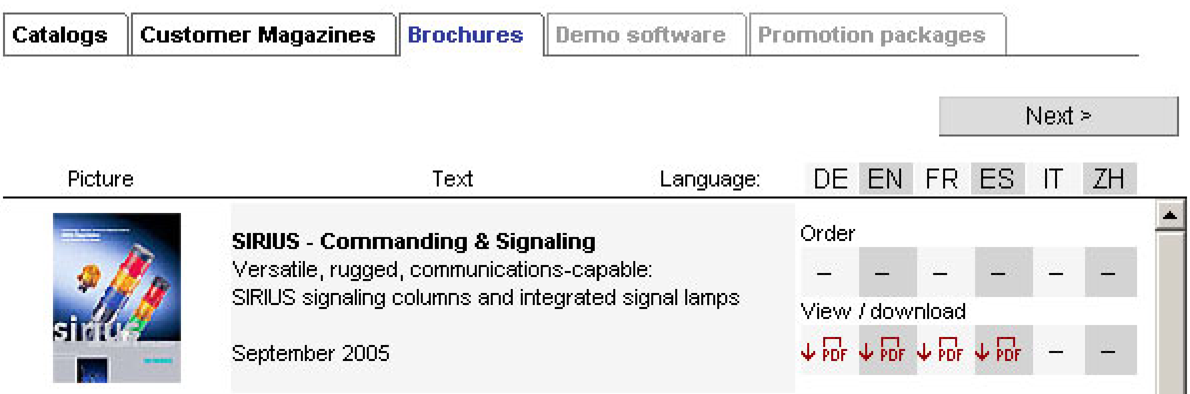


Figure 8-77 Brochure: Signaling Columns (as at 08/2007)

8WD44 series (70 mm diameter)

The following AS-i adapter elements are available for the 8WD44 series:

- Standard slave with 4 electronic outputs
- A/B slave with 3 electronic outputs

You can use a slide switch on the bottom of the adapter element to select the cable via which the signaling elements are supplied:

- Switch position "internal" Power supply for the signaling elements from the AS-i cable. An auxiliary voltage does not need to be connected.
- Switch position "external" Power supply for the signaling elements from the auxiliary voltage.
  24 V DC auxiliary voltage must be connected.

Depending on the position of the switch, the power requirements for the signaling elements must be taken into account when the AS-i power supply unit or auxiliary voltage power supply unit is dimensioned.

In the event of an overload, the outputs are shut down and an I/O error is reported to the AS-i master.

The following table can be used to calculate the power requirements for the AS-i module:

Components	Power requirements 8WD42	Power requirements 8WD44
AS-i module	50 mA	50 mA
Steady light element incandescent lamp (7 W)	300 mA	300 mA

Components	Power requirements 8WD42	Power requirements 8WD44
Steady light element LED	60 mA	45 mA
Buzzer element	25 mA	25 mA
Siren element	—	100 mA

8WD42 series (50 mm diameter)

The following AS-i adapter elements are available for the 8WD42 series:

- Standard slave with 4 relay outputs.
  Auxiliary voltage 0...24 V DC or 0...230 V AC must be connected.
  The max. aggregate current for all the signaling elements is 1.5 A.

The AS-i module for the 8WD42 series is not equipped with overload protection.

Setting the AS-i address

In the 8WD44 series, the addressing socket for setting the AS-i address is located and can be accessed on the bottom of the adapter element (once it has been removed).

To the set AS-i address with the 8WD42 series, however, the addressing device can be connected directly using the AS-i connection cable (no addressing socket).

8.8.2 Order numbers

AS-Interface adapter element for signaling columns

Type	Order no.
AS-Interface adapter element with external 24 V DC auxiliary voltage for 4 signaling elements	8WD4228-0BB
AS-Interface adapter element A/B technology, ASIsafe, with/without external 24 V DC auxiliary voltage, switchable for 3 signaling elements	8WD4428-0BD
AS-Interface adapter element standard AS-i, with external 24 V DC auxiliary voltage, for 4 signaling elements	8WD4428-0BE

For the configuration of the signaling elements, refer to the order numbers in the relevant catalog or brochure.

8.8.3 Connection

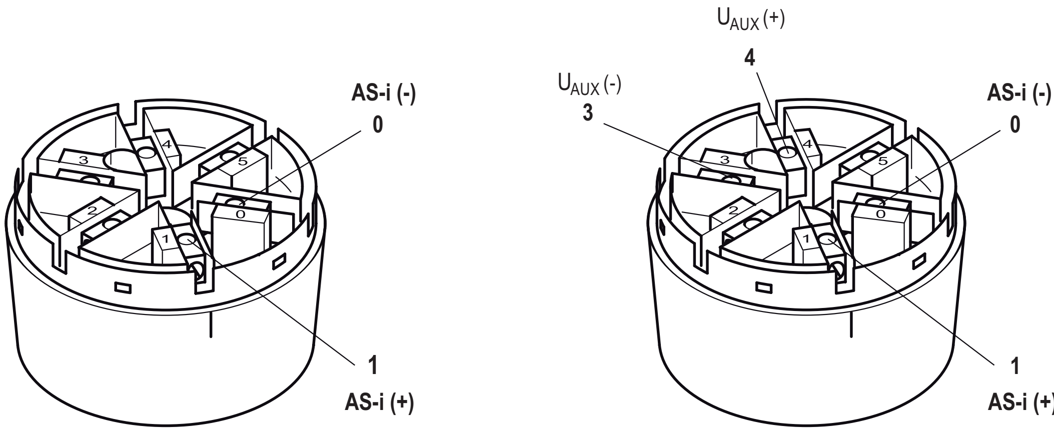


Figure 8-78 Signaling columns - AS-i connection (on left without, on right with AUX POWER)

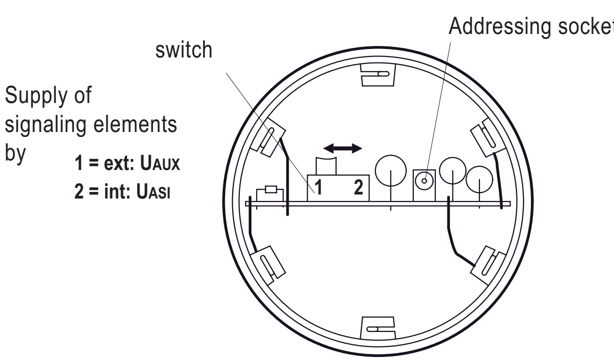


Figure 8-79 Signaling columns - ASI module

8.8.4 Diagnostics

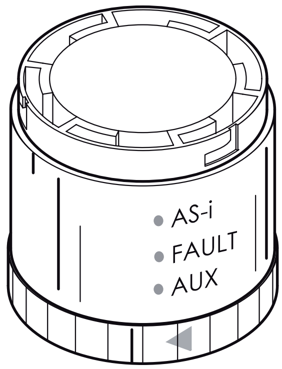


Figure 8-80 LEDs on the 8WD44 signaling column

In the 8WD44 series, the adapter element is equipped with three diagnostic LEDs on the side: AS-i, FAULT, and AUX (auxiliary voltage). The LEDs have the same meaning as that described in "Diagnostics". If the outputs are overloaded, the I/O error bit is set.

No diagnostic LEDs are available in the 8WD42 series.

8.8.5 Technical specifications

AS-Interface adapter elements for signaling columns

Order no.	8WD4228-0BB	8WD4428-0BD	8WD4428-0BE
Slave type	Standard slave	A/B slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.1	AS-i Spec. 2.0
AS-i slave profile IO.ID.ID2	8.F (ID2 not available, replacement value: F)	8.A.E	8.F.F
ID1 code (factory setting)	(ID1 not available, substitute value: F)	7	F
Power supply			
Operating voltage from AS-i cable	18.5 ... 31.6 V		
Current consumption from AS-i cable without external auxiliary voltage with external auxiliary voltage	 — 50 mA	 ≤ 250 mA 50 mA	 — 50 mA

Order no.	8WD4228-0BB	8WD4428-0BD	8WD4428-0BE
Protective measures			
Watchdog	Integrated		
Short-circuit/overload protection	Via external back-up fuse M 1.6 A	Integrated	
Reverse polarity protection	Integrated		
Outputs	4 relay outputs	3 electronic outputs	4 electronic outputs
Load voltage	External auxiliary voltage 24 V DC - 120 V DC max. 230 V AC	Via AS-i cable or external 24 V DC auxiliary voltage, switchable	External auxiliary voltage 24 V DC
Current-carrying capacity without external auxiliary voltage with external auxiliary voltage	— 1.5 A total current	0.2 A total current 0.3 A per output	
Degree of protection	IP54	IP65	
Operating temperature	–20 ... +50°C	–25 ... +50°C	

8.9 AS-Interface connection for LOGO!

8.9.1 Overview

The LOGO! Modular logic module is a user-friendly, cost-effective solution for simple open-loop and closed-loop control tasks in domestic applications/installation engineering, cabinet construction, mechanical and apparatus engineering, and so on. It can also be used for preprocessing signals for other controllers.

To increase the number of inputs and outputs of the basic module LOGO! Modular Basic / Pure, digital and analog expansion and communication modules can be connected.

LOGO! communications module CM AS-Interface allows a LOGO! module to be connected to an AS-i system. It can be combined with any LOGO! modular basic and pure variants.

Figure 8-81 LOGO! CM AS-Interface expansion module (right) connected to a LOGO! basic module (left)

The LOGO! CM AS-Interface is an AS-i slave.

It does not support master functionality, which means that it cannot be used to control other AS-i slaves.

As a result, data cannot be exchanged directly between two LOGO! devices. Data is always exchanged via the AS-Interface master.

The LOGO! CM AS-Interface exchanges four digital input and four digital output statuses with the higher-level controller (PLC) via an AS-i master.

This input and output data can be interconnected in the LOGO! program in the same way as standard inputs and outputs.

The LOGO! program does not make a distinction here between the virtual inputs/outputs (of the AS-Interface communication module) and the standard inputs/outputs (which are wired to physical switches/contactor coils via terminals, for example).

Logical assignment

The LOGO! program numbers the inputs and outputs in the same order in which the modules are connected, starting with I1 (inputs) and Q1 (outputs).

The LOGO! basic module is equipped with eight digital inputs and four digital outputs, which are addressed in the LOGO! program as I1 ... I8 and Q1 ... Q4. The numbering is continued if expansion modules are connected.

If a CM AS-Interface communication module is connected next to the basic module, the four inputs and four outputs on the CM AS-Interface are addressed in the LOGO! program as I9...I12 and Q5...Q8.

If additional expansion modules with digital inputs/outputs are located between the basic module and the communication module, the inputs/outputs on the CM AS-Interface shift accordingly in the LOGO! program.

- In LOGO!, an AS-i output (from the point of view of the PLC) is read as an input.
- In LOGO!, an AS-i input (from the point of view of the PLC) is read as an output.

The assignment is shown in the following table:

AS-Interface system (from the point of view of the PLC)		LOGO! system (use in LOGO! program)	
		General representation (index n depends on slot)	Example: CM AS-Interface directly next to LOGO! basic module
Output data bits		Inputs	Inputs
D0 (out) D1 (out) D2 (out) D3 (out)	⇒	In In+1 In+2 In+3	I9 I10 I11 I12
Input data bits		Outputs	Outputs
D0 (in) D1 (in) D2 (in) D3 (in)	⇐	Qn Qn+1 Qn+2 Qn+3	Q5 Q6 Q7 Q8

Setting the AS-i address

The addressing socket for setting the AS-i address is located on the left-hand side of the lower terminal strip. The address is assigned as usual using the AS-i addressing unit.

If the module is to be addressed via the addressing socket once it has been installed, you must disconnect AS-Interface from the power supply beforehand. This is necessary in the interests of plant safety.

The AS-i address cannot be set via the display of the LOGO! basic module or via the LOGO! software.

8.9.2 Order numbers

Type	Order no.
AS-Interface function module LOGO! standard slave IP20 4DI/4DO	3RK1400-0CE10-0AA2

Additional LOGO! modules can be found in the LOGO! manual (reference, Cont. ID = 21221909 (Page 627)) or in the ST 70 catalog.

8.9.3 Connection

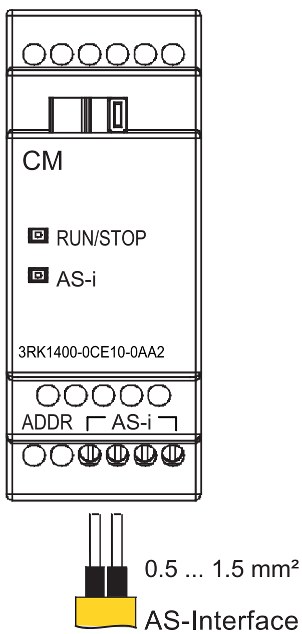


Figure 8-82 LOGO! CM AS-Interface connection

CAUTION

The LOGO! expansion modules must only be connected/disconnected when they are disconnected from the power supply.

The AS-Interface and LOGO! system must not be connected electrically.

LOGO! can support up to 24 digital inputs and 16 digital outputs. Make sure that enough space is available in the LOGO! address space for the four inputs and four outputs of AS-Interface.

You are advised to position the AS-Interface CM on the far right. If the AS-Interface voltage fails, communication in the LOGO! system with the expansion modules to the right of the AS-Interface CM is interrupted.

8.9.4 Diagnostics

Two LEDs are located on the front:

LED status display RUN/STOP

RUN/STOP	Possible cause	Possible remedial measures
Green	Standard operation, No communication with the LOGO! module on the left Module OK	—
Red	No communication with the LOGO! module on the left Module	• Sliding contact with the module on the left must be fully engaged. • Check whether the module on the left is functioning properly. • Check the power supplies: the AS-i voltage must be connected at the same timer as or prior to the power supply for the module on the left. otherwise the expansion module will not be detected when the LOGO! basic module is started.
Yellow	Initialization phase of expansion module active.	Wait until the initialization phase is complete.
OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

LED status display for AS-i

AS-i	Possible cause	Possible remedial measures
Green	Normal operation, AS-i communication OK	—
Red	No AS-i communication: • The master is switched off or offline. • The slave is not configured in the master. • The incorrect slave type is connected. • The slave has the wrong address.	Ensure AS-i communication: • Switch on the master or switch it to online mode. • Reconfigure the master. • Connect the correct module. • Check/correct the slave address.
Yellow/red flashing	The slave has the address 0 (on delivery)	Assign an address that is not 0.
OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

If AS-i communication is interrupted, the outputs are reset after approx. 40 ... 100 ms.

8.9.5 Technical specifications

CM AS-Interface	
Electrical data	
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
Slave profile IO.ID	7.F
ID2, ID1 code	not available (substitute value: F, F)
Power supply from AS-Interface cable, operating voltage in acc. with AS-i Specification	26.5...31.6 V
Reverse polarity protection	Yes
Total current consumption I_{tot}	≤ 70 mA
Degree of protection	IP20
RFI suppression	Limit value class A
Connections	
Digital inputs (I)	The next four inputs behind the physical inputs of the LOGO! (In ... In+3)
Digital outputs (Q)	The next four outputs behind the physical outputs of the LOGO! (In ... In+3)

CM AS-Interface	
Mechanical data	
Dimensions (W x H x D)	36 x 90 x 58 mm
Weight	Approx. 90 g
Assembly	On DIN rail, 35 mm, 2 MW or wall-mounting
Approvals	IEC 61131-2, EN 50178 cULus to UL 508 CSA C22.2 no. 142

8.9.6 Dimension drawings

LOGO! CM AS-Interface communications module

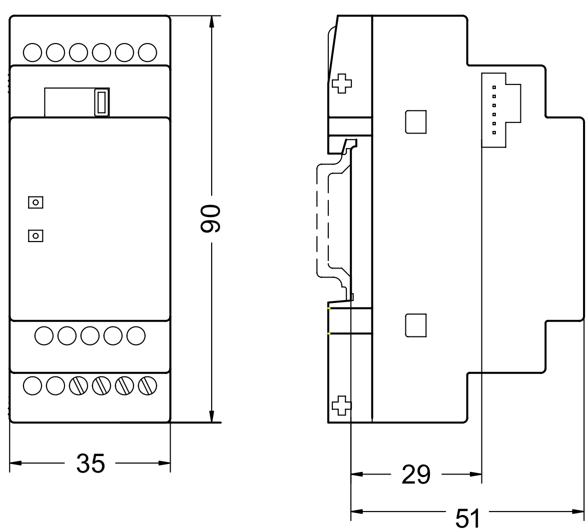


Figure 8-83 Dimensions: LOGO! CM AS-Interface communication module

8.10 Contactors showing remaining service life and connection to AS-Interface

8.10.1 Overview

The contactors 3RT10, 3-pin, sizes S6 ... S12 (for > 45 to 250 kW) with display showing remaining service life can be ordered with an integrated AS-i connection.

Figure 8-84 Contactor 3RT1056

The contactors require an auxiliary voltage of 96 to 127V or 200 to 277V AC/DC.

An upstream control electronics system supplies the magnet coil with just the power necessary for ensuring safe switching and stopping,as a result of which a low pick-up and holding power is required.

The electronic remaining life time (RLT) module determines the actual extent to which the contact has eroded and outputs a signal message via AS-Interface when the remaining life time is < 20%. LEDs on the contactor electronics also indicate 40% and 60% remaining life time.

This means that eroded contacts can be replaced in good time during servicing.

Setting the AS-i address

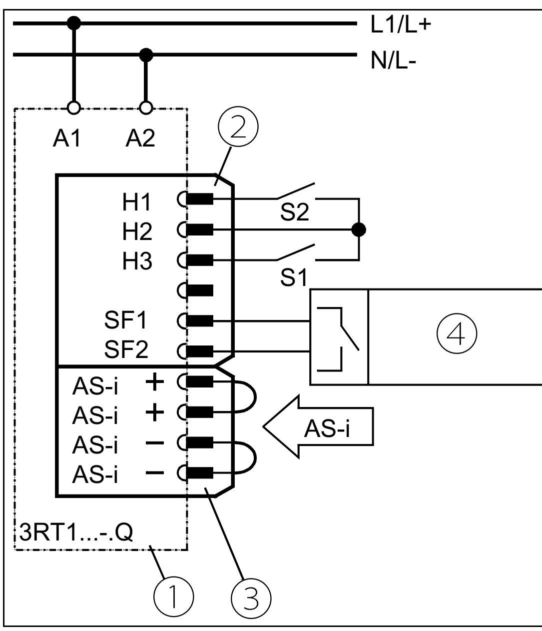
The addressing socket for setting the AS-i address is located on the front of the electronic module. The address is assigned as usual using the AS-i addressing unit.

8.10.2 Order numbers

Power	Size	Connection	Order no.	
			For auxiliary voltage 96-127 V AC/DC	For auxiliary voltage 200-277 V AC/DC
55 kW / 400 V AC-3	S6	Box terminals	—	3RT1054-1QP35
75 kW / 400 V AC-3	S6	Busbar	3RT1055-6QF35	3RT1055-6QP35
90 kW / 400 V AC-3	S6	Busbar	3RT1056-6QF35	3RT1056-6QP35
110 kW / 400 V AC-3	S10	Busbar	3RT1064-6QF35	3RT1064-6QP35
132 kW / 400 V AC-3	S10	Busbar	3RT1065-6QF35	3RT1065-6QP35
160 kW / 400 V AC-3	S10	Busbar	3RT1066-6QF35	3RT1066-6QP35
200 kW / 400 V AC-3	S12	Busbar	3RT1075-6QF35	3RT1075-6QP35
250 kW / 400 V AC-3	S12	Busbar	3RT1076-6QF35	3RT1076-6QP35

Order numbers for accessories: see catalog LV1.

8.10.3 Connecting the electronic module



①	Electronic module for contactor 3RT1...-.Q
②	Plug-in connection, 6-pin
③	Plug-in connection, 4-pin
④	E.g. overload relay 3RB10
S1	S1 selector of automatic control, e.g. via AS-Interface to local control (S1 open: automatic operation)
S2	S2 local control option

Assignment of the inputs DI 0 - DI 3

Input	Status	Meaning
DI 0 "ready"	0	Device not ready / manual mode
	1	Device ready / automatic mode
DI 1 "running"	0	Contactor OFF
	1	Contactor ON
DI 2 " remaining life time"	0	RLT ≥ 20 %
	1	RLT ≤ 20 %
DI 3 "free input"	0	No input signal at free input SF1/2
	1	Input signal at free input SF1/2

Assignment of outputs DO 0 - DO 3

Output	Status	Activation
DO 0 "running"	0	Contactor OFF
	1	Contactor ON
DO 1	0	—
	1	—
DO2	0	—
	1	—
DO3	0	—
	1	—

8.10.4 Diagnostics

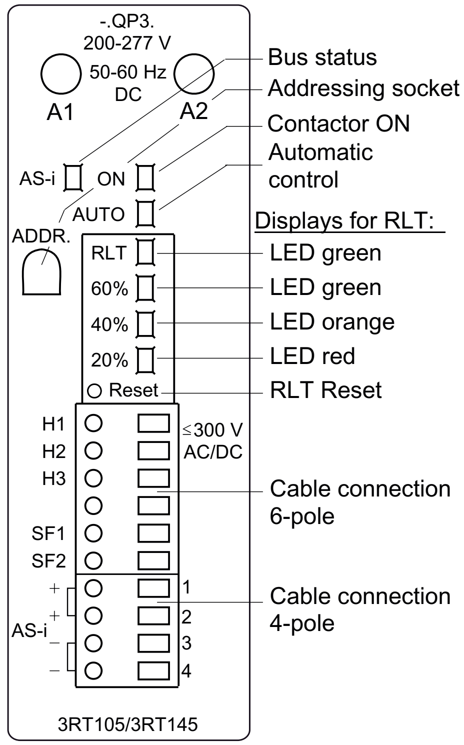


Figure 8-85 LEDs on the electronic module

LED ON

ON	Meaning
Green	Contactor ON (energized status)
OFF	Contactor OFF

LED AUTO

AUTO	Meaning
Green	Automatic mode (via AS-Interface)
OFF	Local control mode

LED AS-i

AS-i	Possible cause	Possible remedial measures
Green	Normal operation, AS-i communication OK	—
Red	No AS-i communication: • The master is switched off or offline. • The slave is not configured in the master. • The incorrect slave type is connected. • The slave has the wrong address.	Ensure AS-i communication: • Switch on the master or switch it to online mode. • Reconfigure the master. • Connect the correct module. • Check/correct the slave address.
Yellow/red flashing	The slave has the address 0 (on delivery)	Assign an address that is not 0.
OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

LED status displays for RLT (remaining life time)

LED		Meaning
RLT	Green	RLT OK
60%	Green	RLT in acc. with LED labeling
40%	Orange	
20%	Red	

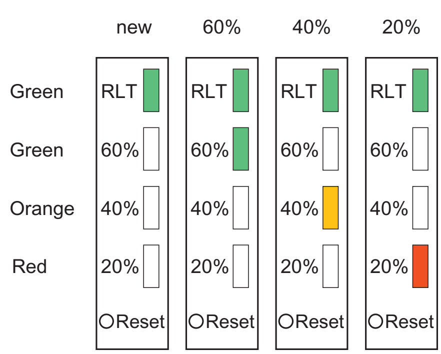


Figure 8-86 Status display of RLT

8.10.5 Technical specifications of the electronic module

Electrical data	
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
AS-i slave profile IO.ID	7.F
ID2, ID1 code	not available (substitute values: F, F)
Power supply (in acc. with AS-Interface Specification)	26.5 ... 31.6 V
AS-Interface current consumption	≤ 20 mA
Contact load on SF1/2	3...6 mA
Watchdog function	Integrated

Additional specifications for the 3RT10 contactors can be found under "3RT10 contactors, 3-pole, 3...250 kW" in catalog LV1 / LV1T or at www.siemens.de/mall (as PDF for all sizes from S00 to S12).

9 Integrated safety systems: ASIsafe

The safety-related design of AS-Interface was standardized for all manufacturers in the "Safety at Work" consortium (sub-group of the AS-i International Association) (see AS-i-Spec. 3.0). It is marketed by Siemens under the copyrighted name "ASIsafe".
The concept allows both standard and safe data to be used in one single bus system. EMERGENCY STOP buttons, laser scanners, and a range of other I/Os can be easily and safely connected directly to AS-i. Existing applications can also be quickly and easily extended to include safety-oriented functions.

"Safety at Work" is certified by the Technical Inspectorate (TÜV) and approved devices bear the ASIsafe logo.

Integrating safety-oriented components

ASIsafe enables safety-oriented components (e.g. EMERGENCY STOP control devices, protective door monitors, optoelectronic protective devices, safety light curtains) to be integrated directly in an AS-Interface network. These are fully compatible with the standard AS-Interface components (master, slaves, power supply unit, repeater, etc.) to IEC 62061/EN 50295 and are operated together on the yellow AS-Interface cable.

The signals from the safety sensors are evaluated by a safety monitor, which not only monitors the switching signals from the safety sensors but also continuously ensures that data is transferred properly. The safety monitor is equipped with one or two enabling circuits, which are configured with one or two channels and are used to switch the machine or plant to safe mode. Sensors and monitors can be connected anywhere within the AS-Interface network. More than one monitor can also be used in a network.

A failsafe controller or special master is not required. The master treats safety slaves in the same way as all the other slaves and receives safety data for information purposes only. This means that all existing AS-Interface networks can also be extended.

ASIsafe ensures a maximum response time of 40 ms. This is the time between the signal being applied to the input of the safe slave and the output on the safety monitor being switched off.

Tested safety

The system is tested and released for worldwide use by TÜV (Germany), NRTL (USA), and INRS (France). The transmission method for safety-oriented signals is designed in such a way that applications up to category 4 according to EN 954-1 and SIL 3 according to IEC 61508 can be implemented.

ASIsafe ensures full compatibility with all other AS-Interface components to EN 50295.

Software

The safety-oriented applications can be compiled and transferred to the monitor using the configuration software "asimon". The software also supports online diagnosis.

Local ASIsafe solution: the safety monitor (Page 353)

A number of simple and cost-effective safety solutions are available. The local ASIsafe solution only needs two components: a safety monitor and safe slaves. Failsafe PLCs or special masters are not required. The safety monitor monitors the safe inputs acquired via the safe slaves, links them using a parameterizable logic, and ensures safe shutdown by means of a built-in safety relay.

The data is transferred via a dynamic, safe protocol. In each cycle, the safety monitor expects from each slave a specific telegram that changes continuously in accordance with a defined algorithm. Configuration software is used to parameterize the shutdown logic of the safety monitor, whereby it can respond accordingly in each case when the safe nodes trip. If no telegram is received (e.g. if a fault or alarm occurs), the safety monitor shuts down after max. 40 ms (worst case) via its two-channel enabling circuits.

The safety monitor can be diagnosed via the controller. This has many benefits, in particular no additional wiring is necessary for the safety components. Ready-made images for operating and monitoring tasks also allow users to visualize the safety-oriented events on SIMATIC HMI panels.

PROFIsafe ASIsafe solution: the DP/AS-i F-Link (Page 123)

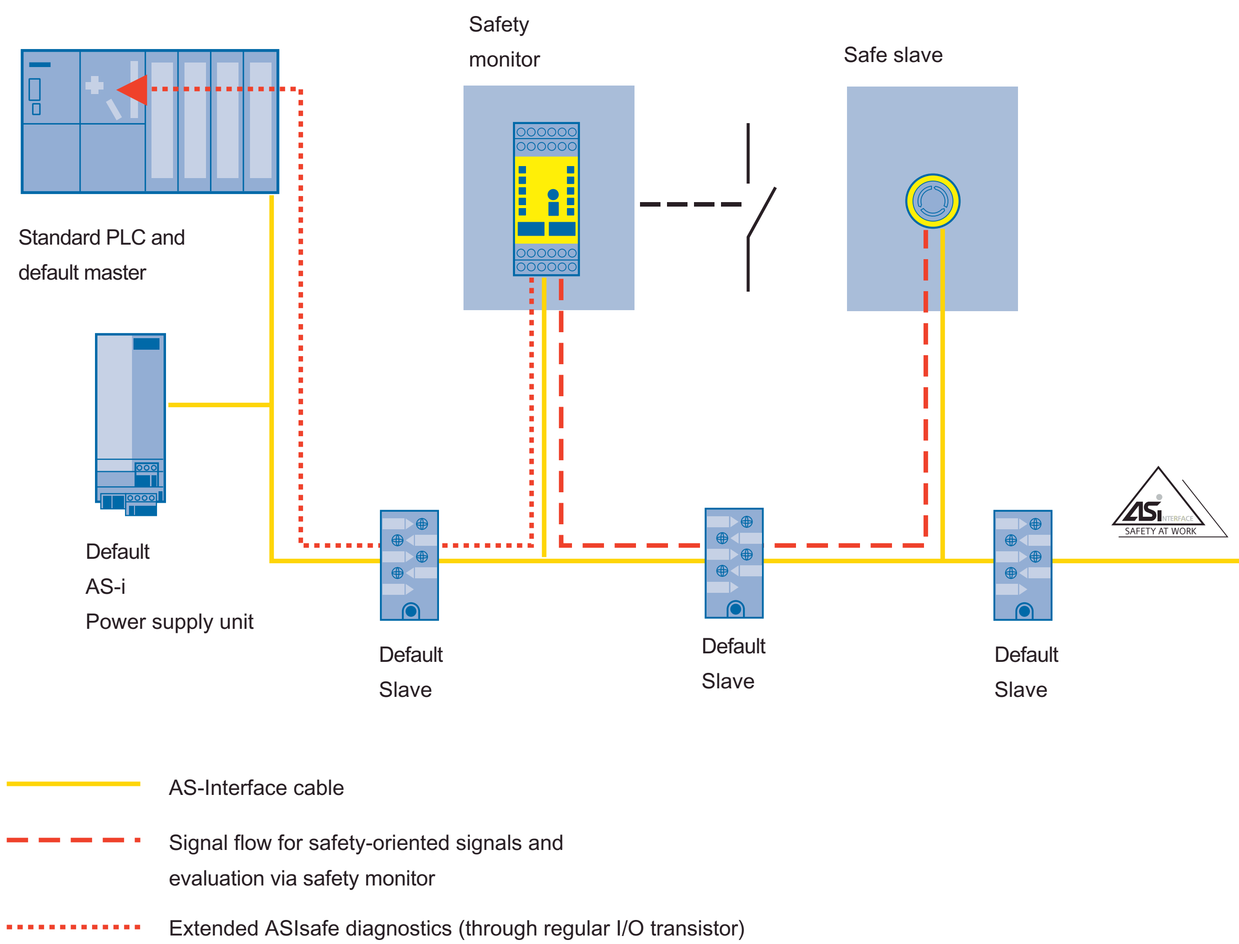
DP/AS-i F-Link allows you to leverage the benefits of AS-i in a wide range of safety applications since it allows the use of AS-i in failsafe SIMATIC or SINUMERIK controllers. It closes a crucial gap in bus-based safety technology in that it ensures that ASIsafe telegrams are converted to the PROFIsafe protocol. Safe signals are acquired as usual with the robust IP67 ASIsafe slaves. The existing F PLC is responsible for evaluating them. Responses are also made at the PROFIsafe level, either by F-DO/F-RO modules in the central rack or by means of the failsafe distributed I/Os. F-Link is the best choice in the following cases:

- When large amounts of safe slaves are used
- When numerous trip circuits have been installed
- For safety-oriented further processing at the higher-level field bus levels
- For extensive, nested logical operations

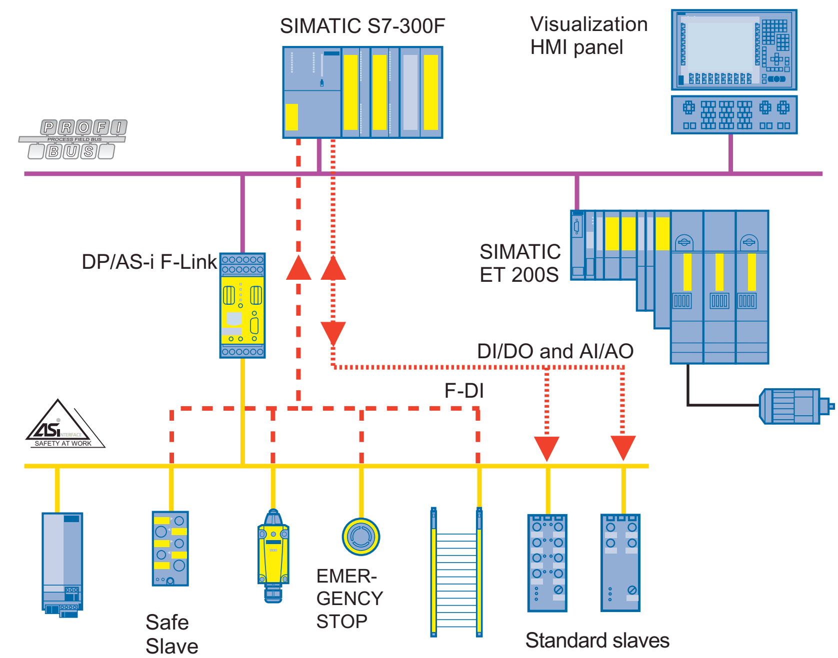
And the level of TIA is greater than ever: configuration and parameterization is carried out via STEP 7 HWConfig, as is the case with PROFIsafe slaves. The safe logic is programmed with the "unlimited" resources of STEP 7 Distributed Safety in F-KOP or F-FUP. The comprehensive library of TÜV-certified function blocks ensures highly efficient and structured user programs. Diagnosis is also carried out using the system functions provided by STEP 7 as well as locally on the devices by means of messages on the display.

	ASIsafe
Possible no. of safe slaves	31
Safety integrity level	Up to SIL3 (IEC 61508)
Safety category	Up to cat. 4 (EN 954-1)
Response time	Max. 40 ms (worst case)

Local ASIsafe solution: Design and components



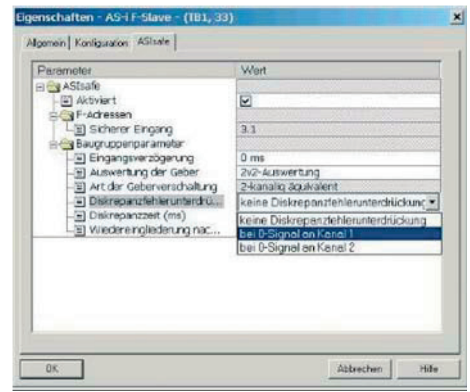
PROFIsafe ASIsafe solution: Design and components



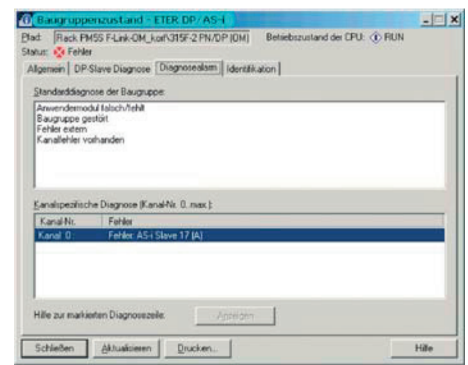
AS-Interface cable

Signal flow for safety-oriented signals
Up to PLC (PROFIsafe level)

Signal flow for digital and analog standard signals



Parameterizing ASIsafe slaves in STEP 7 HW Config



Diagnosing ASIsafe slaves in STEP 7 HW Config

9.1 Safety monitor

Functional principle

The safety monitor monitors data communication on the AS-Interface cable. For safe slaves, dynamic code sequences (8x4 bit data sequence), which are stored in every slave, are transferred.

These are "learnt" by the safety monitor during commissioning. During operation, the safety monitor compares in each cycle the target and actual sequence and, if any discrepancies are identified (e.g. due to device failure, communication faults, etc.), initiates a safe shutdown within 40 ms. The restart time is 100 ms. A range of safe field and cabinet modules as well as intelligent safety sensors and control devices with an AS-Interface chip are available as slaves.

Bus communication and the data protocol have been deemed safe by the BIA and the technology has been certified by TÜV.

The system can be used up to category 4 to EN 954-1 or up to SIL 3 to IEC 61508 [10] and can be used for stop category 0 and 1 to EN 60204-1.

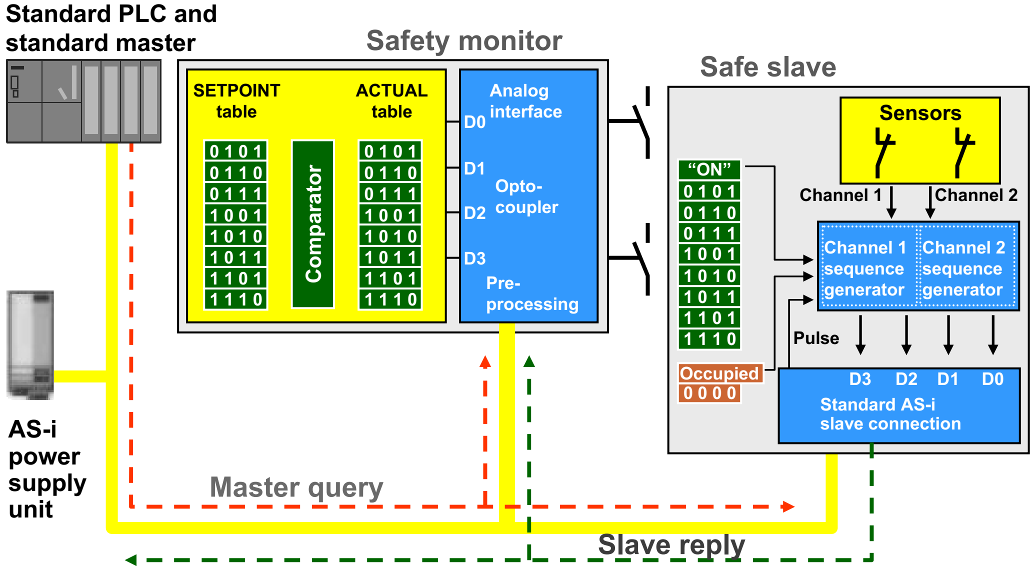
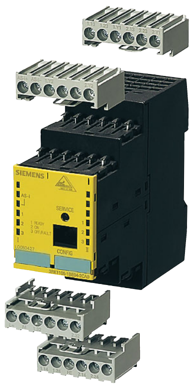


Figure 9-1 ASIsafe functional principle

9.1.1 Overview



The safety monitor is at the heart of ASIsafe. A safe application is configured with a PC via the safety monitor. A range of different application-specific operating modes can be selected here. These include the EMERGENCY OFF function, tumbler, or stop category 0 or 1.

To leverage the benefits of the AS-Interface diagnostic options, the monitor can also be operated with the AS-Interface address. All the diagnostic options can be used further in the higher-level PLC by means of the diagnostic block for STEP 7 supplied with the ASIsafe CD.

The monitor is available in two versions:

- Basic safety monitor with an entry-level range of blocks and basic functionality
- Expanded safety monitor with advanced features and functionality

Both versions are each available with one or two two-channel enabling circuits.

The safety monitor is used in an AS-Interface bus system for monitoring protective devices (e.g. EMERGENCY OFF buttons). It fulfills safety category 4 (to EN 954-1).

In accordance with IEC 61508, the safety monitor can be used in loops up to SIL3. The PFD value of the entire loop must be calculated by the user.

ON period (in months)	Total operation time (in years)	PFD	PFH
3	10	$\leq 4 \times 10^{-5}$	—
6	10	$\leq 6 \times 10^{-5}$	—
12	10	$\leq 9 \times 10^{-5}$	$\leq 9 \times 10^{-9}$

ON period

NOTICE
Depending on the safety components selected, the safety system as a whole can also be classified in a lower safety category.

9.1.2 Function

Comparison between the basic safety monitor and expanded safety monitor

	Basic safety monitor	Expanded safety monitor
No. of monitoring modules	32	48
No. of OR gates (inputs)	2	6
No. of AND gates (inputs)	--	6
Wildcards for monitoring modules	✓	✓
deactivation of monitoring modules	✓	✓
Fault reset	✓	✓
Diagnostics hold	✓	✓
A/B slaves for acknowledgement	✓	✓
Safe time functions	--	✓
"Button" function	--	✓
Contact debouncing	--	✓

No. of monitoring modules

When the expanded safety monitor is used, the number of devices that the safety monitor can handle increases from 32 to 48. This allows more complex and larger applications to be simulated in the safety monitor.

OR logic operation

At the logic level, two elements can be ORed in the basic version and up to six elements in the expanded version.

AND logic operation

With the expanded safety monitor, an AND operation can be added to an OR operation in addition to the standard AND operation in the main path of an enabling circuit. More than two elements can be linked in this AND.

Functions of the basic safety monitor

- Wildcards and deactivation of monitoring modules:
  wildcards are available for configuration purposes. These wildcards are used during configuration and diagnosis and, if required, are easy to activate. This allows for simple, user-friendly configuration, even when the plant configurations vary.

- Fault reset:
  If a module detects a fault, the AS-Interface safety monitor switches to the fault status. In this case, a differentiated fault reset is triggered. The fault reset can be activated by a standard AS-Interface slave (e.g. a button) and is only effective at module level. The main advantage of this is that only the module locked in a fault is reset rather than the entire safety monitor.
- Buffer storage and "Diagnostics hold"
  Momentary disconnections are saved in a buffer memory for diagnostic purposes. Disconnections can also be "frozen" until an acknowledgment is received via a standard slave ("Diagnostics hold" function).

Additional functions of the expanded safety monitor

The following additional features are only available with the expanded safety monitor:

- Safe time functions
  Timers with the following functions are available:
  - ON delay
  - OFF delay
  - Pulse
- "Button" function
  Additional acknowledgment option for restarting the system by means of an additional button. In addition to the "Service" button on the safety monitor, its function (restarting the system) can be assigned to any button on a command and signaling device by configuring this in the asimon software.
- Contact debouncing
  A bounce time after which the system restarts can be set for debouncing contacts.

Compatibility

Existing configurations can be transferred to the "new" safety monitor without changes.

All functions are designed for category 4 to EN 954-1; the safety monitor, monitoring and evaluation unit, as well as the slaves have been certified by TÜV to IEC 61508, NRTL (USA), and INRS (France).

9.1.3 Order numbers

Safety monitor

Type	Order no.	
	Screw connection	Spring-loaded terminal
Basic safety monitor		
One enabling circuit	3RK1105-1AE04-0CA0	3RK1105-1AG04-0CA0
Two enabling circuits	3RK1105-1BE04-0CA0	3RK1105-1BG04-0CA0
Expanded safety monitor		
One enabling circuit	3RK1105-1AE04-2CA0	3RK1105-1AG04-2CA0
Two enabling circuits	3RK1105-1BE04-2CA0	3RK1105-1BG04-2CA0

Accessories

Type	Order no.
ASIsafe CD • asimon V2 plus configuration software • Diagnostics package for STEP 7 (FB102) • Complete HMI templates for WinCCflex (OP / TP 177 – 277)	3RK1 802-2FB06-0GA0
Set of cables • PC configuration cable (RS 232 interface) • Transmission cable between two safety monitors	3RK1 901-5AA00
Sealable cover	3RP1 902

9.1.4 Connection

Circuit diagrams for ASi safety monitors

If terminal M is not connected to ground in the immediate vicinity of the device, the protective conductor must be connected to terminal FE.

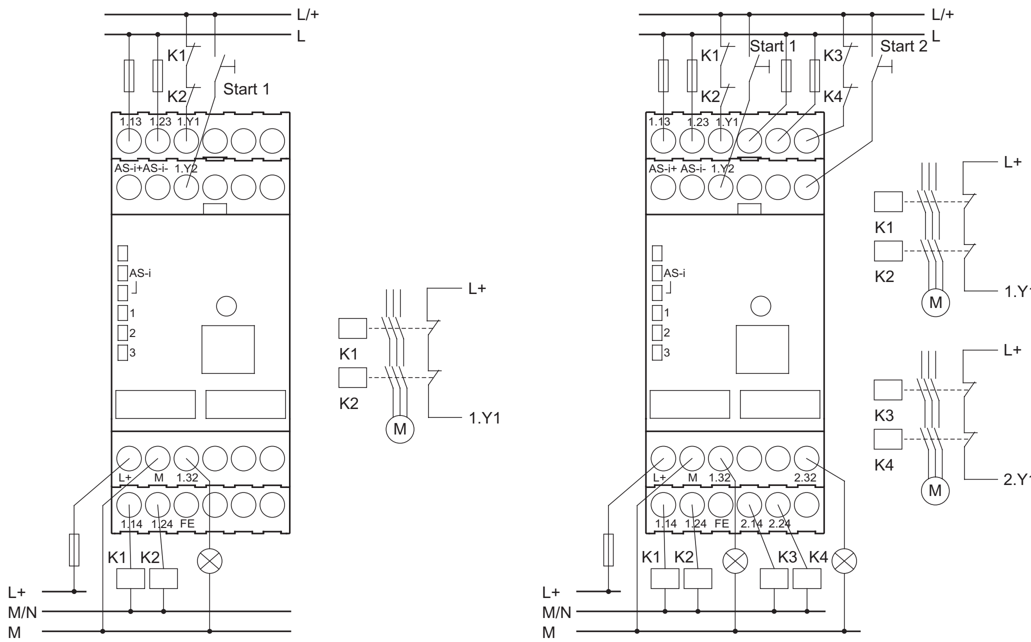


Figure 9-2 Safety monitor with one or two enabling circuits

9.1.5 Diagnostics

LEDs

The LEDs on the front of the AS-Interface safety monitor provide information about the operating mode and device status.

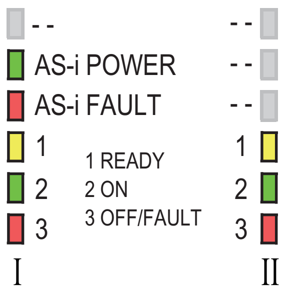


Figure 9-3 Arrangement of the LEDs
(The LED AS-i POWER may also be labeled LED AS-i.
The LED AS-i FAULT may also be an unlabeled LED under the LED AS-i.)

LED: AS-i POWER (AS-i)

AS-i POWER (AS-i)	Possible cause	Possible remedial measures
OFF	No AS-Interface supply	• Check the cable connections. • Check the AS-Interface power supply unit.
Green	Normal operation, AS-i communication OK	—

LED: AS-i FAULT (LED under LED AS-i)

AS-i FAULT	Possible cause	Possible remedial measures
OFF	Normal operation, AS-i communication OK	—
Red	No AS-i communication: • The master is switched off or offline.	Ensure AS-i communication: • Check the master.

LED: 1 READY (for each output circuit)

1 READY	Possible cause	Possible remedial measures
OFF	Normal operation	—
Yellow	Acknowledgement of startup/restart inhibit active	Press the "Start" button.
Flashing yellow	External test required. ON delay active	Open the contacts on the faulty input circuit simultaneously and in pairs.
Flickering yellow LED 1, 2, 3 simultaneously	Internal device error	Connect the device to the PC, see OFF/FAULT. Launch the ASIMON software, note down the error number displayed in the ASIMON message window, and contact Technical Support.

LED: 2 ON (for each output circuit)

2 ON	Possible cause	Possible remedial measures
OFF	The contacts of the output switching elements are open.	—
Green	The contacts of the output switching elements are closed.	—
Flashing green	Delay time running for stop category 1	Wait until delay time has elapsed.
Flickering yellow LED 1, 2, 3 simultaneously	Internal device error	Connect the device to the PC, see OFF/FAULT. Launch the ASIMON software, note down the error number displayed in the ASIMON message window, and contact Technical Support.

LED: 3 OFF/FAULT (for each output circuit)

3 OFF/FAULT	Possible cause	Possible remedial measures
OFF	The contacts of the output switching elements are closed.	—
Red	The contacts of the output switching elements are open.	—
Flashing red	Error at level of monitored AS-Interface components	• Carry out diagnosis with ASIMON. • If necessary, replace defective AS-Interface components.
Flickering yellow LED 1, 2, 3 simultaneously	Internal device error	Connect the device to the PC, see OFF/FAULT. Launch the ASIMON software, note down the error number displayed in the ASIMON message window, and contact Technical Support.

Note

When the "Service" button is pressed, this is acknowledged when all the device LEDs light up once for a brief moment.

As soon as the power supply is applied to the device, the internal system test starts. This operating status is indicated by the fact that all the LEDs installed in the device light up.

Diagnosis via asimon configuration software

When the safety monitor is connected to the serial PC interface, the online diagnosis function can be activated in the asimon software. The status of each module (device) is indicated by a color.

Status display	
Color display	**Meaning**
Green	Device is switched on.
Flashing green	Device is ON, shutdown timer started.
Yellow	Device waiting for local acknowledgement or start condition.
Flashing yellow	Device (two-channel dependent) was actuated on one channel; Test (OFF → ON) required, for "start test" too.
Red	Device has switched off (standard shutdown).
Flashing red	Device has (forcibly) been switched off on one channel, or error with contactor monitoring. Press "Service" button.
Gray	Device communications error between AS-i module and safety monitor
—	Safety monitor is in configuration mode.

Diagnosis via AS-Interface

To forward the diagnosis to the PLC via AS-Interface, the safety monitor requires an AS-i address. This is assigned using the asimon configuration software (Edit ➜ Information about Monitor and bus ➜ Diagnosis / Service ➜ AS-interface diagnosis ➜ Monitor base address).

A function block in the PLC reads the diagnostics data and stores it in a data block. The function block (incl. description) is supplied with the asimon software.

9.1.6 Technical specifications

Order no.	3RK1105-...
Rated operating current	
I_e/AC-12	Up to 250 V, 3 A
I_e/AC-15	115 V, 3 A 230 V, 3 A
I_e/DC-12	Up to 24 V, 3 A
I_e/DC-13	24 V, 1 A 115 V, 0.1 A 230 V, 0.05 A
Response time	≤ 40 ms
Ambient temperature	0 ... +60°C
Storage temperature	-40 ... +85°C
AS-Interface configuration data (for diagnosis via AS-i) applies to the basic address and simulated slaves	
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
AS-i slave profile IO.ID	7.F
ID2, ID1 code	not available (substitute values: F, F)

9.1.7 Dimension drawings

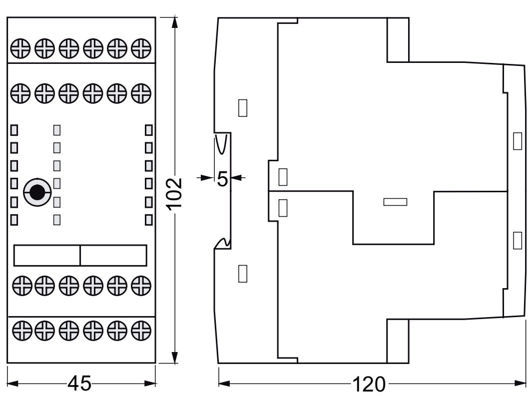


Figure 9-4 Dimension drawing: safety monitor

9.2 ASIsafe modules

9.2.1 Overview

Figure 9-5 ASIsafe modules

Safety modules for AS-Interface (ASIsafe modules) are available for field use in degree of protection IP67 (K20F and K45F compact modules) and for the control cabinet (S22.5F SlimLine modules) in degree of protection IP20.

This means that a highly compact module with an optimum price/performance ratio is available for all types of application.

The following modules are available:

K20F safe compact modules for operation in the field

The K20F module, which is just 20 mm wide, is ideal for applications in which modules need to be installed in a confined area. The K20F modules are connected to AS-Interface using a round cable with an M12 cable plug instead of the AS-Interface flat cable, which allows for an extremely space-saving design. Since the round cable is so flexible, the modules can also be easily installed on moving machine parts. The K20 modules are also suitable for installation on moving parts because their non-encapsulated design means that they are extremely light.

K45F compact safety modules for operation in the field

The platform for the K45F modules covers the following variations:

- Connection of switches /safety sensors with contacts ("mechanical"):
  - K45F 2F-DI: two safety-oriented inputs in operation up to category 2 to EN954-1. If category 4 is required, the module is equipped with a two-channel input.
  - K45F 2F-DI/2DO: two standard outputs are available in addition to the safe inputs. Supplied via the AS-i cable.
  - K45F 2F-DI/2DO Uaux: like K45F 2F-DI/2DO, supplied only via the black 24 V DC cable.

- K45F 4F-DI: four safety-oriented inputs in operation up to category 2, two for category 4. Highly compact double slave (uses two full AS-i addresses).

- Connection of electronic switches / safety sensors (non-contact protective devices, BWS):
  - K45F LS (light sensor): safe input module for connecting electronic safety sensors tested semiconductor outputs (OSSD). In particular, proximity-type protective equipment, such as active, optoelectronic light curtains and arrays for types 2 and 4 to IEC / EN 61496, as well as transmitters and receivers are supplied with power by the yellow AS-i cable. Suitable sensor cables and an optional, separate transmitter supply module are available as accessories.

SlimLine safety modules S22.5F for use in cabinets and on-site switching boxes.

The SlimLine safety module S22.5F is equipped with two safe inputs. This also ensures that signals can be safely connected to ASIsafe networks in the cabinet.
In operation up to category 2, both inputs can be assigned separately. If category 4 is required, the module is equipped with a two-channel input.

Two S22.5F module variants are also available, which are equipped with two standard outputs in addition to the two safe inputs. These are supplied with power either via the yellow AS-Interface cable only or via the auxiliary voltage from the 24 V DC cable.

9.2.2 Order numbers

Safe compact modules

Order no.	Module	Inputs/outputs	Slave type	Connection
3RK1205-0BQ30-0AA3	K20F	2 safe inputs	Standard slave	2 x M12
3RK1205-0BQ00-0AA3	K45F	2 safe inputs	Standard slave	2 x M12
3RK1205-0CQ00-0AA3	K45F	4 safe inputs	Standard slave	4 x M12
3RK1405-0BQ20-0AA3	K45F	2 safe inputs / 2 standard outputs	Standard slave	4 x M12
3RK1405-1BQ20-0AA3	K45F	2 safe inputs / 2 standard outputs with U_{AUX}	Standard slave	4 x M12
3RK1205-0BQ21-0AA3	K45F LS	2 safe inputs, electronic, type 2 [1)]	Standard slave	3 x M12
3RK1205-0BQ24-0AA3	K45F LS	2 safe inputs, electronic, type 4 [2)]	Standard slave	3 x M12
1) Via socket 1/3 connection of Siemens light curtain FS 400 3RG7843 (type 2)				
2) Via socket 1/3 connection of Siemens light curtain FS 400 3RG7846 (type 4), via socket 2/3 for other makes				

Safe SlimLine modules

Order no.	Inputs/outputs	Slave type	Connection type	Sensors	Output
3RK1205-0BE00-0AA2	2 safe inputs	Standard slave	Screw terminals	Mechanical switching contact	—
3RK1205-0BG00-0AA2			Spring-loaded terminals		—
3RK1405-0BE00-0AA2	2 safe inputs / 2 standard outputs	Standard slave	Screw terminals		Electronic
3RK1405-0BG00-0AA2			Spring-loaded terminals		
3RK1405-1BE00-0AA2	2 safe inputs / 2 standard outputs with U_{AUX}	Standard slave	Screw terminals		
3RK1405-1BG00-0AA2			Spring-loaded terminals		

Accessories

Order no.	Description	Comments
3RK1901-2EA00	K45 mounting plate	Wall mounting
3RK1901-2DA00	K45 mounting plate	DIN rail mounting
3RK1901-1AA00	Input jumper for K45F	Black version
3RK1901-1AA01	Input jumper for K45F	Red version
3RK1901-1KA01	M12 sealing caps	Tamper proof
3RG7848-3EA	Connection cable for K45F LS (light sensor) for transmitter, 5-pole, M12 connector at both ends, plug/socket	Straight, 5 m
3RG7848-3EB		Straight/angled, 5 m
3RG7848-3EC		Straight, 10 m
3RG7848-3ED		Straight/angled, 10 m
3RG7848-3EE		Straight, 15 m
3RG7848-3EF		Straight/angled, 15 m
3RG7848-3CA	Connection cable for K45F LS (light sensor) for receiver, 8-pole, M12 connector at both ends, plug/socket	Straight, 5 m
3RG7848-3CB		Straight/angled, 5 m
3RG7848-3CC		Straight, 10 m
3RG7848-3CD		Straight/angled, 10 m
3RG7848-3CE		Straight, 15 m
3RG7848-3CF		Straight/angled, 15 m

9.2.3 Connection

Circuit diagrams for ASi safety modules

K20F compact module

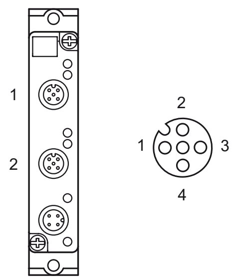


Figure 9-6 Logical assignments - safety compact module K20F

Socket	Assignment
1	Pole 1 and pole 2: influences bits D0 and D1 = channel 1 Pole 3 and pole 4: influences bits D2 and D3 = channel 2 Pole 5 unassigned
2	Pole 1 and pole 2: influences bits D2 and D3 = channel 2 Pole 5 unassigned

If just a one-channel switch is to be connected to the module, it must be connected to channel 1. The second channel must be jumpered. This can be carried out with the M12 connector 3RK1901-1AA00 on socket 2. Pole 3 on socket 1 must be connected to pole 1 on socket 2, and pole 4 on socket 1 must be connected to pole 2 on socket 2.

If both socket pairs are assigned, the inputs are linked.

K45F compact module

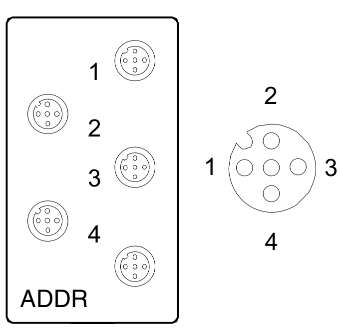


Figure 9-7 Logical assignments - safety compact module K45F

Socket	Assignment
1	Pole 1 and pole 2: influences bits D0 and D1 = channel 1 Pole 3 and pole 4: influences bits D2 and D3 = channel 2 Pole 5 unassigned
2	Pole 1 and pole 2: influences bits D2 and D3 = channel 2 Pole 5 unassigned
3	Unassigned
4	Unassigned

If just a one-channel switch is to be connected to the module, it must be connected to channel 1. The second channel must be jumpered. This can be carried out with the M12 connector 3RK1 901-1AA00 on socket 2.

Pole 3 on socket 1 must be connected to pole 1 on socket 2, and pole 4 on socket 1 must be connected to pole 2 on socket 2. If both socket pairs are assigned, the inputs are linked.

K45F LS compact module (light sensor)

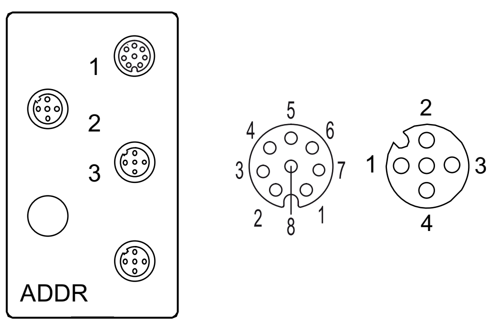
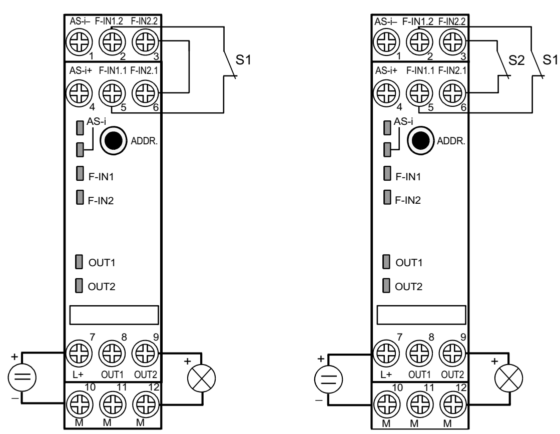


Figure 9-8 Logical assignments - safe compact module K45F LS

Socket	Assignment	
1 M12, 8-pole	Type 2 receiver	Type 4 receiver
	Pole 2 / 3: sensor supply + Pin 5: OSSD1 Pole 6: OSSD2 Pole 1 / 4 / 7 sensor supply – Pole 8: FE	Pole 2 / 3: sensor supply + Pin 5: OSSD1 Pole 6: OSSD2 Pole 1 / 4 diag Pole 7 sensor supply – Pole 8: FE
2 M12, 5-pole	Type 2/4, alternative receiver	
	Pole 1: sensor supply + Pin 2: OSSD2 Pole 3: sensor supply – Pole 4: OSSD1 Pole 5: FE	
3 M12, 5-pole	Type 2/4 transmitter	
	Pole 1 and pole 4: sensor supply + Pin 2: unassigned Pole 3: sensor supply – Pole 5: FE	

SlimLine modules S22.5F



Wiring for safe SlimLine modules S22.5F, 2F-DI, category 2 / SIL1 (left) and up to category 4 / SIL3 (right)

9.2.4 Diagnostics

LED for AS-i/FAULT

The module has one dual LED for AS-i/FAULT for diagnostic purposes; see LED status displays for modules with a dual LED for AS-i/FAULT (Page 174)

LED display AUX POWER

The module also has an LED for AUX POWER; for a description, see LED status display AUX POWER for modules with auxiliary voltage (Page 175).

Status display for the switching state

The switching state of the AS-i inputs and outputs is indicated by a yellow LED; see LED status display for the switching state (yellow) (Page 175).

9.2.5 Technical specifications

Safe compact modules K20F

Order no.	3RK1205-0BQ30-0AA3 K20F 2F-DI
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
No. of inputs/outputs	2 safe inputs
AS-i slave profile IO.ID.ID2	0.B.0
ID1 code (factory setting)	F
PFD value	The PFD value does not have any major effect on the PFD of the system as a whole comprising the AS-Interface bus and safety monitor.
Total power consumption	≤ 45 mA
Inputs	
Sensors	Mechanical switching contact
Input current - high	I_{peak} ≥ 5 mA
Assignment of inputs	Pin 1 and pin 2 = connection / switching contact Pin 3 and pin 4 = connection / switching contact Pin 5 = unassigned
AS-Interface certificate	Available
Approvals	UL, CSA
Degree of protection	IP67
Ground connection	—
Ambient temperature	-25 ... +70 °C
Storage temperature	-40 ... +85°C
No. of I/O sockets	2
Status displays	
I/O display	LED yellow
U_{AUX}	—
AS-Interface / diagnostics	LED green/red
Connection	Direct installation
Address assignment	M12 AS-i connection

Safe compact modules K45F

Order no.	3RK1205-0BQ00-0AA3 K45F 2F-DI	3RK1205-0CQ00-0AA3 K45F 4F-DI	3RK1205-0BQ21-0AA3 LS type 2 3RK1205-0BQ24-0AA3 LS type 4 K45F-LS 2F-DI
Slave type	Standard slave	2 x standard slaves (module contains 2 slaves)	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	2 safe inputs	4 safe inputs	2 safe inputs
AS-i slave profile IO.ID.ID2	0.B.F	0.B.F (valid for both slaves)	0.B.1
ID1 code (factory setting)	F	F (valid for both slaves)	F
PFD value	The PFD value does not have any major effect on the PFD of the system as a whole comprising the AS-Interface bus and safety monitor.		
Total power consumption	≤ 45 mA	≤ 70 mA	≤ 270 mA
Inputs			
Sensors	Mechanical switching contact		Self-testing semiconductor outputs (OSSD)
Input current - high	I_{peak} ≥ 5 mA		I_{peak} ≥ 5 mA
Assignment of inputs	Socket 1: Pin 1 and pin 2 = connection / switching contact F-IN1 Pin 3 and pin 4 = connection / switching contact F-IN2 Pin 5 = unassigned Socket 2: Pin 1 and pin 2 = connection / switching contact F-IN2 Pin 3 and pin 4 = unassigned Pin 5 = unassigned Input signal F-IN2 can be wired to either socket 1 only or socket 2 only. Socket 3 (with 3RK1205-0CQ00-0AA3 only): Pin 1 and pin 2 = connection / switching contact F-IN3 Pin 3 and pin 4 = connection / switching contact F-IN4 Pin 5 = unassigned Socket 4 (with 3RK1205-0CQ00-0AA3 only): Pin 1 and pin 2 = connection / switching contact F-IN4 Pin 3 and pin 4 = unassigned Pin 5 = unassigned Input signal F-IN4 can be wired to either socket 3 only or socket 4 only.		Type 2 receiver: Pin 1/4/7: – Pin 2/3: + Pin 5: CH1 Pin 6: CH2 Pin 8: FE Type 4 receiver: Pin 1/4 diag. Pin 2/3: + Pin 5: CH1 Pin 6: CH2 Pin 7: – Pin 8: FE Type 2/4, alternative receiver (5-pin): Pin 1: + Pin 2: CH2 Pin 3: – Pin 4: CH1 Pin 5: FE Type 2/4 transmitter: Pin 1/4: + Pin 3: – Pin 5: FE
AS-Interface certificate	Available		
Approvals	UL, CSA		
Degree of protection	IP67		
Ground connection	—		Via PIN5 on M12 sockets and outgoing feeder via 2.8 mm flat connector.
Ambient temperature	-25 ... +70 °C		

Order no.	3RK1205-0BQ00-0AA3 K45F 2F-DI	3RK1205-0CQ00-0AA3 K45F 4F-DI	3RK1205-0BQ21-0AA3 LS type 2 3RK1205-0BQ24-0AA3 LS type 4 K45F-LS 2F-DI
Storage temperature	-40 ... +85°C		
No. of I/O sockets	2	4	3
Status displays			
I/O display	LED yellow		
U_{AUX}	—		
AS-Interface / diagnostics	LED green/red		
Connection	K45 mounting plate		
Address assignment	Addressing socket		
1) Via socket 1/3: connection of Siemens light curtain FS 400 3RG7843 (type 2). 2) Via socket 1/3: connection of Siemens light curtain FS 400 3RG7846 (type 4), via socket 2/3: other manufacturers. (Only input sockets can be assigned.)			

Order no.	3RK1405-0BQ20-0AA3 K45F 2F-DI / 2DO	3RK1405-1BQ20-0AA3 K45F 2F-DI / 2DO U_{AUX}
Slave type	Standard slave	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	2 safe inputs / 2 standard outputs	2 safe inputs / 2 standard outputs with U_{AUX}
AS-i slave profile IO.ID.ID2	7.B.0	7.B.0
ID1 code (factory setting)	F	F
PFD value	The PFD value does not have any major effect on the PFD of the system as a whole comprising the AS-Interface bus and safety monitor.	
Total power consumption	≤ 250 mA	≤ 60 mA
Inputs		
Sensors	Mechanical switching contact	
Input current - high	$I_{peak} \geq 5$ mA	
Assignment of inputs	Pin 1 and pin 2 = connection / switching contact Pin 3 and pin 4 = connection / switching contact Pin 5 = unassigned	
Outputs		
Output type	Electronic	
Current-carrying capacity per output	≤ 150 mA	≤ 0.7 A
Total current of all outputs	≤ 150 mA	≤ 1.4 A
Socket assignment: outputs	Pin 3 = "-" Pin 4 = output Pin 5 = unassigned	
Short-circuit protection	Integrated	
Inductive interference protection	Integrated	
External 24 V DC power supply	—	Via black AS-Interface flat cable
Watchdog	Integrated	

Order no.	3RK1405-0BQ20-0AA3 K45F 2F-DI / 2DO	3RK1405-1BQ20-0AA3 K45F 2F-DI / 2DO U_{AUX}
Assignment of outputs OUT 1 (D0) OUT 2 (D1)	Socket 3 - pin 4 Socket 4 - Pin 4	
AS-Interface certificate	Available	
Approvals	UL, CSA	
Degree of protection	IP67	
Ground connection	—	
Ambient temperature	-25 ... +70 °C	
Storage temperature	-40 ... +85°C	
No. of I/O sockets	4	4
Status displays		
I/O display	LED yellow	
U_{AUX}	—	LED green
AS-Interface / diagnostics	LED green/red	
Connection	K45 mounting plate	
Address assignment	Addressing socket	

Safe SlimLine modules S22.5F

Order no.	3RK1205-0BE00-0AA2 3RK1205-0BG00-0AA2	3RK1405-0BE00-0AA2 3RK1405-0BG00-0AA2	3RK1405-1BE00-0AA2 3RK1405-1BG00-0AA2
Slave type	Standard slave		
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.0	AS-i Spec. 2.0
No. of inputs/outputs	2 safe inputs	2 safe inputs / 2 standard outputs	2 safe inputs / 2 standard outputs with U_{AUX}
Connection type	Screw terminal (-.BE..-) or spring-loaded terminal (-.BG..-)		
AS-i slave profile IO.ID.ID2	0.B.F	7.B.F	7.B.F
ID1 code (factory setting)	F	F	F
PFD value	The PFD value does not have any major effect on the PFD of the system as a whole comprising the AS-Interface bus and safety monitor.		
Total power consumption	≤ 45 mA	≤ 270 mA	≤ 60 mA
Inputs			
Sensors	Mechanical switching contact		
Input current - low	Contact open		
Input current - high	Contact closed I_{peak} ≥ 5 mA		
Assignment of inputs	F-IN1.1 and F-IN1.2 = connection for switching contact F-IN2.1 and F-IN2.2 = connection for switching contact		

Order no.	3RK1205-0BE00-0AA2 3RK1205-0BG00-0AA2	3RK1405-0BE00-0AA2 3RK1405-0BG00-0AA2	3RK1405-1BE00-0AA2 3RK1405-1BG00-0AA2
Outputs			
Output type	—	Electronic	Electronic
Typ. current-carrying capacity on each output 12/13 DC	—	0.15 A	0.7 A
Max. total current for each module	—	0.15 A	1.4 A
Short-circuit protection	—	Integrated	
Inductive interference protection	—	Integrated	
External 24 V DC power supply	—	—	✓
Watchdog	—	Integrated	
Assignment of outputs			
OUT 1 OUT 2	— —	DO D1	
AS-Interface certificate	Available	Available soon	Available soon
Approvals	UL, CSA		
Mechanical data			
Degree of protection	IP20		
Shock load (IEC 60068-2-6)	15 g / 11 ms		
Vibratory load (IEC 60068-2-27)	5 ... 500 Hz 5 ... 26 Hz: 0.75 mm amplitude 26 ... 500 Hz: 2 g		
Ground connection	—		
Ambient temperature	-25 ... +70 °C		
Storage temperature	-40 ... +85°C		
Status displays			
I/O display	LED yellow		
U_{AUX}	—	—	LED green
AS-Interface / diagnostics	LED green/red		
Address assignment	Addressing socket		

9.2.6 Dimension drawings

Dimension drawings of the AS-i safety modules

The dimensions of the safe AS-i modules are the same as those for the standard modules of series K20 (Page 211) , K45 (Page 201), and SlimLine 22.5 (Page 248). They are specified in the relevant sections.

9.3 3SF1 position switches with ASIsafe interface

9.3.1 Overview

Position switches are used to convert the mechanical positions of moving machine parts to electrical signals.

The 3SF1 position switches comprise a standard position switch and an ASIsafe slave in the switch housing whose safe inputs are wired to the position switch contacts.

Category 3 to EN 954-1 is achieved with the 3SF1 3 position switch with two-channel interrogation in the appropriate operating mode. Category 4 can be achieved by combining the 3SF1 position switch with an 3SE5 position switch.

Figure 9-9 ASIsafe position switches, modular system

Type variants

Position switches are available as:

- Standard position switch:
  the basic switch and matching actuator head (roller lever, twist lever, plunger, etc.) are ordered separately.
- Position switches with separate control element:
  the basic switch is supplied complete with the actuator head (for inserting the control element). The corresponding control element (for different assembly types) is ordered separately.
- Position switches with separate control element and tumbler:
  the basic switch is supplied complete with the actuator head (for inserting the control element). The corresponding control element (for different assembly types) is ordered separately. The tumbler interlocks the control element in the inserted position.
- Hinge switch:
  the basic switch and matching actuator head (for different switching angles, with hollow or solid shaft) are ordered separately.

Enclosure variants

Position switches are available with:

- Plastic enclosures
- Metal enclosures

Variants without tumbler

The standard position switches, position switches with separate control element (without tumbler), and hinge switches are available in the following widths:

- 31 mm (to EN 50047)
- 40 mm (to EN 50047)
- 50 mm
- 56 mm

The position switches with a width of 31 mm and 40 mm are wired internally as follows:

F-IN1 to NC contact 1
F-IN2 to NC contact 2

AS-i connection via M12 connector (pin 1 = ASI+, pin 3 = ASI-)

The position switches with a width of 50 mm and 56 mm are wired internally as follows:

F-IN1 to NC contact 1
F-IN2 to M12 socket on side (pin 1 and pin 2)

AS-i connection via M12 connector (pin 1 = ASI+, pin 3 = ASI-)

A second standard position switch (without integrated ASIsafe slave) can be connected via the M12 socket on the side to achieve safety category 4 (to EN 954-1).

The max. power requirements (from the AS-i cable) are 60 mA.

Variants with tumbler

The position switches with a separate control element and tumbler have a width of:

- 54 mm

The locking force is 1300 N with a plastic enclosure and 2600 N with a metal enclosure.

Two versions of the control element interlock are available:

- Spring-locked (failsafe principle) with a range of unlocking options
- Magnetic force (open-circuit principle)

The position switches with a separate control element and tumbler are wired internally as follows:

- Variant -1BA1:
  F-IN1 to NC contact of control element (contact closed when control element inserted)
  F-IN2 to NC contact of magnet (contact closed when control element interlocked)

AS-i connection via M12 connector (pin 1 = ASI+, pin 3 = ASI-)

- Variant -1BA1:
  F-IN1 to NC contact 1 of control element (contact closed when control element inserted)
  F-IN2 to NC contact 2 of control element (contact closed when control element inserted)

AS-i connection via M12 connector (pin 1 = ASI+, pin 3 = ASI-)

The max. power requirements (from the AS-i cable) are 230 mA (of which 170 mA required by magnet).

Setting the AS-i address

The AS-i address can be set by connecting the AS-i M12 connector to the addressing unit. No additional AS-i addressing socket is available.

9.3.2 Order numbers

Due to the large number of variants and accessories, the orders numbers are not listed here.

For a detailed overview of the range of position switches (ASIsafe variants and standard switches), please visit:

www.siemens.com/automation/infocenter

On the left of the screen, choose the product path:

Automation and Drives ➜ Low-Voltage Controls and Distribution ➜ SIRIUS Industrial Controls ➜ Detecting Devices

In the middle of the screen under the "Brochures" tab, download the PDF file onto your PC in the required language.

Figure 9-10 Brochure for position switches

9.3.3 Connection

Figure 9-11 ASIsafe position switches, basic switches, 56 mm wide

Position switches are connected to AS-i via an M12 connector.

In the case of position switches with a width of 50 mm and 56 mm, a second standard position switch (without integrated ASIsafe slave) can be connected via the M12 socket on the side to achieve safety category 4 (to EN 954-1).

9.3.4 Diagnostics

The standard position switches, position switches with separate control element (without tumbler), and hinge switches are equipped with a status display comprising three LEDs: AS-i/FAULT, F-IN1, and F-IN2.

The position switches with a separate control element and tumbler are equipped with a status display comprising four LEDs: AS-i, FAULT (Page 173) , F-IN1, and F-IN2 (Page 175), see "Diagnostics".

9.3.5 Dimension drawings

3SF1234-.....-....   3SF1244-.....-....

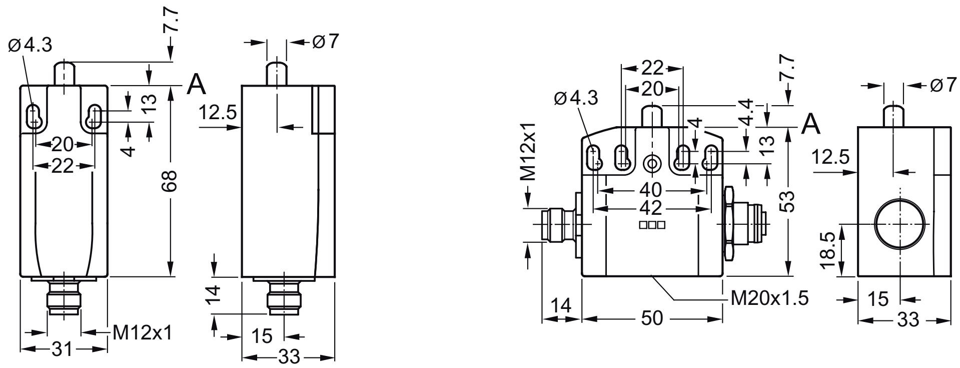


Figure 9-12 Basic switch with actuator head, 31 / 50 mm wide, plastic enclosure

3SF1114-.....-....   3SF1124-.....-....

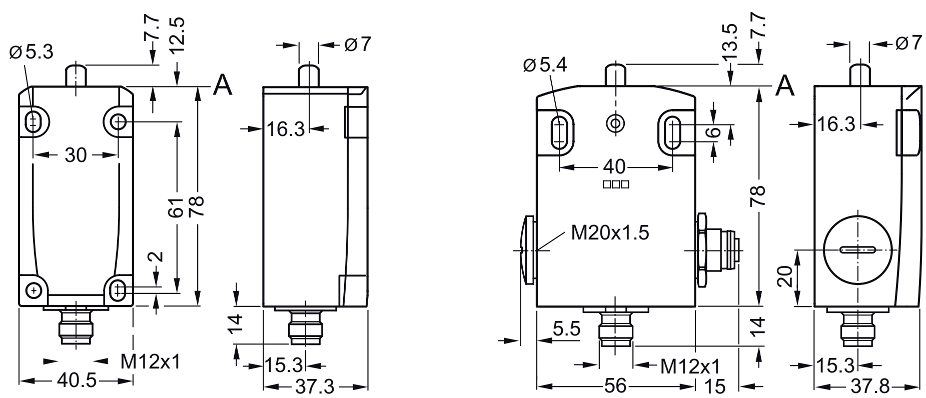


Figure 9-13 Basic switch with actuator head, 40 / 56 mm wide, metal enclosure

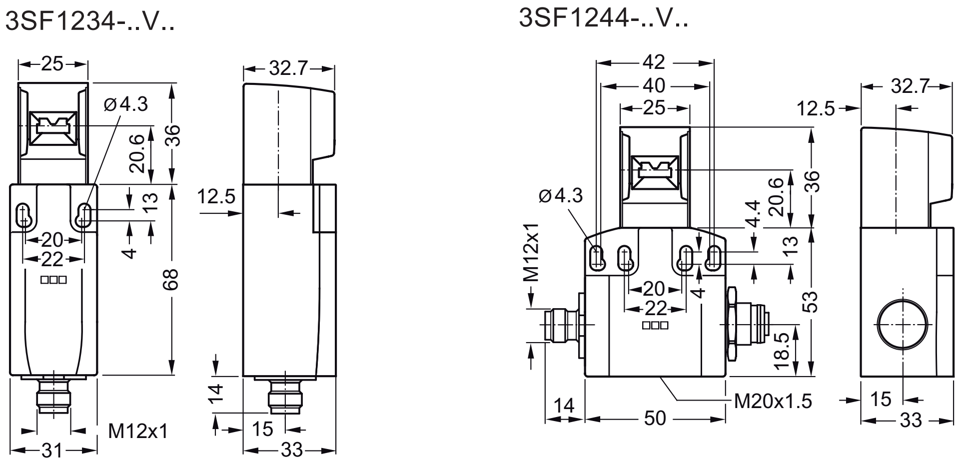


Figure 9-14 Basic switch with actuator head, 31 / 50 mm wide, plastic enclosure, with separate control element

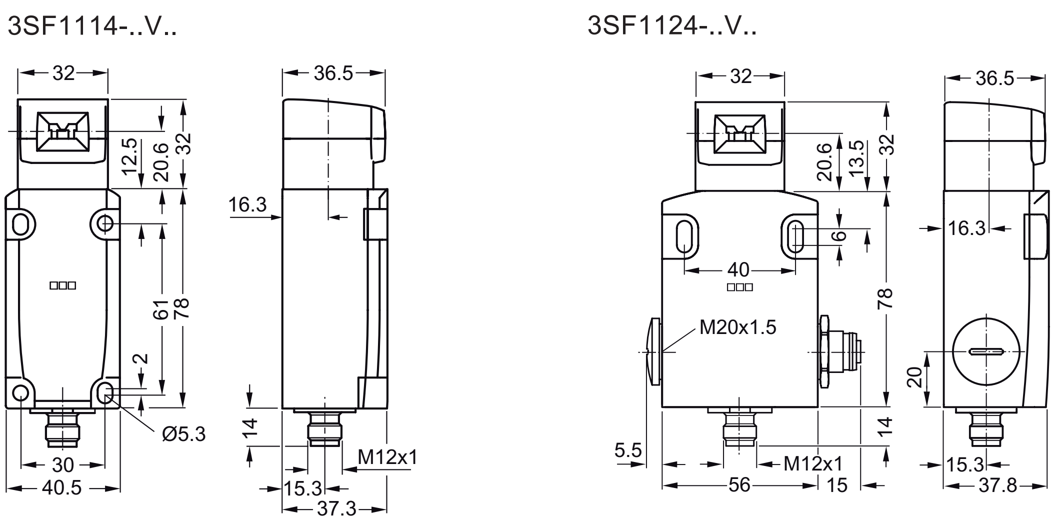


Figure 9-15 Basic switch with actuator head, 40 / 56 mm wide, metal enclosure, with separate control element

9.4 SIMATIC FS400 light curtains and arrays

9.4.1 Overview

The non-contact and active optoelectronic light curtains and arrays for categories 2 and 4 to EN 954-1 protect operating personal working on or near running machines and plants.

A standard light curtain or array comprises a transmitter and receiver, which must be installed opposite each other. A transceiver combines the transmitter and receiver, whereby a passive reflecting mirror (additionally required) reflects the light beams. A number of transmit and receive diodes are placed one above the other depending on the resolution and length. The infrared LEDs on the transmitter emit short light pulses, which are picked up by the receive diodes.

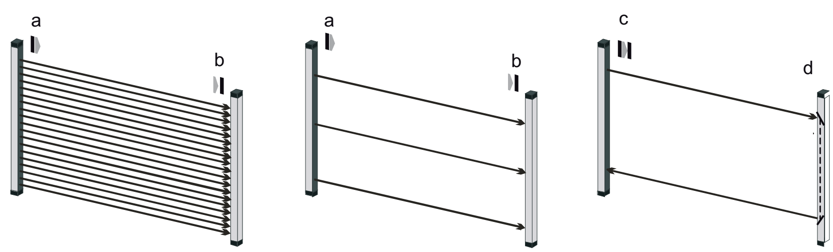


Figure 9-16 Optoelectronic protective devices: Light curtain, light array, and transceiver (a = transmitter, b = receiver, c = transceiver, d = reflecting mirror)

Light curtains have between 8 and 240 beams of light and are designed for protecting hazardous areas. Depending on the resolution, they can detect fingers, hands, arms, feet, thighs, etc.

Light arrays have 2, 3, or 4 beams and are designed for detecting people entering hazardous areas. They are not suitable for protecting hazardous areas since this requires a device that can detect fingers, hands, or arms etc.

In the case of transceiver light arrays, the transceiver emits a beam of light from the upper part of the enclosure, which is then reflected by the reflecting mirror with an offset of 500 mm (beam spacing) and received again in the lower part of the transceiver enclosure. In this case, the reflecting mirror is a housing with two mirrors. The range of the transceiver is specified as the distance between the transceiver and reflecting mirror (if one reflecting mirror is used). If more than one reflecting mirror is used, the range decreases by 15% with each additional reflecting mirror. To configure interlinked protective zones, light curtains can be arranged one behind the other by cascading host and guest devices via plug-in cable connections. This also allows transmitter/receiver pairs with different resolutions to be combined.

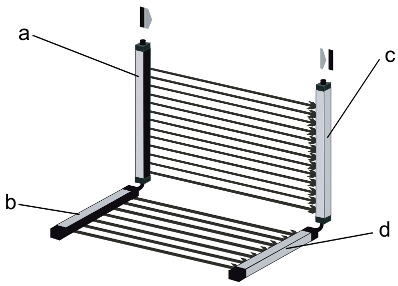


Figure 9-17 Structure of a cascaded system
a = host transmitter, b = guest transmitter, c = host receiver, d = guest receiver

The light curtains and arrays are available for standard wiring and with an integrated ASIsafe slave. The type variants for standard wiring are not covered here. The following description only refers to the type variants with an integrated ASIsafe slave.

For the complete range of light curtains and arrays (ASIsafe and standard variants), see catalog FS10 or visit the A&D Mall at: www.siemens.com/automation/mall

Choose "Products"
and then the following product path on the left:

Automation and Drives ➜ Sensor, Measuring and Testing Technology ➜ Fail-safe Sensors

Then choose the products you want and download the required information.

3SF7844 light curtains and arrays

All ASIsafe 3SF7844 light curtains and arrays are equipped with the following standard functions (can be deactivated via the setting switch):

- Contactor monitoring (incl. connection for contactor checkback signals)
- Start inhibit (after voltage OFF/ON) and restart inhibit (after beam interruption) (incl. connection for "Start" button)
- Option for connecting an additional safety device (e.g. EMERGENCY STOP button).

External sensors can be connected via an 8-pin M12 socket (local interface) on the receiver.

The ASIsafe 3SF7844 light curtains and arrays are each equipped with an integrated function package (can be deactivated via the setting switch):

The 3SF7844 light curtains and arrays comply with the following standards:

- Safety category 4 to EN 954-1
- Safety Integrity Level SIL 3 to IEC 61508
- Type 4 to IEC 61496-1, -2

ASIsafe 3SF7844 light curtains

The ASIsafe 3SF7844 light curtains are available in the following versions:

- Standard transmitter and standard receiver
- Host transmitter and host receiver
- Guest transmitter and guest receiver (order no. 3RG7844...)

Available with the following resolutions, protective zone heights (incremental), and ranges:

- Resolution 14 mm, protective zone height 150 ... 1800 mm, range 0 ... 6 m
- Resolution 30 mm, protective zone height 150 ... 1800 mm, range 0 ... 18 m
- Resolution 50 mm, protective zone height 450 ... 3000 mm, range 0 ... 18 m (on request)

Each with an integrated function package (can be deactivated)

- Blanking
- Muting
- Muting with integrated LED indicator light
- Sequence control system

ASIsafe 3SF7844 light arrays

The ASIsafe 3SF7844 light arrays are available in two versions:

- Transmitter and receiver
- Transceiver

With the following no. of beams, beam spacing, and ranges (for transmitters/receivers)

- 2 beams, beam spacing 500 mm, range 0.8 ... 18 m or 6 ... 70 m
- 3 beams, beam spacing 400 mm, range 0.8 ... 18 m or 6 ... 70 m
- 4 beams, beam spacing 300 mm, range 0.8 ... 18 m or 6 ... 70 m

Or with the following no. of beams, beam spacing, and range (for transceivers)

- 2 beams, beam spacing 500 mm, range 0 ... 6.5 m incl. 1 double mirror
- 15% loss

Each with an integrated function package (can be deactivated)

- Muting
- Muting with integrated LED indicator light

The integrated function package can be deactivated by means of a setting switch, which means that light arrays can also be used without the function package.

All ASIsafe 3SF7844 light curtains are equipped with the following standard functions (can be deactivated via the setting switch):

- Contactor monitoring (incl. connection for contactor checkback signals)
- Start inhibit (after voltage OFF/ON) and restart inhibit (after beam interruption) (incl. connection for "Start" button)

- Option for connecting an additional safety device (e.g. EMERGENCY STOP button).

In addition to the 8-pin M12 socket (local interface), the transceiver version is equipped with five additional 4-pin M12 sockets for connecting muting sensors, for example.

3SF7842 light curtains and arrays

The 3SF7842 light curtains do not have an integrated function package or any other standard functions.

The 3SF7842 light curtains and arrays comply with the following standards:

- Safety category 4 to EN 954-1
- Type 4 to IEC 61496-1, -2

ASIsafe 3SF7842 light curtains

The ASIsafe 3SF7842 light curtains are available in two versions:

- Standard transmitter and standard receiver
- Host transmitter and host receiver
- Guest transmitter and guest receiver (order no. 3RG7842...)

Available with the following resolutions, protective zone heights (incremental), and ranges:

- Resolution 14 mm, protective zone height 150 ... 1800 mm, range x m
- Resolution 30 mm, protective zone height 150 ... 1800 mm, range x m
- Resolution 50 mm, protective zone height 450 ... 3000 mm, range x m
- Resolution 90 mm, protective zone height 750 ... 3000 mm, range x m

ASIsafe 3SF7842 light arrays

The ASIsafe 3SF7842 light arrays are available in two versions:

- Transmitter and receiver

With the following no. of beams, beam spacing, and ranges:

- 2 beams, beam spacing 500 mm, range 0.8 ... 18 m or 6 ... 60 m
- 3 beams, beam spacing 400 mm, range 0.8 ... 18 m or 6 ... 60 m
- 4 beams, beam spacing 300 mm, range 0.8 ... 18 m or 6 ... 60 m

Setting the AS-i address

The AS-i address of the receiver (or transceiver) can be set by connecting the AS-i M12 connector (pin 1 = ASI+, pin 3 = ASI–) to the addressing unit.

No additional AS-i addressing socket is available.

For 3SF7844 light curtains and arrays, all the receiver electronics are supplied via the AS-i connection, that is, a max. current of 140 mA is also required when the AS-i address is set. You are advised to connect an AS-i power supply unit in parallel with the addressing unit so that the addressing unit does not output an overload signal.

The transmitter does not require an AS-i address.

9.4.2 Order numbers

3SF7844 light curtains and arrays (with integrated evaluation function)

Light curtains with blanking function package		
Protective zone height	Receiver	Transmitter
Standard device, 14 mm resolution		
300 mm	3SF7844-6BB04-0SS1	3SF7844-6SB04-0SS0
450 mm	3SF7844-6BB06-0SS1	3SF7844-6SB06-0SS0
600 mm	3SF7844-6BB08-0SS1	3SF7844-6SB08-0SS0
750 mm	3SF7844-6BB11-0SS1	3SF7844-6SB11-0SS0
900 mm	3SF7844-6BB13-0SS1	3SF7844-6SB13-0SS0
1050 mm	3SF7844-6BB15-0SS1	3SF7844-6SB15-0SS0
1200 mm	3SF7844-6BB17-0SS1	3SF7844-6SB17-0SS0
1350 mm	On request	On request
1500 mm	On request	On request
1650 mm	On request	On request
1800 mm	On request	On request
Standard device, 30 mm resolution		
300 mm	3SF7844-6BD04-0SS1	3SF7844-6SD04-0SS0
450 mm	3SF7844-6BD06-0SS1	3SF7844-6SD06-0SS0
600 mm	3SF7844-6BD08-0SS1	3SF7844-6SD08-0SS0
750 mm	3SF7844-6BD11-0SS1	3SF7844-6SD11-0SS0
900 mm	3SF7844-6BD13-0SS1	3SF7844-6SD13-0SS0
1050 mm	3SF7844-6BD15-0SS1	3SF7844-6SD15-0SS0
1200 mm	3SF7844-6BD17-0SS1	3SF7844-6SD17-0SS0
1350 mm	3SF7844-6BD20-0SS1	3SF7844-6SD20-0SS0
1500 mm	3SF7844-6BD22-0SS1	3SF7844-6SD22-0SS0
1650 mm	3SF7844-6BD24-0SS1	3SF7844-6SD24-0SS0
1800 mm	3SF7844-6BD26-0SS1	3SF7844-6SD26-0SS0

Light curtains with muting function package		
Protective zone height	Receiver	Transmitter
Standard device, 30 mm resolution		
300 mm	3SF7844-6MD04-0SS1	3SF7844-6SD04-0SS0
450 mm	3SF7844-6MD06-0SS1	3SF7844-6SD06-0SS0
600 mm	3SF7844-6MD08-0SS1	3SF7844-6SD08-0SS0
750 mm	3SF7844-6MD11-0SS1	3SF7844-6SD11-0SS0
900 mm	3SF7844-6MD13-0SS1	3SF7844-6SD13-0SS0
1050 mm	3SF7844-6MD15-0SS1	3SF7844-6SD15-0SS0
1200 mm	3SF7844-6MD17-0SS1	3SF7844-6SD17-0SS0
1350 mm	3SF7844-6MD20-0SS1	3SF7844-6SD20-0SS0
1500 mm	3SF7844-6MD22-0SS1	3SF7844-6SD22-0SS0
1650 mm	3SF7844-6MD24-0SS1	3SF7844-6SD24-0SS0
1800 mm	3SF7844-6MD26-0SS1	3SF7844-6SD26-0SS0

Light curtains with muting function package, integrated LED indicator light		
Protective zone height	Receiver	Transmitter
Standard device, 30 mm resolution		
300 mm	3SF7844-6MD04-0KS1	3SF7844-6SD04-0SS0
450 mm	3SF7844-6MD06-0KS1	3SF7844-6SD06-0SS0
600 mm	3SF7844-6MD08-0KS1	3SF7844-6SD08-0SS0
750 mm	3SF7844-6MD11-0KS1	3SF7844-6SD11-0SS0
900 mm	3SF7844-6MD13-0KS1	3SF7844-6SD13-0SS0
1050 mm	3SF7844-6MD15-0KS1	3SF7844-6SD15-0SS0
1200 mm	3SF7844-6MD17-0KS1	3SF7844-6SD17-0SS0

Light curtains with sequence control system function package		
Protective zone height	Receiver	Transmitter
Standard device, 14 mm resolution		
300 mm	3SF7844-6TB04-0SS1	3SF7844-6SB04-0SS0
450 mm	3SF7844-6TB06-0SS1	3SF7844-6SB06-0SS0
600 mm	3SF7844-6TB08-0SS1	3SF7844-6SB08-0SS0
750 mm	3SF7844-6TB11-0SS1	3SF7844-6SB11-0SS0
900 mm	3SF7844-6TB13-0SS1	3SF7844-6SB13-0SS0
Standard device, 30 mm resolution		
300 mm	3SF7844-6TD04-0SS1	3SF7844-6SD04-0SS0
450 mm	3SF7844-6TD06-0SS1	3SF7844-6SD06-0SS0
600 mm	3SF7844-6TD08-0SS1	3SF7844-6SD08-0SS0
750 mm	3SF7844-6TD11-0SS1	3SF7844-6SD11-0SS0
900 mm	3SF7844-6TD13-0SS1	3SF7844-6SD13-0SS0

Light arrays with muting function package			
No. of beams	Beam spacing	Receiver	Transmitter
Standard device, range 0.8 to 18 m			
4 beams	300 mm	3SF7844-6MM50-0SS1	3SF7844-6SM50-0SS0
3 beams	400 mm	3SF7844-6MP50-0SS1	3SF7844-6SP50-0SS0
2 beams	500 mm	3SF7844-6MS50-0SS1	3SF7844-6SS50-0SS0
Standard device, range 6 to 70 m			
4 beams	300 mm	3SF7844-6MM51-0SS1	3SF7844-6SM51-0SS0
3 beams	400 mm	3SF7844-6MP51-0SS1	3SF7844-6SP51-0SS0
2 beams	500 mm	3SF7844-6MS51-0SS1	3SF7844-6SS51-0SS0

Light arrays with muting function package			
No. of beams	Beam spacing	Receiver	Transmitter
Standard device, range 0.8 to 18 m			
4 beams	300 mm	3SF7844-6MM50-0KS1	3SF7844-6SM50-0SS0
3 beams	400 mm	3SF7844-6MP50-0KS1	3SF7844-6SP50-0SS0
2 beams	500 mm	3SF7844-6MS50-0KS1	3SF7844-6SS50-0SS0

Transceiver with muting function package, integrated LED indicator light			
No. of beams	Beam spacing	Type	Order no.
Range 6.5 m			
2 beams	500 mm	Transceiver	3SF7844-6MS50-0ST0
2 beams	500 mm	Transceiver with integrated LED indicator light	3SF7844-6MS50-0MT0
—	—	Reflecting mirrors for transceiver	3RG7848-1TL

3SF7842 light curtains and arrays

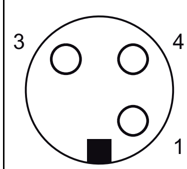
Light curtains		
Protective zone height	Receiver	Transmitter
Standard device, 14 mm resolution		
150 mm	3SF7842-6BB01	3SF7842-6BB00
225 mm	3SF7842-6BC01	3SF7842-6BC00
300 mm	3SF7842-6BD01	3SF7842-6BD00
450 mm	3SF7842-6BE01	3SF7842-6BE00
600 mm	3SF7842-6BF01	3SF7842-6BF00
750 mm	3SF7842-6BG01	3SF7842-6BG00
900 mm	3SF7842-6BH01	3SF7842-6BH00
1050 mm	3SF7842-6BJ01	3SF7842-6BJ00
1200 mm	3SF7842-6BK01	3SF7842-6BK00
1350 mm	3SF7842-6BL01	3SF7842-6BL00
1500 mm	3SF7842-6BM01	3SF7842-6BM00
1650 mm	3SF7842-6BN01	3SF7842-6BN00
1800 mm	3SF7842-6BP01	3SF7842-6BP00
Standard device, 30 mm resolution		
150 mm	3SF7842-6DB01	3SF7842-6DB00
225 mm	3SF7842-6DC01	3SF7842-6DC00
300 mm	3SF7842-6DD01	3SF7842-6DD00
450 mm	3SF7842-6DE01	3SF7842-6DE00
600 mm	3SF7842-6DF01	3SF7842-6DF00
750 mm	3SF7842-6DG01	3SF7842-6DG00
900 mm	3SF7842-6DH01	3SF7842-6DH00
1050 mm	3SF7842-6DJ01	3SF7842-6DJ00
1200 mm	3SF7842-6DK01	3SF7842-6DK00
1350 mm	3SF7842-6DL01	3SF7842-6DL00
1500 mm	3SF7842-6DM01	3SF7842-6DM00
1650 mm	3SF7842-6DN01	3SF7842-6DN00
1800 mm	3SF7842-6DP01	3SF7842-6DP00
Standard device, 50 mm resolution		
450 mm	3SF7842-6EE01	3SF7842-6EE00
600 mm	3SF7842-6EF01	3SF7842-6EF00
750 mm	3SF7842-6EG01	3SF7842-6EG00
900 mm	3SF7842-6EH01	3SF7842-6EH00
1050 mm	3SF7842-6EJ01	3SF7842-6EJ00
1200 mm	3SF7842-6EK01	3SF7842-6EK00
1350 mm	3SF7842-6EL01	3SF7842-6EL00
1500 mm	3SF7842-6EM01	3SF7842-6EM00
1650 mm	3SF7842-6EN01	3SF7842-6EN00
1800 mm	3SF7842-6EP01	3SF7842-6EP00

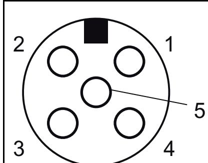
Light curtains		
Protective zone height	Receiver	Transmitter
2100 mm	3SF7842-6ER01	3SF7842-6ER00
2400 mm	3SF7842-6ES01	3SF7842-6ES00
2700 mm	3SF7842-6ET01	3SF7842-6ET00
3000 mm	3SF7842-6EU01	3SF7842-6EU00
Standard device, 90 mm resolution		
750 mm	3SF7842-6JG01	3SF7842-6JG00
900 mm	3SF7842-6JH01	3SF7842-6JH00
1050 mm	3SF7842-6JJ01	3SF7842-6JJ00
1200 mm	3SF7842-6JK01	3SF7842-6JK00
1350 mm	3SF7842-6JL01	3SF7842-6JL00
1500 mm	3SF7842-6JM01	3SF7842-6JM00
1650 mm	3SF7842-6JN01	3SF7842-6JN00
1800 mm	3SF7842-6JP01	3SF7842-6JP00
2100 mm	3SF7842-6JR01	3SF7842-6JR00
2400 mm	3SF7842-6JS01	3SF7842-6JS00
2700 mm	3SF7842-6JT01	3SF7842-6JT00
3000 mm	3SF7842-6JU01	3SF7842-6JU00

Light arrays			
No. of beams	Beam spacing	Receiver	Transmitter
Standard device, range 0.8 to 18 m			
4 beams	300 mm	3SF7842-6MH00	3SF7842-6MH01
3 beams	400 mm	3SF7842-6PG00	3SF7842-6PG01
2 beams	500 mm	3SF7842-6SE00	3SF7842-6SE01
Standard device, range 6 to 60 m			
4 beams	300 mm	3SF7842-6MH50	3SF7842-6MH51
3 beams	400 mm	3SF7842-6PG50	3SF7842-6PG51
2 beams	500 mm	3SF7842-6SE50	3SF7842-6SE51

9.4.3 Connection

3SF7844 light curtains and arrays

Transmitter		
M12 connector for supply	Pin	Assignment
	1	ASI+
	2	Unavailable / unassigned
	3	ASI–
	4	Unassigned

Receiver / transceiver		
M12 connector for supply and communication	Pin	Assignment
	1	ASI+
	2	GND auxiliary voltage
	3	ASI–
	4	+24 V DC auxiliary voltage
	5	Functional ground FE, can be connected if required

Empfänger/Transceiver (Lokal-Interface, 3SF7844)

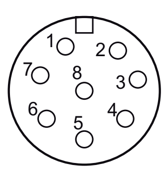


Figure 9-18 M12 socket (8-pin)

Additional sensors (e.g. buttons) and actuators (e.g. indicator lights) can be connected to the local interface in the connection cap of the device.

The assignment of the 8-pin local M12 device socket in the connection cap depends on the integrated function package. You can use the SafetyLab PC software to individually assign the inputs/outputs of the local interface to the different device functions.

A local connection box is available as an accessory. This divides the pins of the 8-pin M12 socket into six individual 5-pin M12 sockets, thereby making it easier to connect the sensors and actuators.

For a description of this, refer to the manual for light curtains/arrays, which is available for each specific function package.

Receiver / transceiver (optional local connector panel, 3SF7844)

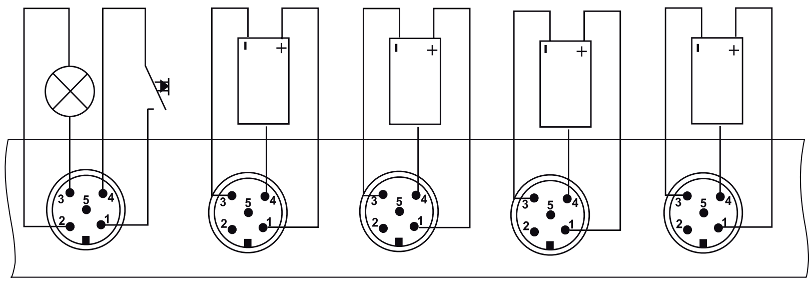


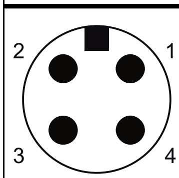
Figure 9-19 Connection example: local connector panel

Depending on the version, five additional 5-pin M12 sockets may be available in the section of the front panel on the device that does contain any optical equipment. These can be used to connect muting sensors, for example.

The assignment of the 5-pin M12 sockets in the connection cap depends on the integrated function package. You can use the SafetyLab PC software to individually assign the inputs/outputs of the local connector panel to the different device functions. For a description of this, refer to the manual for light curtains/arrays, which is available for each specific function package.

3SF7842 light curtains and arrays

Transmitters and receivers (M12 connector for supply, including communication)

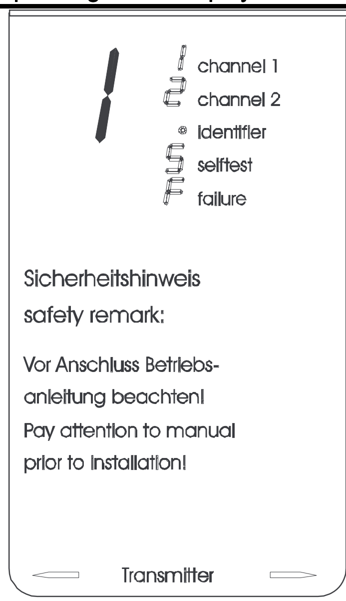
Receiver / transceiver		
M12 connector for supply and communication	**Pin**	**Assignment**
	1	ASI+
	2	Unassigned
	3	ASI–
	4	Unassigned

9.4.4 Diagnostics

3SF7844 light curtains and arrays

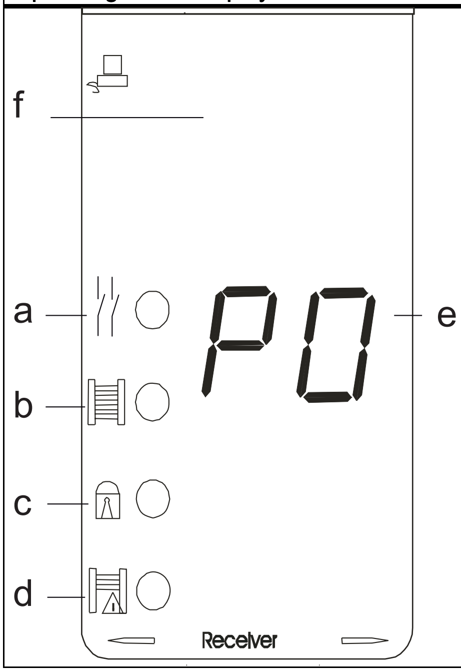
Transmitter

When the 7-segment display on the transmitter lights up, this means that the power supply has been connected.

Operating status display	Meaning	
	8	Hardware reset in start-stop torque
	S	Sel-test in progress (for approx. 1 s)
	1	Normal operation, channel 1 set
	2	Normal operation, channel 2 set
	.	Point next to number: test ON, the transmitter is not emitting valid pulses (jumpers 3 – 4 not closed)
	F / x	Device fault x = fault number, displayed alternating with "F"

Receiver / transceiver

Four LEDs and two 7-segment displays indicate the operating statuses of the receiver.

Operating status display	Description	
	a	LED1, red/green
	b	LED2, orange
	c	LED3, yellow
	d	LED4, blue
	e	7-segment displays
	f	Parameterization interface for MagnetKey, SafetyKey, or PC adapter cable

The messages on the 7-segment display refer specifically to the integrated function package (blanking / muting / sequence control system) and are listed in the relevant device manual.

Meaning of the LEDs on the front panel of the receiver/transceiver

LED1	Meaning
Red	Safety outputs in OFF status
Green	Safety outputs in ON status
OFF	Device without power supply

LED2	Meaning
Orange	LED operating mode with internal start/restart inhibit in OFF status (LED1 red): protective zone unoccupied
Orange	Operating mode without/with internal start/restart inhibit in ON status (LED1 green): weak beam indicated with unoccupied, effective protective zone

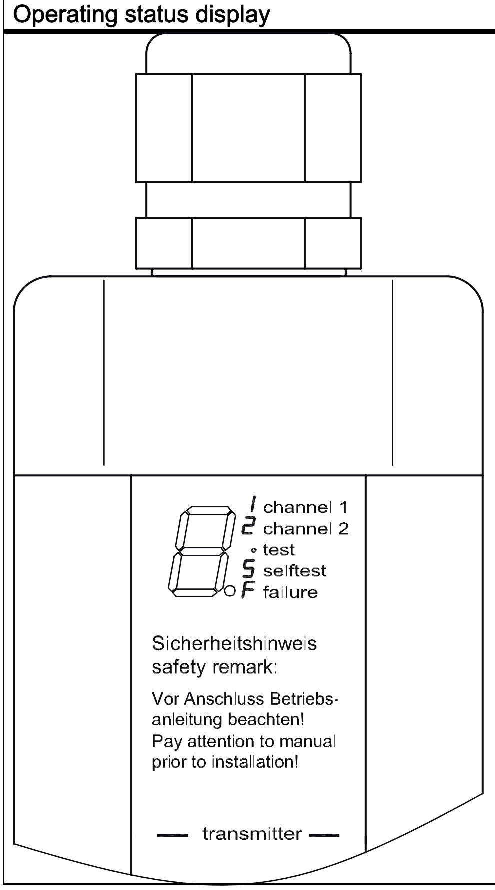
LED3	Meaning
Yellow	Internal restart inhibit interlocked
Yellow, flashing 2 x	Two entries into protective zone expected (sequence control system function package only)
Yellow, flashing 1 x	One entry into protective zone expected (sequence control system function package only)
OFF	Restart inhibit unlocked or not active

LED4	Meaning
Blue	Special function in accordance with the integrated function package (blanking / muting / sequence control system) activated (see device manual)
OFF	No special function

3SF7842 light curtains and arrays

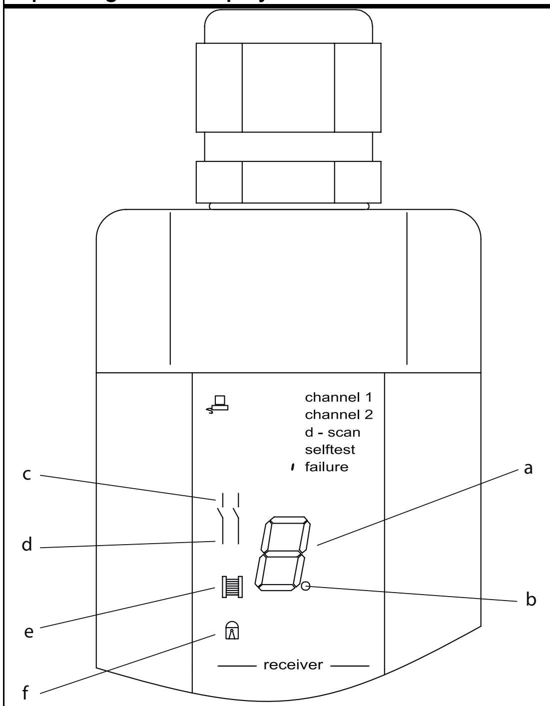
Transmitter

When the 7-segment display on the transmitter lights up, this means that the power supply has been connected.

Operating status display	Meaning	
	8.	Hardware reset in start-stop torque
	S	Sel-test in progress (for approx. 1 s)
	1	Normal operation, channel 1 set
	2	Normal operation, channel 2 set
	.	Point next to number: transmitter in test mode
	F / x	Device fault x = fault number, fault number, displayed alternating with "F" The fault numbers are listed in the device manual.

Receiver / transceiver

Four LEDs and two 7-segment displays indicate the operating statuses of the receiver.

Operating status display	Meaning	
	8.	Hardware reset in start-stop torque
	S	Sel-test in progress (for approx. 1 s)
	1	Normal operation, channel 1 set
	2	Normal operation, channel 2 set
	.	Point next to number: double scan
	F / x	Device fault x = fault number, fault number, displayed alternating with "F" The fault numbers are listed in the device manual.

Meaning of the LEDs on the front panel of the receiver/transceiver

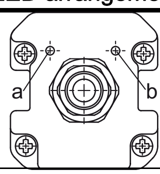
LED1 (c)	Meaning
Red	Safety outputs (OSSDs) in OFF status
OFF	—

LED2 (d)	Meaning
Green	Safety outputs (OSSDs) in ON status
OFF	—

LED3 (e)	Meaning
Orange	Weak beam
OFF	—

LED4 (f)	Meaning
Operating mode with internal RES function:	
Yellow	Internal restart inhibit interlocked and protective zone unoccupied
OFF	Both OSSDs in OFF status (LED1=red), internal restart inhibit interlocked and protective zone occupied

AS-i status LED in the connection cap of receiver:

LED arrangement	LED	3SF7844	3SF7842
	a	PWR (green)	AS-i/FAULT (green/red)
	b	FAULT (red)	Not available

3SF7844		3SF7842	Possible cause	Possible remedial measures
AS-i	FAULT	AS-i/FAULT		
Green	Off	Green	AS-i communication OK	—
Flashing green	Red	Red	The slave has the address 0 (on delivery)	Assign valid address
Green	Red	Red/yellow flashing	No AS-i communication: • The master is switched off or offline. • The slave is not configured in the master. • The incorrect slave type is connected. • The slave has the wrong address.	Ensure AS-i communication: • Switch on the master or switch it to online mode. • Reconfigure the master. • Connect the correct module. • Check/correct the slave address.
Green	Flashing red	Flashing red	Device fault	Send device for repair.
OFF	—	Off	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

Diagnosis via AS-Interface

The cyclic input/output data is used to transfer exactly one item of safe, binary data from the ASIsafe slave to the master (or safety monitor):

Cyclic input data (4 bit)

Status of light curtain/array	Input data bits D0 ... D3	Significance of the safe data
Protective zone unoccupied and start/restart inhibit is unlocked (if parameterized)	Valid code table	1
Protective zone is occupied or start/restart inhibit is interlocked (if parameterized)	Value 0 (on all four bits)	0

Cyclic output data (4 bit)

The cyclic output data bits (from the point of view of the PLC) are not evaluated by the light curtain/array.

Acyclic data

The acyclic parameter data can be used to exchange additional non-safety-oriented data between the AS-i master and slave. The AS-i master can use a "parameter call" (write parameter) to send four parameter bits to the slave whereby the slave responds by sending four parameter echo bits back to the master. The parameter call must be triggered by the user program. With a SIMATIC S7-300/400, this can be carried out using command 02 of the AS-i master command interface (FC ASI_3422 (Page 71)). The parameter echo bits can only be received if the parameter bits were sent.

The following table applies to 3SF7844 light curtains/arrays:

Parameter bit (PLC / master ➜ light curtain/array)	Signal assignment / meaning
P0	Must be set to 1.
P1	Must be set to 1.
P2	Control data M1, can be assigned to any input function of the receiver using the SafetyLab PC software. Factory setting: no assignment
P3	Control data M2, can be assigned to any input function of the receiver using the SafetyLab PC software. Factory setting: no assignment

Parameter echo bit (light curtain/array ➜ PLC/master)	Signal assignment / meaning
P0	Diagnostic data M3, can be assigned to any output function of the receiver using the SafetyLab PC software. Factory setting: 0 = active protective zone unoccupied/ready to unlock 1 = protective zone occupied Note: The status of the protective zone is indicated here, regardless of any parameterized start/restart inhibit, that is, the message bit is not the same as the safety-oriented data received via the cyclic input data.
P1	Diagnostic data M4, can be assigned to any output function of the receiver using the SafetyLab PC software. Factory setting: 0 = no fault/signal 1 = fault/contamination group signal.
P2	Not used
P3	Not used

The following table applies to 3SF7842 light curtains/arrays:

Parameter bit (light curtain/array ➜ PLC/master)	Signal assignment / meaning
P0	Setting for the min. restart time: 0 = 100 ms 1 = 500 ms (default value)
P1	Must be set to 1.
P2	Not used (recommended default value = 1)
P3	Not used (recommended default value = 1)

Parameter echo bit (light curtain/array ➜ PLC/master)	Signal assignment / meaning
P0	Not used
P1	Fault signal
P2	Not used
P3	Not used

Diagnosis cannot be carried out via the AS-i parameter channel.

9.4.5 Technical specifications

3SF7844 light curtains and arrays

AS-i data	
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	Spec 2.0
AS-i slave profile IO.ID	0.B
ID2, ID1 code	Not available (replacement values: F, F)
Operating voltage in acc. with AS-Interface Specification	26.5 ... 31.6 V
Auxiliary voltage U_{AUX}	24 V DC (+/-20%)
Total power consumption from AS-i	Typ. 50 mA
Current consumption from auxiliary voltage U_{AUX}	Typ. 400 mA
Overcurrent protection: auxiliary voltage	1.25 A fuse, medium time-lag
Cycle time in acc. with AS-i Specification	5 ms
Additional response time of AS-i system	40 ms

9.4.6 Dimension drawings

3SF7844 light curtains and arrays

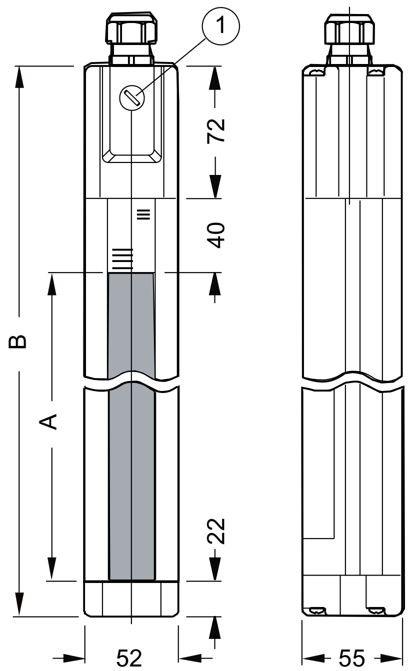


Figure 9-20 Dimensions: 3SF7844 light curtain

A	Protective zone height (see order numbers (Page 385))
B	Total length = protective zone height A + 134 mm
(1)	Sealing cap Pg 9 (receiver only, for local interface)

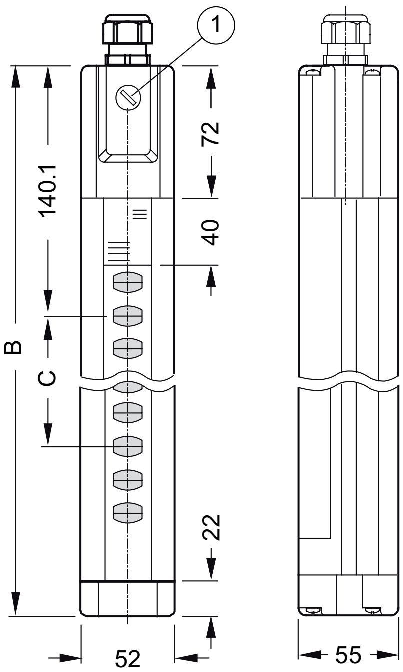


Figure 9-21 Dimensions: 3SF7844 light array

Additional dimensions applicable to light arrays only:

Type	B	C	Beams
3SF7844-..M	1184 mm	300 mm	4
3SF7844-..P	1034 mm	400 mm	3
3SF7844-..S	734 mm	500 mm	2

3SF7842 light curtains and arrays

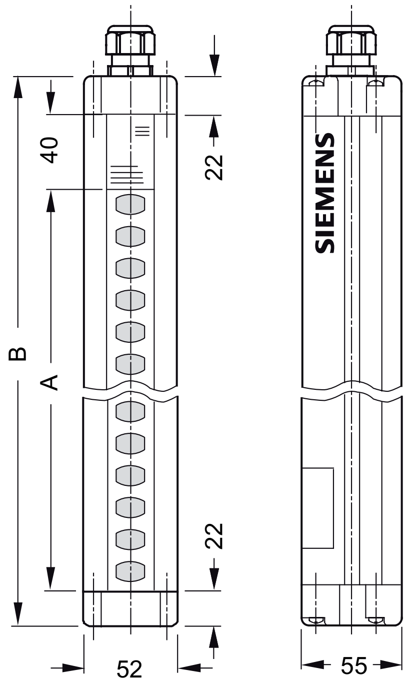


Figure 9-22 Dimensions: 3SF7842 light curtain

A	Protective zone height (see order numbers (Page 385))
B	Total length = protective zone height A + 84 mm

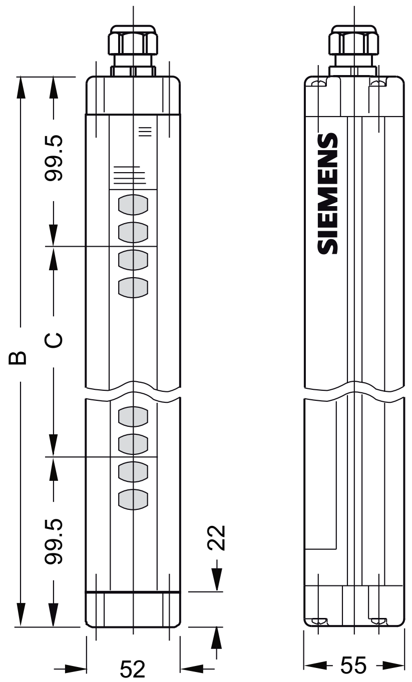


Figure 9-23 Dimensions: 3SF7842 light array

Type	B	C	Beams
3SF78 42-6M...	499 mm	300 mm	4
3SF78 42-6P…	599 mm	400 mm	3
3SF78 42-6S…	699 mm	500 mm	2

9.5 SIMATIC FS600 laser scanners

9.5.1 Overview

The laser scanner is a highly versatile optical distance sensor for protecting hazardous areas.

It uses a laser diode with transmission optics to continuously generate bundled light pulses, which are scattered over the entire working range by an integrated rotating mirror. If any objects or people enter the zone, the scanner evaluates the reflected light pulses and uses the light propagation time to continuously calculate the exact position coordinates. If the defined protective zone is violated, it initiates an immediate machine shutdown within the system response time (via a suitable ASIsafe configuration). Depending on the operating mode, the stop function is reset either automatically or after acknowledgement (via an optional button that can be fitted on the laser scanner) when the protective zone is free.

The working range of the laser scanner covers 190°. The laser scanner detects people at a distance of up to 4 meters (protective zone, safety oriented). People and objects can also be detected at a distance of up to 15 meters for the purpose of outputting warnings (warning zone, non-safety-oriented).

Four variable (can be set via the PC software) protective zone pairs for the protective and warning zone mean that the laser scanner can be easily adjusted in line with requirements. One protective zone pair can be active at any one time. The active protective zone pair can be selected by means of switching contacts, which are connected to an M12 socket on the laser scanner.

The laser scanner can be installed in stationary applications (e.g. on machines and in plants) as well as mobile applications (e.g. vehicles, driverless transportation systems or traversing trucks). In this way, different working ranges around a robot, for example, can be monitored whereby the laser scanners operate consecutively with respect to space and time. This can significantly increase plant availability.

Protecting hazardous areas

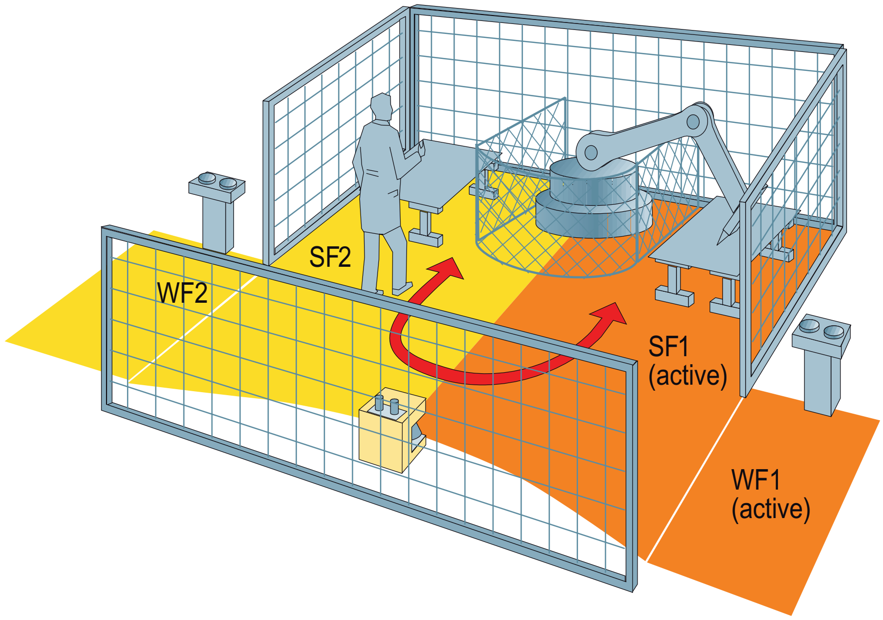


Figure 9-24 Example of horizontal hazardous area protection with more than one protective zone pair (SF = protective zone, WF = warning zone)

In driverless transportation systems, the four programmed protective zones (SF) (e.g. fast (SF2), slow (SF1), left curve (SF3), and right curve (SF4)) can be protected. Unlike bumpers or hoop guards, the laser scanner offers a larger protective zone and, therefore, allows vehicles to be driven at higher speeds.

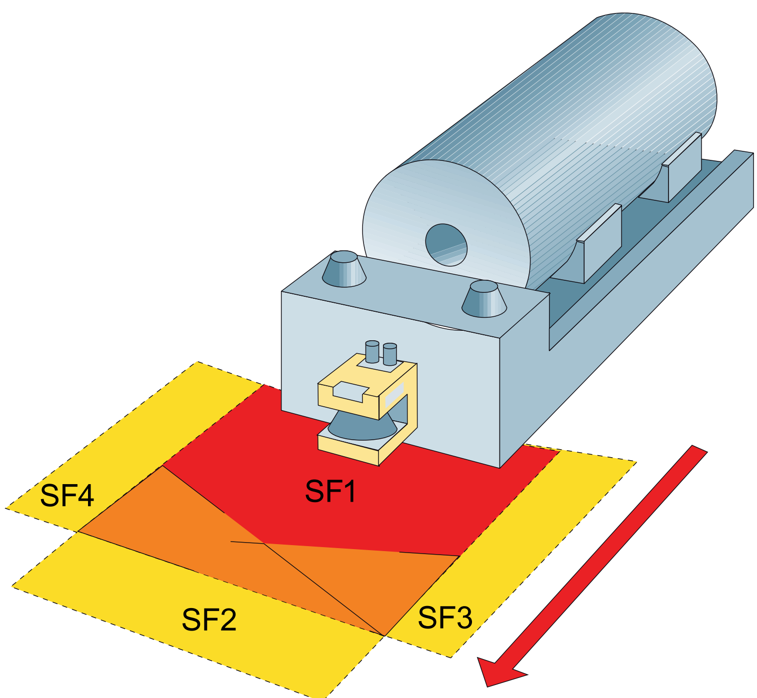


Figure 9-25 Example of route monitoring for driverless transportation systems (SF = protective zone; optional warning zones not shown).

Additional information

Laser scanners are available for standard wiring and with an integrated ASIsafe slave (or also with integrated PROFIBUS interface).

The type variants for standard wiring and other bus systems are not covered here. The following description only refers to the device with an integrated ASIsafe slave.

For the complete range of laser scanners, see catalog FS10 or visit the A&D Mall at:

www.siemens.com/automation/mall

Choose "Products".

On the left of the screen, choose the product path:

Automation and Drives ➜ Sensor, Measuring and Testing Technology ➜ Fail-safe Sensors

Then choose the products you want and download the required information.

The ASIsafe laser scanner requires a connection to the AS-i cable for bus communication and a separate 24 V DC supply. It is connected via a 5-pin M12 connector (X1) on the top of the housing. The laser scanner is assigned an AS-i address.

The scanner is equipped with a restart inhibit function (when a person/object is detected), which can be activated/deactivated via the software. The optional "Start" button can be connected via an additional 5-pin M12 connector (X4). A restart signal can also be sent via AS-Interface (acyclic parameter data).

You can switch between protective zones via a 5-pin M12 socket (X3). The protective zone pairs are activated by applying 24 V (pin 5) to the corresponding inputs (pin 1 ...4). The second protective zone pair must always be activated before the first protective zone pair is deactivated. The switchover must occur within 1 s. The switchover procedure must never be configured to deactivate all the protective zone pairs. Except during the switchover procedure, only one protective zone pair must be active at any one time.

The laser scanner complies with the following standards:

- Safety category 3 to EN 954-1
- Type 3 to IEC 61496-1 or EN 61496-3

LS4soft software

The LS4soft PC software can be used to parameterize and define the protective zones. The software is required for commissioning and is supplied with the laser scanner. It also offers a comprehensive range of diagnostic options.

To transfer the configuration and diagnostics data, a special PC cable with an infrared adapter is required. This must be ordered separately (order no. 3RG7838-1DC). The 9-pin SUB D connector is connected to the serial interface (e.g. COM1) of the PC. The infrared adapter is placed in an appropriate position on the top of the ASIsafe laser scanner where it is secured by a built-in permanent magnet. For more information, refer to the software manual.

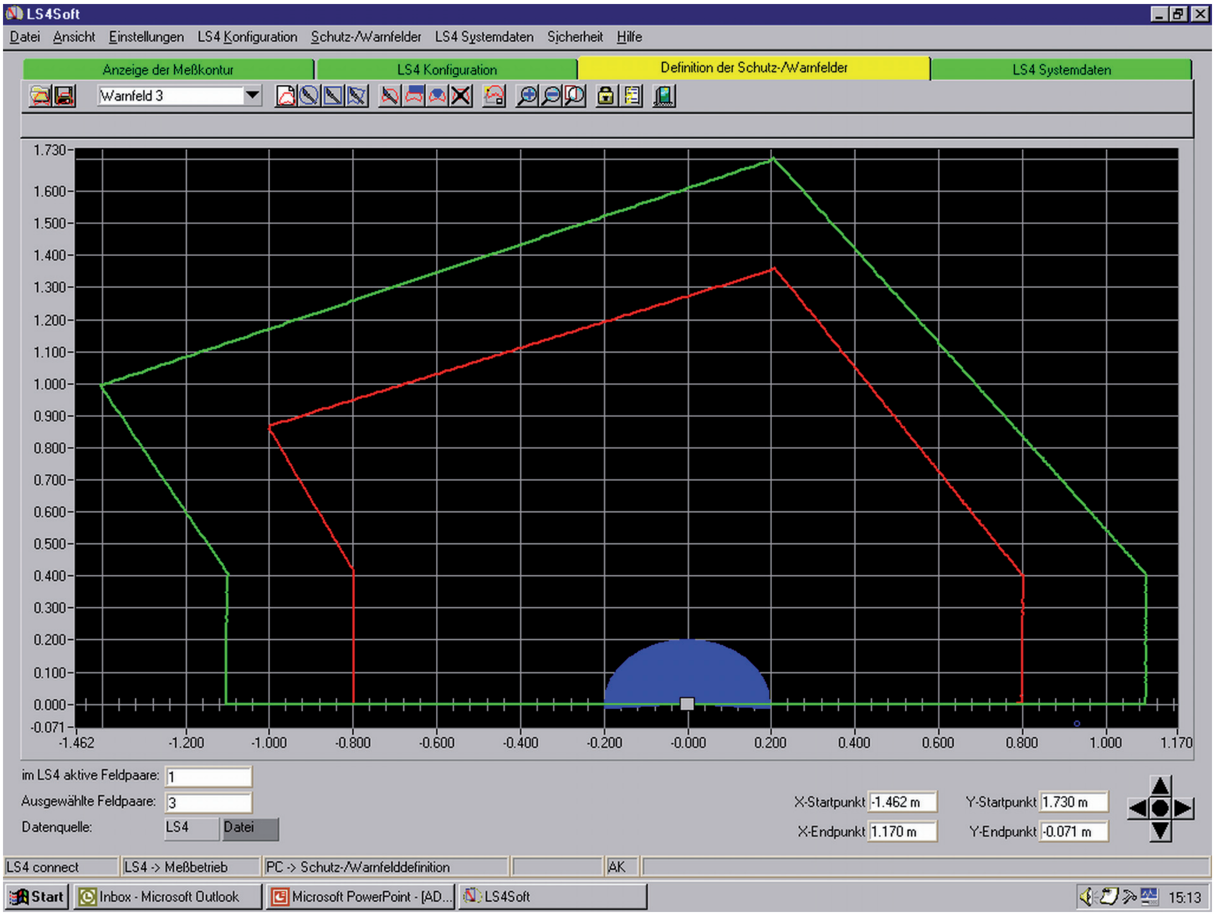


Figure 9-26 Defining the protective zone area using the LS4soft software

Setting the AS-i address

The addressing socket (X2) for setting the AS-i address is located on the top of the laser scanner. The address is assigned as usual using the AS-i addressing unit.

9.5.2 Order numbers

Laser scanner

Type	Order no.
SIMATIC FS620I laser scanners, protective zone 4 m radius 4 protective and warning zones incl. LS4soft software, AS-Interface connection	3SF7834-6DD00
SIMATIC FS660I laser scanners, vertical protection for hazardous areas and entrances, protective zone 4 m radius, 4 protective and warning zones, incl. software with ASIsafe connection	3SF7834-6DE00

Accessories

Type	Order no.
Assembly system, swivel-mounted, for easy adjustment	3RG7838-1AA
Adapter plate for LS4 laser scanner	3RG7838-1AB
Cleaning set comprising: cleaning fluid (1000 ml) cloths (100 pcs)	3RG78 38-7RS
PC connection cable for configuring the ASIsafe laser scanner, with 9-pin SUB D connector for serial PC interface and infrared adapter for optical interface on laser scanner	3RG78 38-1DC
M12 jumper plug for fixed assignment of protective zone pair SF1 (connection: pin 1 - pin 5)	3RG78 38-1DF

9.5.3 Connection

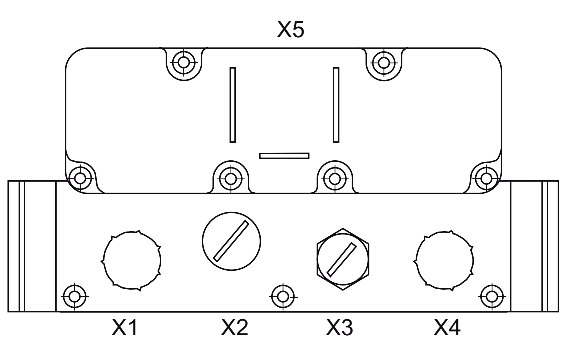


Figure 9-27 Position of the connections on the laser scanner

X1: M12 connector for supply and communication

Pin	Assignment
1	ASI+
2	GND auxiliary voltage
3	ASI–
4	Auxiliary supply + 24 V DC
5	Functional ground FE (mid contact of M12 connector), connect to plant ground

X2: AS-i addressing socket

For setting the AS-i address with an AS-i addressing unit

X3: M12 socket for switching protective zones

Pin	Assignment
1	Input for selecting protective zone pair SF1
2	Input for selecting protective zone pair SF2
3	Input for selecting protective zone pair SF3
4	Input for selecting protective zone pair SF4
5	+ 24 V DC for connection with an input

X4: M12 connector for restart button

Pin	Assignment
1	Unassigned
2	Input for restart
3	Unassigned
4	+ 24 V DC for connection with an input
5	Unassigned

X5: Window for infrared adapter

For configuring and diagnosing (locally) AS-Interface using PC software.

9.5.4 Diagnostics

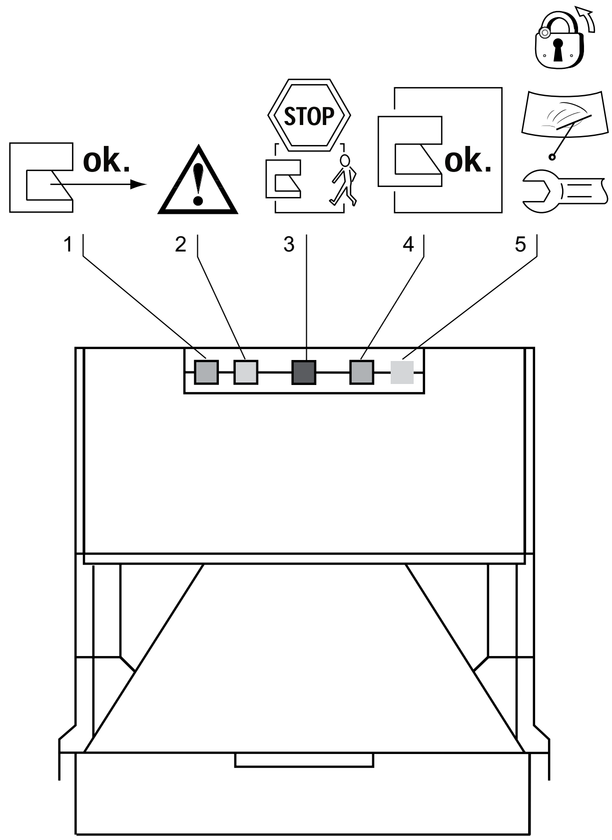


Figure 9-28 LEDs on the laser scanner

LED	Color	Meaning
1	Green	Sensor is active, active protective zone is free
2	Yellow	Warning zone is occupied
3	Red	OSSD outputs are deactivated
4	Green	OSSD outputs are activated
5	Continuous yellow light slow flashing (approx. 0.25 Hz) rapid flashing (approx. 4 Hz)	Restart inhibit Alarm Fault signal

Diagnosis via AS-Interface

The cyclic input/output data is used to transfer exactly one item of safe, binary data from the ASIsafe slave to the master (or safety monitor):

Cyclic input data (4 bit)

Status of laser scanner	Input data bits D0 ... D3	Significance of the safe data
Protective zone unoccupied and start/restart inhibit is unlocked (if parameterized)	Valid code table	1
Protective zone is occupied or start/restart inhibit is interlocked (if parameterized)	Value 0 (on all four bits)	0

Cyclic output data (4 bit)

The cyclic output data bits (from the point of view of the PLC) are not evaluated by the laser scanner.

Acyclic data

The acyclic parameter data can be used to exchange additional non-safety-oriented data between the AS-i master and slave. The AS-i master can use a "parameter call" (write parameter) to send four parameter bits to the slave whereby the slave responds by sending four parameter echo bits back to the master. The parameter call must be triggered by the user program. In SIMATIC S7-300/400, this can be carried out using command 02 of the AS-i master command interface (FC ASI_3422 (Page 71)). The parameter echo bits can only be received if the parameter bits were sent.

The following table applies to the ASIsafe laser scanner:

Parameter bit (PLC / master ➜ laser scanner)	Signal assignment / meaning
P0	Must be set to 1.
P1	Must be set to 1.
P2	Must be set to 1.
P3	Must be set to 1.

Parameter echo bit (laser scanner ➜ PLC / master)	Signal assignment / meaning
P0	0 = diagnostic message "Alarm"
	1 = no alarm
P1	See "Protective zone display" table
P2	See "Protective zone display" table
P3	Not used

The diagnostic message "Alarm" can be configured using the LS4soft software.
The following alarm signaling types are available:

- No alarm
- Device alarm (e.g. face plate dirty)
- Warning zone violated
- Device alarm, or warning zone violated

Protective zone display

Status of parameter echo bit		Meaning
P2	P1	
0	0	Protective zone pair SF1 active
0	1	Protective zone pair SF2 active
1	0	Protective zone pair SF3 active
1	1	Protective zone pair SF4 active

9.5.5 Technical specifications

AS-i data	
Slave type	Standard slave
Suitable for AS-i master to Spec. ... (or higher)	Spec 2.0
AS-i slave profile IO.ID	0.B
ID2, ID1 code	Not available (replacement values: F, F)
Operating voltage in acc. with AS-Interface Specification	26.5 ... 31.6 V
Auxiliary voltage U_{AUX}	24 V DC (+/-20%)
Total power consumption from AS-i	Typ. 50 mA
Current consumption from auxiliary voltage U_{AUX}	Typ. 400 mA
Overcurrent protection: auxiliary voltage	1.25 A fuse, medium time-lag
Cycle time in acc. with AS-i Specification	5 ms
Additional response time of AS-i system	40 ms

9.5.6 Dimension drawings

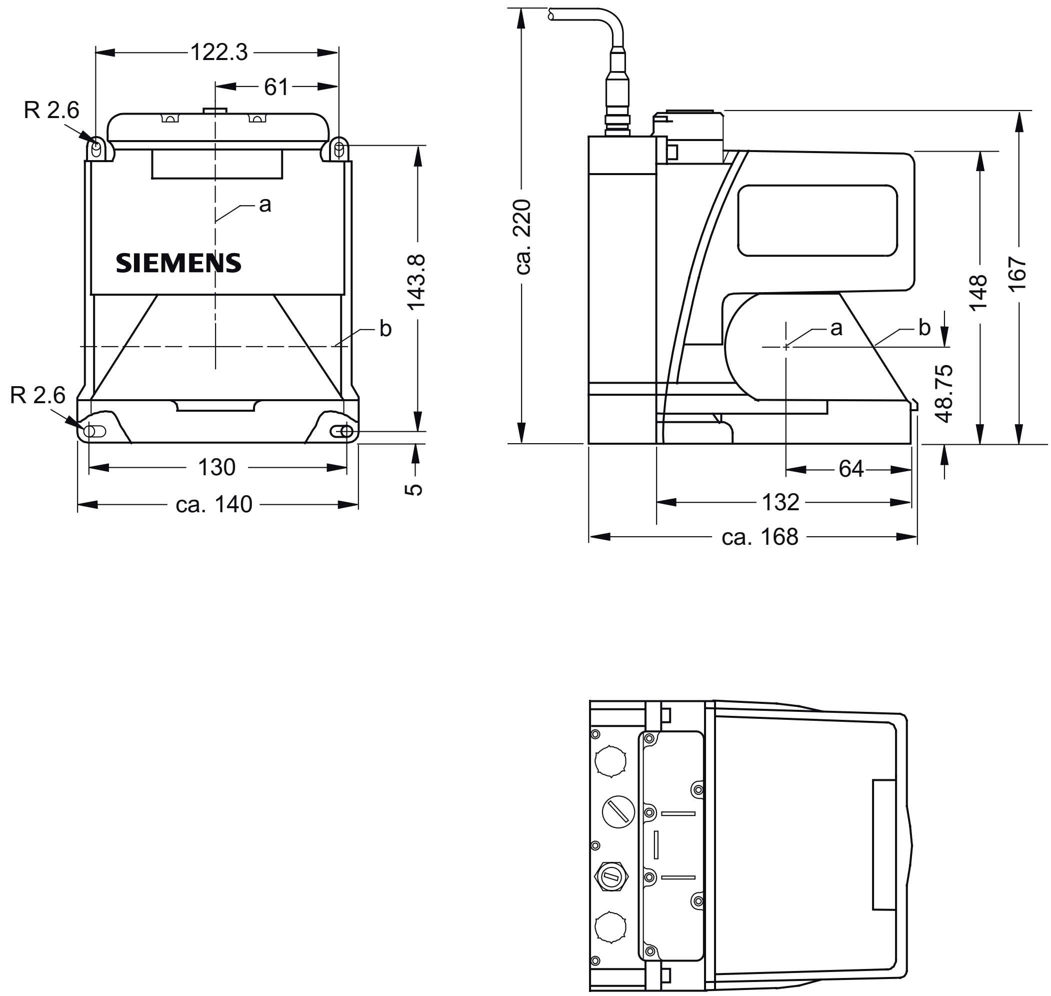


Figure 9-29 Dimensions of the 3FS7834 laser scanners

System accessories 10

10.1 Extension plug

10.1.1 Overview

An extension plug or extension plug plus can be used to increase the maximum possible cable length in an AS-Interface segment from 100 m to 200 m.

The extension plug / extension plug plus is a passive component and is installed at the point in the network that is furthest away from the AS-Interface power supply unit. This point does not need to be determined exactly; it is sufficient just to connect the extension plug / extension plug plus somewhere near the end of the cable (≤ 10 m).

It is equipped with an M12 connector and can be connected with an AS-Interface M12 branch with degree of protection IP67.

The extension plug / extension plug plus is equipped with integrated undervoltage detector for monitoring the AS-Interface voltage to ensure that the required voltage is present even at the end of the bus cable. Undervoltage is indicated on the extension plug by means of a diagnostics LED. The extension plug plus is equipped with an AS-i A/B slave and communicates this diagnostics data directly to the AS-Interface master.

Setting the AS-i address

The AS-i address of the extension plug plus can be set by connecting the AS-i M12 connector to the addressing unit. No additional AS-i addressing socket is available.

The extension plug (not "plus") is not assigned an AS-i address.

10.1.2 Order numbers

Extension plug

Type	Order no.
AS-Interface extension plug	3RK1901-1MX00
AS-Interface extension plug plus (with integrated A/B slave)	3RK1901-1MX01

Accessories

Type	Order no.
AS-Interface transition from AS-i cable to M12 socket	3RX9801-0AA00
Further transitions: see accessories for the K20 compact module	

10.1.3 Connection

The extension plug / extension plug plus is connected to an AS-Interface M12 branch with degree of protection IP67 (PIN1: U_{ASI} +, PIN3: U_{ASI} –).

Figure 10-1 Extension plug with M12 branch

Segment with max. 200 m:

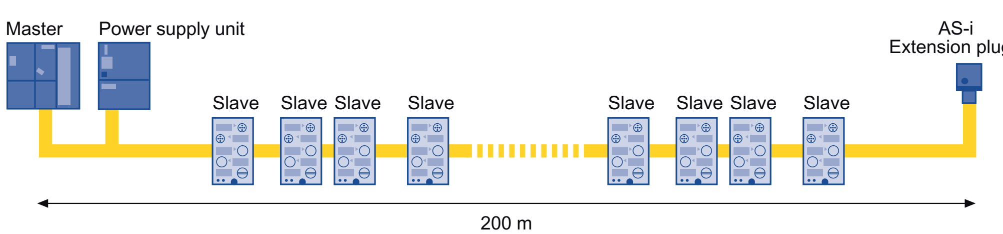


Figure 10-2 Extension plug in a segment

10.1.4 Diagnostics

Extension plug

If the minimum voltage as defined by the AS-Interface Specification is undershot, this is indicated on the extension plug when the green LED starts flashing. If the AS-Interface voltage is sufficient, however, it is lit up continuously. To detect undervoltage, the LED is configured with a delay so that even momentary voltage dips can be detected.

LED display

LED	Possible cause	Possible remedial measures
Green	Normal operation, AS-i voltage OK	—
Flashing green	Undervoltage, AS-i voltage < 26.5 V	• Move the AS-i power supply unit. • Increase the cross-section of the AS-i cable. • Reduce the load caused by slaves/sensors. • Check whether or not the network quality is still sufficient despite undervoltage.
OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

The condition for undervoltage must be present for at least 5 ms in order to be signaled via the LED. The undervoltage message is displayed for at least 100 ms, even if the voltage only drops momentarily.

Extension plug plus

The extension plug plus is equipped with an AS-i A/B slave and does not have a diagnostics LED.

If the minimum voltage is undershot, this event is sent as digital input data directly to the AS-Interface master. Two different voltage values can be set as the threshold value; these can be selected by setting the output bits. Two different input bits can be used to distinguish between brief and longer voltage dips.

Assignment of the inputs DI 2 - DI 3

Input	Status	Meaning
DI 2	0	Undervoltage detected with duration > 50 ms
	1	No undervoltage
DI 3	0	Undervoltage detected with duration > 5 ms
	1	No undervoltage

Assignment of outputs DO 0 - DO 1

Input	Status	Meaning
DI 0	—	Not used
DI 1	0	Threshold value for undervoltage 26.5 V
	1	Threshold value for undervoltage 23 V

10.1.5 Technical specifications

Order no.	3RK1901-1MX00 Extension plug	3RK1901-1MX01 Extension plug plus
Slave type	No integrated slave	A/B slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0	AS-i Spec. 2.1
AS-i slave profile IO.ID.ID2	—	B.A.E
ID1 code (factory setting)	—	7
Operating voltage in acc. with AS-Interface Specification	26.5 ... 31.6 V	
Reverse polarity protection	Available	
Total power consumption	≤ 10 mA	≤ 15 mA
Degree of protection	IP67	
Ambient temperature	-25 ... +85°C	
Connection to AS-Interface	Via M12 plug connector PIN 1: U_{ASI} + PIN 3: U_{ASI} –	

10.1.6 Dimension drawings

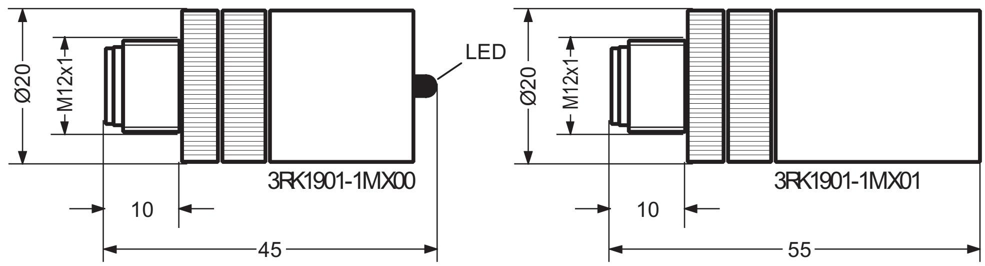


Figure 10-3 Dimensions of the extension plug / extension plug plus

10.2 Repeaters

10.2.1 Overview

In its basic configuration, an AS-i network comprises one segment with a maximum cable length of 100 m. An extension plug can be used to increase the length of the cable to 200 m.

If this is insufficient, however, you can use one or more repeaters.

A repeater extends an existing segment with an additional segment, which can have a maximum cable length of 100 m (without an extension plug) or 200 m (with an extension plug).

Each segment requires a separate AS-i power supply unit.

The additional power supply can increase the current supply for slaves/sensors and lower the voltage drop on the AS-i cable.

Properties of the repeater:

- Slaves can be installed in both segments (upstream and downstream of the repeater).
- The two AS-i cable segments are electrically isolated, that is, fault signals/EMC and ground faults are blocked on the repeater.
- The repeater reconstructs the bit information in the AS-i telegram.
- A maximum of two repeaters connected in series can be used if an AS-i extension plug is not used.
- When an AS-i extension plug is used (in segment 1 or/and segment 2), repeaters must not be connected in series.
- Several repeaters can be connected in parallel (star configuration).
- When several repeaters are used in a combination of parallel and series connections (tree configuration), the cable length can be extended to several kilometers. For the sake of clarity, however, catalogs and brochures usually state maximum total lengths of no more than a few hundred meters. Even when repeaters are used, the maximum number of slaves that can be connected is 31 (without A/B slaves) or 62 (with A/B slaves).
- Repeaters can also be used in conjunction with ASIsafe slaves and safety monitors or F-Link.
- The AS-i addresses (and any safety monitors) can be distributed across the segments as required. The only restriction here is that no more than 35 load equivalents are installed in each segment to prevent the communications voltage from being attenuated excessively. The following equivalences apply:
  - Standard slave (incl. ASIsafe slave) ≡ 1 load equivalent
  - A/B slave ≡ 0.5 load equivalent
  - Safety monitor ≡ 1 load equivalent
  - Repeater (per segment connection) ≡ 1 load equivalent

   – Other components without an AS-i address (e.g. ground fault detector) ≡ 1 load equivalent,
     Example:
     Segment with 20 standard slaves (incl. ASIsafe slaves), 10 A/B slaves, 3 safety monitors, 1 repeater, 1 ground fault detector.
     Result:
     20 + 10 x 0.5 + 3+ 1 + 1 = 30; this is a permissible configuration because the load equivalent is ≤ 35.

- The repeater is designed symmetrically, that is, it does not matter whether or not the AS-i master is installed in segment 1 (upstream of the repeater) or in segment 2 (downstream of the repeater).
- The repeater can be installed anywhere on an AS-i cable. The AS-i flat cable of each segment is fed through the repeater without interruption. If necessary, the cable can end in the repeater.

Setting the AS-i address

A repeater is not assigned an AS-i address.

10.2.2 Order numbers

Type	Order no.
Repeater for AS-Interface for cable extension, incl. mounting plate	6GK1210-0SA01

10.2.3 Connection

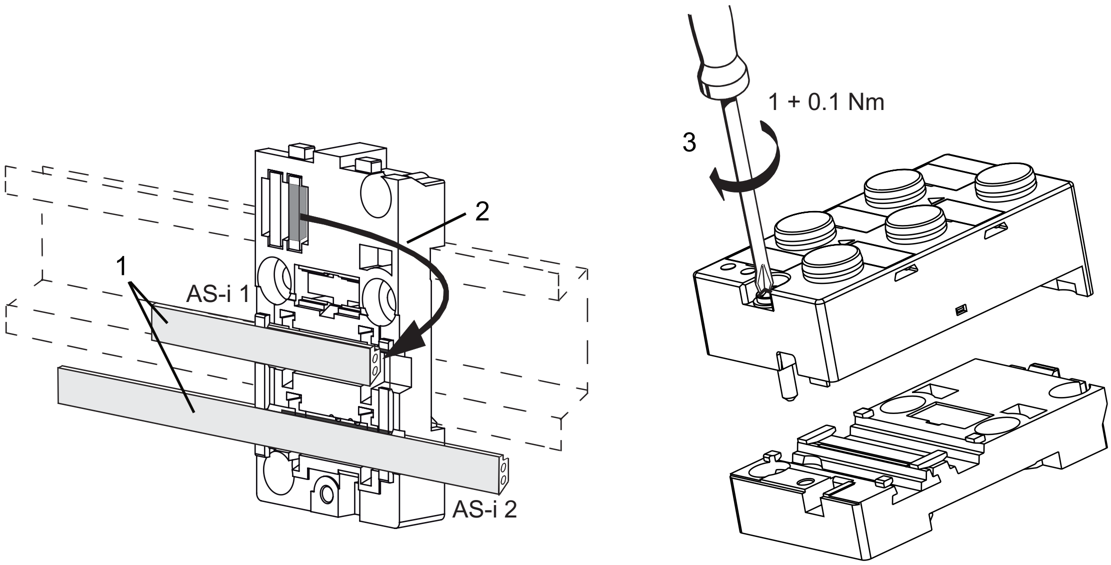


Figure 10-4 Connecting the repeater

To commission the repeater, carry out the following steps:

Step	Procedure
1	Insert the AS-i cables into the cable routings on the mounting plate: top = AS-i cable segment 1 (AS-i 1), bottom = AS-i cable segment 2 (AS-i 2).
2	If a cable ends in the repeater, use the gasket set 3RK1902-0AR00.
3	Screw the repeater onto the mounting plate. The LEDs light up when the AS-i voltage has been applied.

Structure

- Slaves can be used on both sides of the repeater
- An AS-Interface power supply is required on both sides
- Electrical isolation of the two AS-Interface shaped cable lines.
  Separate display of the correct AS-Interface voltage for each side.
- Max. two repeaters can be connected in series (max. cable length 300 m)
- Several repeaters can be connected in parallel (star configuration)

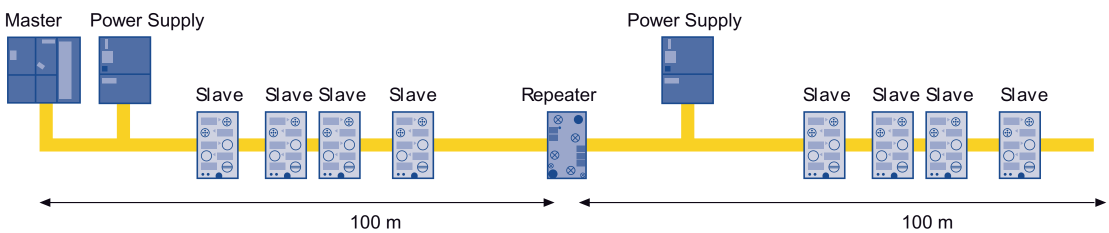


Figure 10-5 Repeater: integration in the AS-i network

Maximum configuration: 600 m with repeaters

Repeaters can be used to increase the length of the cable. Since repeaters cannot be connected in series when they are used in conjunction with AS-i extension plugs, this results in a maximum distance of 400 m between the master and slave and a maximum cable extension of 600 m (master in the middle of the network). Repeaters can be connected in parallel in a star configuration each with up to 200 m long segments.

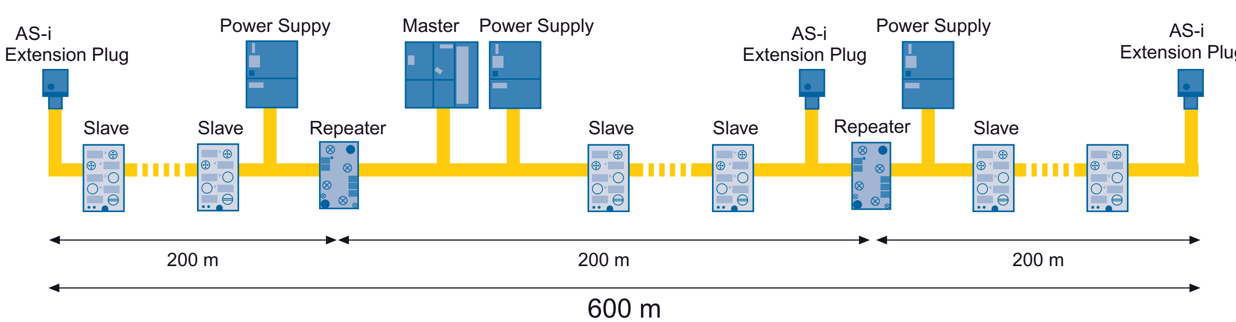


Figure 10-6 Repeaters in combination with extension plugs for a maximum configuration of 600 m

10.2.4 Diagnostics

The LED lights up if the AS-Interface voltage is correct.

LED per segment

LED	Possible cause	Possible remedial measures
Green	Normal operation, AS-i voltage OK	—
OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

10.2.5 Technical specifications

Order no.	6GK1210-0SA01
Slave type	No integrated slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
AS-i slave profile IO.ID	—
ID2 code	—
Operating voltage in acc. with AS-Interface Specification	26.5 ... 31.6 V
Total power consumption from AS-Interface	≤ 40 mA per segment

10.2.6 Dimension drawings

Repeater

The dimensions of the repeater are the same as those for the housing of the K45 compact modules (Page 201).

10.3 Extenders

10.3.1 Overview

The extender has almost the same function as the repeater, but with the following differences:

- The AS-i master only is connected in segment 1. The AS-i power supply unit and slaves must not be installed in segment 1. (Data decoupling required for the AS-i system is integrated in the extender for segment 1.)
- The AS-i power supply unit, the slaves, and any safety monitors are connected to segment 2.
- No electrical isolation of the two AS-i cable segments.
  Segment 1 is automatically supplied from segment 2, whereby the current for segment 1 is restricted to 100 mA. For this reason, the extender can only be used in conjunction with AS-i masters that are supplied via a separate voltage source. Extenders cannot be used in conjunction with DP/AS-i Link20E because Link20E requires approx. 200 mA from the AS-i cable. The same applies to other AS-i masters (e.g. DP/AS-i Link Advanced with internal supply via AS-i).
- Several extenders cannot be connected in series or in parallel.
- A maximum of one extender and one repeater connected in series can be used if an AS-i extension plug is not used.
- When an AS-i extension plug is used (in segment 1 or/and segment 2), extenders and repeaters must not be connected in series. If an AS-i extension plug is installed in segment 1, it must be located near the AS-i master.

The extender is used, for example, where the AS-i master (in the cabinet) is installed far away from the installation location of the slaves (machine configuration).

Setting the AS-i address

The extender is not assigned an AS-i address.

10.3.2 Order numbers

Type	Order no.
Extender for AS-Interface for remote master installation (up to 100 m) incl. FK-E base	6GK1210-1SA00

10.3.3 Connection

The FK-E coupling module is suppled with the extender.

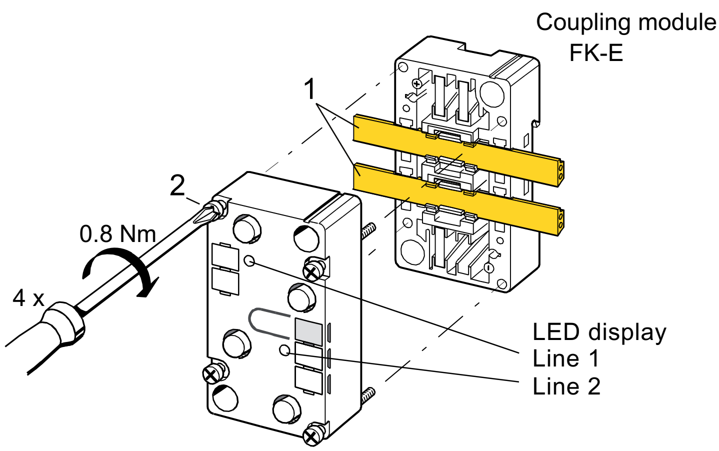


Figure 10-7 Connecting the extender

To commission the extender, carry out the following steps:

Step	Procedure
1	Insert the AS-i cables into the cable routings on the coupling module: top = AS-i cable segment 1 (line 1), bottom = AS-i cable segment 2 (line 2). If a cable ends in the extender, use the gasket set 3RK1902-0AR00.
2	Screw the extender onto the coupling module. The LEDs light up when the AS-i voltage has been applied.

Using the extender

The AS-Interface extender is used in applications in which the master is located some distance away from the actual AS-Interface installation.
The extender has the following characteristics:

- Masters can be located at a distance of up to 100 m from the AS-Interface segment.
- Slaves can only be used on the side of the extender that is not facing the master.
- A power supply is only required on the side that is not facing the master.
- No electrical isolation of the two lines.
- The correct voltage is displayed.

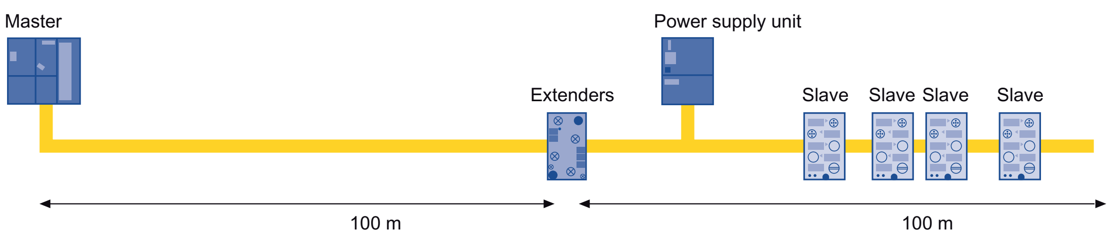


Figure 10-8 Integrating the extender in the AS-i network

10.3.4 Diagnostics

The LEDs have the same function as those for the repeaters (Page 424).

10.3.5 Technical specifications

Order no.	6GK1210-1SA00
Slave type	No integrated slave
Suitable for AS-i master to Spec. ... (or higher)	AS-i Spec. 2.0
AS-i slave profile IO.ID	—
ID2 code	—
Operating voltage in acc. with AS-Interface Specification	26.5 ... 31.6 V
Total power consumption from AS-Interface	≤ 100 mA

Note

An extender cannot be operated on DP/AS-Interface Link 20E if it does not have its own power supply.

10.3.6 Dimension drawings

The dimensions of the extender are the same as those for the housing of the overvoltage protection module (Page 445) (but without grounding cable).

10.4 Addressing unit

10.4.1 Overview

To exchange data with the master, all nodes must be addressed before they are integrated in the AS-Interface network. This can be carried out:

- Offline with an addressing unit
- Online by the AS-Interface system master

The addresses are the values 1 to 31 (or 1A to 31A and 1B to 31B for the extended AS-Interface Specification 2.1).

A new slave that has not yet been assigned its own address has the default address 0. It is identified by the master as a new, non-addressed slave and, as such, does not yet take part in standard communication.

Addresses can be assigned as required, that is, it does not matter whether the first slave is assigned address 21 or 1, for example.

Function

- Reads the slave address 0 to 31, A/B
- Reads the IO and ID codes of the slaves
- Standard and extended ID code1 and ID code2
- Standard and extended addressing mode in acc. with AS-Interface version 2.1
- Programs ID code1
- Functional check of slaves: read inputs and write outputs of digital/analog slaves
- AS-Interface test: measure the voltage (measurement range: 0 to 35 V) and current consumption (measurement range: 0 to 100 mA) of the AS-Interface bus.
- Save: complete plant configurations can be saved (profile of all the slaves, also with extension in accordance with AS-Interface specification 2.1)
- Detects all plant components

10.4.2 Order numbers

Addressing and diagnostic unit

Type	Order no.
AS-Interface addressing and diagnostic unit for active AS-i modules, intelligent sensors, and actuators, with functionality to v2.1 with M12 socket	3RK1904-2AB01

Accessories

Type	Order no.
AS-Interface coupling module FK/address, with integrated addressing socket, for 2 AS-Interface cables (yellow), connection with insulation displacement method EMS (electromagnetic interface)	3RK1901-1MA00
M12 - M12 connection cable, 3-pin, with 1.5 m PUR cable, black, 3 x 0.34 mm², straight cable plug, straight connector	3RX8000-0GF32-1AB5

10.4.3 Technical specifications

Order no.	3RK1 904-2AB01
Power supply	4 batteries IEC LR6 (NEDA 15)
Ambient conditions	
Ambient temperature	0 ... +55°C
Storage temperature	-20 ... +55°C (without batteries)
Relative humidity	Max. 75%, (without condensation)
Height above sea level	Up to 2,000 m
Location	Indoors only
Mechanical design	
Degree of protection	IP40
Dimensions (W x H x D)	84 x 195 x 35 mm
Connection via M12 socket:	
Pin 1: Pin 3: Pin 2 / 4 / 5:	ASI+ ASI– / GND IR addressing

To save the battery, the system is shut down automatically approx. 1 min after the last operator action to ensure that at least 2,500 device addressing operations can be performed.

10.5 Analyzer

10.5.1 Overview

The AS-Interface analyzer is used for checking AS-Interface networks. This ensures that faults can be identified systematically and facilitates continuous monitoring.

This device can help identify installation errors (e.g. insecure contacts or EMC faults with extreme loads).

The user-friendly software allows users without specialist knowledge of AS-Interface to assess the quality of entire networks. The AS-Interface analyzer also allows commissioning and servicing tasks to be documented by creating test reports for the recordings performed.

Trigger functions allow expert AS-Interface users to carry out detailed diagnoses.

As a passive node, the AS-Interface analyzer "listens in" on communication in the AS-Interface network. The device is also supplied from the AS-Interface cable.

The analyzer interprets the physical signals in the AS-Interface network and records communication.

An RS232 interface is used to transfer the data acquired on a PC (e.g. notebook) where it can be evaluated using the diagnostics software supplied.

Online statistics

This mode provides an overview of the existing AS-Interface system. The error rates for each slave are represented in a traffic light format (green, amber, red).

The bus configuration and the slave data that is currently being transferred are clearly displayed.

The extended statistics function can be used to determine the error rate as the number of transferred or invalid bus telegrams.

The bundle error overview provides a graded overview of how many telegram repetitions have occurred so that users can perform a targeted, predictive assessment of the transfer quality.

Data mode

In this mode, the analyzer displays not only the digital input/output values but also the current analog values as well as the input status of the safety slaves.

Trace mode

This mode provides a comprehensive range of trigger functions as well as trace and view filters in a similar format to that of the field bus analyzer.

An external trigger input and output round off the functional scope allowing even the most complex errors to be located.

For troubleshooting in conjunction with safety monitor applications, status changes in the code tables for safety slaves are detected and evaluated.

Test report

The recorded data of the online statistics can be easily output and documented via a test report. Verification of the status of the plant for approvals or servicing tasks can then be provided.

The measurement Wizard records the bus signals for a variable duration, thereby triggering creation of an automatic test report. This allows the quality of AS-i plants to be checked using standardized procedures.

10.5.2 Order numbers

Analyzer

Type	Order no.
AS-Interface analyzer V2 diagnostic unit with functionality to V2.1 Extended version with ASIsafe evaluation and measurement Wizard	3RK1904-3AB01

Accessories

Type	Order no.
M12 cable connector, 4-pin, with 5 m PUR cable, black, 4 X 0.34 mm^2	3RX8000-0CD42-1AF0
AS-Interface transition from AS-i cable to M12 socket	3RX9801-0AA00

10.5.3 Connection

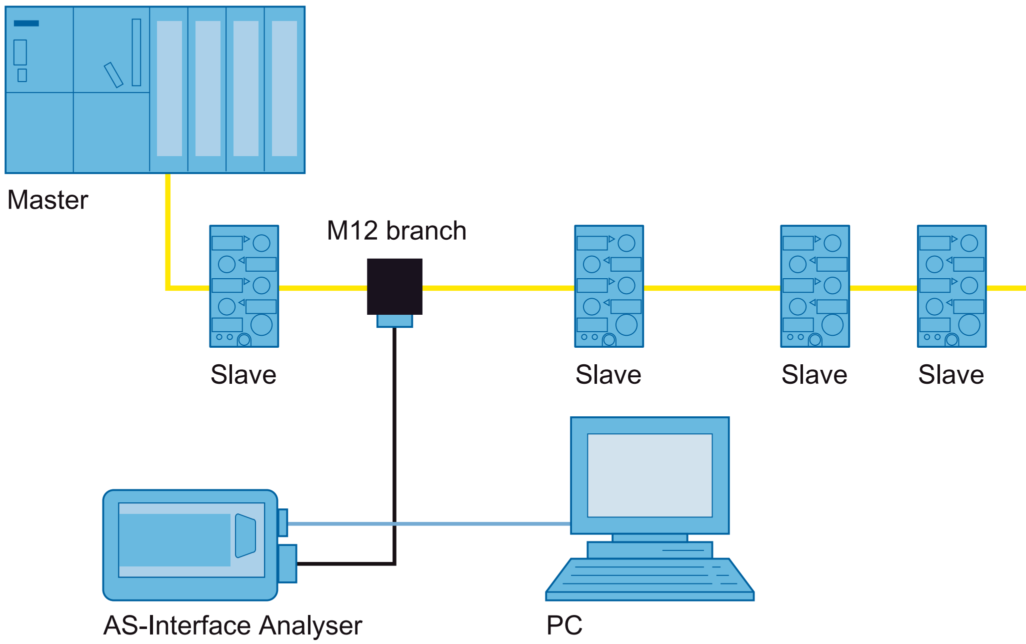


Figure 10-9 Connecting the analyzer to the AS-i network

10.6 Ground fault detection module

10.6.1 Overview

"... Ground faults in control circuits must not cause machines to start unintentionally, cause dangerous machine movements, or prevent machines from shutting down (EN 60204, part 1 or DIN VDE 0113)".

The AS-Interface ground fault detection module can be used to ensure that these requirements are fulfilled. This SlimLine module reliably detects and reports ground faults in AS-Interface systems.

The following ground faults are detected:

- AS-i "+" ground fault
- AS-i "-" ground fault
- Ground faults in sensors and actuators supplied by the AS-Interface voltage.

One module for each AS-Interface network is sufficient.

Function

The ground fault is detected by the module, displayed via an LED, and signaled via two signaling outputs (1. no ground fault / O.K.; 2. ground fault / fault). The ground fault signal is stored in the module. Once the ground fault has been rectified (and not before), the module can be reset by switching off the AS-Interface voltage, pressing the "Reset" button, or by applying a high level at the floating remote reset input.

External auxiliary voltages are not monitored by this module with respect to ground faults.

Test / reset

Carry out regular checks to ensure that the module is functioning properly:

When you press the TEST/RESET button very briefly (< 2 s), this simulates a ground fault and the FAULT output is set. This status remains until the system is reset with the TEST/RESET button (> 2 s). This sets the OK output and resets the FAULT output. The system cannot be reset when a ground fault is present.

The module can also be reset by means of a high level at the floating remote reset input (R-RES). Again, the system cannot be reset when a ground fault is present.

The test function results in a ground fault. Switch the system to a safe state prior to the test.

Setting the AS-i address

The ground fault detection module is a passive module without IC and, therefore, does not require its own address in the AS-Interface network.

10.6.2 Checking for ground faults with a voltage measuring instrument

A ground fault anywhere in the AS-i cable can be detected using a high-resistance voltage measuring instrument (R_i >= 20 MΩ, e.g. digital multimeter).

Procedure:

1. Set the measuring instrument to voltage measurement (V DC).

2. Connect the minus measuring lead to the system ground/ground.

3a. Connect the plus measuring lead to AS-i plus.

- Without a ground fault, a voltage of approx. 15 V (+/- 3 V) is set. (Since the AS-i cable is ideally only set via a capacitive voltage divider symmetrically with respect to system ground, the measured voltage may drift slightly due to the internal resistance of the measuring instrument.)
- If a ground fault vis-à-vis AS-i plus occurs, the voltage can drop to as low as 0 V (depending on the resistance in the ground connection).
- If a ground fault vis-à-vis AS-i minus occurs, the voltage can increase to as much as the maximum AS-i voltage (approx. 30 V, and depending on the resistance in the ground connection).

Alternative:

3b. Connect the plus measuring lead to AS-i minus.

- Without a ground fault, a negative voltage of approx. -15 V (+/- 3 V) is set. (Since the AS-i cable is ideally only set via a capacitive voltage divider symmetrically with respect to system ground, the measured voltage may drift slightly due to the internal resistance of the measuring instrument.)
- If a ground fault vis-à-vis AS-i plus occurs, the voltage can increase to as much as the maximum AS-i voltage, that is, a negative voltage as low as approx. -30 V is measured (depending on the resistance in the ground connection).
- If a ground fault vis-à-vis AS-i minus occurs, the voltage can drop to as low as 0 V, that is, a slight negative voltage about 0 V is measured (depending on the resistance in the ground connection).

Note

Since the connected sensors are supplied by the AS-i voltage, a ground fault on the sensor cable also causes a ground fault on the AS-i cable (with the exception of modules with floating inputs).

If the outputs are supplied from the AS-i cable, the same applies to the actuator cables.

The cause of a ground fault could be anywhere in the AS-i network. Due to the flexibility of the topology, no measurement procedure exists for automatically determining the location of the fault.

Tips for locating ground faults:

- Are cables moved constantly?
- Have any cables been driven over or otherwise damaged by vehicles (e.g. fork-lift trucks)?
- If possible, disconnect the AS-i cable segment by segment (AS-i plus and minus cable)
- Disconnect neuralgic sensor cables one after the other or disconnect entire modules (and connected sensors) one after the other from the AS-i cable (AS-i plus and minus cable).

Check whether – as described above – a ground fault exists using the voltage measuring instrument.

- Check the AS-i cable and sensor cables for insulation faults (chafing points, compression, cuts, frayed litz wires at the terminals, even in prefabricated connectors, wet cable connectors, etc.) and replace if necessary.
- Make sure that all the cables are properly connected (AS-i cable and sensor cables; see note above - must not be connected at any point to ground or external voltage).
- Once the errors have been rectified, the ground fault detection module must be reset (press the RESET/TEST button for ≥ 2 s or remote reset).

10.6.3 Order numbers

Type	Order no.
Ground fault detection module, screw terminals	3RK1408-8KE00-0AA2
Ground fault detection module, spring-loaded terminal	3RK1408-8KG00-0AA2

10.6.4 Connection

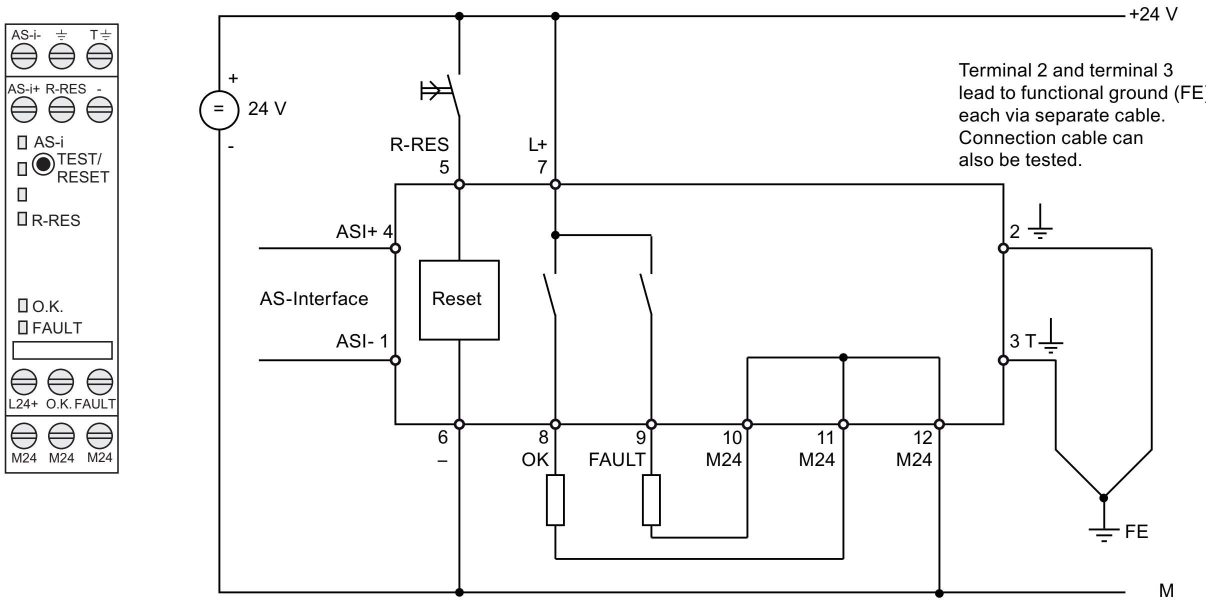


Figure 10-10 Connections on the ground fault detection module

Connection cross-sections

Cable	Screw terminals	Spring-loaded terminals
Single-core	1 x 0.5 ... 4.0 mm² 2 x 0.5 ... 2.5 mm²	2 x 0.25 ... 1.5 mm²
Finely stranded with wire end ferrule	1 x 0.5 ... 2.5 mm² 2 x 0.5 ... 1.5 mm²	2 x 0.25 ... 1.5 mm²
Finely stranded without wire end ferrule	—	2 x 0.25 ... 1.5 mm²
AWG cables, single or multi-core	2 x 20 to 14	2 x 24 to 16

10.6.5 Diagnostics

LED: AS-i

AS-i	Possible cause	Possible remedial measures
Green	AS-i voltage present	—
OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

LEDs: OK and FAULT

OK	FAULT	Possible cause	Possible remedial measures
Green	OFF	No ground fault	—
Red	OFF	Ground fault detected	—
OFF	OFF	No AS-i voltage	Switch on AS-i voltage

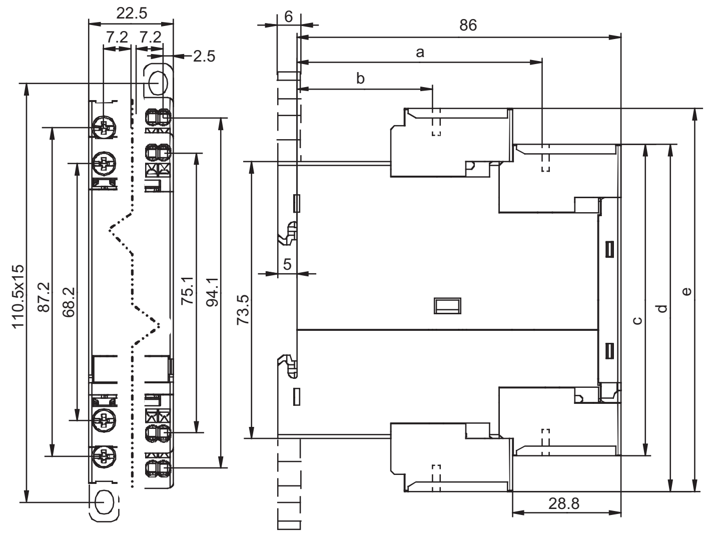
LED: R-RES

R-RES	Meaning
Yellow	Reset signal present
OFF	—

10.6.6 Technical specifications

Order no.	3RK1408-8KE00-0AA2	3RK1408-8KG00-0AA2
Connection type	Screw terminals	Spring-loaded terminals
Slave type	The ground fault detection module is not equipped with a slave and does not require an AS-Interface address.	
Rated operating voltage	24 ... 48 V	
Total power consumption	≤ 40 mA	
Approvals		
Degree of protection	IP20	
Ambient temperature	-25 ... +70 °C	
Storage temperature	-40 ... +85 °C	
Low signal range I_{IN}	≤ 1.5 mA	
High signal range U_{IN} I_{IN}	 ≥ 10 V ≤ 40 mA	
Current-carrying capacity DC 12 DC 13 DC 13	 1 A (max. 2 A per module) 500 mA (24 V) 200 mA (48 V)	
Switches	2 x 106	
Assignment of the terminals	1: AS-i - connection 2: Connection for system ground 3: Connection for system ground (for test function) 4: AS-i + connection 5: Remote reset input (R-RES) 6: Remote reset ground (-) 7: External power supply for signaling outputs L24+ 8: Signaling output OK 9: Signaling output FAULT (ground fault signal) 10: External power supply for signaling outputs M24 11: Minus connection for signaling output M24 12: Minus connection for signaling output M24	
Notes	When repeaters are used, note that a ground fault detection module is used for each AS-Interface segment (no. of AS-Interface power supply units = no. of ground fault detection modules).	
	U_{AUX} should be fused with 2 A time-lag fuses.	
	The service life of the relay increases when inductive consumers with free-wheeling diodes are used.	
	Route terminals 2 and 3 via separate cables to the system.	

10.6.7 Dimension drawings



	a	b	c	d	e
3RK....-..E.	65	36	82.6	92.2	101.6
3RK....-..G.	—	—	84.4	93.9	103.4

Figure 10-11 Dimensions: ground fault detection module

10.7 Overvoltage protection module

10.7.1 Overview

The AS-Interface overvoltage protection module protects downstream AS-Interface devices or individual system sections in AS-Interface networks against mains-borne overvoltage that can potentially be caused by switching operations or distant lightning strikes.

In the lightning protection zone concept, the overvoltage protection module is located at the transition from zone 1 to 2/3. Direct lightning strikes must be handled by additional protective measures at the transitions from lightning protection zone 0A to 1.

The AS-Interface overvoltage protection module can now also be used to integrate AS-Interface in the overall overvoltage protection concept of a plant or machine.

The module has the same design and degree of protection (IP67) as the AS-Interface user modules and is also connected in the same way. It is a passive module without AS-i IC and, therefore, does not require its own address in the AS-Interface network.

It can be connected to an AS-Interface system via the FK-E or PG-E coupling module. The EEMS interface can be used to protect the AS-Interface cable and auxiliary voltage cable against overvoltage.

Overvoltage is discharged via a grounding cable with a green/yellow oil-resistant outer sheath. This cable is fixed permanently in the module and must be connected with low resistance to system ground.

Rated discharge current I_{sn}

The rated discharge current is the peak value of a surge current with the wave form 8/20 microseconds for which the overvoltage protection module is rated in accordance with a specific test program.

With the waveform 8/20, 100 % of the value is achieved after 8 microseconds and 50 % after 20 microseconds.

Protection level U_p

The protection level of an overvoltage protection module is the maximum momentary value of the voltage at the terminals as determined by means of individual tests.

The protection level characterizes the capability of an overvoltage protection module to limit overvoltage to a residual level.

Accessories

An FK-E or PG-E coupling module is required for connecting the AS-Interface cable and the auxiliary power supply cable.

Installation guidelines

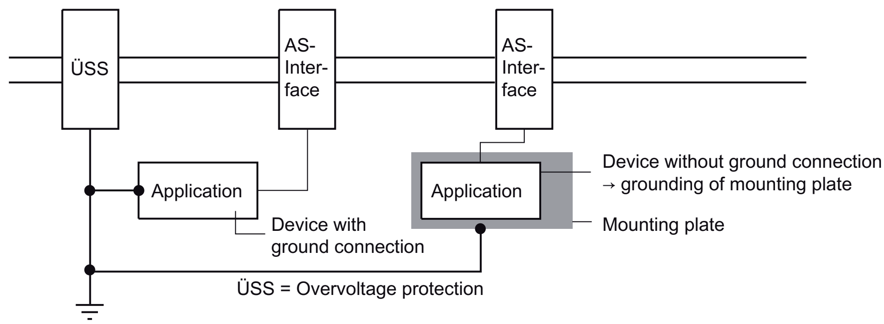


Figure 10-12 Installation guidelines for overvoltage protection modules

The protection modules and devices to be protected must grounded via a joint grounding point (equipotential bonding). If devices with total insulation are protected, their mounts must also be included in the grounding points.

Application example

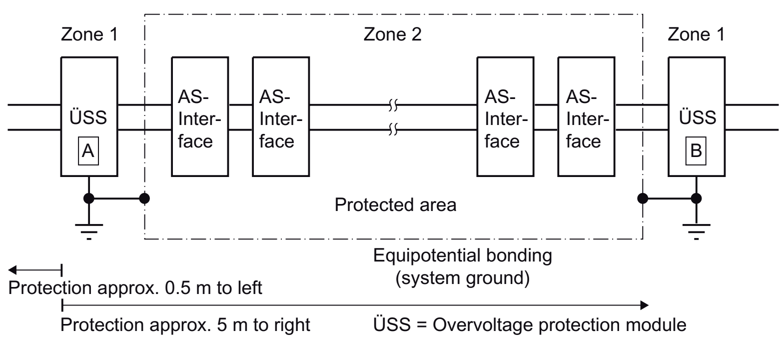


Figure 10-13 Application example for overvoltage protection modules

Setting the AS-i address

The overvoltage protection module is not equipped with a slave, which means that it does not require an AS-Interface address.

10.7.2 Order numbers

Type	Order no.
Overvoltage protection module	3RK1901-1GA00
FK-E coupling module for AS-i cable (yellow) and AUX-POWER cable (black)	3RG9030-0AA00

10.7.3 Connection

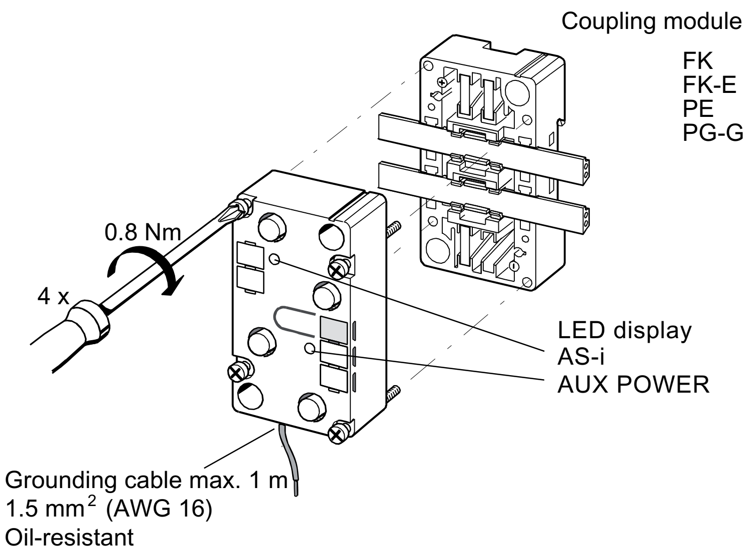


Figure 10-14 Connecting the overvoltage protection module

To commission the overvoltage protection module, carry out the following steps:

Step	Procedure
1	Insert the AS-i cable or 24 V DC auxiliary power cable (AUX POWER) into the cable routing(s) of the coupling module.
2	Screw the overvoltage protection module onto the coupling module. The LEDs light up when the AS-i / AUX POWER has been applied.
3	Connect the grounding cable with low resistance to the joint ground for the AS-i device to be protected.

10.7.4 Diagnostics

LED: AS-i

AS-i	Possible cause	Possible remedial measures
Green	AS-i voltage present	—
OFF	No AS-i voltage, AS-i voltage connected with incorrect polarity, AS-i voltage too low	Switch on the AS-i voltage, connect it properly, measure the AS-i voltage (approx. 30 V DC)

LED: AUX POWER

AUX POWER	Possible cause	Possible remedial measures
Green	AUX POWER present	—
OFF	No AUX POWER	Switch on AUX POWER, connect properly,

10.7.5 Technical specifications

Order no.	**3RK1901-1GA00**	
Slave type	The overvoltage protection module is not equipped with a slave, which means that it does not require an AS-Interface address.	
Overvoltage protection	For AS-Interface	For AUX power
Rated discharge current Isn with waveform 8/20 • Core-prot. cond. • Core-core	 10 kA 0.5 kA	 10 kA 0.5 kA
Protection level Up for Isn • Core-prot. cond. • Core-core	 ≤ 1.8 kV ≤ 100 V	 ≤ 1.8 kV ≤ 70 V
Protection level Up for 1 kV / µs • Core-prot. cond. • Core-core	 ≤ 700 V ≤ 50 V	 ≤ 600 V ≤ 40 V
Degree of protection	IP67	
Ambient temperature	-25 ... +85 °C	
Storage temperature	-40 ... +85 °C	

10.7.6 Dimension drawings

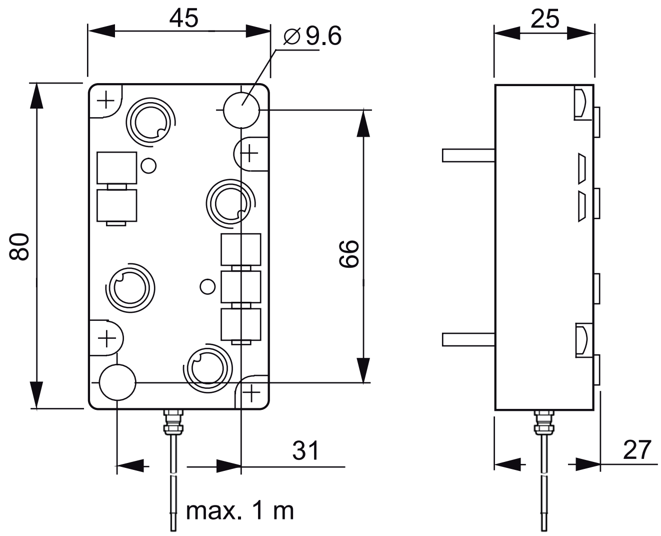


Figure 10-15 Dimensions: overvoltage protection module

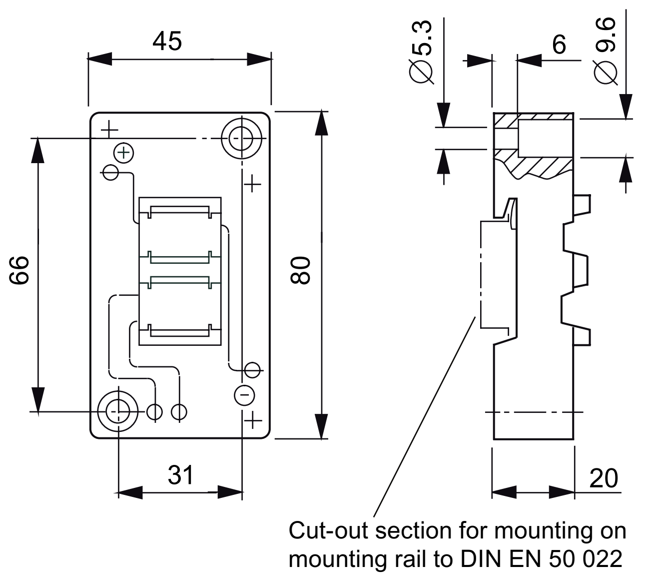
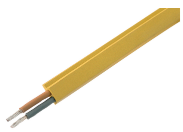


Figure 10-16 Coupling module for installing the overvoltage protection module

10.8 Other accessories

10.8.1 AS-Interface shaped cable

10.8.1.1 Overview



The actuator-sensor interface, the networking system used for the lowest field range, is characterized by the ease with which it can be assembled and installed. A new connection system has been specially developed for AS-Interface,

whereby the network nodes are connected by the AS-Interface cable. This two-core cable has a trapezoidal profile to protect against incorrect polarity.

Connections are established with the insulation displacement method, whereby contact pins penetrate the shaped AS-Interface cable to provide secure contacting with the two cores. The cables do not need to be cut or stripped. which means that AS-Interface nodes (e.g. I/O modules, intelligent devices) can be connected in no time at all. The devices can also be quickly and easily replaced.

To enable devices to be used in a wide range of different ambient conditions (e.g. in oily areas), the AS-Interface cable is available in different materials (rubber, TPE, PUR).

A standard round cable is also available for special applications. With AS-Interface, data and power for the sensors (e.g. BERO proximity switches) and actuators (e.g. indicator lights) are transferred via the yellow AS-Interface cable.

The black AS-i cable can be used for actuators with a 24 V DC supply (e.g. solenoid valves).

10.8.1.2 Order numbers

Type			Order no.
Material	Color	Quantity	
Rubber (EPDM: ethylene-propylene-diene-rubber)	Yellow (AS-Interface)	100 m roll	3RX9 010-0AA00
		1000 m drum	3RX9 012-0AA00
	Black (24 V DC)	100 m roll	3RX9 020-0AA00
		1000 m drum	3RX9 022-0AA00
TPE (thermoplastic elastomer)	Yellow (AS-Interface)	100 m roll	3RX9 013-0AA00
		1000 m drum	3RX9 014-0AA00
	Black (24 V DC)	100 m roll	3RX9 023-0AA00
		1000 m drum	3RX9024-0AA00
TPE special version to UL Class2	Yellow (AS-Interface)	100 m roll	3RX9 017-0AA00
	Black (24 V DC)	100 m roll	3RX9 027-0AA00
PUR[1)] (polyurethane, TPE-U)	Yellow (AS-Interface)	100 m roll	3RX9 015-0AA00
		1000 m drum	3RX9 016-0AA00
	Black (24 V DC)	100 m roll	3RX9 025-0AA00
		1000 m drum	3RX9 026-0AA00
1) Note regarding the towability of the AS-Interface cable with the PUR outer sheath: to the determine its towability, the AS-Interface cable was tested in "IGUS tow chains" of type 10.2.048 and 20.2.55. The tow chain was fitted with 3 × AS-Interface cables and various round cables for this purpose. After it was subject to three million bendings (travel), the cores, litz wires, and outer sheath remained undamaged (tow chain equipped to 50 %).			

10.8.1.3 Technical specifications

AS-Interface shaped cable	EPDM (rubber)	TPE (special PVC compound)	TPE special version to UL Class 2	PUR (polyurethane)
Temperature application range				
Stationary	-40 ... +85°C	-40 ... +105°C	-30 ... +90°C	-50 ... +90°C
Moving	-25 ... +85°C	-30 ... +105°C	-20 ... +90°C	-50 ... +90°C
Core colors	Brown, blue			
Flexibility	Very good		Good	
Behavior in fire	Flammable	Flame resistant to IEC 60332-1 VDE 0482 T. 265-2-1 UL 1581 sec. 1061 cable flame UL 1581 sec. 1060 CSA FT1		Flame resistant to IEC 60332-1 VDE 0482 T. 265-2-1
Halogen free (PVC free)	Yes	No	No	Yes
Without silicone precipitation	Yes	Yes	Yes	Yes
Ozone and weather resistant	Partially resistant	Resistant	Resistant	Resistant

AS-Interface shaped cable	EPDM (rubber)	TPE (special PVC compound)	TPE special version to UL Class 2	PUR (polyurethane)
Oil resistant	Partially resistant	Resistant	Resistant	Resistant
Min. permissible bending radii to DIN VDE 0298, part 300				
Fixed	12 mm	12 mm	12 mm	12 mm
Freely movable	24 mm	24 mm	24 mm	24 mm
Bending behavior to DIN VDE 0472, part 603				
	No breakage after 30,000 movements back and forth			
UL approved	No	UL 758 AWM	UL 758 AWM, UL 13 Class 2, UL 444 CMG	No
CSA approved	No	C22.2 No.210.2 AWM	C22.2 No. 214-02	No
Monitored inspection (VDE)	No	No	No	VDE reg. no. 9971, 300 V / 500 V stationary: -40 ... +70°C Transportation: -25 ... +70°C Moved: -15 ... +70°C permitted for marine and offshore application up to 300 V / 500 V: Germanischer Lloyd, Lloyds Register of Shipping, ABS Europe LTD, Bureau Veritas, Det Norske Veritas

10.8.1.4 Dimension drawings

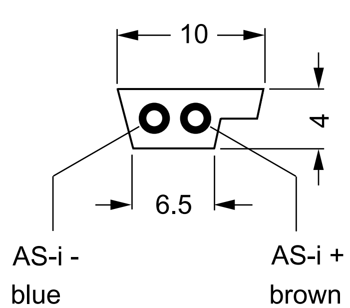


Figure 10-17 Dimensions of the shaped cable

10.8.2 Installation material

Type	Order no.
AS-Interface standard distributor for AS-I shaped cable	3RK1901-1NN00
AS-Interface compact distributor for AS-I shaped cable	3RK1901-1NN10
AS-Interface M12 branch	
For AS-i shaped cable on M12 socket, cable end possible in branch	3RX9801-0AA00
For AS-i shaped cable on M12 socket, cable end not possible in branch	3RK1901-1NR10
For AS-i shaped cable on M12 cable plug, cable length 1 m, cable end not possible in branch	3RK1901-1NR11
For AS-i shaped cable on M12 cable plug, cable length 2 m, cable end not possible in branch	3RK1901-1NR12
For AS-i U_{AUX} shaped cable on M12 socket, cable end not possible in branch	3RK1901-1NR20
For AS-i / U_{AUX} shaped cable on M12 cable plug, cable length 2 m, cable end not possible in branch	3RK1901-1NR21
For AS-i / U_{AUX} shaped cable on M12 cable plug, cable length 2 m, cable end not possible in branch	3RK1901-1NR22
AS-Interface M12 branch (4 x) for AS-i / U_{AUX} shaped cable on 4 x M12 socket, delivery incl. coupling module, cable end possible in branch	3RK1901-1NR00
M12 T distributor IP68, 1 x M12 connector, 2 x M12 plug	3RK1901-1TR00
M12 Y coupler plug for connecting two sensors to one M12 socket with Y assignment	6ES7194-1KA01-0XA0
Addressing cable jack plug on M12 for addressing slaves with M12 bus connection, only required for addressing unit 3RK1904-2AB00	3RK1901-3RA00
AS-Interface M12 sealing caps for unassigned M12 sockets	3RK1901-1KA00
AS-Interface M12 sealing caps, tamper proof for unassigned M12 sockets	3RK1901-1KA01
AS-Interface M8 sealing caps for unassigned M8 sockets	3RK1901-1PN00
AS-Interface M20 seal for AS-Interface cable, shaped and for insertion in M20 screw glands	3RK1901-1MD00
Cable adapter for flat cables Connecting the AS-Interface cable to metric screw glands with insulation displacement method	
Further routing via standard cable for M16 screw gland for M20 screw gland	 3RK1901-3QM00 3RK1901-3QM10
Further routing via pins for M16 screw gland for M20 screw gland	 3RK1901-3QM01 3RK1901-3QM11
Cable clip for cable adapter	3RK1901-3QA00
Cable end terminator for sealing open cable ends (AS-i shaped cable) with IP67	3RK1901-1MN00

Type	Order no.
K45 mounting plate for wall mounting for DIN rail installation	 3RK1901-2EA00 3RK1901-2DA00
K60 mounting plate for wall mounting for DIN rail installation	 3RK1901-0CA00 3RK1901-0CB01
Gasket set for K60 mounting plate and standard distributor (cannot be used for K45 mounting plate) one set contains one straight and one shaped gasket	3RK1902-0AR00

System integration

11

11.1 Integration in open-loop control systems

11.1.1 Totally Integrated Automation

System integration with Totally Integrated Automation

Totally Integrated Automation (TIA) is a one-stop, end-to-end, integrated solution platform from Siemens. Networing covers everything from the plant control level and field/process level through to the actuator/sensor level where AS-Interface is used.

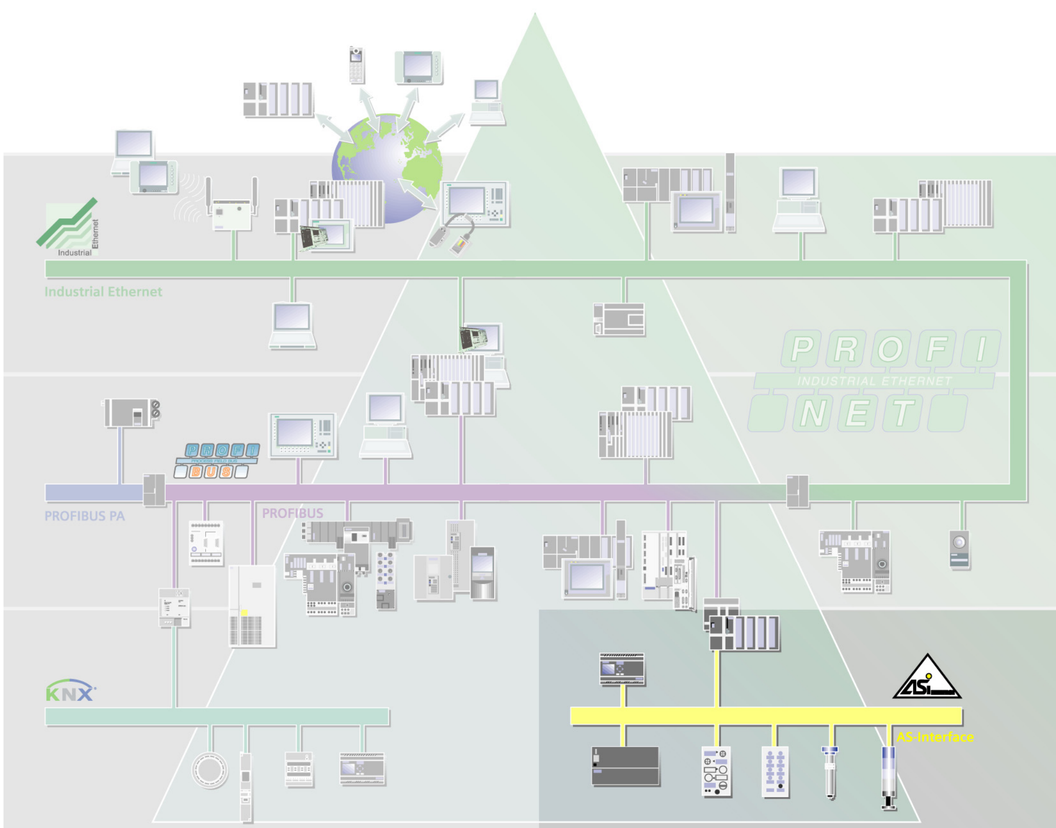


Figure 11-1 System integration with Totally Integrated Automation

Benefits of system integration

Totally Integrated Automation provides you with the technology you need to boost productivity in automation, save time, cut costs, ensure and improve quality, and protect your investments. You can leverage the benefits of TIA throughout the entire production lifecycle of a plant or machine. The benefits of integrating AS-Interface are outlined below.

- Benefits during configuration:
  the seamless interaction of the software tools and standardized operating concept help boost productivity in the configuration phase.
  You can configure hardware and networks systematically in a graphical development environment and parameterize the configuration using input dialogs. The bus configuration can be changed without needing to access the user program. You no longer have to spend time programming the interfaces. The software checks the configuration data automatically to ensure that it is plausible and consistent.
  Systematic data storage allows you to transfer variable changes automatically during configuration and within the programs.
- Benefits during installation and commissioning:
  The distribution of plant communication across bus systems reduces the time and effort involved in cabling and installation. Safety technology and standard modules used for mixed operation can be connected to the same bus systems.
  The configuration can be downloaded to the PLC, HMI, drives, and so on centrally. The documentation for commissioning the plant components is archived in the configuration environment.
- Benefits during operation and maintenance:
  During operation, you can monitor the modular plant components centrally. System-wide communication can also take place across network boundaries.
  Diagnostic and error messages are displayed in plain text and localize the fault or error in the hardware or software. Downtimes due to maintenance are minimized. When you replace modular components, the devices receive starting data from the CPU in RUN mode too. New sensors (e.g. AS-i analog modules) adopt the parameters automatically.
  You can use MMCs to transfer the entire configuration to a new CPU even without the use of a PC / PG. The MMCs ensure that no data goes missing in the CPU during a power failure.
- Benefits for extending the production plant:
  To optimize processes, simulation modules or software can be used in addition to parameter settings and program changes. The modular and harmonized TIA system concept allows plants to be easily extended not only during configuration but also when the hardware is extended.

11.1.2 Integration of AS-i networks in SIMATIC

SIMATIC Technology is an integral part of Totally Integrated Automation. Connecting AS-Interface to the higher-level controller via modules or routers allows you to leverage the full range of benefits offered by TIA.

SIMATIC Manager is the starting point for all software tools. Engineering is carried out with and in STEP 7, the SIMATIC configuration environment. Device-specific function modules are either already available in STEP 7 or can be specially installed. The Distributed Safety software package is available for safety applications.
PROFIBUS and Industrial Ethernet can be configured in a standardized graphical development environment. Function modules can be parameterized in user-friendly dialogs. Module libraries containing pre-programmed functions in STEP 7 are available for user programs.

11.1.3 Integration in third-party controllers

PROFIBUS DP slaves and PROFINET IO devices can be integrated in the relevant networks as standard DP slaves or standard IO devices using a GSD file. This allows open communication right down to the operator control level. A GSD file (device master data file) contains all the information required for communication between the CPU and AS-i master. You can use the GSD file for the network integration of AS-i masters within a third-party system.

The device-specific GSD files contain data for the PROFIBUS DP master and slave or the PROFINET IO controller and device as well as general manufacturer specifications. These files are provided by the manufacturers of PROFIBUS DP slaves and PROFINET IO devices.

State-of-the-art configuration tools provide interfaces for the GSD data. The GSD file can also be used for predecessor versions of STEP 7 that do comply with the device requirements.

An example of integrating AS-Interface with a GSD file is described with STEP 7. The configuration procedure and the contents of the dialogs are much the same for third-party systems.

11.2 Data storage in the controller

11.2.1 Binary data

The controller accesses the binary inputs and outputs on the AS-i slaves cyclically via the AS-i master. The input and output data of the AS-i slaves is mapped in a contiguous data area in the controller.

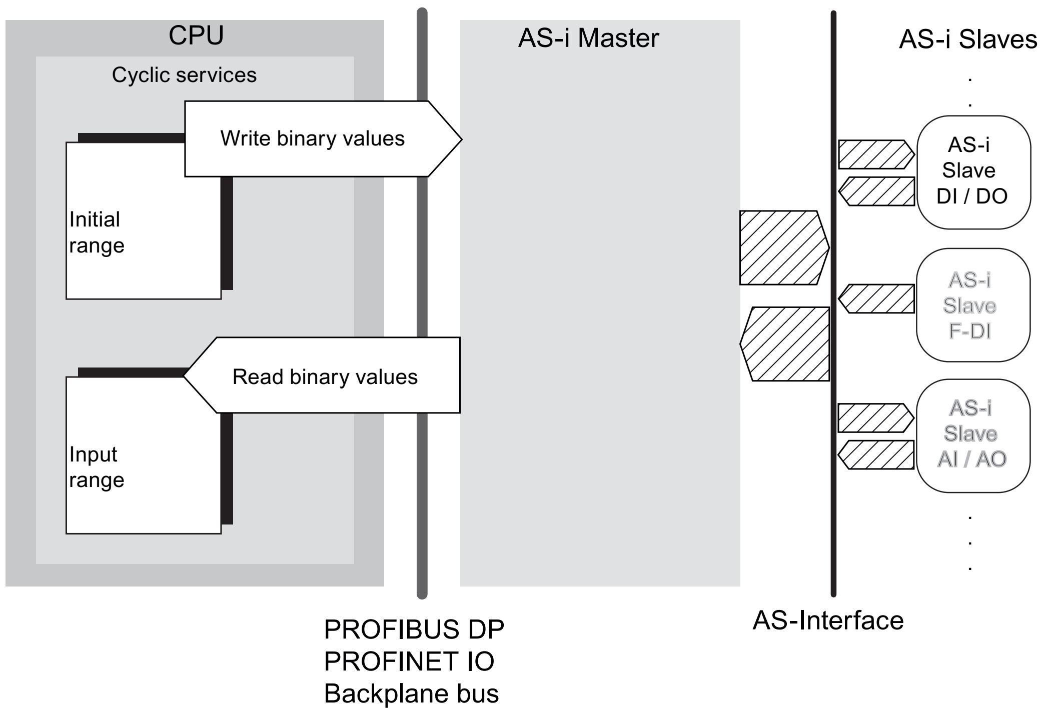


Figure 11-2 Communications principle for transferring binary data

The acyclic exchange of binary data via data blocks (DB 150) is also possible.

In the data area for binary data in the controller, the AS-i master occupies:

- Max. 32 input and 32 output bytes with up to 62 A/B slaves assigned
- Max. 16 input and 16 output bytes with up to 31 standard A/B slaves assigned (for CP 343-2 P)

The start addresses of the input/output data depend on how the CPU is configured. When configuration is carried out using STEP 7, digital output addresses must have the same start value as the input addresses (system dependent). The arrangement of the I/O bits with respect to the AS-i addresses also depends on the configuration. The following sort types are only possible for routers:

- CLASSIC
- LINEAR (with STEP 7 configuration only)
- Packed (with STEP 7 configuration only)

Assignment of the I/O data bits for an AS-i Slave

An example of how the AS-i connections for the AS-i slaves are assigned to the data bits of the input/output bytes is shown below for slave no. 1A.

AS-i addr.	Module	Order Number	I Address	Q Address
	DP/AS-i 1M		0...31	0...31
	DP/AS-i Link Adv.			
1A	AS-i K60, 4DI/4DO, A/B	3RK2 400-1DQ00-0AA3	0.0...0.3	0.0...0.3
B	AS-i K45, 2DI/2DO, A/B	3RK2 400-1BQ20-0AA3	16.0...16.1	16.0...16.1

Figure 11-3 Data area of the binary I/O data

In this example, the start addresses for the input and output data area are "0". With the CLASSIC sort type, bit 0 to bit 3 are assigned to this AS-i slave in byte 0.

Figure 11-4 Assignment of the AS-i connections to the data bits of the input/output bytes

CLASSIC sorting

CLASSIC sort type is the standard sort type for configuration with the GSD file. The order corresponds to the keystroke configuration on the AS-i master. The CLASSIC sort type is defaulted for configuration with STEP 7.
The table shows the memory assignment for 32 bytes. For a memory assignment of 16 bytes, the table ends at m + 15.

Byte 1)	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
m + 0	Status nibble / Reserved 2)				Slave 1 / 1A			
m + 1	Slave 2 / 2A				Slave 3 / 3A			
m + 2	Slave 4 / 4A				Slave 5 / 5A			
m + 3	Slave 6 / 6A				Slave 7 / 7A			
m + 4	Slave 8 / 8A				Slave 9 / 9A			
m + 5	Slave 10 / 10A				Slave 11 / 11A			
m + 6	Slave 12 / 12A				Slave 13 / 13A			
m + 7	Slave 14 / 14A				Slave 15 / 15A			
m + 8	Slave 16 / 16A				Slave 17 / 17A			
m + 9	Slave 18 / 18A				Slave 19 / 19A			

Byte[1)]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
m + 10	Slave 20 / 20A				Slave 21 / 21A			
m + 11	Slave 22 / 22A				Slave 23 / 23A			
m + 12	Slave 24 / 24A				Slave 25 / 25A			
m + 13	Slave 26 / 26A				Slave 27 / 27A			
m + 14	Slave 28 / 28A				Slave 29 / 29A			
m + 15	Slave 30 / 30A				Slave 31 / 31A			
m + 16	Reserved				Slave 1B			
m + 17	Slave 2B				Slave 3B			
m + 18	Slave 4B				Slave 5B			
m + 19	Slave 6B				Slave 7B			
m + 20	Slave 8B				Slave 9B			
m + 21	Slave 10B				Slave 11B			
m + 22	Slave 12B				Slave 13B			
m + 23	Slave 14B				Slave 15B			
m + 24	Slave 16B				Slave 17B			
m + 25	Slave 18B				Slave 19B			
m + 26	Slave 20B				Slave 21B			
m + 27	Slave 22B				Slave 23B			
m + 28	Slave 24B				Slave 25B			
m + 29	Slave 26B				Slave 27B			
m + 30	Slave 28B				Slave 29B			
m + 31	Slave 30B				Slave 31B			

Key:
1) m = start address of the input/output data
2) Bits 4 to 7 in the first byte of the **input data** are known as status nibbles. They are reserved for the command interface of the AS-i master. Bits 4 to 7 in the first byte of the **output data** are irrelevant and are also reserved.

AS-i addr.	Module	Order Number	I Address	Q Address
	DP/AS-i 1M		*0...31*	*0...31*
	DP/AS-i Link Adv.			
1A	AS-i K60, 4DI/4DO, A/B	3RK2 400-1DQ00-0AA3	0.0...0.3	0.0...0.3
B	AS-i K45, 2DI/2DO, A/B	3RK2 400-1BQ20-0AA3	16.0...16.1	16.0...16.1
2A	AS-i K45, 2DI/2DO, A/B	3RK2 400-1BQ20-0AA3	1.4...1.5	1.4...1.5
B	AS-i K60, 4DI/4DO, A/B	3RK2 400-1DQ00-0AA3	17.4...17.7	17.4...17.7
3A	AS-i K60, 4DI	3RK1 200-0CQ00-0AA3	1.0...1.3	
B				
4A	AS-i K60, 4DO	3RK1 100-1CQ00-0AA3		2.4...2.7
B				
5A	AS-i K60, 2DI/2DO	3RK1 400-1BQ00-0AA3	2.0...2.1	2.0...2.1
B				
6A	AS-i K45, 4DI	3RK1 200-0CQ20-0AA3	3.4...3.7	
B				

Figure 11-5 Example of the CLASSIC sorting

LINEAR sorting

LINEAR sorting can only be selected for configuration with STEP 7 and with the links. The data for standard / A slave and B slave with the same AS-i address are combined in one byte, whereby the standard / A slave is assigned the low nibble and the B slave the high nibble.

Byte[1)]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
m + 0	Status nibble / Reserved [2)]				Reserved			
m + 1	Slave 1B				Slave 1 / 1A			
m + 2	Slave 2B				Slave 2 / 2A			
m + 3	Slave 3B				Slave 3 / 3A			
m + 4	Slave 4B				Slave 4 / 4A			
m + 5	Slave 5B				Slave 5 / 5A			
m + 6	Slave 6B				Slave 6 / 6A			
m + 7	Slave 7B				Slave 7 / 7A			
m + 8	Slave 8B				Slave 8 / 8A			
m + 9	Slave 9B				Slave 9 / 9A			
m + 10	Slave 10B				Slave 10 / 10A			
m + 11	Slave 11B				Slave 11 / 11A			
m + 12	Slave 12B				Slave 12 / 12A			
m + 13	Slave 13B				Slave 13 / 13A			
m + 14	Slave 14B				Slave 14 / 14A			
m + 15	Slave 15B				Slave 15 / 15A			
m + 16	Slave 16B				Slave 16 / 16A			
m + 17	Slave 17B				Slave 17 / 17A			
m + 18	Slave 18B				Slave 18 / 18A			
m + 19	Slave 19B				Slave 19 / 19A			
m + 20	Slave 20B				Slave 20 / 20A			
m + 21	Slave 21B				Slave 21 / 21A			
m + 22	Slave 22B				Slave 22 / 22A			
m + 23	Slave 23B				Slave 23 / 23A			
m + 24	Slave 24B				Slave 24 / 24A			
m + 25	Slave 25B				Slave 25 / 25A			
m + 26	Slave 26B				Slave 26 / 26A			
m + 27	Slave 27B				Slave 27 / 27A			
m + 28	Slave 28B				Slave 28 / 28A			
m + 29	Slave 29B				Slave 29 / 29A			
m + 30	Slave 30B				Slave 30 / 30A			
m + 31	Slave 31B				Slave 31 / 31A			

Key:
1) m = start address of the input/output data
2) Bits 4 to 7 in the first byte of the input data are known as status nibbles. They are reserved for the command interface of the AS-i master. Bits 4 to 7 in the first byte of the output data are irrelevant and are also reserved.

AS-i addr.	Module	Order Number	I Address	Q Address
	DP/AS-i 1M		0...31	0...31
	DP/AS-i Link Adv.			
1A	AS-i K60, 4DI/4DO, A/B	3RK2 400-1DQ00-0AA3	1.0...1.3	1.0...1.3
B	AS-i K45, 2DI/2DO, A/B	3RK2 400-1BQ20-0AA3	1.4...1.5	1.4...1.5
2A	AS-i K45, 2DI/2DO, A/B	3RK2 400-1BQ20-0AA3	2.0...2.1	2.0...2.1
B	AS-i K60, 4DI/4DO, A/B	3RK2 400-1DQ00-0AA3	2.4...2.7	2.4...2.7
3A	AS-i K60, 4DI	3RK1 200-0CQ00-0AA3	3.0...3.3	
B				
4A	AS-i K60, 4DO	3RK1 100-1CQ00-0AA3		4.0...4.3
B				
5A	AS-i K60, 2DI/2DO	3RK1 400-1BQ00-0AA3	5.0...5.1	5.0...5.1
B				
6A	AS-i K45, 4DI	3RK1 200-0CQ20-0AA3	6.0...6.3	
B				

Figure 11-6 Example of LINEAR sorting

Packed sorting

The "pack" command, which is available during configuration with STEP 7, allows you to save address space. The I/O addresses of the AS-i slaves are arranged consecutively in accordance with the corresponding memory requirements.

AS-i addr.	Module	Order Number	I Address	Q Address
	DP/AS-i 1M		0...3	0...2
	DP/AS-i Link Adv.			
1A	AS-i K60, 4DI/4DO, A/B	3RK2 400-1DQ00-0AA3	0.0...0.3	1.0...1.3
B	AS-i K45, 2DI/2DO, A/B	3RK2 400-1BQ20-0AA3	3.0...3.1	2.2...2.3
2A	AS-i K45, 2DI/2DO, A/B	3RK2 400-1BQ20-0AA3	2.4...2.5	1.6...1.7
B	AS-i K60, 4DI/4DO, A/B	3RK2 400-1DQ00-0AA3	2.0...2.3	1.3...1.6
3A	AS-i K60, 4DI	3RK1 200-0CQ00-0AA3	1.0...1.3	
B				
4A	AS-i K60, 4DO	3RK1 100-1CQ00-0AA3		0.0...0.3
B				
5A	AS-i K60, 2DI/2DO	3RK1 400-1BQ00-0AA3	2.6...2.7	2.0...2.1
B				
6A	AS-i K45, 4DI	3RK1 200-0CQ20-0AA3	1.4...1.7	
B				

Figure 11-7 Example of "packed" sorting

11.2.2 Safe binary data

Only DP/AS-i F-Link evaluates the input data of the ASIsafe slaves and transfers the switching status (safety oriented) cyclically to the PROFIBUS DP master via PROFIsafe telegrams. The safety program of the F-CPU assigns the safe data to the safe address range. You can access the F I/Os in the same way as the standard I/Os via the process image (PII). You cannot access the I/Os directly, however. The channels of an F I/O must only be accessed from an F run-time group. Non-safe data from the ASIsafe slaves occupy the same address space as binary AS-i slaves.

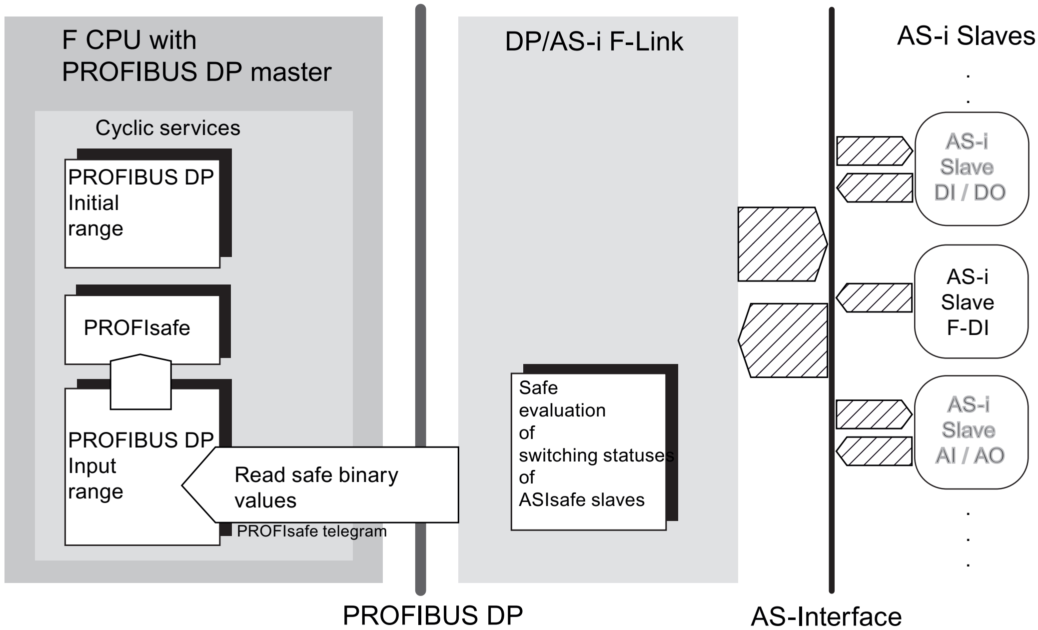


Figure 11-8 Communications principle for transferring safe data

The PROFIsafe message frame occupies the following lengths in the PROFIBUS DP address space:

- PIO 4 bytes (only PROFIsafe administration information)
- PII 12 bytes (of which the first four 4 bytes are user data). The PII also contains safe binary input data of the ASIsafe slaves (F-DI)

The start addresses of the safe input/output data depend on how the PROFIBUS DP master is configured. When configuration is carried out with STEP 7, F-O addresses must have the same start value as the F-I addresses (system dependent).

AS-i addr.	Module	Order number	I Address	Q Address	F I Address	F Q Address
	F-Link(PROFIsafe)				*0...11*	*0...3*
	DP/AS-i		*12...43*	*12...43*		
	DP/AS-i F-Link					
1A	ASIsafe K45F, 2F-DI	3RK1 205-0BQ00-0AA3	12.0...12.3		0.1	
B						
2A	AS-i SM-L, 2DI/1DO, 3RA5 DS	3RA5 120-xxxxx-0BB4	13.4...13.5	13.4...13.5		
B						
3A	ASIsafe K45F, 2F-DI/2DO	3RK1 405-1BQ20-0AA3	13.0...13.3	13.0...13.3	0.3	
B						
4A	AS-i K60, 4DO	3RK1 100-1CQ00-0AA3		14.4...14.7		
B						
5A	ASIsafe K20F, 2F-DI	3RK1 205-0BQ30-0AA3	14.0...14.3		0.5	
B						

Figure 11-9 Assignment of the safe binary data

Arrangement of the safe binary data in an F-CPU

The following table shows how the AS-i addresses are assigned to the safe input bits.

Byte[1)]	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Meaning							
m+0	F-DI Slave 7	F-DI Slave 6	F-DI Slave 5	F-DI Slave 4	F-DI Slave 3	F-DI Slave 2	F-DI Slave 1	Reserved
m+1	F-DI Slave 15	F-DI Slave 14	F-DI Slave 13	F-DI Slave 12	F-DI Slave 11	F-DI Slave 10	F-DI Slave 9	F-DI Slave 8
m+2	F-DI Slave 23	F-DI Slave 22	F-DI Slave 21	F-DI Slave 20	F-DI Slave 19	F-DI Slave 18	F-DI Slave 17	F-DI Slave 16
m+3	F-DI Slave 31	F-DI Slave 30	F-DI Slave 29	F-DI Slave 28	F-DI Slave 27	F-DI Slave 26	F-DI Slave 25	F-DI Slave 24
m+4	Reserved							
m+5	Reserved							
m+6	Reserved							
m+7	Reserved							
m+8	PROFIsafe administrative information							
m+9								
m+10								
m+11								
1) m = start address of the safe input data in the F-CPU								

Representation of the ASIsafe slaves in the non-safe process image

Cyclic interrogation of the ASIsafe slaves writes status information to the PII. The assignment of the AS-i addresses to the address bytes corresponds to the configured sort type for the binary data.
The meaning of the data bits of an ASIsafe slave are shown in the following table:

PII bit	Description	Value	Meaning
D.0	F-IN 1	0	Contact 1 (pin 1 - pin 2) open
		1	Contact 1 (pin 1 - pin 2) closed
D.1	Status ASIsafe slave	0	ASIsafe slave not activated
		1	ASIsafe slave activated
D.2	F-IN 2	0	Contact 2 (pin 3 - pin 4) open
		1	Contact 2 (pin 3 - pin 4) closed
D.3	I/O error bit	0	No I/O error
		1	I/O error pending

11.2.3 Analog data

AS-i analog data can be transferred by means of two access types:

- Cyclic data exchange:
  This data access type is available as an option with the STEP 7 configuration only.
  The controller accesses the data of analog AS-i slaves directly in the cyclic process image. The input or output data of analog AS-i slaves is mapped in a contiguous data area in the controller.
  The priority given to cyclic data exchange ensures that the process image is constantly refreshed.
- Acyclic data exchange:
  Acyclic access to analog data via data blocks is supported with GSD and STEP 7 configuration. For this purpose, authorize write and read access to the analog data blocks in your user program (e.g. SFC 58 / SFC 59). The transmitted analog value is always consistent with regard to an AS-i slave. The data is transferred to the channels sequentially.
  You can save space in the address space in the CPU if you configure analog data exchange using data blocks.

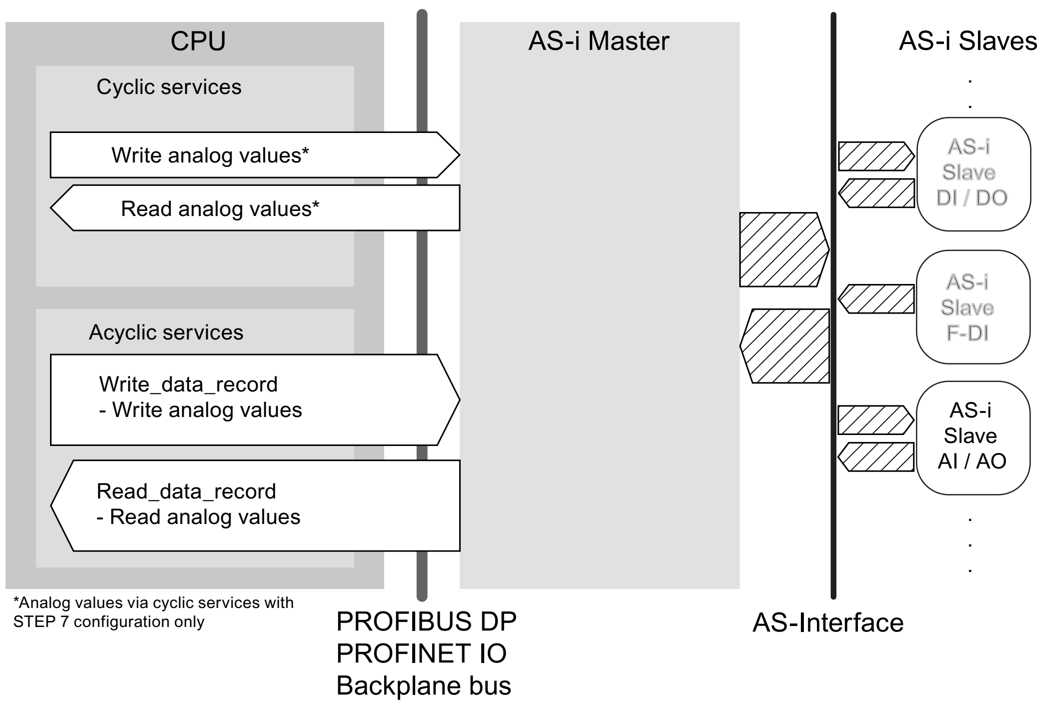


Figure 11-10 Communications principle for transferring analog data

If read access is also assigned, the cyclic process image has priority over the data blocks. Write access to analog data of an AS-i slave via cyclic and acyclic services is not permitted at the same time.

NOTICE
Restriction for AS-i slaves to profile 7.1 and 7.2
The following descriptions only apply to AS-i slaves that handle analog value transfer in accordance with the AS-i slave profile 7.3, 7.4, 7.5.5, 7.A.5, B.A.5, 7.A.A, 7.A.8, 7.A.9, and 6.0 (Combined Transaction Types CTT 1 to 5 in accordance with AS-i Specification V3.0). AS-i masters do not support analog value transfer in accordance with the AS-i slave profile 7.1 / 7.2. In this case, analog data can be transferred via a user program.

Analog addresses

With STEP 7 configuration, up to 31 AS-i addresses can be assigned to analog slaves. AS-i masters to Specification 3.0 also support up to 62 analog A / B slaves in the extended address space. Up to 8 bytes of data are available for each address. You can configure a maximum of four analog channels for each AS-i address, which all originate from an analog AS-i slave. A total of 240 bytes are available for the process data.
For the start area, see the analog data in the configuration.

AS-i addr.	Module	Order Number ...	I Address	Q Address
	DP/AS-i 1M		*0...3*	*0...2*
	DP/AS-i Link Adv.			
1A	AS-i K60, 2AI-V	3RK1 207-2BQ40-0AA3	256...259	
B				
2A	AS-i K45, 2DI/2DO	3RK1 400-1BQ20-0AA3	1.4...1.5	1.4...1.5
B				
3A	AS-i K60, 2AI-C, A/B	3RK2 207-1BQ50-0AA3	260...263	
B	AS-i K60, 2AI-C, A/B	3RK2 207-1BQ50-0AA3	264...267	
4A	AS-i K60, 2AO-C	3RK1 107-1BQ40-0AA3		256...259
B				
5A	AS-i K60, 4AI-RTD	3RK1 207-3BQ44-0AA3	276...283	
B				

Figure 11-11 Assignment of the analog data

For example, the AS-i slave with address 1A occupies bytes 256 to 259 in the analog input data area in the controller.

Arrangement of the analog data in the cyclic process image

Byte no. (start address + offset)	Analog value channel
m + 0	Channel 1 / high byte
m + 1	Channel 1 / low byte
m + 2	Channel 2 / high byte
m + 3	Channel 2 / low byte
m + 4	Channel 3 / high byte
m + 5	Channel 3 / low byte
m + 6	Channel 4 / high byte
m + 7	Channel 4 / low byte

Analog A / B slaves only occupy "half an address", which is why they only have a maximum of 2 channels. A slaves occupy bytes 0 to 3 and B slaves bytes 4 to 7.

Note

Representation of the analog values or the transparent values

- The analog values are arranged as 16-bit values in the two's complement.
- The transparent values must be interpreted as two independent bytes.

With SIMATIC S7 as the CPU, AS-i analog values are accessed with word commands.

Example:
If you have configured an AS-i slave "2AI" with input address 256, you can use the STEP 7 command "L PEW 258" to access the second analog channel of the slave.

Data blocks for analog value transfer

Authorize the commands read_data_block and write_data_block as described in the AS-i master manuals. The data blocks can be used for the analog input and analog output area.

- DP/AS-i LINK Advanced and DP/AS-Interface LINK 20E:
  To access analog values, choose one of the data blocks from 140 to 147.
  The data blocks have different lengths. Each data block is assigned a contiguous address space of AS-i slaves. If you operate fewer analog AS-i slaves than the AS-i master supports, optimize the reserved data area in your application program by making the appropriate selection. For each AS-i address, the data blocks contain one block of 8 bytes of data. The arrangement of the analog data within this data block corresponds to that in the cyclic process image.
- DP/AS-i F-Link:
  The following data blocks are also available:
  - DB 151: Analog image of the output data for AS-i slaves 1 ... 29
  - DB 152: Analog image of the input data for AS-i slaves 1 ... 29
  - DB 153: Analog image of the output data for AS-i slaves 3 ... 31
  - DB 154: Analog image of the input data for AS-i slaves 3 ... 31

- CP 343-2 and CP 343-2P:
  The same assignment applies here as for DP/AS-i LINK Advanced. Data blocks 140 to 143, however, are restricted to 16 AS-i addresses.
- IE/AS-i LINK PN IO
  Choose data block 2 (command interface) for calling up the following AS-i commands:
  - Read AS-i line analog input data (Read_AIDI, Index 0019_H)
  - Write AS-i line analog output data (Write_AODI, Index $001A_H$)
  - Read AS-i slave analog input data (Read_Analog_Input_Data, Index 0053_H)
  - Write AS-i slave analog output data (Write_Analog_Output_Data, Index 0052_H)

11.3 CP 343-2 integration with STEP 7

11.3.1 Prerequisites

Before you use the CP 343-2, the following additional devices and bus systems must be assembled, wired, and set up in accordance with the respective documentation:

- SIMATIC S7-300 CPU or ET 200M
- AS-i cable with AS-i power supply and AS-i slaves
- PC / PG equipped with the following:
  - STEP 7, as of version 5.2
  - PC / PG connected to CPU

11.3.2 Integration procedure

The table below describes a potential procedure for integrating AS-Interface in your system via the AS-i master.

Step	Procedure
1	Configuring the AS-i master in the rack of the CPU module (Page 466)
2	Parameterizing AS-Interface (Page 467)
3	Completing configuration (Page 468)
4	Switching on the AS-i power supply (Page 468)
5	Addressing AS-i slaves (Page 469)
6	Saving the configuration (Page 469)
7	Copying starting data blocks (Page 470)

11.3.3 Configuring the AS-i master in the rack of the CPU module

Configure the CP 343-2 as a module in the rack of the S7 300-CPU in HW Config.

Step	Action
1	Open your STEP 7 project with a SIMATIC S7-CPU (e.g. CPU 315).
2	Open HW Config for the SIMATIC S7-CPU.
3	Select the CP 343-2 in the "Hardware Catalog" window. Path: SIMATIC 300 > CP-300 > AS-Interface > CP 343-2 AS-i
4	Drag & drop the selected CP 343-2 to a free slot on the S7-300 station rack.

Result

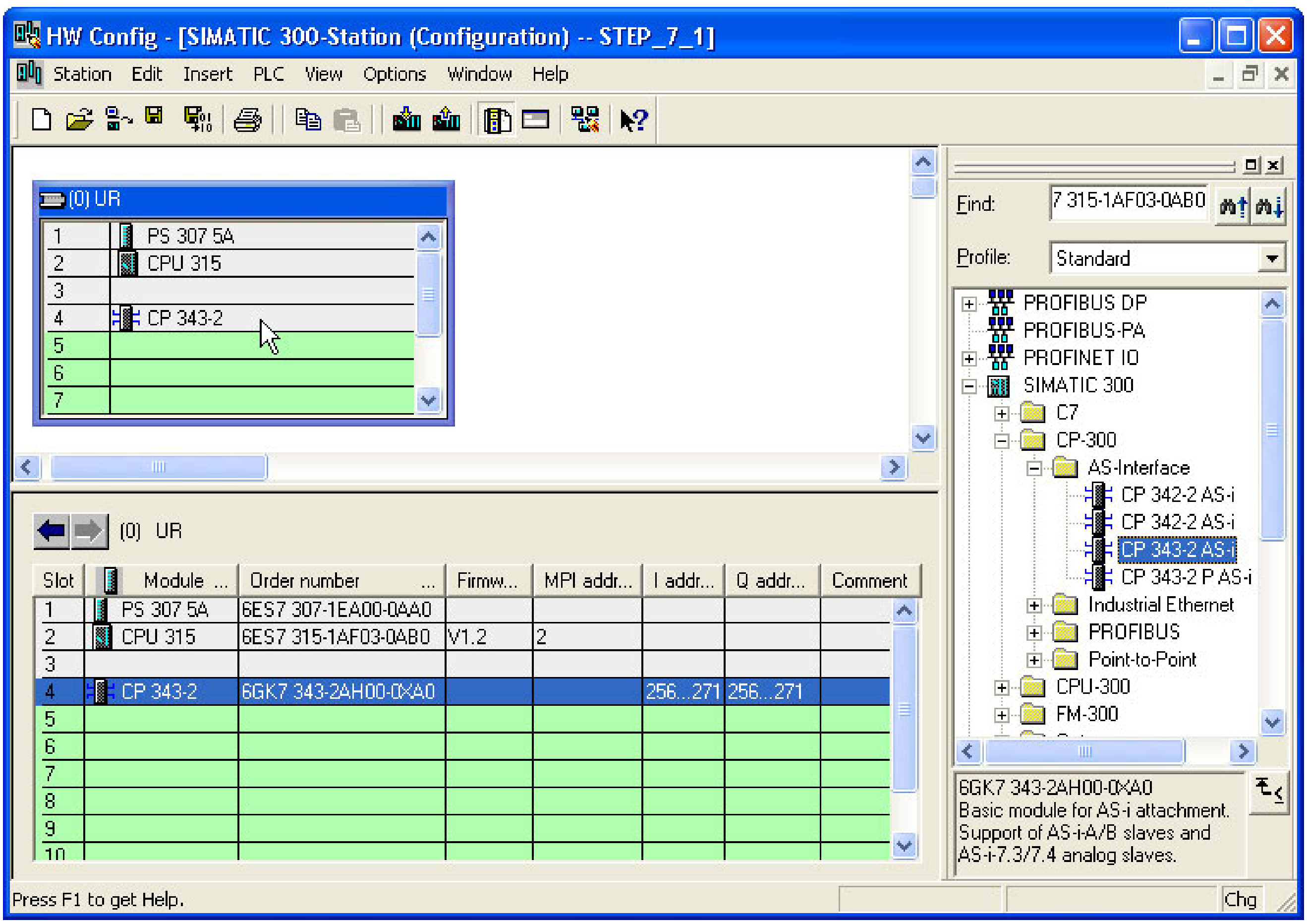
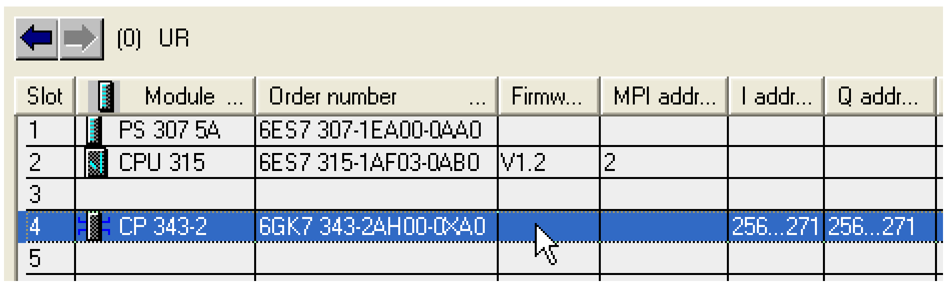


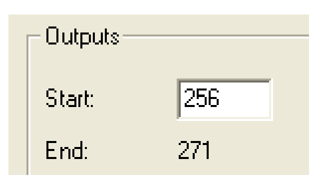
Figure 11-12 Configuration of the CP 343-2

The CP 343-2 occupies a free slot on the S7-300 station rack. A detailed view of the CP 343-2 is displayed in the lower part of the station window. The assigned address spaces depend on the slot configuration.

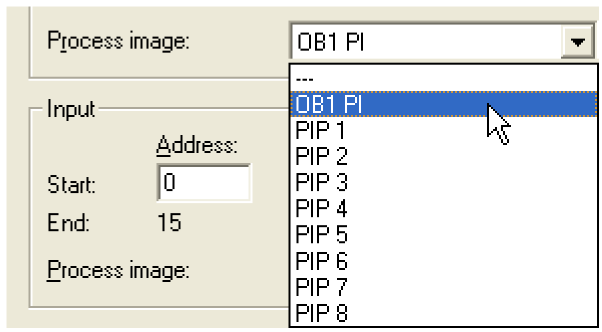
11.3.4 Parameterizing AS-Interface

Parameterize the properties and behavior of the CP 343-2 as an AS-i master in the "Properties - CP 343-2 -..." dialog.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Double-click the slot for the CP 343-2.


A window is displayed containing the "Properties - CP 343-2 -..." dialog, which contains the "General" and "Addresses" tabs.</td></tr>
<tr><td>2</td><td colspan="2">If required, enter the name and a comment for the AS-i line on the "General" tab.</td></tr>
<tr><td rowspan="3">3</td><td colspan="2">To configure the binary I/O address spaces for the AS-i slaves, choose the "Addresses" tab.
In the analog address space of the S7-300 CPU, the CP 343-2 occupies 16 bytes for binary data. This memory is available to standard and A slaves. To enable bit-serial access, you first have to transfer the input data to certain words (data, flags). Data can be accessed by means of load and transfer commands. Depending on the system, even byte addresses can only be accessed with word or double-word commands.
E.g.:
<code>L PEW 256   // load I/O input word</code>
<code>T PAD 258   // transfer I/O output double word</code>
Move the output data from the words (data, flags) to the analog address space.
You can access binary I/O data of B slaves via data block 150.</td></tr>
<tr><td>3.1</td><td>Set the I/O address for the binary input data or accept the value displayed. If you enter an invalid address, the system proposes a new one.


Input addresses relate to a max. 16-byte memory area in which the input values of the AS-i slaves are stored (standard and A slaves).
For the digital output addresses, the same starting value as for the input addresses applies depending on the system.</td></tr>
<tr><td>3.2</td><td>If the "Process image" drop-down list contains the entry "- - -", this means that no process image is available for the specified address space.
If you plan to access data in the area of the process images and the CPU allows the address space to be shifted, choose a lower input address.
The process image can be used to access I/O data with individual bit commands.</td></tr>
</table>

Step	Action	
	3.3	If the "Process image" drop-down list contains selection data, this means that the PROFIBUS DP master is a CPU that manages partial process images (e.g. CPU 416). Choose a partial process image number (TPA no.) or the OB1 process image for cyclic updates. 

11.3.5 Completing configuration

To complete the project and download it to the CPU, carry out the following steps.

Step	Action
1	Save and compile the configuration in the current project.
2	Download the hardware configuration to the module.

11.3.6 Switching on the AS-i power supply

Switch on the AS-i power supply unit for supplying AS-Interface.

Step	Action
1	Switch on the voltage for the 30 V AS-i power supply unit.

11.3.7 Addressing AS-i slaves

Address the AS-i slaves in accordance with the configuration.

Step	Action
1	If the addresses of the AS-i slaves do not match the configuration, the CER and SF LEDs light up. Address the AS-i slaves in one of the following ways: • With an addressing unit • With a STEP 7 user program using the "Change_AS-i_slave_address" command in the command interface

11.3.8 Saving the configuration

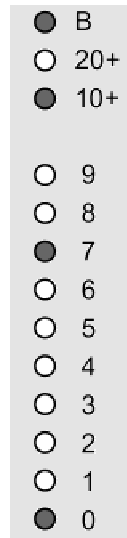
In "configuration" mode, the CP 343-2 exchanges data with all the connected AS-i slaves. The CP 343-2 instantly recognizes new AS-i slaves, activates them, and includes them in cyclic data exchange (except AS-i slaves with the address "0" or if an AS-i address has been assigned more than once). The CP 343-2 saves the following AS-i slave data to a non-volatile memory:

- Addresses
- ID codes
- I/O configuration

Note

Button configuration on the device when the CPU is in "STOP" mode only

Before saving the AS-i configuration, you must ensure that no communication is taking place with the CPU. If necessary, switch the CPU to "STOP" mode.

Step	Action
1	If the CM LED does not light up, switch to configuration mode with the SET button.
2	Check whether all the connected AS-i slaves are displayed.  The three LEDs at the top encode B slaves and the "tens" digits in the AS-i addresses. The group display is switched on a time-controlled basis. The lower LEDs encode the "ones" digit in the AS-i address. In the graphic above, for example, the AS-i addresses 10B and 17B are recognized within the "tens" group.
3	Save the configuration by pressing the SET button. The CP 343-2 saves the recognized actual configuration as a target configuration in the internal EEPROM.

11.3.9 Copying starting data blocks

Copy the starting data blocks from the STEP 7 configuration to the CP 343-2P.

Step	Action
1	Switch on the CPU. The CP 343-2P receives its starting data blocks from the CPU and switches to "protected" mode.

11.4 CP 343-2P integration with STEP 7

11.4.1 Prerequisites

Before you use the CP 343-2P, the following additional devices and bus systems must be assembled, wired, and set up in accordance with their application documentation:

- SIMATIC S7-300 CPU or ET 200M
- AS-i cable with AS-i power supply and AS-i slaves
- PC / PG with the following equipment:
  - STEP 7, as of version 5.2
  - PC / PG connected to CPU

11.4.2 Integration procedure

The table below describes a potential procedure for integrating AS-Interface in your system via the AS-i master.

Step	Procedure
1	Configuring the AS-i master in the rack of the CPU module (Page 471)
2	Parameterizing AS-Interface (Page 473)
3	Configuring AS-i slaves (Page 475)
4	Specifying AS-i slaves (Page 476)
5	Completing configuration (Page 479)
6	Switching on the AS-i power supply (Page 479)
7	Addressing AS-i slaves (Page 479)
8	Copying starting data blocks (Page 479)

11.4.3 Configuring the AS-i master in the rack of the CPU module

Configure CP 343-2P as a module in the rack of the S7 300-CPU in HW Config.

Step	Action
1	Open your STEP 7 project with a SIMATIC S7-CPU (e.g. CPU 315).
2	Open HW Config for the SIMATIC S7-CPU.
3	Select the CP 343-2P in the "Hardware Catalog" window. Path: SIMATIC 300 > CP-300 > AS-Interface > CP 343-2 P AS-i
4	Drag & drop the selected CP 343-2P to a free slot on the S7-300 station rack.

Result

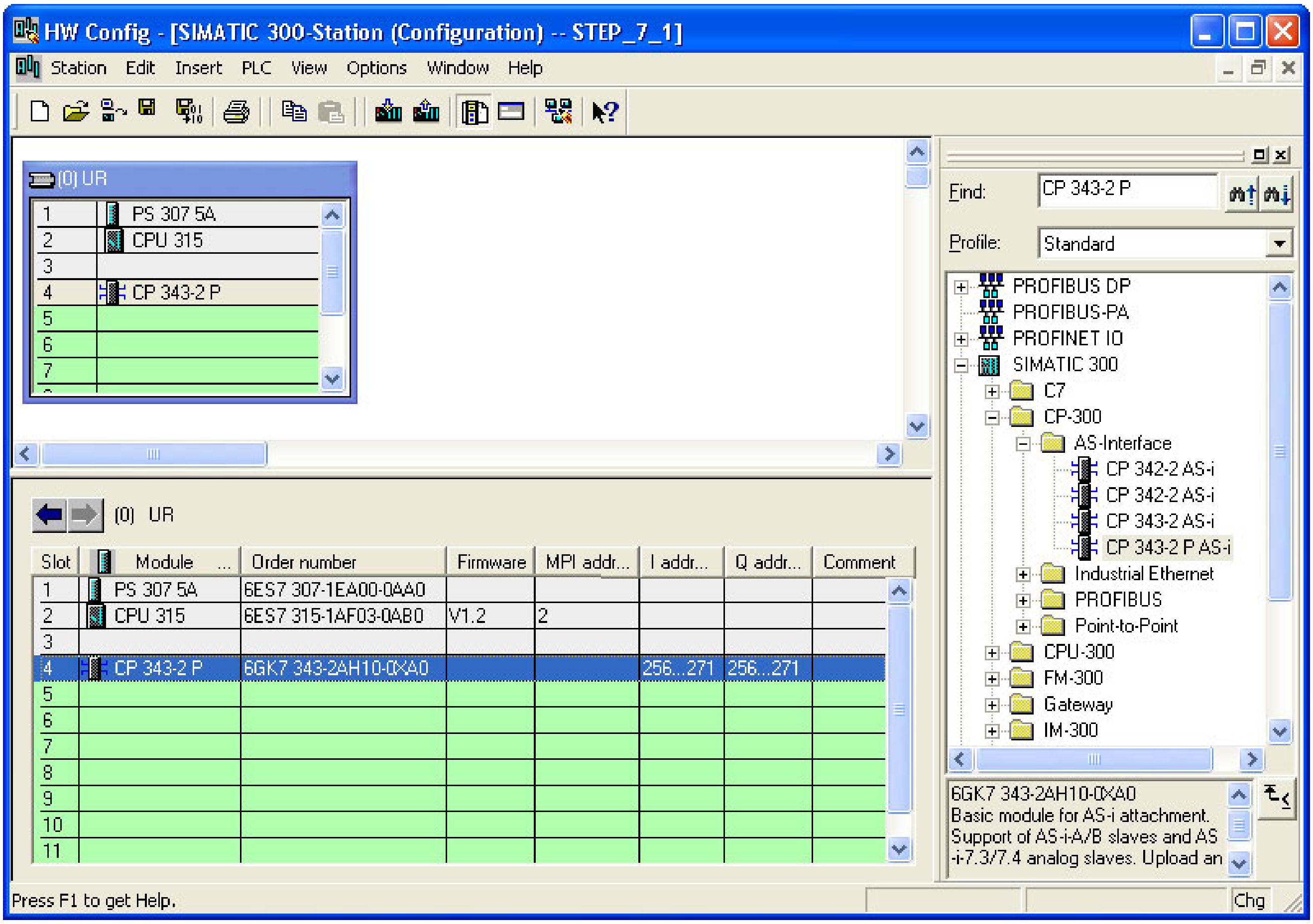
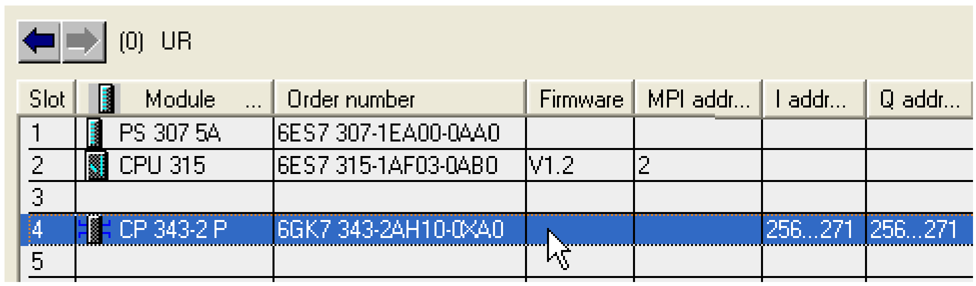


Figure 11-13 Configuration of the CP 343-2P

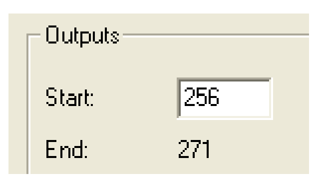
The CP 343-2P occupies a free slot on the S7-300 station rack. A detailed view of the CP 343-2P is displayed in the lower part of the station window. The predefined address spaces depend on the slot configuration.

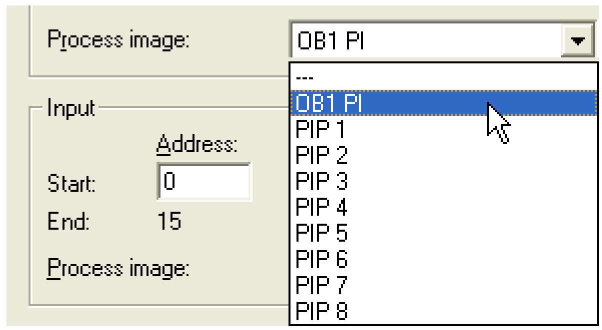
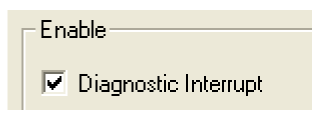
11.4.4 Parameterizing AS-Interface

Parameterize the properties and behavior of the CP 343-2P as an AS-i master in the "Properties - CP 343-2 P -..." dialog.

Step		Action
1		Double-click the slot for the CP 343-2P.  A window is displayed containing the "Properties - CP 343-2 P -..." dialog, which contains the "General", "Addresses", "Operating Parameters", "Slave Configuration", and "AS-i Slave options" tabs.
2		If required, enter the name and a comment for the AS-i line on the "General" tab.

3		To configure the binary I/O address spaces for the AS-i slaves, choose the "Addresses" tab.
		In the analog address space of the S7-300, the CP 343-2P occupies 16 bytes for binary data. This memory is available to standard and A slaves. To enable bit-serial access, you first have to transfer the input data to certain words (data, flags). Data can be accessed by means of load and transfer commands. Depending on the system, even byte addresses can only be accessed with word or double-word commands.
		E.g.:
		`L PEW 256    // load I/O input word`
		`T PAD 258    // transfer I/O output double word`
		Move the output data from the words (data, flags) to the analog address space.
		You can access binary I/O data of B slaves via data block 150.

	3.1	Set the I/O address for the binary input data or accept the displayed value. If you enter an invalid address, the system proposes a new one.  Input addresses relate to a max. 16 byte memory area in which the input values of the AS-i slaves are stored (standard and A slaves). For the digital output addresses, the same starting value as for the input addresses applies depending on the system.
	3.2	If the "Process image" drop-down list contains the entry "- - -", this means that no process image is available for the specified address space. If you plan to access data in the area of the process images and the CPU allows the address space to be shifted, choose a lower input address. The process image can be used to access I/O data with individual bit commands.

Step		Action
	3.3	If the "Process image" drop-down list contains selection data, this means that the PROFIBUS DP master is a CPU that manages partial process images (e.g. CPU 416). Choose a partial process image number (PPI no.) or the OB1 process image for cyclic updates. 
4		On the "Operating Parameters" tab, set the behavior of the CP 343-2P as an AS-i master.
	4.1	Activate the alarm enable for diagnostic interrupts (OB82).  Diagnostic interrupts are triggered if the following faults occur: • Group fault (SF) • Internal fault (= device fault) • External fault (e.g. AS-i slave failed) • At least one AS-i slave does not match the target specification. • Voltage on AS-i bus too low (AS-i Power Fail, APF) • Hardware fault (internal watchdog) • EEPROM defective
	4.2	Choose the option for automatic address programming.  When you choose the option "Automatic address programming" (default), an AS-i slave that has failed can be replaced by a new, identical slave with the address "0" (as-delivered state). The CP 343-2P automatically assigns the new slave the address of the old one. If this option is deactivated, you have to program the address into the new slave when the slave is replaced.

11.4.5 Configuring AS-i slaves

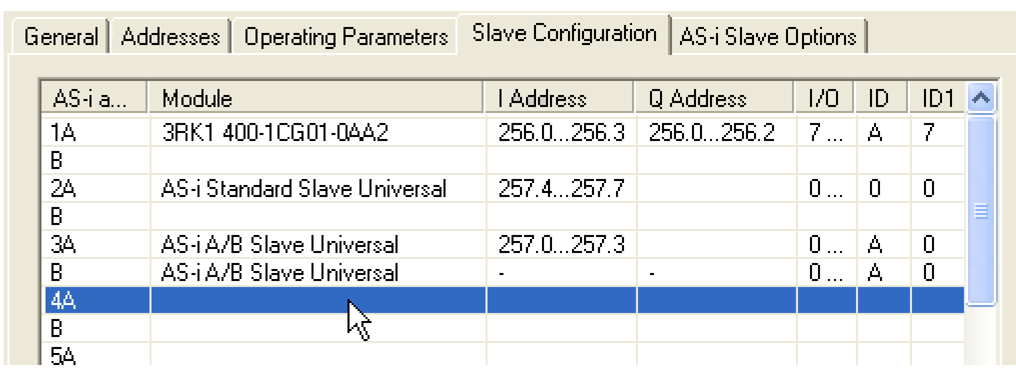
Configure the AS-i slaves within the address table.

Note

Reading the actual configuration to the AS-i address table

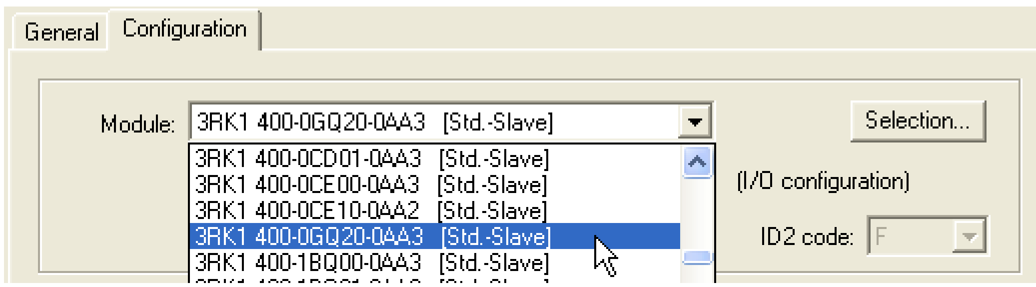
If an online connection has been established, you can read an existing AS-i configuration to the AS-i address table.

1. Skip the commissioning procedure until you reach Completing configuration (Page 479).
2. Follow the integration procedure until Copying starting data blocks (Page 479).
3. Copy the current configuration with the command "Upload to PG".
   "AS-i Slave Options" tab in the "Properties - CP 343-2 P - ..." dialog.
4. Parameterize the AS-i slaves subsequently in STEP 7.

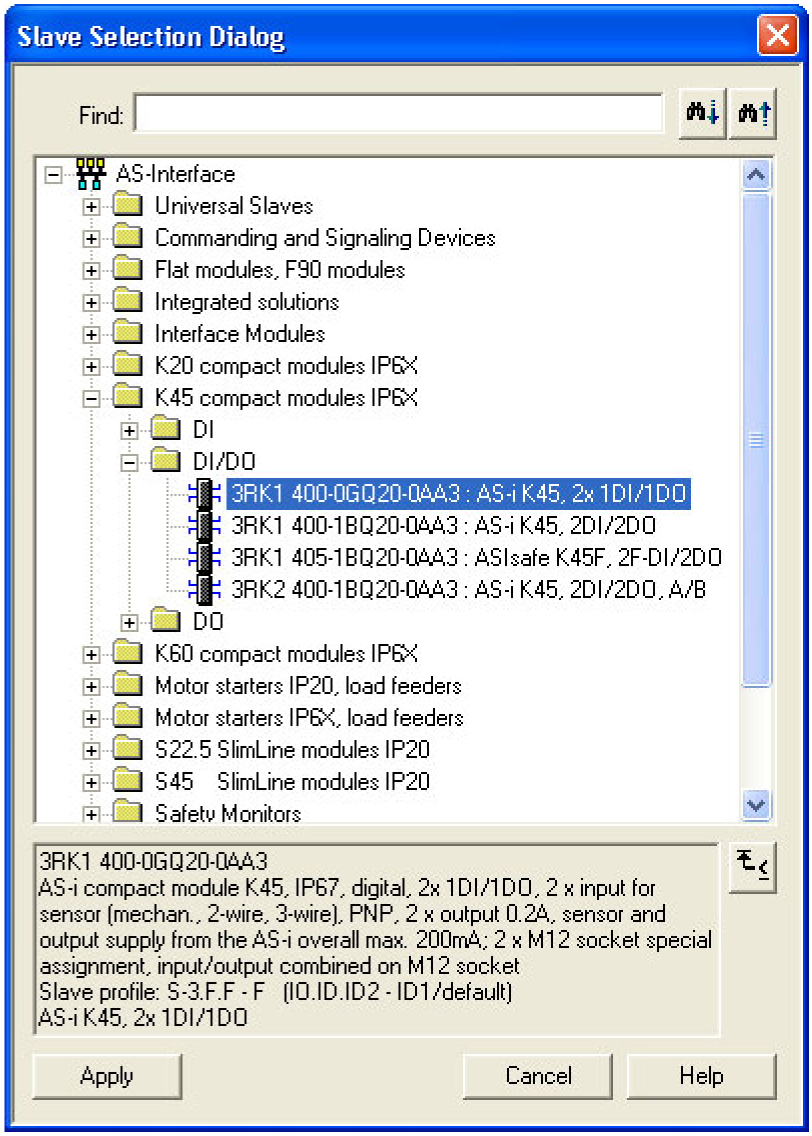
Step	Action
1	Choose the "Slave Configuration" tab.  The AS-i address table contains an overview of all the AS-i slaves that have already been configured on the CP 343-2P. Designations, configured I/O address spaces, and the codes of the AS-i slaves are displayed sorted according to AS-i addresses. One line for standard / A slaves and one line for B slaves are provided for each AS-i address.
2	You have the following options for assigning empty address lines: • Via the properties dialog for an AS-i slave: open the dialog by double-clicking an address line or by choosing "Edit" from the context menu. • Copy and insert via the clipboard.
3	Note that standard slaves and certain analog slaves use a full AS-i address (A and B address line).

11.4.6 Specifying AS-i slaves

Specify the AS-i slaves in the "Properties - CP 343-2 P - ..." dialog in the corresponding AS-i address line.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Double-click an address line in the AS-i address table.
A window is displayed with the "Properties - CP 343-2 -..." dialog, which contains the "General" and "Configuration" tabs.</td></tr>
<tr><td>2</td><td colspan="2">You can specify the AS-i slaves on the "Configuration" tab in one of the following ways:</td></tr>
<tr><td></td><td>A</td><td>In the "Module" drop-down list, select a Siemens module via its order number.


The IO, ID, and ID2 codes are permanently defined by means of the properties of the Siemens modules. On the other hand, the ID1 code can be variable on certain modules.</td></tr>
</table>

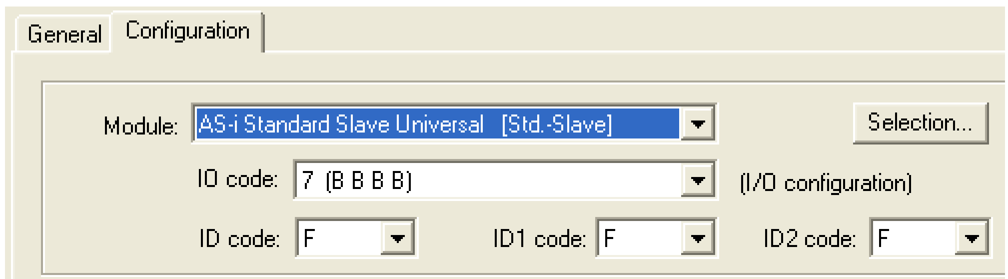
<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td></td><td>B</td><td>Choose a Siemens module from the AS-Interface catalog. To do so, click "Selection...".


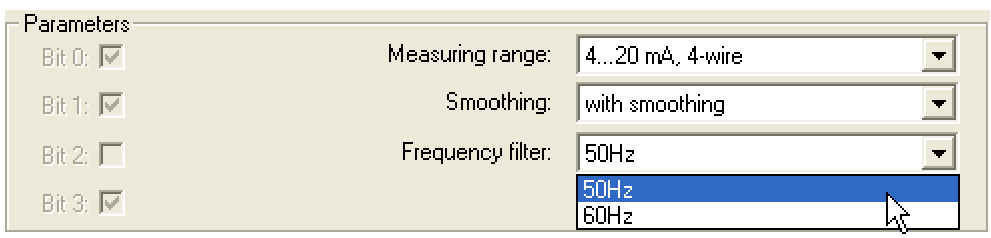
The following selection options are available for AS-i slaves:
• Navigation through the hierarchical folder structure according to module type
• Search function using a keyword from the infotext
Transfer the module you have selected to the configuration by double-clicking it or selecting it and clicking "Apply".
The IO code, ID code and ID2 code are permanently assigned by means of the properties of the Siemens modules. On the other hand, the ID1 code can be variable on certain modules.</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td></td><td>C</td><td>If you cannot select an AS-i slave via the order number or AS-Interface catalog, use a universal slave. The following modules are available:

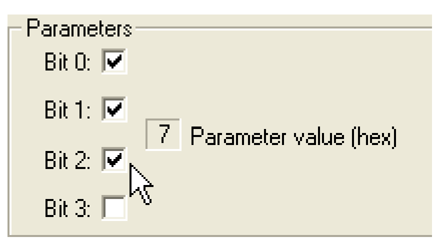
"AS-i Standard Slave Universal" for AS-i slaves that are assigned a full AS-i address
"AS-i A/B Slave Universal" for AS-i slaves in the extended address space

Set the IO and ID codes in accordance with the manufacturer guidelines. If the ID1 code and ID2 code are not specified, choose F_H.


</td></tr>
<tr><td>3</td><td colspan="2">Parameterize the AS-i slaves.</td></tr>
<tr><td></td><td>3.1</td><td>If the selected Siemens modules support special parameter settings, you can select them from a range of drop-down lists.



The bit checkboxes cannot be changed separately. Their assignment is predefined by the modules or is based on the entries in the adjacent fields.</td></tr>
<tr><td></td><td>3.2</td><td>Set the parameter bits for universal slaves in accordance with the manufacturer guidelines.



With an A/B module, the checkbox for parameter bit 3 is not displayed.</td></tr>
<tr><td>4</td><td colspan="2">If required, enter the name and a comment for an AS-i slave on the "General" tab. When you close the dialog, your entries appear in the AS-i address table.</td></tr>
</table>

11.4.7 Completing configuration

To complete the project and download it to the CPU, carry out the following steps.

Step	Action
1	Save and compile the configuration in the current project.
2	Download the hardware configuration to the module.

11.4.8 Switching on the AS-i power supply

Switch on the AS-i power supply unit for supplying AS-Interface.

Step	Action
1	Switch on the voltage for the 30 V AS-i power supply unit.

11.4.9 Addressing AS-i slaves

Address the AS-i slaves in accordance with the configuration.

Step	Action
1	If the addresses of the AS-i slaves do not match the configuration, the CER and SF LEDs light up. Address the AS-i slaves in one of the following ways: • With an addressing unit • With a STEP 7 user program using the "Change_AS-i_slave_address" command in the command interface

11.4.10 Copying starting data blocks

Copy the starting data blocks from the STEP 7 configuration to the CP 343-2P.

Step	Action
1	Switch on the CPU. The CP 343-2P receives its starting data blocks from the CPU and switches to "protected" mode.

11.5 DP/AS-Interface Link 20E - integration with STEP 7

11.5.1 Prerequisites

Before you use DP/AS-Interface Link 20E, the following additional devices and bus systems must be assembled, wired, and set up in accordance with their application documentation:

- SIMATIC S7-CPU with PROFIBUS DP master and PROFIBUS cable
- AS-i cable with AS-i power supply and AS-i slaves
- PC / PG with the following equipment:
  - STEP 7, as of version 5.0 with Service Pack 3
  - PC / PG connected to CPU

11.5.2 Integration procedure

The table below describes a potential procedure for integrating AS-Interface in your system via the AS-i master.

Step	Procedure
1	Configuring the PROFIBUS DP master system (Page 481)
2	Parameterizing DP/AS-Interface Link 20E as a PROFIBUS DP slave (Page 482)
3	Parameterizing AS-Interface (Page 483)
4	Configuring AS-i slaves (Page 485)
5	Specifying AS-i slaves (Page 487)
6	Completing configuration (Page 490)
7	Switching on the AS-i power supply (Page 490)
8	Setting the PROFIBUS address on DP/AS-Interface Link 20E (Page 491)
9	Addressing AS-i slaves (Page 492)
10	Copying starting data blocks (Page 492)

11.5.3 Configuring the PROFIBUS DP master system

Configure DP/AS-Interface Link 20E as a modular PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

Step	Action
1	Open your STEP 7 project with a SIMATIC S7-CPU with the PROFIBUS DP master (e.g. CPU 315-2 DP).
2	Open HW Config for the PROFIBUS DP master.
3	If the DP master system is not yet available on the CPU, you have to create it. To do so, insert the DP master system in slot X2 (DP) of the CPU (e.g. via the "Insert master system" context menu).
4	Select the DP/AS-Interface Link 20E in the "Hardware Catalog" window. Path: PROFIBUS-DP > DP/AS-i > DP/AS-i Link 20E > Product version 3 A DP/AS-Interface Link 20E in product version 1 or 2 is not equipped with the "Load to PG" function.
5	Drag & drop the selected DP/AS-Interface Link 20E to the DP master system. The "Properties - PROFIBUS interface..." dialog is displayed.
6	Choose the PROFIBUS address for DP/AS-Interface Link 20E and close the dialog.

Result

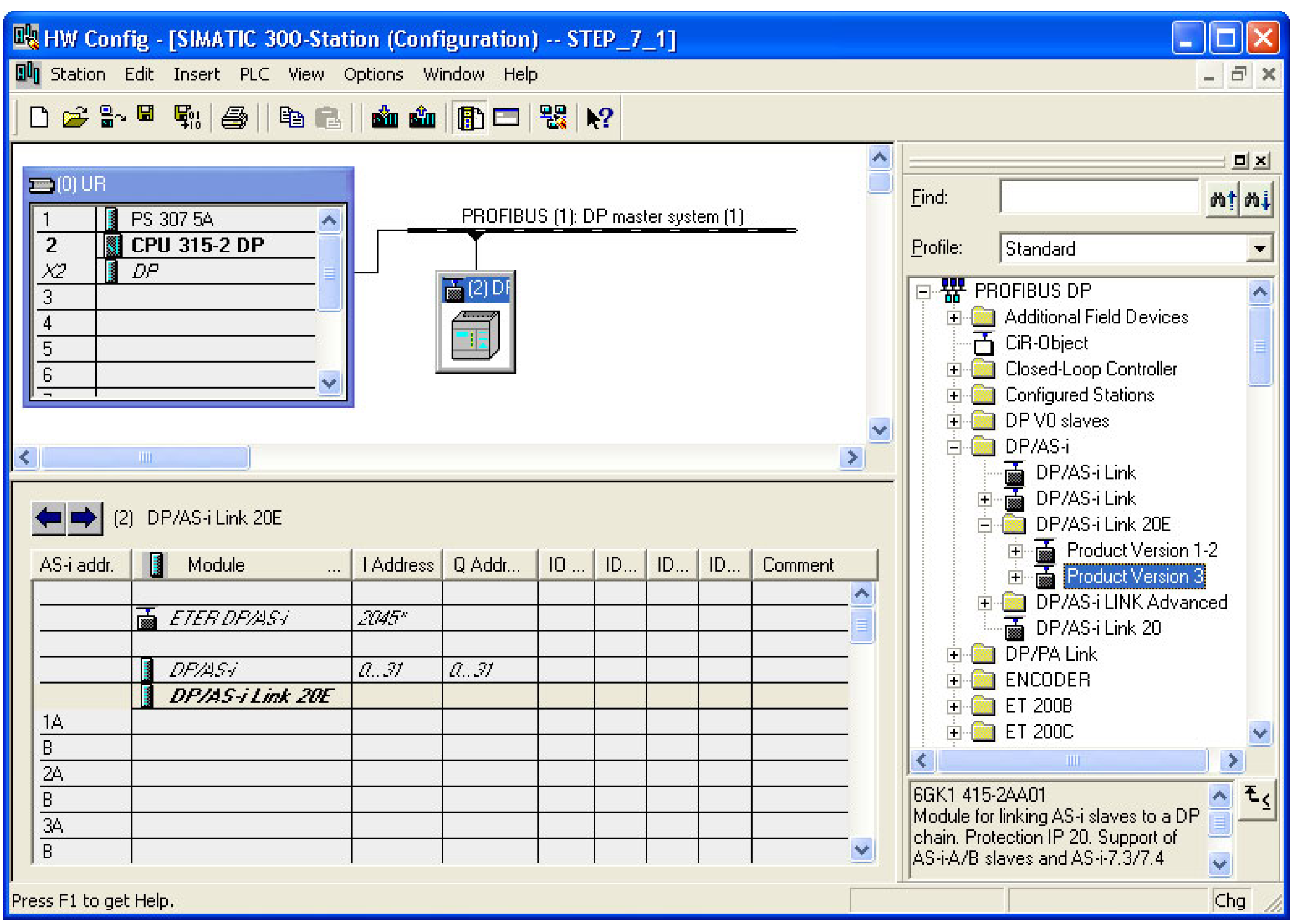
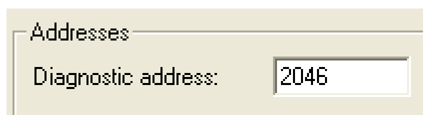


Figure 11-14 Configuration of DP/AS-Interface Link 20E on the DP master system

DP/AS-Interface Link 20E is attached to the DP master system as an icon. A detailed view of DP/AS-Interface Link 20E along with its possible slots and DP IDs is displayed in the lower part of the station window. This is followed by the lines for the AS-i address table, which has yet to be maintained.

11.5.4 Parameterizing DP/AS-Interface Link 20E as a PROFIBUS DP slave

Parameterize DP/AS-Interface Link 20E as a PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

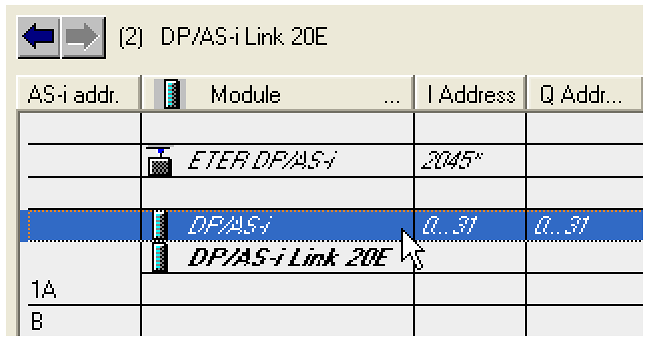
<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Double-click the icon for DP/AS-Interface Link 20E on the DP master system. A window is displayed with the "Properties - DP Slave" dialog, which contains the "General" tab.</td></tr>
<tr><td rowspan="3">2</td><td colspan="2">On the "General" tab, set the properties of DP/AS-Interface Link 20E as a node on the PROFIBUS DP.</td></tr>
<tr><td>2.1</td><td>Enter the diagnostics address or use the displayed value.
If you enter an invalid address, the system proposes a new one.


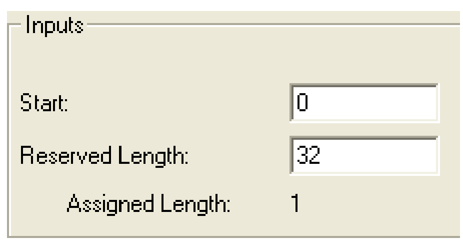
The PROFIBUS DP master uses the diagnostics address to find out about a failure or return of a PROFIBUS DP slave and starts the OB 86. You can also call up the full diagnosis of the slave under this address with SFC 13 DPNRM_DG and include it in your user program.</td></tr>
<tr><td>2.2</td><td>Activate the watchdog so that DP/AS-Interface Link 20E can respond to errors in the PROFIBUS DP master or if bus data traffic is interrupted.


If the PROFIBUS DP master does not address DP/AS-Interface Link 20E within the configured monitoring time, the PROFIBUS DP slave switches to safe mode and sets all outputs to "0".</td></tr>
</table>

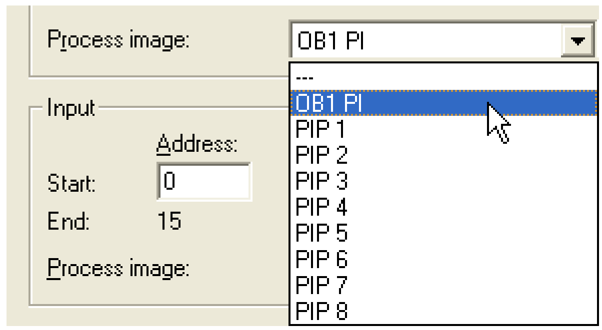
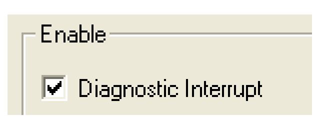
11.5.5 Parameterizing AS-Interface

Parameterize the properties and behavior of DP/AS-Interface 20E as an AS-i master in the "Properties - DP/AS-i - ..." dialog.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">In the AS-i address table, double-click the fourth line with the "DP/AS-i" module.


A window is displayed with the "Properties - DP/AS-i - ..." dialog, which contains the "General", "Digital Addresses", "Operating Parameters", and "AS-i Slave Options" tabs.</td></tr>
<tr><td>2</td><td colspan="2">If required, enter the name and a comment for the AS-i line on the "General" tab.</td></tr>
<tr><td>3</td><td colspan="2">To configure the binary I/O address spaces for the AS-i slaves, choose the "Digital Addresses" tab.</td></tr>
<tr><td></td><td>3.1</td><td>Set the I/O address for the binary input data or accept the value displayed. If you enter an invalid address, the system proposes a new one.


Digital input addresses relate to a max. 32-byte memory area in which the binary input values of the AS-i slaves are stored.
For the digital output addresses, the same starting value as for the input addresses applies depending on the system.</td></tr>
<tr><td></td><td>3.2</td><td>If you use the CLASSIC sort type for the I/O addresses (default setting), you can set the "Reserved Length" value.
You can use this parameter to suppress unassigned I/O addresses at the lower end of the table or set a contiguous address space for future extensions to AS-Interface.
The "Assigned Length" shows the amount of memory currently occupied by the AS-i slaves in bytes.</td></tr>
</table>

Step		Action
	3.3	If the "Process Image" drop-down list contains selection data, this means that the PROFIBUS DP master is a CPU that manages partial process images (e.g. CPU 416). Choose a partial process image number (PPI no.) or the OB1 process image for cyclic updates. 
	3.4	Choose a sort type for the I/O addresses of the AS-i slaves (default: "CLASSIC").  The "Pack" button moves the I/O addresses of the AS-i modules in the AS-i address table in such a way that they require less room in the address space. In addition, the "Reserved Length" is optimized. The "CLASSIC sorting" pushbutton sorts the I/O addresses according to AS-i addresses. The standard / A slaves are at the beginning, followed by the B slaves. The "LINEAR sorting" pushbutton sorts the I/O addresses in ascending order. Standard / A slaves and B slaves with the same AS-i address are combined in one byte (standard / A slave in the low nibble, B slave in the high nibble).
4	On the "Operating Parameters" tab, set the behavior of DP/AS-Interface 20E as an AS-i master.	
	4.1	Activate the alarm enable for diagnostic interrupts (OB82).  Diagnostic interrupts are triggered if the following faults occur: • Group fault (SF) • Internal fault (= device fault) • External fault (e.g. AS-i slave failed) • At least one AS-i slave does not match the target specification. • Voltage on AS-i bus too low (AS-i Power Fail, APF) • Hardware fault (internal watchdog) • EEPROM defective

Step	Action	
	4.2	Choose the option for automatic address programming.  When you choose the option "Automatic address programming" (default), an AS-i slave that has failed can be replaced by a new, identical slave with the address "0" (on delivery). DP/AS-Interface 20E automatically assigns the new slave the address of the old one. If this option is deactivated, you have to program the address in to the new slave when manually.

11.5.6 Configuring AS-i slaves

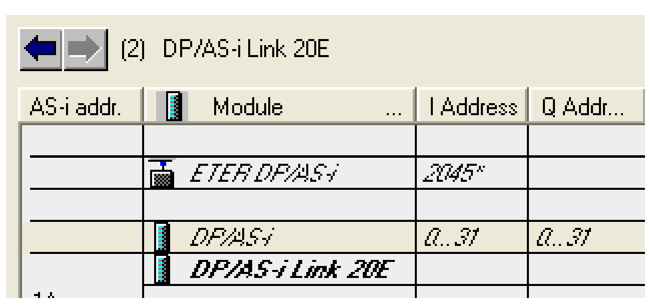
Configure the AS-i slaves within the address table.

Note

Reading the actual configuration to the AS-i address table

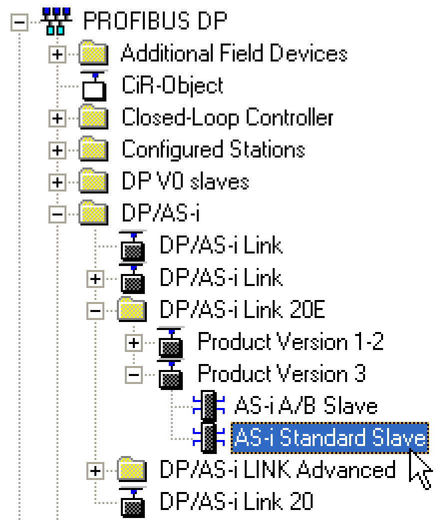
If an online connection has been established, you can read an existing AS-i configuration to the AS-i address table.

1. Skip the commissioning procedure until you reach Completing configuration (Page 490).
2. Follow the integration procedure until Copying starting data blocks (Page 492).
3. Then copy the current configuration with the command "Download to PG".
   "AS-i Slave Options" tab in the "Properties - DP/AS-i - ..." dialog.
4. Parameterize the AS-i slaves subsequently in STEP 7.

Step	Action
1	Click the DP/AS-Interface Link 20E icon on the DP master system.  A detailed view of DP/AS-Interface Link 20E is displayed in the lower part of the station window. The fourth line in the table contains address information for the binary signals. The "DP/AS-i Link 20E" module is followed by the lines for the AS-i address table, which has yet to be maintained. One line for standard / A slaves and one line for B slaves are provided for each AS-i address.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>2</td><td>
First enter dummy modules in the AS-i address table. You can then specify these later on.
The following dummy modules are available:

AS-i A/B slave for AS-i slaves in the extended address space
AS-i standard slave

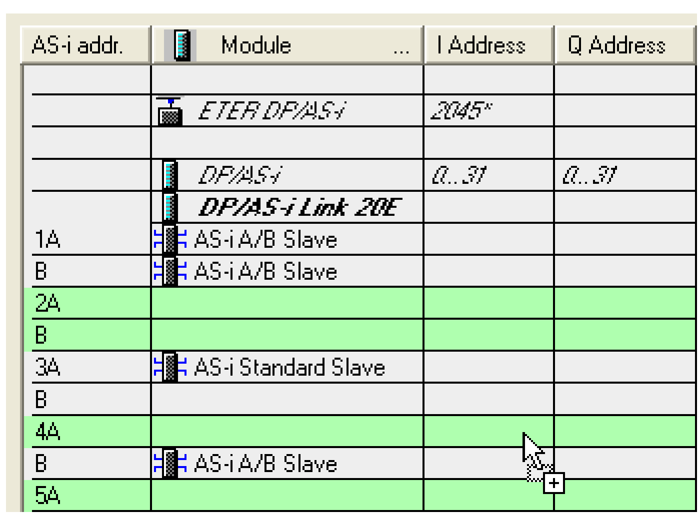


You have the following options for assigning the AS-i address lines:

Drag and drop an AS-i slave from the hardware catalog
Path: PROFIBUS-DP > DP/AS-i > DP/AS-i Link 20E > Product version 3
Select an AS-i slave via the context menu "Insert Object..."
Path: Product Version 3
Copy and insert via the clipboard.
Move the line content by pressing down the left mouse button.
A configured slave changes its AS-i address as a result.

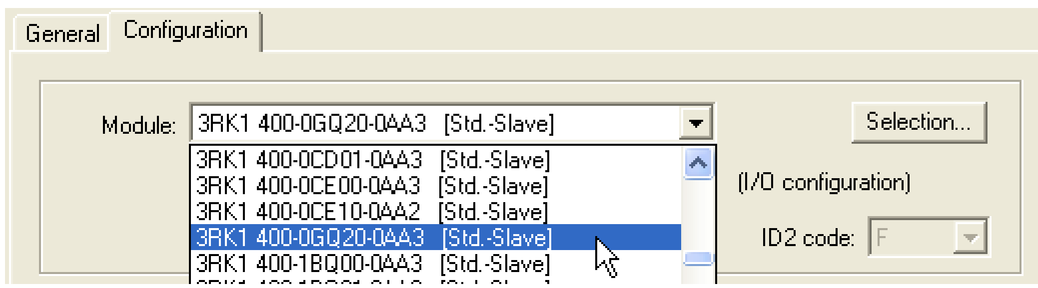
</td></tr>
<tr><td>3</td><td>
Note the following rules for assigning addresses:

The lines containing potential target addresses are highlighted in green.
Standard slaves and certain analog slaves use a full AS-i address (A and B address line).


<table>
<tr><th>AS-i addr.</th><th>Module ...</th><th>I Address</th><th>Q Address</th></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>ETER DP/AS-i</td><td>2045*</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>DP/AS-i</td><td>0...31</td><td>0...31</td></tr>
<tr><td></td><td>DP/AS-i Link 20E</td><td></td><td></td></tr>
<tr><td>1A</td><td>AS-i A/B Slave</td><td></td><td></td></tr>
<tr><td>B</td><td>AS-i A/B Slave</td><td></td><td></td></tr>
<tr><td>2A</td><td></td><td></td><td></td></tr>
<tr><td>B</td><td></td><td></td><td></td></tr>
<tr><td>3A</td><td>AS-i Standard Slave</td><td></td><td></td></tr>
<tr><td>B</td><td></td><td></td><td></td></tr>
<tr><td>4A</td><td></td><td></td><td></td></tr>
<tr><td>B</td><td>AS-i A/B Slave</td><td></td><td></td></tr>
<tr><td>5A</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
</table>

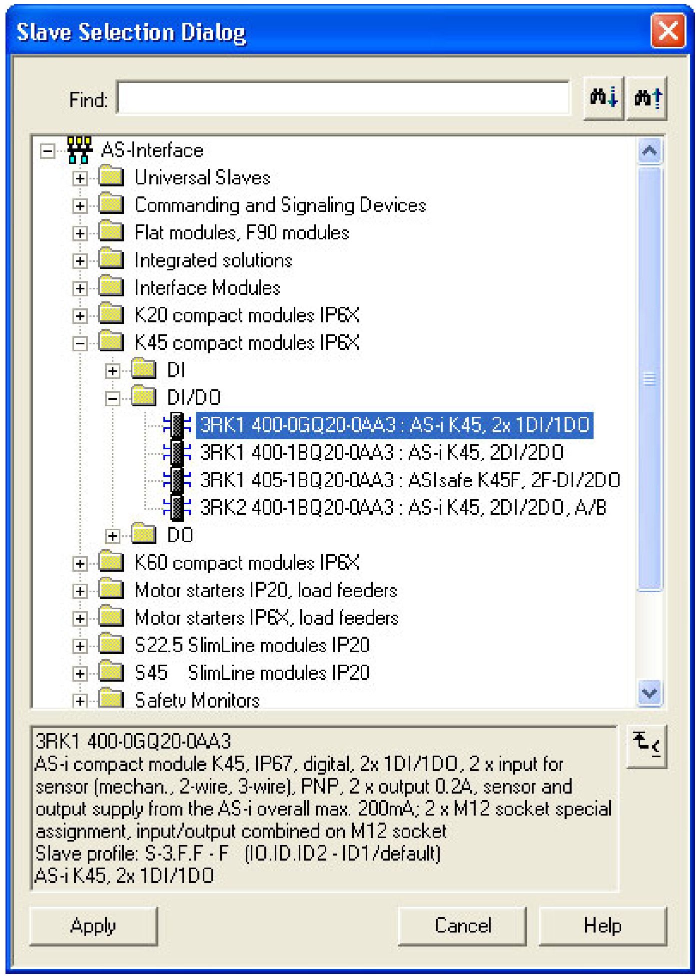
11.5.7 Specifying AS-i slaves

Specify the AS-i slaves in the "Properties - AS-i standard slave - ..." or "Properties - AS-i A/B slave - ..." dialog.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Double-click an occupied address line in the AS-i address table.
• For an "AS-i standard slave" module, the window containing the "Properties - AS-i Standard Slave - ..." dialog is displayed.
• For an "AS-i A/B slave" module, the window containing the "Properties - AS-i A/B Slave - ..." dialog is displayed.</td></tr>
<tr><td rowspan="2">2</td><td colspan="2">You can specify the AS-i slaves on the "Configuration" tab in one of the following ways:</td></tr>
<tr><td>A</td><td>In the "Module" drop-down list, select a Siemens module via its order number.


The IO, ID, and ID2 codes are permanently defined by the properties of the Siemens modules. On the other hand, the ID1 code can be variable on certain modules.</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td></td><td>B</td><td>Choose a Siemens module from the AS-Interface catalog. To do so, click "Selection...".

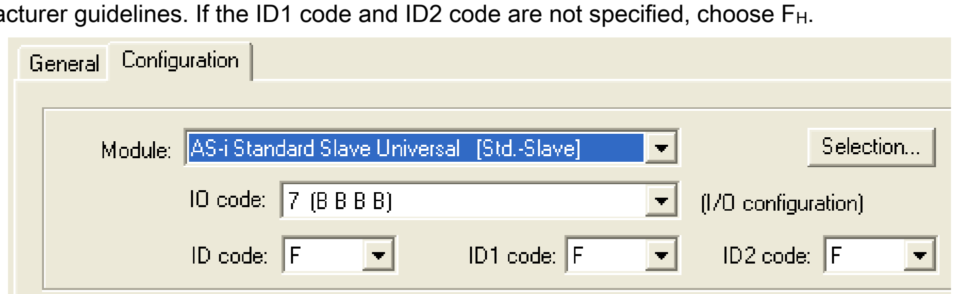


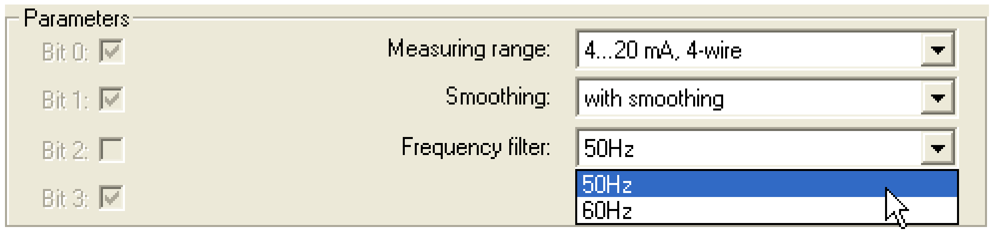
The following selection options are available for AS-i slaves:

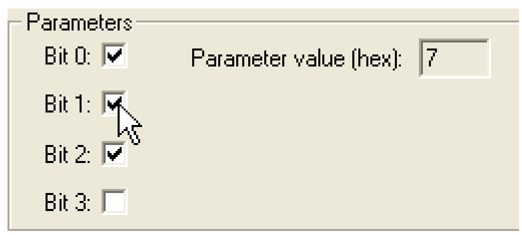
- Navigation through the hierarchical folder structure according to module type
- Search function using a keyword from the infotext

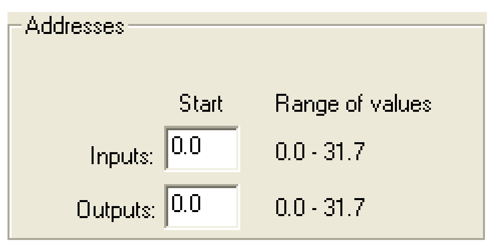
Transfer the module you have selected to the configuration by double-clicking it or selecting it and clicking "Apply".

The IO code, ID code and ID2 code are fixed by the properties of the Siemens modules. On the other hand, the ID1 code can be variable on certain modules.</td></tr>
<tr><td></td><td>C</td><td>For AS-i slaves that are not available for selection, set the IO and ID codes in accordance with the manufacturer guidelines. If the ID1 code and ID2 code are not specified, choose F_H.


</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td rowspan="3">3</td><td colspan="2">Parameterize the AS-i slaves.</td></tr>
<tr><td>3.1</td><td>If the selected Siemens modules support special parameter settings, you can select them from a range of drop-down lists.


The bit checkboxes cannot be changed separately. Their assignment is predefined by the modules or results from the entries in the adjacent fields.</td></tr>
<tr><td>3.2</td><td>If the AS-i slaves are not available for selection, set the parameter bits in accordance with the manufacturer guidelines.


With an A/B module, the checkbox for parameter bit 3 is not displayed.</td></tr>
<tr><td>4</td><td colspan="2">Accept the system proposal for the binary input and output address space.
If you change addresses for binary data exchange, note the I/O configuration of your AS-i slaves.


If a binary AS-i slave has not been assigned any inputs or outputs, the corresponding field is empty.</td></tr>
<tr><td>5</td><td colspan="2">If required, enter the name and a comment for an AS-i slave on the "General" tab. When you close the dialog, your entries appear in the AS-i address table.</td></tr>
</table>

11.5.8 Completing configuration

To complete the project and download it to the CPU, carry out the following steps.

Step	Action
1	Save and compile the configuration in the current project.
2	Download the hardware configuration to the module.

11.5.9 Switching on the AS-i power supply

Note

Only set addresses on the device when PROFIBUS communication has been interrupted

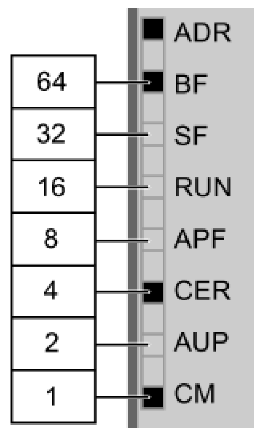
When you make the required settings on DP/AS-Interface Link 20E, you must ensure that no communication is currently taking place with the PROFIBUS DP master. If necessary, switch off the CPU or disconnect the PROFIBUS plug.

Switch on the AS-i power supply unit for supplying AS-Interface.

Step	Action
1	Switch on the voltage for the 30 V AS-i power supply unit.

11.5.10 Setting the PROFIBUS address on DP/AS-Interface Link 20E

Set the PROFIBUS address of DP/AS-Interface Link 20E as specified in the configuration directly on the device.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Press the "DISPLAY" button under the front cover until the ADR LED at the top lights up red.
If you start from the status display, for example, you have to press the button 15 times.
On the other 7 LEDs, DP/AS–Interface Link 20E indicates the current PROFIBUS address.


The bit significance of the LEDs yields the set PROFIBUS address.
For example, the LEDs in the diagram above signal the PROFIBUS address: 64 + 4 + 1 = 69.</td></tr>
<tr><td>2</td><td colspan="2">If you want to retain the set PROFIBUS address, press the DISPLAY button.
DP/AS-Interface Link 20E returns to the status display.</td></tr>
<tr><td rowspan="4">3</td><td colspan="2">Enter the new PROFIBUS address.
Use the same PROFIBUS address as in the configuration. Address 1 to 125 only can be used for exchanging data with the PROFIBUS DP master.</td></tr>
<tr><td>3.1</td><td>Press the "SET" button.
The flashing BF LED indicates the most-significant bit in the PROFIBUS address.</td></tr>
<tr><td>3.2</td><td>To set the bit, choose "SET"; to delete the bit, choose "DISPLAY".
When the bit is set, the LED lights up. After you have made the relevant entry, the SF LED starts flashing to indicate the next bit.</td></tr>
<tr><td>3.3</td><td>Set or delete the remaining address bits in the same way.
Once all the address bits have been set, the corresponding LEDs flash, alternating between red/green or yellow/green.</td></tr>
<tr><td>4</td><td colspan="2">If you want to apply the new PROFIBUS address, press the SET button.
If you want to reject the PROFIBUS address, press the DISPLAY button. To enter a new address, start at step 3.1.</td></tr>
</table>

11.5.11 Addressing AS-i slaves

Address the AS-i slaves in accordance with the configuration.

Step	Action
1	If the addresses of the AS-i slaves do not match the configuration, the CER and SF LEDs light up. Address the AS-i slaves in one of the following ways: • With an addressing unit • With a STEP 7 user program using the "Change_AS-i_slave_address" command in the command interface

11.5.12 Copying starting data blocks

Copy the starting data blocks from the STEP 7 configuration to DP/AS-Interface Link 20E.

Step	Action
1	Switch on the CPU or connect the device to PROFIBUS. DP/AS-Interface Link 20E receives its starting data blocks from the CPU and switches to "protected" mode.

11.6 DP/AS-Interface Link 20E - integration with GSD

11.6.1 Prerequisites

Before you use DP/AS-Interface Link 20E, the following additional devices and bus systems must be assembled, wired, and set up in accordance with their application documentation:

- CPU with PROFIBUS DP master and PROFIBUS cable
- AS-i cable with AS-i power supply and AS-i slaves
- PC / PG with the following equipment:
  - PLC-specific configuration tool (e.g. STEP 7)
  - GSD file for DP/AS-Interface Link 20E
    The GSD file for DP/AS-Interface Link 20E (http://support.automation.siemens.com/WW/view/en/5281638) can be downloaded free of charge from the Internet.
  - PC / PG connected to CPU

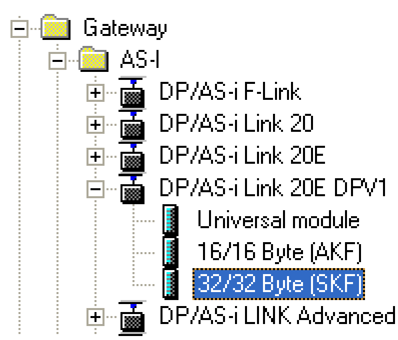
11.6.2 Integration procedure

The table below describes a potential procedure for integrating AS-Interface in your system via the AS-i master.

Step	Procedure
1	Configuring the PROFIBUS DP master system (Page 494)
2	Parameterizing DP/AS-Interface Link 20E as a PROFIBUS DP slave (Page 496)
3	Parameterizing AS-Interface (Page 497)
4	Parameterizing binary AS-i slaves (Page 498)
5	Completing configuration (Page 499)
6	Switching on the AS-i power supply (Page 499)
7	Setting the PROFIBUS address on DP/AS-Interface Link 20E (Page 500)
8	Addressing AS-i slaves (Page 501)
9	Saving the configuration (Page 501)
10	Copying starting data blocks (Page 502)

11.6.3 Configuring the PROFIBUS DP master system

Configure DP/AS-Interface Link 20E as a modular PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

Step	Action
1	Open your STEP 7 project with a CPU with the PROFIBUS DP master (e.g. CPU 315-2 DP).
2	Open HW Config for the PROFIBUS DP master.
3	If the DP master system is not yet available on the CPU, you have to create it. To do so, insert the DP master system in slot X2 (DP) of the CPU (e.g. via the "Insert master system" context menu).
4	Select the DP/AS-Interface Link 20E in the "Hardware Catalog" window. Path: PROFIBUS-DP > Other FIELD DEVICES > Gateway > AS-I > DP/AS-i Link 20E DPV1
5	Drag & drop the selected DP/AS-Interface Link 20E to the DP master system. The "Properties - PROFIBUS interface..." dialog is displayed.
6	Choose the PROFIBUS address for DP/AS-Interface Link 20E and close the dialog.
7	Drag & drop the module "16/16 Byte (AKF)" or "32/32 Byte (SKF)" to the free slot 1 in the lower part of the station window. • "16/16 Byte (AKF)" allows up to 31 standard and A slaves to be used. B slaves cannot be used. • "32/32 Byte (SKF)" allows A/B slaves to be used that are set to B addresses. In this case, the entire binary data interface of DP/AS-Interface Link 20E can be used. • The universal module cannot be used. 

Result

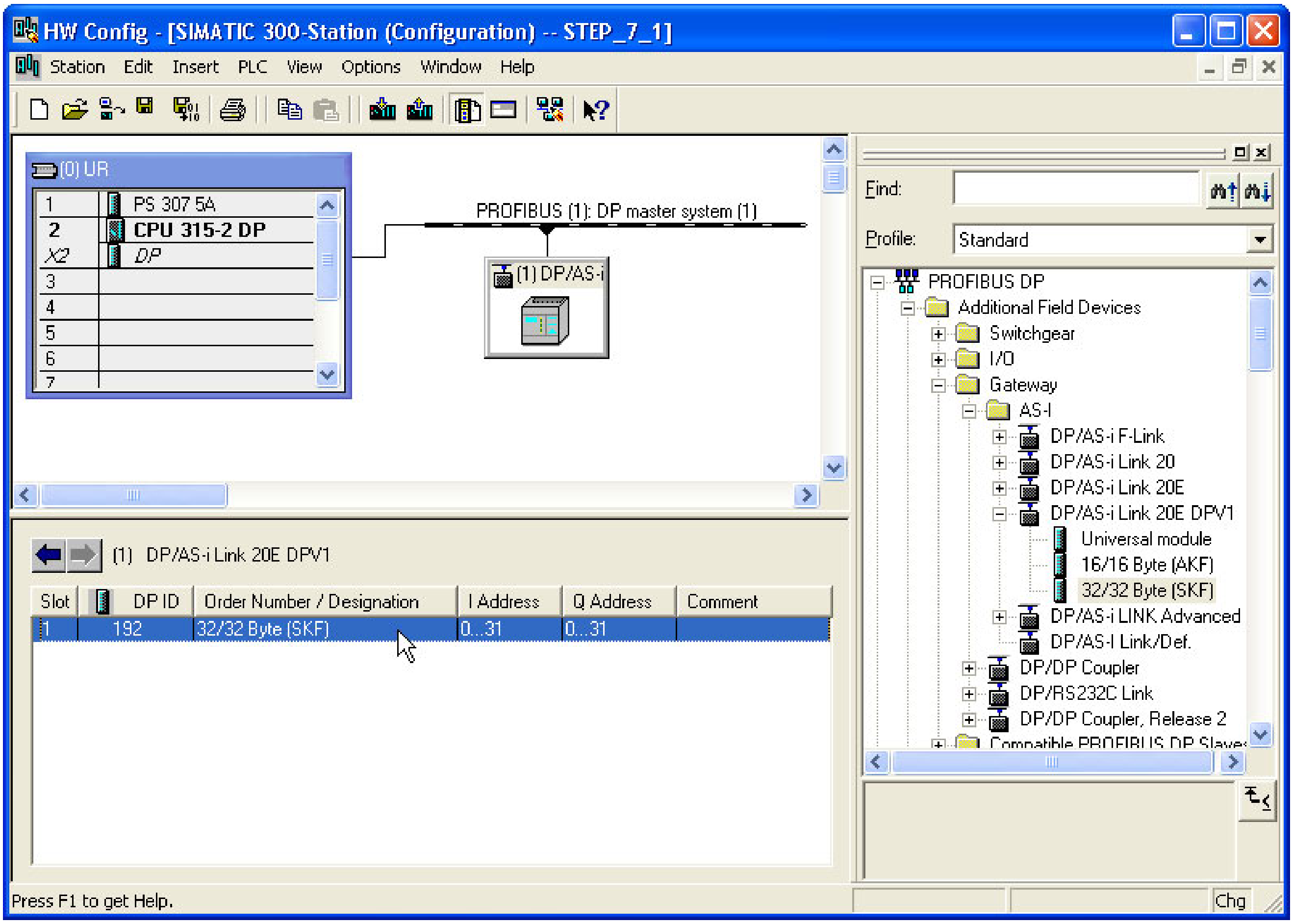
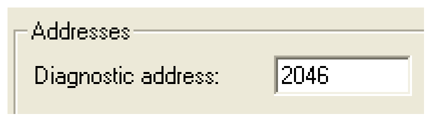
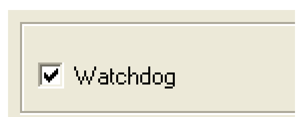


Figure 11-15 Configuration of DP/AS-Interface Link 20E on the DP master system

DP/AS-Interface Link 20E is attached to the DP master system as an icon. A detailed view of DP/AS-Interface Link 20E along with the DP ID and the occupied slot 1 is displayed in the lower part of the station window.

11.6.4 Parameterizing DP/AS-Interface Link 20E as a PROFIBUS DP slave

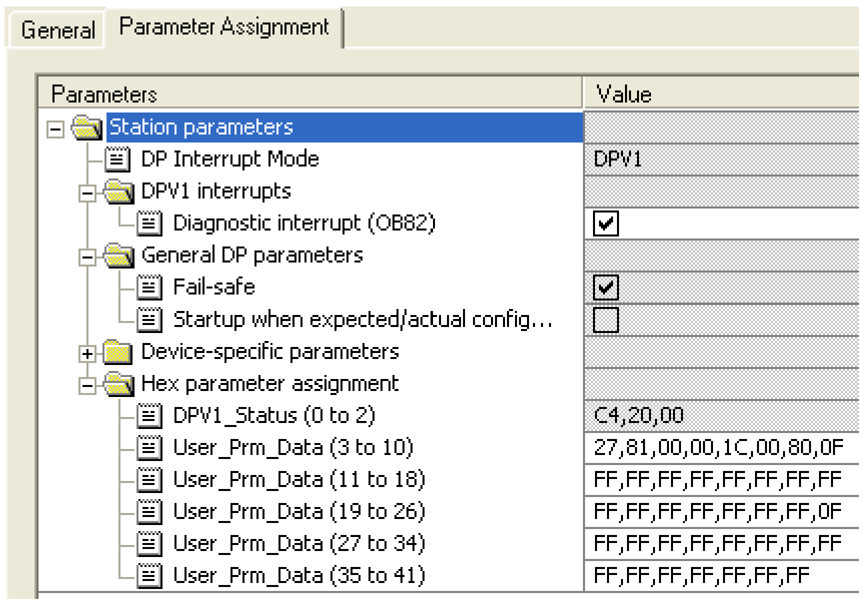
Parameterize DP/AS-Interface Link 20E as a PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

Step		Action
1		Double-click the DP/AS-Interface Link 20E icon on the DP master system. A window is displayed containing the "Properties - DP Slave" dialog, which contains the "General" and "Parameterization" tabs.
2		On the "General" tab, set the properties of DP/AS-Interface Link 20E as a node on the PROFIBUS DP.
	2.1	Enter the diagnostics address or use the displayed value. If you enter an invalid address, the system proposes a new one.  The PROFIBUS DP master uses the diagnostics address to find out about a failure or return of a PROFIBUS DP slave and starts the OB 86. You can also call up the full diagnosis of the slave under this address with SFC 13 DPNRM_DG and include it in your user program.
	2.2	Activate the watchdog so that DP/AS-Interface Link 20E can respond to errors in the PROFIBUS DP master or if bus data traffic is interrupted.  If the PROFIBUS DP master does not address DP/AS-Interface Link 20E within the configured monitoring time, the PROFIBUS DP slave switches to safe mode and sets all outputs to "0".

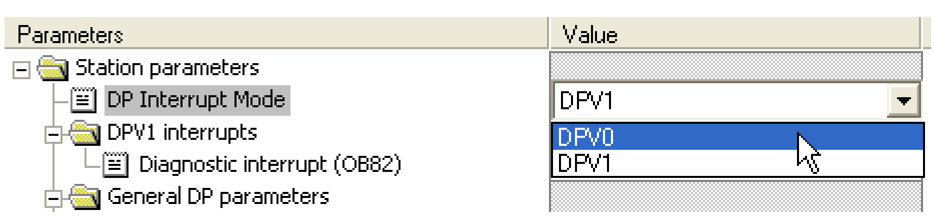
11.6.5 Parameterizing AS-Interface

Parameterize the properties and behavior of DP/AS-Interface Link 20E as a PROFIBUS DP slave and AS-i Master on the "Parameterization" tab.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Call up the "Parameterize" tab in the "Properties - DP-Slave" dialog.


</td></tr>
<tr><td>2</td><td>In the relevant option box, activate the alarm enable for diagnostic interrupts (OB82).
Diagnostic interrupts are triggered if the following faults occur:

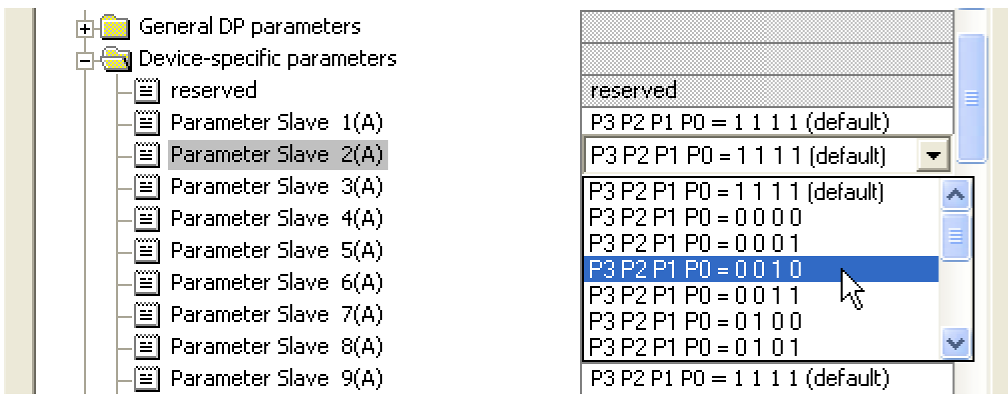
Group fault (SF)
Internal fault (= device fault)
External fault (e.g. AS-i slave failed)
At least one AS-i slave does not match the target specification.
Voltage on AS-i bus too low (AS-i Power Fail, APF)
Hardware fault (internal watchdog)
EEPROM defective
</td></tr>
<tr><td>3</td><td>When you change the operating mode of the PROFIBUS DP master from DPV1 to DPV0, you first have to deactivate the "Diagnostic interrupt (OB 82)" option.
Then choose the operating mode from the "Interrupt Mode" drop-down list.

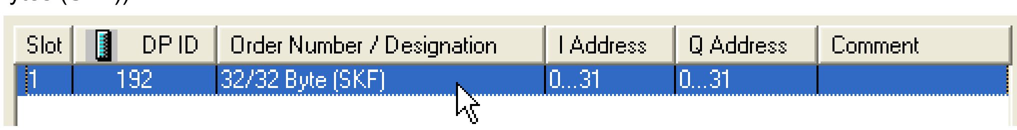

</td></tr>
<tr><td>4</td><td>Use only the parameters described above to make changes to the parameterization telegram. To prevent any unforeseen events, do not change any values in the "Hex parameterization" folder.</td></tr>
</table>

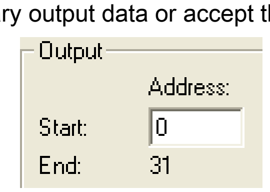
11.6.6 Parameterizing binary AS-i slaves

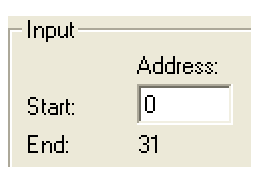
Parameterize the AS-i slaves on the "Parameter Assignment" tab and in the "Properties - DP Slave" dialog for slot 1.

The parameters must match the configuration of the AS-i slaves, which you can configure on DP/AS-Interface Link 20E later on during commissioning.

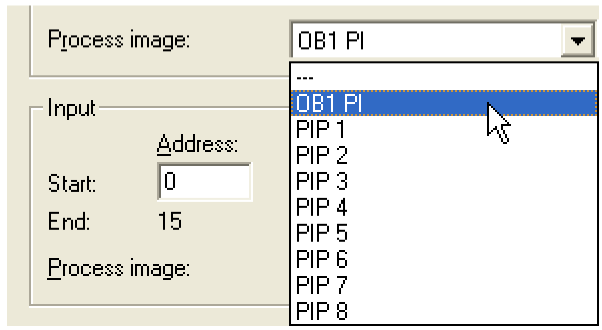
<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>In the "Device-specific parameters" folder, choose the parameter bits of the AS-i slaves from the drop-down lists.


For explanations of the individual parameters, consult the AS-i slave manuals.</td></tr>
<tr><td>2</td><td>To close the "Properties - DP Slave" dialog, confirm your settings with "OK".</td></tr>
<tr><td>3</td><td>Double-click line 1 in the configuration table with the selected module (16/16 Bytes (AKF) or 32/32 Bytes (SKF)).


A window is displayed with the "Properties - DP Slave" dialog, which contains the "Address / ID" tab.</td></tr>
<tr><td>4</td><td>On this tab, set the I/O address of the binary output data or accept the system proposal.


Depending on the selected module, the system calculates the end address and signals any errors that occur. When configuration is carried out using the GSD file, the I/O data of the AS-i slaves is sorted according to the CLASSIC sort type.</td></tr>
<tr><td>5</td><td>Set the I/O address for the binary input data or accept the system proposal.


Depending on the selected module, the system calculates the end address and reports any errors that occur.</td></tr>
</table>

Step	Action
6	If the "Process Image" drop-down list contains selection data, this means that the PROFIBUS DP master is a CPU that manages partial process images (e.g. CPU 416). Choose a partial process image number (PPI no.) or the OB1 process image for cyclic updates. 

11.6.7 Completing configuration

To complete the project and download it to the CPU, carry out the following steps.

Step	Action
1	Save and compile the configuration in the current project.
2	Download the hardware configuration to the module.

11.6.8 Switching on the AS-i power supply

Note

Only set addresses on the device when PROFIBUS communication has been interrupted

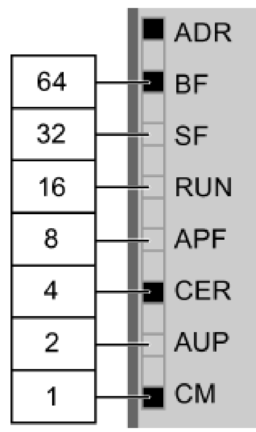
When you make the required settings on DP/AS-Interface Link 20E, you must ensure that no communication is currently taking place with the PROFIBUS DP master. If necessary, switch off the CPU or disconnect the PROFIBUS plug.

Switch on the AS-i power supply unit for supplying AS-Interface.

Step	Action
1	Switch on the voltage for the 30 V AS-i power supply unit.

11.6.9 Setting the PROFIBUS address on DP/AS-Interface Link 20E

Set the PROFIBUS address of DP/AS-Interface Link 20E as specified in the configuration directly on the device.

Step		Action
1		Press the "DISPLAY" button under the front cover until the ADR LED at the top lights up red. If you start from the status display, for example, you have to press the button 15 times. On the other 7 LEDs, DP/AS–Interface Link 20E shows the current PROFIBUS address.  The bit significance of the LEDs yields the set PROFIBUS address. For example, the LEDs in the diagram above signal the PROFIBUS address: 64 + 4 + 1 = 69.
2		If you want to retain the set PROFIBUS address, press the DISPLAY button. DP/AS-Interface Link 20E returns to the status display.
3		Enter the new PROFIBUS address. Use the same PROFIBUS address as in the configuration. Address 1 to 125 only can be used for exchanging data with the PROFIBUS DP master.
	3.1	Press the "SET" button. The flashing BF LED shows the most-significant bit in the PROFIBUS address.
	3.2	To set the bit, choose "SET"; to delete the bit, choose "DISPLAY". When the bit is set, the LED lights up. After you have made the relevant entry, the SF LED starts flashing to display the next bit.
	3.3	Set or delete the remaining address bits in the same way. Once all the address bits have been set, the corresponding LEDs flash, alternating between red/green or yellow/green.
4		If you want to apply the new PROFIBUS address, press the SET button. If you want to reject the PROFIBUS address, press the DISPLAY button. To enter a new address, start at step 3.1.

11.6.10 Addressing AS-i slaves

Address the AS-i slaves in accordance with the configuration.

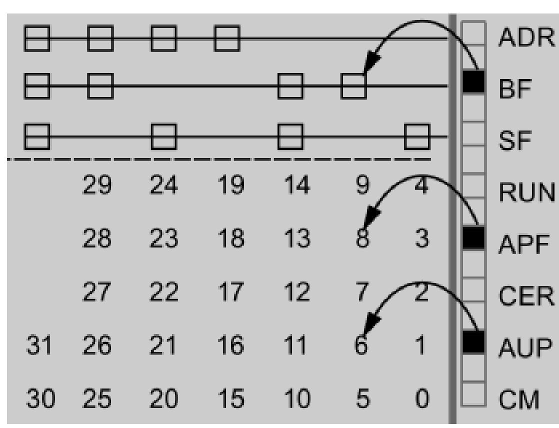
Step	Action
1	If the addresses of the AS-i slaves do not match the configuration, the CER and SF LEDs light up. Address the AS-i slaves in one of the following ways: • With an addressing unit • With a STEP 7 user program using the "Change_AS-i_slave_address" command in the command interface

11.6.11 Saving the configuration

In "configuration" mode, DP/AS-Interface Link 20E exchanges data with all the connected AS-i slaves. DP/AS-Interface Link 20E instantly recognizes new AS-i slaves, activates them, and includes them in cyclic data exchange (except AS-i slaves with the address "0" or if an AS-i address has been assigned more than once). DP/AS-Interface Link 20E saves the the following AS-i slave data to a non-volatile memory:

- Addresses
- ID codes
- I/O configuration
-

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Press the "DISPLAY" button.
The LED display switches to "status display" mode.</td></tr>
<tr><td>2</td><td colspan="2">Press the "DISPLAY" button.
The LED display switches to "slave display" mode.</td></tr>
<tr><td rowspan="2">3</td><td colspan="2">Check whether all the connected AS-i slaves appear in the display.



The three upper LEDs encode a group of five AS-i slaves. The five lower LEDs indicate the recognized slaves. Standard and A slaves light up green permanently, while B slaves flash.
In the graphic above, for example, AS-i addresses 6 and 8 are recognized within the second group of five.</td></tr>
<tr><td>3.1</td><td>To display the next group, press the DISPLAY button.</td></tr>
</table>

Step	Action	
	3.2	Once the last group has been displayed, press DISPLAY twice. The LED display returns to "slave display" mode.
4	Save the configuration by pressing the SET button. DP/AS-Interface Link 20E saves the recognized actual configuration as a target configuration in the internal EEPROM.	

11.6.12 Copying starting data blocks

Copy the starting data blocks from the configuration to DP/AS-Interface Link 20E.

Step	Action
1	Switch on the CPU or connect the device to PROFIBUS. DP/AS-Interface Link 20E receives its starting data blocks from the CPU and switches to "protected" mode.

11.7 DP/AS-i LINK Advanced - integration with STEP 7

11.7.1 Prerequisites

Before you use DP/AS-i LINK Advanced, the following additional devices and bus systems must be assembled, wired, and set up in accordance with their application documentation:

- SIMATIC S7-CPU with PROFIBUS DP master and PROFIBUS cable
- AS-i cable with AS-i power supply and AS-i slaves
  When you use DP/AS-i LINK Advanced as a double master, two independent AS-i networks can be connected.
- PC / PG with the following equipment:
  - STEP 7, as of version 5.4
  - PC / PG connected to CPU

Note

Power supply for DP/AS-i LINK Advanced

The AS-i shaped cable (line 1) supplies DP/AS-i LINK Advanced with voltage. Alternatively, a 24 V DC power supply can be provided via the power supply unit.

11.7.2 Integration procedure

The table below describes a potential procedure for integrating AS-Interface in your system via the AS-i master.

Step	Procedure
1	Configuring the PROFIBUS DP master system (Page 504)
2	Parameterizing DP/AS-i LINK Advanced as a PROFIBUS DP slave (Page 505)
3	Parameterizing AS-Interface (Page 506)
4	Configuring AS-i slaves (Page 509)
5	Specifying AS-i slaves (Page 511)
6	Completing configuration (Page 514)
7	Switching on the AS-i power supply (Page 514)
8	Switching on the optional power supply for DP/AS-i LINK Advanced (Page 514)
9	Setting the PROFIBUS address on DP/AS-i LINK Advanced (Page 515)
10	Addressing AS-i slaves (Page 515)
11	Copying starting data blocks (Page 516)

11.7.3 Configuring the PROFIBUS DP master system

Configure DP/AS-i LINK Advanced as a modular PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

Step	Action
1	Open your STEP 7 project with a SIMATIC S7-CPU with the PROFIBUS DP master (e.g. CPU 315-2 DP).
2	Open HW Config for the PROFIBUS DP master.
3	If the DP master system is not yet available on the CPU, you have to create it. To do so, insert the DP master system in slot X2 (DP) of the CPU (e.g. via the "Insert master system" context menu).
4	Choose DP/AS-i LINK Advanced in the "Hardware Catalog" window. Path: PROFIBUS-DP > DP/AS-i > DP/AS-i LINK Advanced > 6GK1411-2BA10 > V1.0 (or as double master 6GK1411-2BA20 > V1.0)
5	Drag & drop the selected DP/AS-i LINK Advanced to the DP master system. The "Properties - PROFIBUS Interface..." dialog opens.
6	Choose the PROFIBUS address for DP/AS-i LINK Advanced and close the dialog.

Results for single and double master

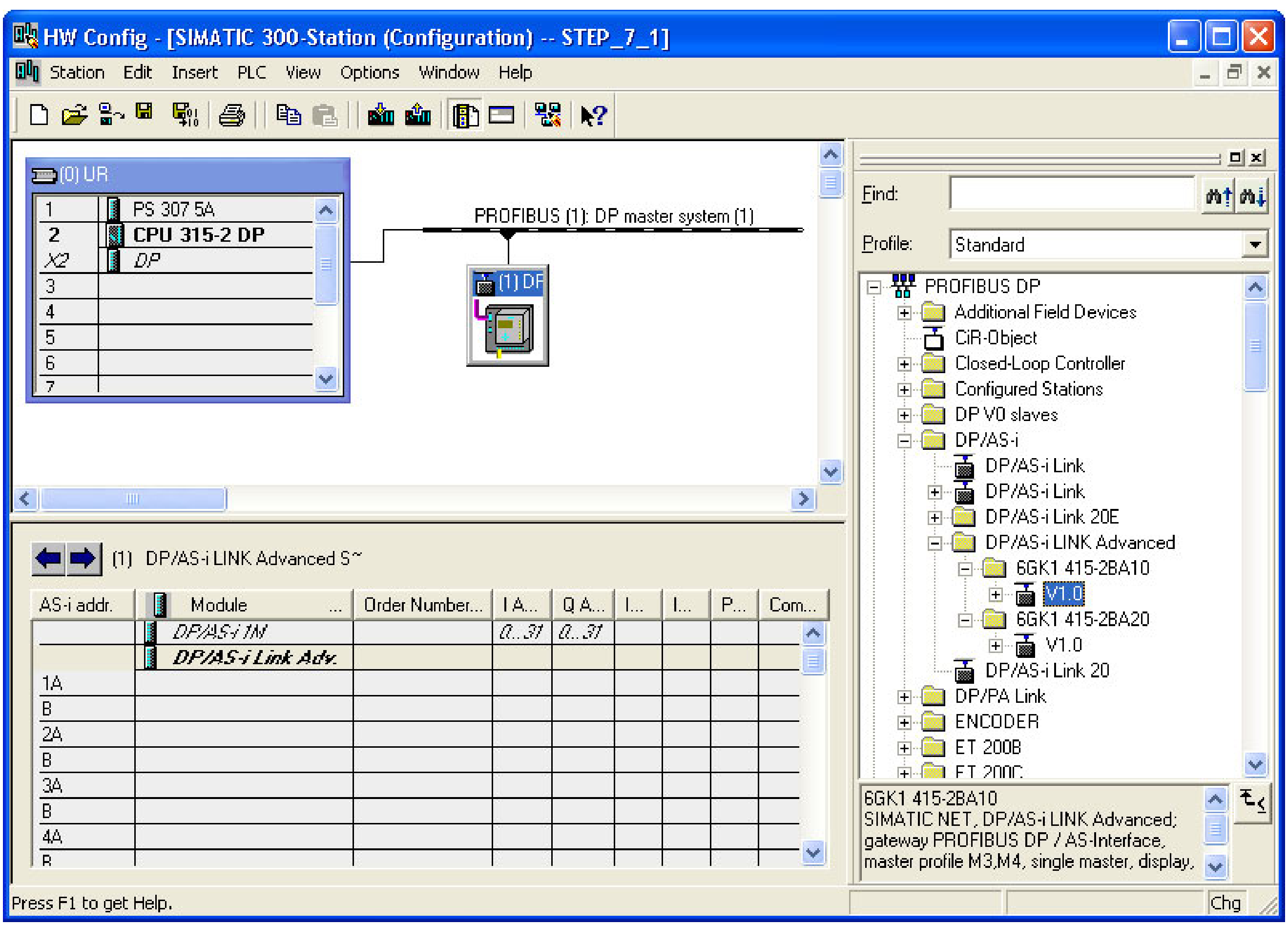


Figure 11-16 Configuration of DP/AS-i LINK Advanced as single master on the DP master system

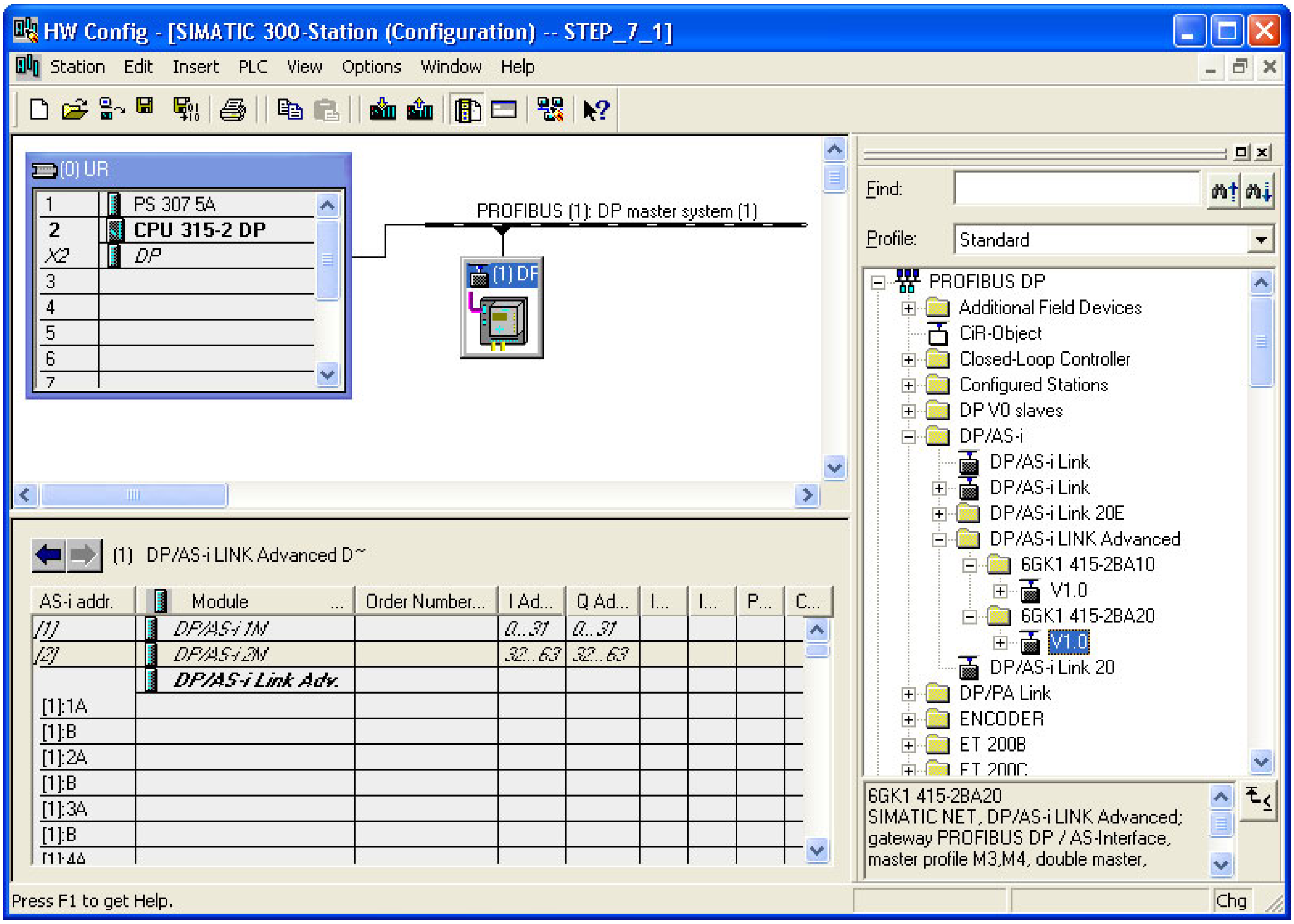


Figure 11-17 Configuration of DP/AS-i LINK Advanced as double master on the DP master system

DP/AS-i LINK Advanced is attached to the DP master system as an icon. A detailed view of DP/AS-i LINK Advanced along with its possible slots and DP IDs is displayed in the lower part of the station window. This is followed by the lines for the AS-i address table, which has yet to be maintained.

11.7.4 Parameterizing DP/AS-i LINK Advanced as a PROFIBUS DP slave

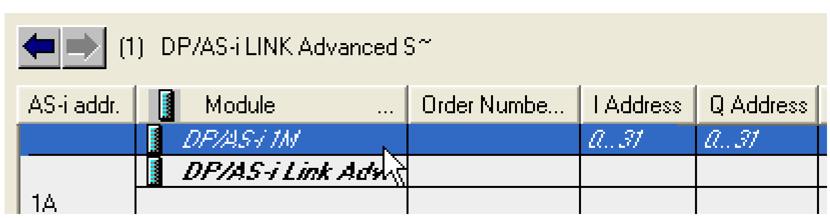
Parameterize DP/AS-i LINK Advanced as a PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

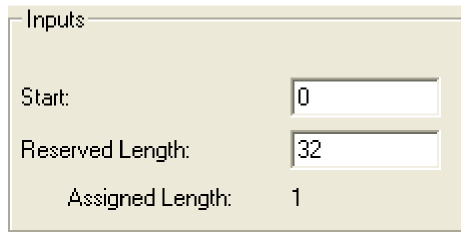
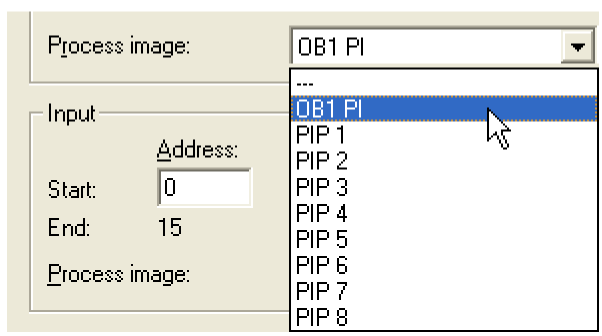
Step	Action
1	Double-click the DP/AS-i LINK Advanced icon on the DP master system. A window is displayed containing the "Properties - DP Slave" dialog, which contains the "General" tab.
2	On the "General" tab, set the properties of DP/AS-i LINK Advanced as a node on the PROFIBUS DP.

Step	Action	
	2.1	Enter the diagnostics address or use the displayed value. If you enter an invalid address, the system proposes a new one.  The PROFIBUS DP master uses the diagnostics address to find out about a failure or return of a PROFIBUS DP slave and starts the OB 86. You can also call up the full diagnosis of the slave under this address with SFC 13 DPNRM_DG and include it in your user program.
	2.2	Activate response monitoring so that DP/AS-i LINK Advanced can respond to errors in the PROFIBUS DP master or if bus data traffic is interrupted.  If the PROFIBUS DP master does not address DP/AS-i LINK Advanced within the configured monitoring time, the PROFIBUS DP slave switches to safe mode and sets all the outputs to "0".

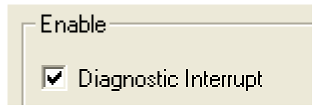
11.7.5 Parameterizing AS-Interface

Parameterize the properties and behavior of DP/AS-i LINK Advanced as an AS-i master in the "Properties - DP/AS-i ..." dialog.

Step	Action
1	In the AS-i address table, double-click the first line with the "DP/AS-i 1M" module. The following settings apply to DP/AS-i LINK Advanced as a single master or to AS-i line 1 of a double master.  A window is displayed containing the "Properties - DP/AS-i 1M - ..." dialog, which contains "General", "Digital Addresses", "Operating Parameters", and "AS-i Slave Options" tabs.
2	If required, enter the name and a comment for the AS-i line on the "General" tab.
3	To configure the binary I/O address spaces for the AS-i slaves, choose the "Digital Addresses" tab.

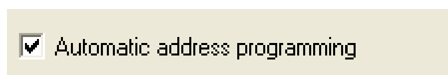
Step		Action
	3.1	Set the I/O address for the binary input data or accept the displayed value. If you enter an invalid address, the system proposes a new one.  Digital input addresses relate to a max. 32 byte memory area in which the binary input values of the AS-i slaves are stored. For the digital output addresses, the same starting value as for the input addresses applies depending on the system.
	3.2	If you use the CLASSIC sort type for the I/O addresses (default setting), you can set the "Reserved lengths" value. You can use this parameter to suppress unassigned I/O addresses at the lower end of the table or fix an associated address space for future extensions on AS-Interface. The "Assigned length" shows the amount of memory currently occupied by the AS-i slaves in bytes.
	3.3	If the "Process image" drop-down list contains selection data, this means that the PROFIBUS DP master is a CPU that manages partial process images (e.g. CPU 416). Choose a partial process image number (PPI no.) or the OB1 process image for cyclic updates. 
	3.4	Choose a sort type for the I/O addresses of the AS-i slaves (default: "CLASSIC").  The "Pack" button moves the I/O addresses of the AS-i modules in the AS-i address table in such a way that they require less room in the address space. In addition, the "Reserved length" is optimized. The "CLASSIC sorting" pushbutton sorts the I/O addresses according to AS-i address. The standard / A slaves are at the beginning, followed by the B slaves. The "LINEAR sorting" pushbutton sorts the I/O addresses in ascending order. Standard / A slaves and B slaves with the same AS-i address are combined in one byte (standard / A slave in the low nibble, B slave in the high nibble).

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td rowspan="3">4</td><td colspan="2">On the "Operating Parameters" tab, set the behavior of DP/AS-i LINK Advanced as an AS-i master.</td></tr>
<tr><td>4.1</td><td>Activate the alarm enable for diagnostic interrupts (OB82).

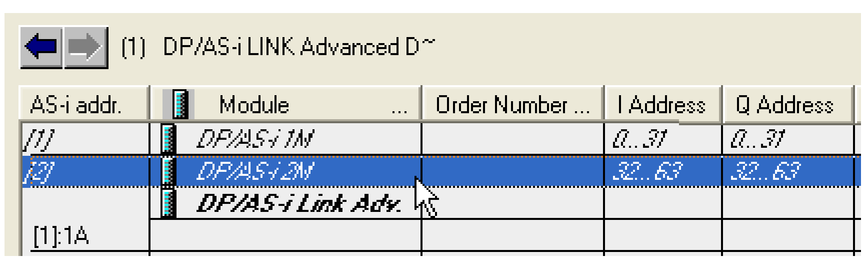


Diagnostic interrupts are triggered if the following faults occur:

- Group fault (SF)
- Internal fault (= device fault)
- External fault (e.g. AS-i slave failed)
- At least one AS-i slave does not match the target specification.
- Voltage on AS-i bus too low (AS-i Power Fail, APF)
- Hardware fault (internal watchdog)
- EEPROM defective
</td></tr>
<tr><td>4.2</td><td>Choose the option for automatic address programming.



When you choose the option "Automatic AS-i address programming" (default), an AS-i slave that has failed can be replaced by a new, identical slave with the address "0" (on delivery).
DP/AS-i LINK Advanced automatically assigns the new slave the address of the old one.
If this option is deactivated, you have to program the address in to the new slave when manually.</td></tr>
<tr><td>5</td><td colspan="2">To close the "Properties - DP/AS-i 1M - ..." dialog, confirm your settings with "OK".</td></tr>
<tr><td>6</td><td colspan="2">When you parameterize AS-i line 2 of a double master, double-click in the address table the second line with the module "DP/AS-i 2M".



A window is displayed containing the "Properties - DP/AS-i 2M - ..." dialog, which contains "General", "Digital Addresses", "Operating Parameters", and "AS-i Slave Options" tabs.</td></tr>
<tr><td>7</td><td colspan="2">Repeat steps 2 to 4 for AS-i line 2.</td></tr>
</table>

11.7.6 Configuring AS-i slaves

Configure the AS-i slaves in accordance with the address table.

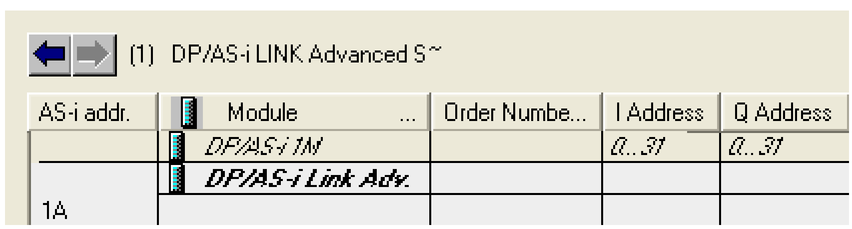
Note

Reading the pending actual configuration to the AS-i address table

If an online connection has been established, you can read an existing AS-i configuration to the AS-i address table.

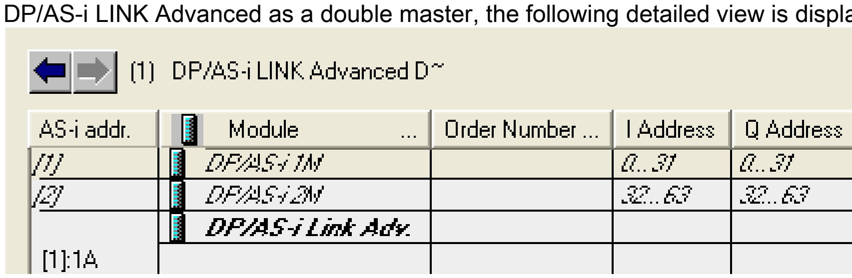
1. Skip the integration procedure until you reach Completing configuration (Page 514).
2. Follow the integration procedure until Copying starting data blocks (Page 516).
3. Then copy the current configuration for each connected AS-i line with the command "Upload to PG".
"AS-i Slave Options" tab in the "Properties - DP/AS-i ..." dialog.
4. Parameterize the AS-i slaves subsequently in STEP 7.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Click the DP/AS-i LINK Advanced icon on the DP master system.



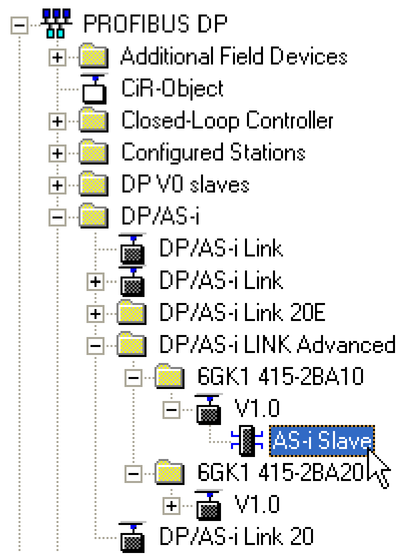
A detailed view of DP/AS-i LINK Advanced is displayed in the lower part of the station window. The first line in the table contains address information for the binary signals.
The "DP/AS-i Link Adv." module is followed by the lines for the AS-i address table, which has yet to be maintained. One line for standard / A slaves and one line for B slaves are provided for each AS-i address.

When you use DP/AS-i LINK Advanced as a double master, the following detailed view is displayed:



The second line in the table contains address information for the binary signals of AS-i line 2. The AS-i address lines (rows) are ordered by line 1 and line 2.</td></tr>
</table>

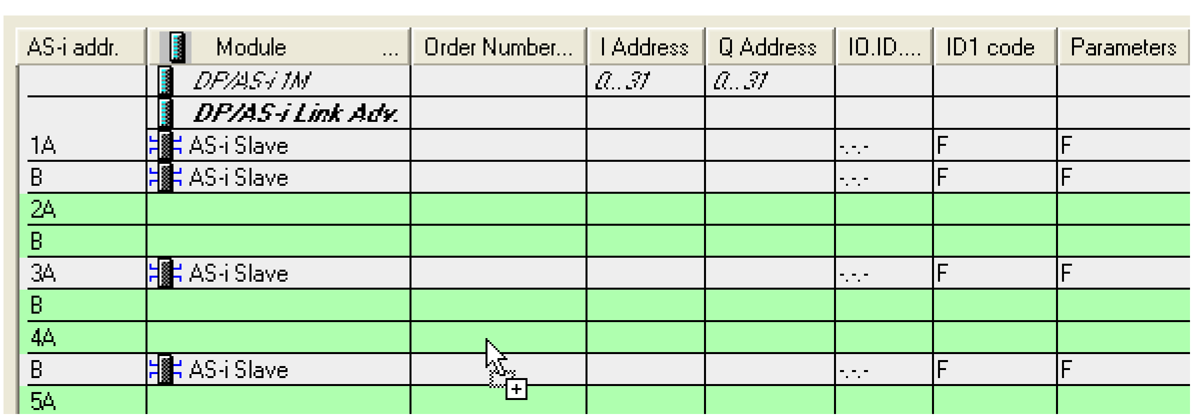
<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>2</td><td>
First enter dummy modules in the lines, which you can specify later on.



You have the following options for assigning the AS-i address lines:

- Drag and drop an AS-i slave from the hardware catalog
Path: PROFIBUS-DP > DP/AS-i > DP/AS-i LINK Advanced > 6GK1411-2BA10 > V1.0
- Select an AS-i slave via the context menu "Insert Object..."
Path: PROFIBUS-DP > 6GK1411-2BA10 > V1.0 > AS-i slave
- Copy and insert via the clipboard
- Move the line content by pressing down the left mouse button.
A configured slave changes its AS-i address as a result.
</td></tr>
<tr><td>3</td><td>
Note the following rules for assigning addresses:

- The lines containing potential target addresses are highlighted in green.
- Standard slaves and certain analog slaves use a full AS-i address (A and B address line).
- Some AS-i slaves (e.g. CTT5) require the following full addresses, depending on whether the slaves are of type 2, 3, or 4. Make sure that the following addresses remain free.

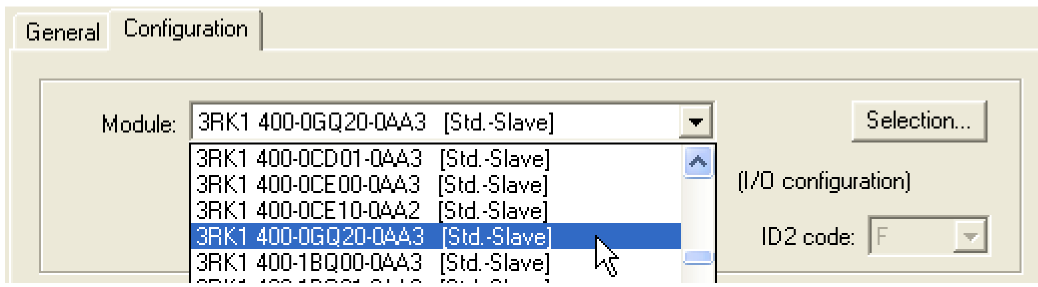


</td></tr>
</table>

11.7.7 Specifying AS-i slaves

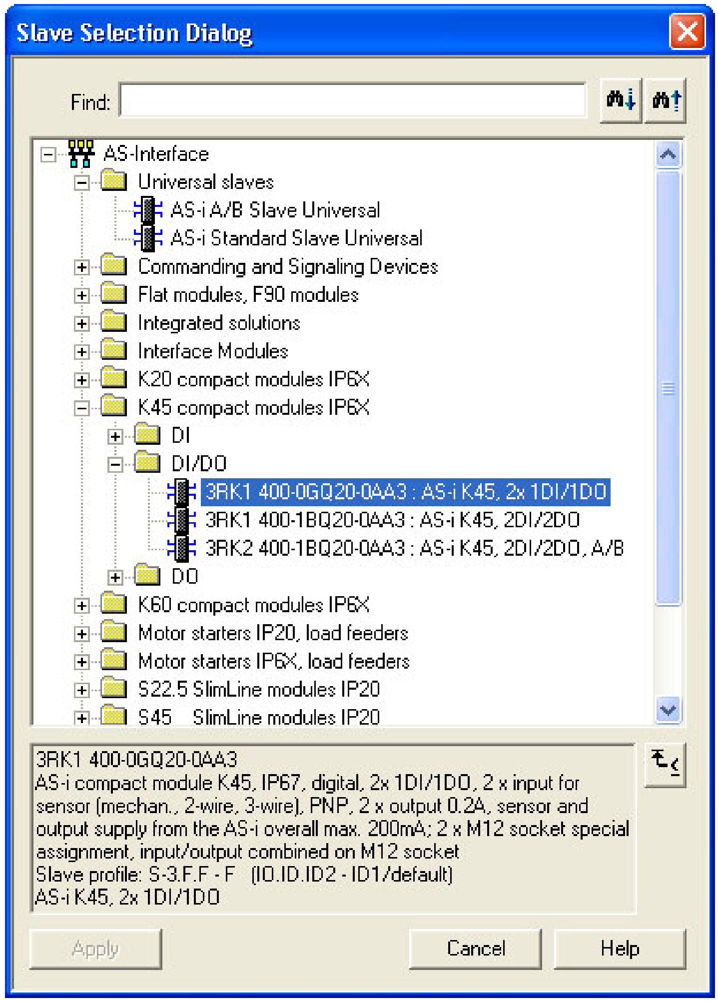
Specify the AS-i slaves in the "Properties - AS-i Slave - ..." dialog.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Double-click an occupied address line in the AS-i address table.
For an AS-i slave module, the window containing the "Properties - AS-i Slave - ..." dialog is displayed.</td></tr>
<tr><td>2</td><td colspan="2">You can specify the AS-i slaves on the "Configuration" tab in one of the following ways:</td></tr>
<tr><td></td><td>A</td><td>In the "Module" drop-down list, select a Siemens module via its order number.



The IO, ID, and ID2 codes are permanently defined by the properties of the Siemens modules. On the other hand, the ID1 code can be variable on certain modules.</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td></td><td>B</td><td>Choose a Siemens module from the AS-Interface catalog. To do so, click "Selection...".

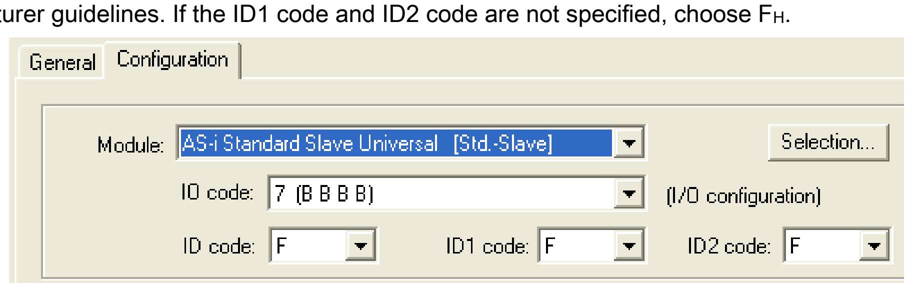


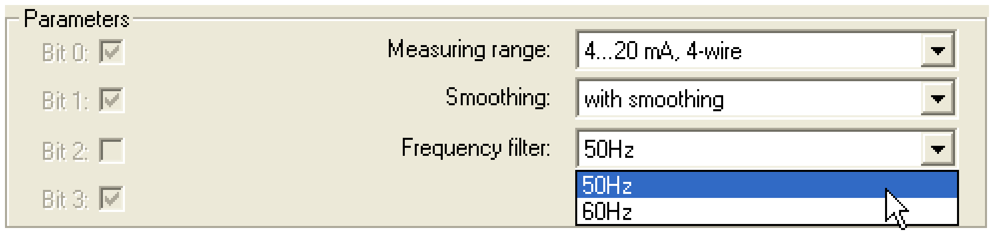
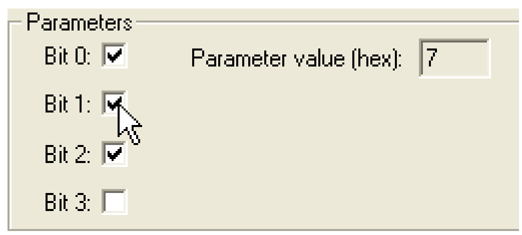
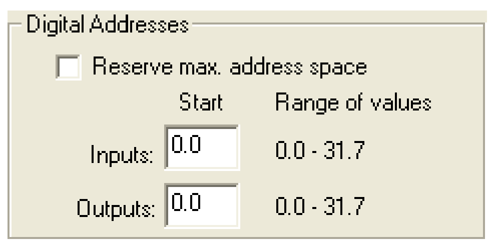
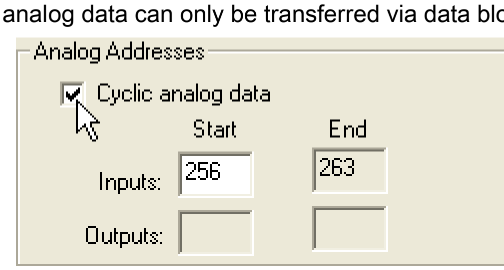
The following selection options are available for AS-i slaves:

- Navigation through the hierarchic folder structure according to module type
- Search function using a keyword from the infotext

Transfer the module you have selected to the configuration by double-clicking it or selecting it and clicking "Apply".

The IO code, ID code and ID2 code are fixed by the properties of the Siemens modules. On the other hand, the ID1 code can be variable on certain modules.</td></tr>
<tr><td></td><td>C</td><td>For AS-i slaves that are not available for selection, set the IO and ID codes in accordance with the manufacturer guidelines. If the ID1 code and ID2 code are not specified, choose F_H.


</td></tr>
</table>

Step	Action	
3	Parameterize the AS-i slaves.	
	3.1	If the selected Siemens modules support special parameter settings, you can select them from a range of drop-down lists.  The bit checkboxes cannot be changed separately. Their assignment is predefined by the modules or results from the entries in the adjacent fields.
	3.2	If the AS-i slaves are not available for selection, set the parameter bits in accordance with the manufacturer guidelines.  With an A/B module, the checkbox for parameter bit 3 is not displayed.
4	If you activate the "Reserve max. address space" checkbox, the system makes the 4-bit input addresses and 4-bit output addresses available for the AS-i slave in the I/O memory.  The system displays an input and output address range for digital data exchange. If a digital AS-i slave has not been assigned any inputs or outputs, the corresponding field is empty.	
5	If you intend to transfer analog data for an analog AS-i slave via cyclic PROFIBUS DP services, activate the appropriate option. Otherwise, analog data can only be transferred via data blocks.  The system proposes an input and output address space. The values can be changed. The system reports incorrect values.	
6	If required, enter the name and a comment for an AS-i slave on the "General" tab. When you close the dialog, your entries appear in the AS-i address table.	

11.7.8 Completing configuration

To complete the project and download it to the CPU, carry out the following steps.

Step	Action
1	Save and compile the configuration in the current project.
2	Download the hardware configuration to the module.

11.7.9 Switching on the AS-i power supply

Note

Only set addresses on the device when PROFIBUS communication has been interrupted

When you make the required settings on DP/AS-i LINK Advanced, you must ensure that no communication is currently taking place with the PROFIBUS DP master. If necessary, switch off the CPU or disconnect the PROFIBUS plug.

Switch on the AS-i power supply unit for supplying AS-Interface.

Step	Action
1	Switch on the voltage for the 30 V AS-i power supply unit. When started for the first time, DP/AS-i LINK Advanced performs a self-test. All LEDs light up for 15 s.

11.7.10 Switching on the optional power supply for DP/AS-i LINK Advanced

Switch on the 24 V DC power supply unit to provide an optional power supply for DP/AS-i LINK Advanced.

Step	Action
1	If you use an optional power supply for DP/AS-i LINK Advanced, switch on the voltage for the additional 24 V DC power supply unit.

11.7.11 Setting the PROFIBUS address on DP/AS-i LINK Advanced

Set the PROFIBUS address of DP/AS-i LINK Advanced as specified in the configuration directly on the device.

Step	Action
1	Press the "OK" button. The display for DP/AS-i LINK Advanced switches to the menu view.
2	Use the arrow keys to select the menu option "PROFIBUS" and confirm with "OK".
3	Use the arrow keys to select the menu option "DP address" and confirm with "OK". The existing PROFIBUS address is displayed.
4	Use the arrow keys to set the new PROFIBUS address. Use the same PROFIBUS address as in the configuration.
5	Confirm the new PROFIBUS address with "OK".

11.7.12 Addressing AS-i slaves

Address the AS-i slaves in accordance with the configuration.

Step	Action
1	If you use DP/AS-i LINK Advanced for assigning addresses, no AS-i slaves with the same address must be connected to an AS-i line. Remove any AS-i slaves with the same address. New AS-i slaves have the address "0".
2	Press the "OK" button. The display for DP/AS-i LINK Advanced switches to the menu view.
3	Use the arrow keys to select the menu option "AS-i" for a single master and confirm with "OK". The menu options "AS-i line 1" and "AS-i line 2" are available for a double master.
4	Use the arrow keys to select the menu option "Change address" and confirm with "OK". The lowest AS-i address found is displayed.
5	Use the arrow pointing right to go to the field "New".
6	Use the arrow keys to choose the new AS-i address in accordance with the configuration.
7	When all the existing AS-i slaves have been addressed, connect the nearest configured AS-i slave to AS-Interface.
8	If you address another AS-i slave on this AS-i line, repeat steps 4 to 7.
9	If you change the AS-i line when using a double master, press "ESC". Repeat steps 3 to 8.

11.7.13 Copying starting data blocks

Copy the starting data blocks from the STEP 7 configuration to DP/AS-i LINK Advanced.

Step	Action
1	Switch on the CPU or connect the device to PROFIBUS. DP/AS-i LINK Advanced receives its starting data blocks from the CPU and switches to "protected" mode.

11.8 DP/AS-i LINK Advanced - integration with GSD

11.8.1 Prerequisites

Before you use DP/AS-i LINK Advanced, the following additional devices and bus systems must be assembled, wired, and set up in accordance with their application documentation:

- CPU with PROFIBUS DP master and PROFIBUS cable
- AS-i cable with AS-i power supply and AS-i slaves
  When you use DP/AS-i LINK Advanced as a double master, two independent AS-i networks can be connected.
- PC / PG equipped with the following:
  - SPS-specific configuration tool (e.g. STEP 7)
  - GSD file for DP/AS-i LINK Advanced
    The GSD file for DP/AS-i LINK Advanced (http://support.automation.siemens.com/WW/view/en/113250) can be downloaded free of charge from the Internet.
  - PC / PG connected to CPU

Note

Power supply for DP/AS-i LINK Advanced

The AS-i shaped cable (line 1) supplies DP/AS-i LINK Advanced with voltage. Alternatively, a 24 V DC power supply can be provided via the power supply unit.

11.8.2 Integration procedure

The table below describes a potential procedure for integrating AS-Interface in your system via the AS-i master.

Step	Procedure
1	Configuring the PROFIBUS DP master system (Page 518)
2	Parameterizing DP/AS-i LINK Advanced as a PROFIBUS DP slave (Page 519)
3	Parameterizing AS-Interface (Page 520)
4	Parameterizing the binary address space (Page 521)
5	Parameterizing the analog address space (Page 523)
6	Completing configuration (Page 525)
7	Switching on the AS-i power supply (Page 525)
8	Switching on the optional power supply for DP/AS-i LINK Advanced (Page 526)
9	Setting the PROFIBUS address on DP/AS-i LINK Advanced (Page 526)
10	Addressing AS-i slaves (Page 526)
11	Saving the configuration (Page 527)
12	Copying starting data blocks (Page 528)

11.8.3 Configuring the PROFIBUS DP master system

Configure DP/AS-i LINK Advanced as a modular PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

Step	Action
1	Open your STEP 7 project with a CPU with the PROFIBUS DP master (e.g. CPU 315-2 DP).
2	Open HW Config for the PROFIBUS DP master.
3	If the DP master system is not yet available on the CPU, you have to create it. To do so, insert the DP master system in slot X2 (DP) of the CPU (e.g. via the "Insert master system" context menu).
4	Choose DP/AS-i LINK Advanced in the "Hardware Catalog" window. Path: PROFIBUS-DP > Additional FIELD DEVICES > Gateway > AS-I > DP/AS-i LINK Advanced The same icon is used to indicate single and double masters. A distinction is made between them via the configuration for the AS-i slaves.
5	Drag & drop the selected DP/AS-i LINK Advanced to the DP master system. The "Properties - PROFIBUS interface..." dialog is displayed.
6	Choose the PROFIBUS address for DP/AS-i LINK Advanced and close the dialog.

Result

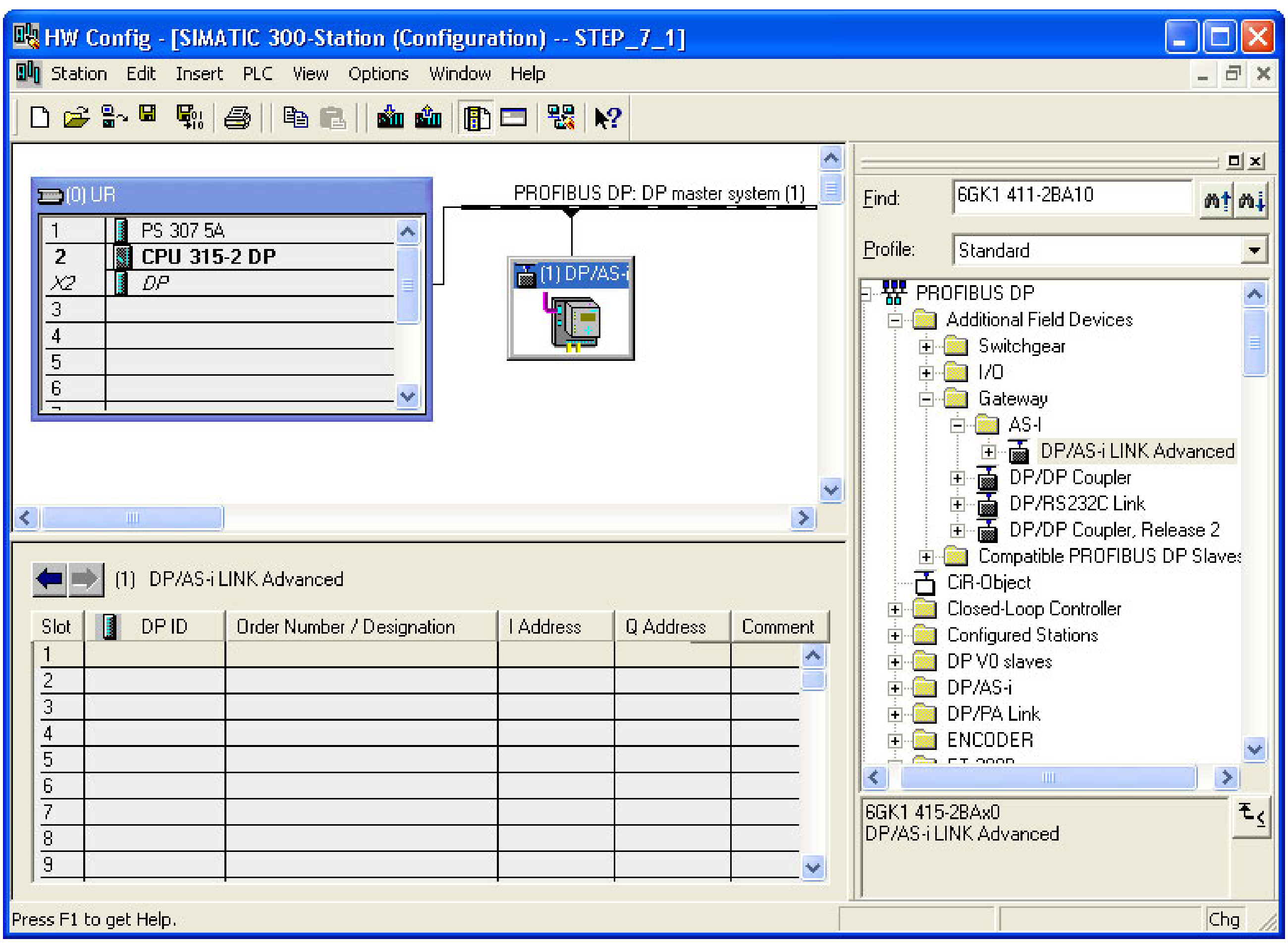
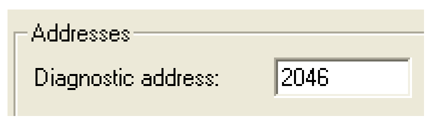


Figure 11-18 Configuration of DP/AS-i LINK Advanced on the DP master system

DP/AS-i LINK Advanced is attached to the DP master system as an icon. A detailed view of DP/AS-i LINK Advanced along with its possible slots is displayed in the lower part of the station window.

11.8.4 Parameterizing DP/AS-i LINK Advanced as a PROFIBUS DP slave

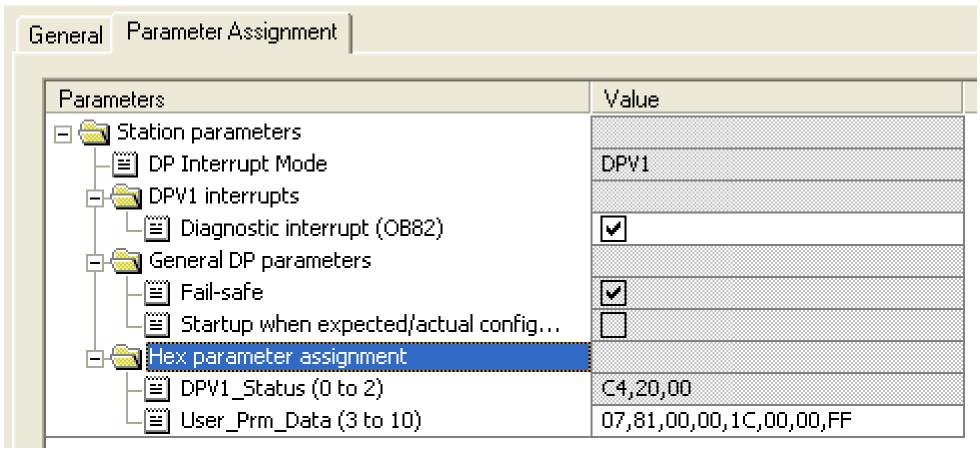
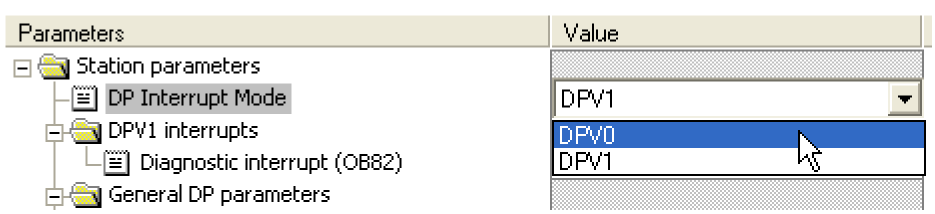
Parameterize DP/AS-i LINK Advanced as a PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Double-click the DP/AS-i LINK Advanced icon on the DP master system.
A window is displayed containing the "Properties - DP Slave" dialog, which contains the "General" and "Parameterization" tabs.</td></tr>
<tr><td rowspan="3">2</td><td colspan="2">On the "General" tab, set the properties of DP/AS-i LINK Advanced as a node on the PROFIBUS DP.</td></tr>
<tr><td>2.1</td><td>Enter the diagnostics address or use the displayed value.
If you enter an invalid address, the system proposes a new one.

The PROFIBUS DP master uses the diagnostics address to find out about a failure or return of a PROFIBUS DP slave and starts the OB 86. You can also call up the full diagnosis of the slave under this address with SFC 13 DPNRM_DG and include it in your user program.</td></tr>
<tr><td>2.2</td><td>Activate response monitoring so that DP/AS-i LINK Advanced can respond to errors in the PROFIBUS DP master or if bus data traffic is interrupted.

If the PROFIBUS DP master does not address DP/AS-i LINK Advanced within the configured monitoring time, the PROFIBUS DP slave switches to safe mode and sets all the outputs to "0".</td></tr>
</table>

11.8.5 Parameterizing AS-Interface

Parameterize the properties and behavior of DP/AS-i LINK Advanced as a PROFIBUS DP slave and AS-i Master on the "Parameterization" tab.

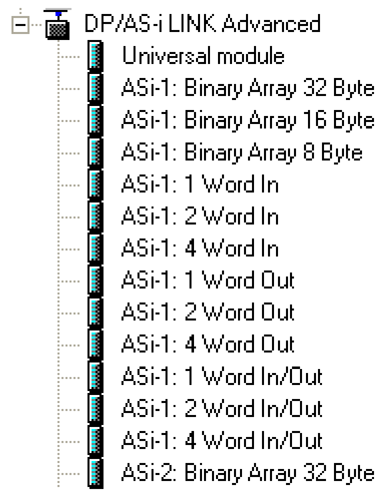
<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Call up the "Parameterize" tab in the "Properties - DP-Slave" dialog.

</td></tr>
<tr><td>2</td><td>In the relevant option box, activate the alarm enable for diagnostic interrupts (OB82).
Diagnostic interrupts are triggered if the following faults occur:
Group fault (SF)
Internal fault (= device fault)
External fault (e.g. AS-i slave failed)
At least one AS-i slave does not match the target specification.
Voltage on AS-i bus too low (AS-i Power Fail, APF)
Hardware fault (internal watchdog)
EEPROM defective</td></tr>
<tr><td>3</td><td>When you change the operating mode of the PROFIBUS DP master from DPV1 to DPV0, you first have to deactivate the "Diagnostic interrupt (OB 82)" option.
Then choose the operating mode from the "Interrupt Mode" drop-down list.

</td></tr>
<tr><td>4</td><td>Use only the parameters described above to make changes to the parameterization telegram. To prevent any unforeseen events, do not change any values in the "Hex parameterization" folder.</td></tr>
</table>

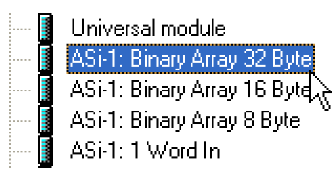
11.8.6 Parameterizing the binary address space

Assign the binary AS-i slaves an address space via the slot assignment in the station window.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Note the following assignment with the drag & drop slot assignment from the hardware catalog:

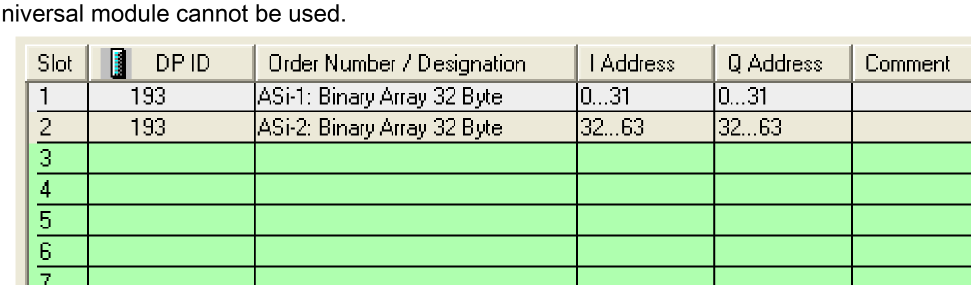
Choose just one ASi-1 module for a single master or line 1 of a double master.
Choose ASi-2 modules for line 2 of a double master.

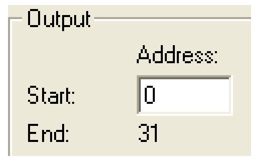
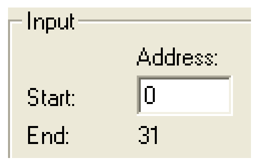
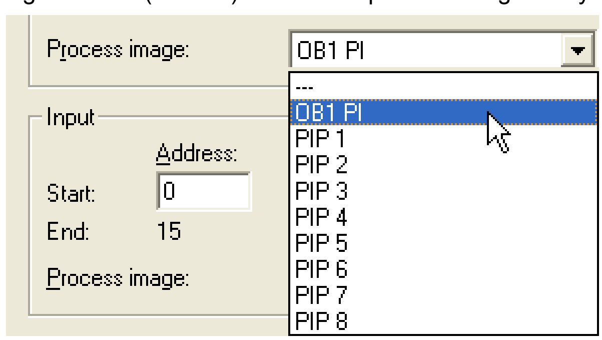
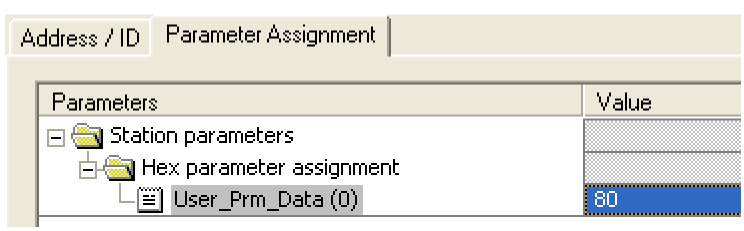


</td></tr>
<tr><td>2</td><td>Position just one binary module for each AS-i line.


The following binary modules are available:

"Binary Array 32 Byte" allows A/B slaves to be used that are set to B addresses. In this case, the entire binary data interface of DP/AS-i LINK Advanced can be used.
"Binary Array 16 Byte" allows a maximum configuration with 31 standard AS-i slaves. B slaves cannot be used.
With "Binary Array 8 Byte", you reserve a reduced memory space. Only standard AS-i slaves with the addresses 1 ... 15 can be used, however.
The universal module cannot be used.


<table>
<tr><th>Slot</th><th>DP ID</th><th>Order Number / Designation</th><th>I Address</th><th>Q Address</th><th>Comment</th></tr>
<tr><td>1</td><td>193</td><td>ASi-1: Binary Array 32 Byte</td><td>0...31</td><td>0...31</td><td></td></tr>
<tr><td>2</td><td>193</td><td>ASi-2: Binary Array 32 Byte</td><td>32...63</td><td>32...63</td><td></td></tr>
<tr><td>3</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
You are advised to assign an "ASi-1" binary module to slot 1. For a double master, assign an "ASi-2" binary module to slot 2.</td></tr>
</table>

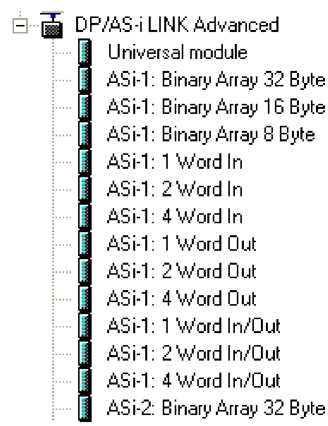
Step	Action
3	Double-click the line in the configuration table with the selected binary module (binary array) for AS-i line 1. A window is displayed with the "Properties - DP Slave" dialog, which contains the "Address / ID" and "Parameter Assignment" tabs.
4	On this tab, set the I/O address of the binary output data or accept the system proposal.  Depending on the selected module, the system calculates the end address and reports any errors that occur. When configuration is carried out using the GSD file, the I/O data of the AS-i slaves is sorted according to the CLASSIC sort type.
5	Set the I/O address for the binary input data or accept the system proposal.  Depending on the selected module, the system calculates the end address and signals any errors that occur.
6	If the "Process Image" drop-down list contains selection data, this means that the PROFIBUS DP master is a CPU that manages partial process images (e.g. CPU 416). Choose a partial process image number (PPI no.) or the OB1 process image for cyclic updates. 
7	If you make changes in the "Hex parameter assignment" folder, you need to know how the parameterization telegram is structured. Note EN 50170 or IEC 61158 here.  The data for the parameter assignment message is specified in hexadecimal format.
8	To close the "Properties - DP Slave" dialog, confirm your settings with "OK".
9	If you use AS-i line 2 on a double master, repeat steps 3 to 8.

11.8.7 Parameterizing the analog address space

Assign additional address space to each AS-i slave that occupies more than 4 bits of I/O address space (e.g. analog slaves).

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>
Choose a "Word" module for each corresponding AS-i slave.
You have the following options for selecting the modules:

Drag and drop a module from the hardware catalog.
Path: PROFIBUS-DP > Additional FIELD DEVICES > Gateway > AS-I > DP/AS-i LINK Advanced
Select a module via the context menu "Insert Object..."
Path: DP/AS-i LINK Advanced
Copy and insert via the clipboard.
Move the line content by pressing down the left mouse button.

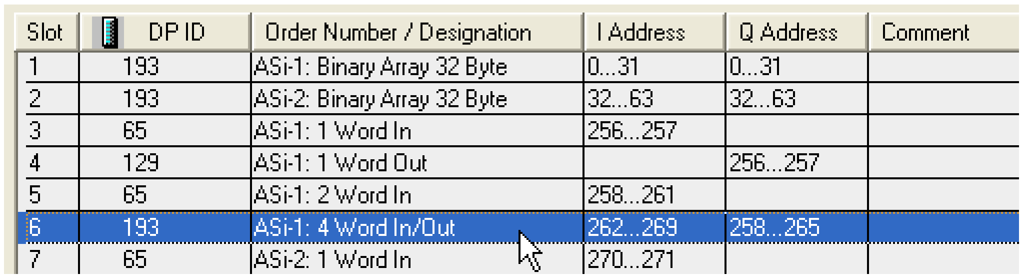


The modules that can be selected differ with respect to their memory capacity requirements.

"1 word" for AS-i slaves that require up to 4 bits of address space.
"2 word" / "4 word" for AS-i slaves that require up to 4 bits of address space (e.g. analog slaves).
"In" for AS-i slaves that only require input address space.
"Out" for AS-i slaves that only require output address space.
"In/Out" for AS-i slaves that require I/O address space.

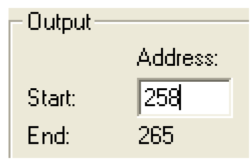
Example:
the analog module AS-i-1: 2 Word In, for example, is suitable for a two-channel analog input slave.
</td></tr>
<tr><td>2</td><td>
Position the selected modules in empty rows in the station window.
The slots can be assigned as required. Configuration is only complete, however, when there are no more gaps.
<table>
<tr><th>Slot</th><th>DP ID</th><th>Order Number / Designation</th><th>I Address</th><th>Q Address</th><th>Comment</th></tr>
<tr><td>1</td><td>193</td><td>ASi-1: Binary Array 32 Byte</td><td>0...31</td><td>0...31</td><td></td></tr>
<tr><td>2</td><td>193</td><td>ASi-2: Binary Array 32 Byte</td><td>32...63</td><td>32...63</td><td></td></tr>
<tr><td>3</td><td>65</td><td>ASi-1: 1 Word In</td><td>256...257</td><td></td><td></td></tr>
<tr><td>4</td><td>129</td><td>ASi-1: 1 Word Out</td><td></td><td>256...257</td><td></td></tr>
<tr><td>5</td><td>65</td><td>ASi-1: 2 Word In</td><td>258...261</td><td></td><td></td></tr>
<tr><td>6</td><td>193</td><td>ASi-1: 4 Word In/Out</td><td>262...269</td><td>258...265</td><td></td></tr>
<tr><td>7</td><td>65</td><td>ASi-2: 1 Word In</td><td>270...271</td><td></td><td></td></tr>
<tr><td>8</td><td>129</td><td>ASi-2: 1 Word Out</td><td></td><td>266...267</td><td></td></tr>
<tr><td>9</td><td>65</td><td>ASi-2: 2 Word In</td><td>272...275</td><td></td><td></td></tr>
<tr><td>10</td><td>193</td><td>ASi-2: 4 Word In/Out</td><td>276...283</td><td>268...275</td><td></td></tr>
<tr><td>11</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
The DP ID and I/O addresses are displayed for each module in the station window.
</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>3</td><td colspan="2">Parameterizing the selected "Word" modules.</td></tr>
<tr><td></td><td>3.1</td><td>Double-click the line with the selected module in the configuration table.

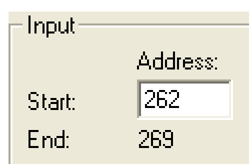


Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	193	ASi-1: Binary Array 32 Byte	0...31	0...31	
2	193	ASi-2: Binary Array 32 Byte	32...63	32...63	
3	65	ASi-1: 1 Word In	256...257		
4	129	ASi-1: 1 Word Out		256...257	
5	65	ASi-1: 2 Word In	258...261		
6	193	ASi-1: 4 Word In/Out	262...269	258...265	
7	65	ASi-2: 1 Word In	270...271		

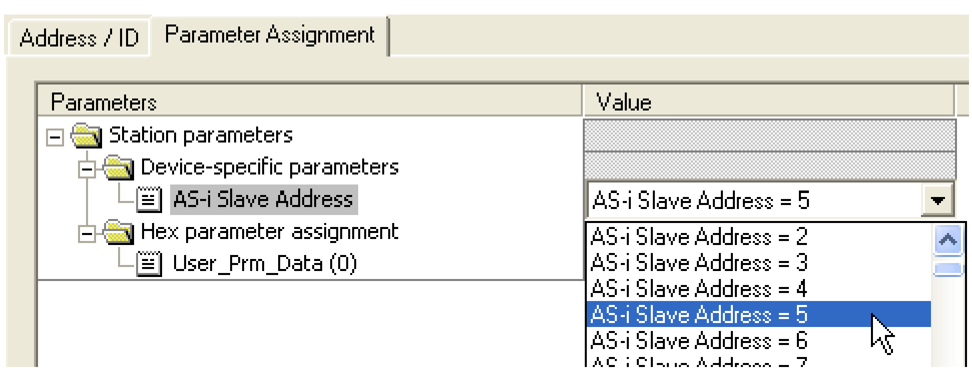
A window is displayed containing the "Properties - DP Slave" dialog, which contains the "Address / ID" and "Parameterization" tabs.</td></tr>
<tr><td></td><td>3.2</td><td>On this tab, set the start address of the output data or accept the system proposal.



Depending on the selected module, the system calculates the end address and reports any errors that occur.</td></tr>
<tr><td></td><td>3.3</td><td>Set the start address for the input data or accept the system proposal.



Depending on the selected module, the system calculates the end address and signals any errors that occur.</td></tr>
<tr><td></td><td>3.4</td><td>Choose the "Parameterization" tab.</td></tr>
<tr><td></td><td>3.5</td><td>In the "Device-specific parameters" folder, choose the AS-i address of the selected module via the drop-down list.



These AS-i addresses must match the configured AS-i configuration on DP/AS-i LINK Advanced.</td></tr>
</table>

Step	Action	
	3.6	If you change any data in the "Hex Parameterization" folder, you need to know how the parameterization telegram is structured. Note EN 50170 or IEC 61158 here.  The data for the parameterization telegram is specified in hexadecimal format.

11.8.8 Completing configuration

To complete the project and download it to the CPU, carry out the following steps.

Step	Action
1	Save and compile the configuration in the current project.
2	Download the hardware configuration to the module.

11.8.9 Switching on the AS-i power supply

Note

Only set addresses on the device when PROFIBUS communication has been interrupted

When you make the required settings on DP/AS-i LINK Advanced, you must ensure that no communication is currently taking place with the PROFIBUS DP master. If necessary, switch off the CPU or disconnect the PROFIBUS plug.

Switch on the AS-i power supply unit for supplying AS-Interface.

Step	Action
1	Switch on the voltage for the 30 V AS-i power supply unit. When started for the first time, DP/AS-i LINK Advanced performs a self-test. All LEDs light up for 15 s.

11.8.10 Switching on the optional power supply for DP/AS-i LINK Advanced

Switch on the 24 V DC power supply unit to provide an optional power supply for DP/AS-i LINK Advanced.

Step	Action
1	If you use an optional power supply for DP/AS-i LINK Advanced, switch on the voltage for the additional 24 V DC power supply unit.

11.8.11 Setting the PROFIBUS address on DP/AS-i LINK Advanced

Set the PROFIBUS address of DP/AS-i LINK Advanced as specified in the configuration directly on the device.

Step	Action
1	Press the "OK" button. The display for DP/AS-i LINK Advanced switches to the menu view.
2	Use the arrow keys to select the menu option "PROFIBUS" and confirm with "OK".
3	Use the arrow keys to select the menu option "DP address" and confirm with "OK". The existing PROFIBUS address is displayed.
4	Use the arrow keys to set the new PROFIBUS address. Use the same PROFIBUS address as in the configuration.
5	Confirm the new PROFIBUS address with "OK".

11.8.12 Addressing AS-i slaves

Address the AS-i slaves in accordance with the configuration.

Step	Action
1	If you use DP/AS-i LINK Advanced for assigning addresses, no AS-i slaves with the same address must be connected to an AS-i line. Remove any AS-i slaves with the same address. New AS-i slaves have the address "0".
2	Press the "OK" button. The display for DP/AS-i LINK Advanced switches to the menu view.
3	Use the arrow keys to select the menu option "AS-i" for a single master and confirm with "OK". The menu options "AS-i line 1" and "AS-i line 2" are available for a double master.
4	Use the arrow keys to select the menu option "Change address" and confirm with "OK". The lowest AS-i address found is displayed.
5	Use the arrow pointing right to go to the "New" field.
6	Use the arrow keys to choose the new AS-i address in accordance with the configuration.
7	When all the existing AS-i slaves have been addressed, connect the next configured AS-i slave to AS-Interface.

Step	Action
8	If you address another AS-i slave on this AS-i line, repeat steps 4 to 7.
9	If you change the AS-i line when using a double master, press "ESC". Repeat steps 3 to 8.

11.8.13 Saving the configuration

In "configuration" mode, DP/AS-i LINK Advanced exchanges data with all the connected AS-i slaves. DP/AS-i LINK Advanced instantly recognizes new AS-i slaves, activates them, and includes them in cyclic data exchange (except AS-i slaves with the address "0" or if an AS-i address has been assigned more than once). DP/AS-i LINK Advanced saves the the following AS-i slave data to a non-volatile memory:

- Addresses
- ID codes
- I/O configuration

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Press the "OK" button.
The display for DP/AS-i LINK Advanced switches to the menu view.</td></tr>
<tr><td>2</td><td colspan="2">Use the arrow keys to select the menu option "AS-i" for a single master and confirm with "OK".
The menu options "AS-i line 1" and "AS-i line 2" are available for a double master.</td></tr>
<tr><td rowspan="4">3</td><td colspan="2">Check whether all the connected AS-i slaves have been detected.</td></tr>
<tr><td>3.1</td><td>Use the arrow keys to select the menu option "Lifelist" and confirm with "OK".</td></tr>
<tr><td>3.2</td><td>Switch the address spaces using the arrow keys.</td></tr>
<tr><td>3.3</td><td>End the check with "ESC".</td></tr>
<tr><td>4</td><td colspan="2">Use the arrow keys to select the menu option "Detect -> New" and confirm with "OK".</td></tr>
<tr><td>5</td><td colspan="2">Confirm the prompt with "OK".
DP/AS-i LINK Advanced saves the recognized configuration in the internal EEPROM.</td></tr>
<tr><td>6</td><td colspan="2">If you change the AS-i line when using a double master, press "ESC". Repeat steps 2 to 5.</td></tr>
</table>

11.8.14 Copying starting data blocks

Copy the starting data blocks from the configuration to DP/AS-i LINK Advanced.

Step	Action
1	Switch on the CPU or connect the device to PROFIBUS. DP/AS-i LINK Advanced receives its starting data blocks from the CPU and switches to "protected" mode.

11.9 DP/AS-i F-Link - integration with STEP 7

11.9.1 Prerequisites

Before you use DP/AS-i F-Link, the following additional devices and bus systems must be assembled, wired, and set up in accordance with their application documentation:

- Failsafe SIMATIC S7-CPU with PROFIBUS DP master and PROFIBUS cable
  A standard PROFIBUS DP master, however, can be used for non-safe communication with non-safe AS-i slaves.
- AS-i cable with AS-i power supply and AS-i slaves or ASIsafe slaves
- PELV power supply unit (24 V DC) for DP/AS-i F-Link
- PC / PG equipped with the following:
  - STEP 7, as of version 5.4 with Service Pack 1
  - Option package S7 Distributed Safety, as of version 5.4 with Service Pack 1 (for S7-300 / 416 F-CPU).
  - S7 F configuration pack, as of version 5.5 (e.g. for SINUMERIK 840D)
  - Object Manager for DP/AS-i F-Link
    The Object Manager for DP/AS-i F-Link (http://support.automation.siemens.com/WW/view/en/24063754) can be downloaded free of charge from the Internet. Choose the "Downloads" tab.
  - PC / PG connected to failsafe CPU

11.9.2 Integration procedure

The table below describes a potential procedure for integrating AS-Interface in your system via the AS-i master.

Step	Procedure
1	Configuring the PROFIBUS DP master system (Page 530)
2	Parameterizing DP/AS-i F-Link as a PROFIBUS DP slave (Page 532)
3	Parameterizing PROFIsafe communication (Page 533)
4	Parameterizing AS-Interface (Page 535)
5	Configuring AS-i slaves (Page 538)
6	Specifying AS-i slaves (Page 540)
7	Paremeterizing ASIsafe slaves (Page 543)
8	Completing configuration (Page 544)
9	Switching on the AS-i power supply (Page 544)
10	Switching on the DP/AS-i F-Link power supply (Page 545)
11	Setting the PROFIsafe address on the DP/AS-i F-Link (Page 545)
12	Setting the PROFIBUS address on DP/AS-i F-Link (Page 546)
13	Addressing AS-i slaves (Page 546)
14	Copying starting data blocks (Page 547)

Step	Procedure
15	Teaching in code tables for ASIsafe slaves (Page 547)
16	Information about the user program (Page 548)

11.9.3 Configuring the PROFIBUS DP master system

Configure DP/AS-i F-Link as a modular PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

Step	Action
1	Open your STEP 7 project with a failsafe SIMATIC S7-CPU with the PROFIBUS DP master (e.g. CPU 315F-2 DP).
2	Open HW Config for the PROFIBUS DP master.
3	If the DP master system is not yet available on the CPU, you have to create it. To do so, insert the DP master system in slot X2 (DP) of the CPU (e.g. via the "Insert master system" context menu).
4	Select the DP / AS-i F-Link in the "Hardware Catalog" window. Path: PROFIBUS-DP > DP/AS-i > DP/AS-i F-Link > 3RK3141-xCD10 > V1.0
5	Drag & drop the selected DP/AS-i F-Link to the DP master system. The "Properties - PROFIBUS interface..." dialog is displayed.
6	Choose the PROFIBUS address for DP/AS-i F-Link and close the dialog.

Result

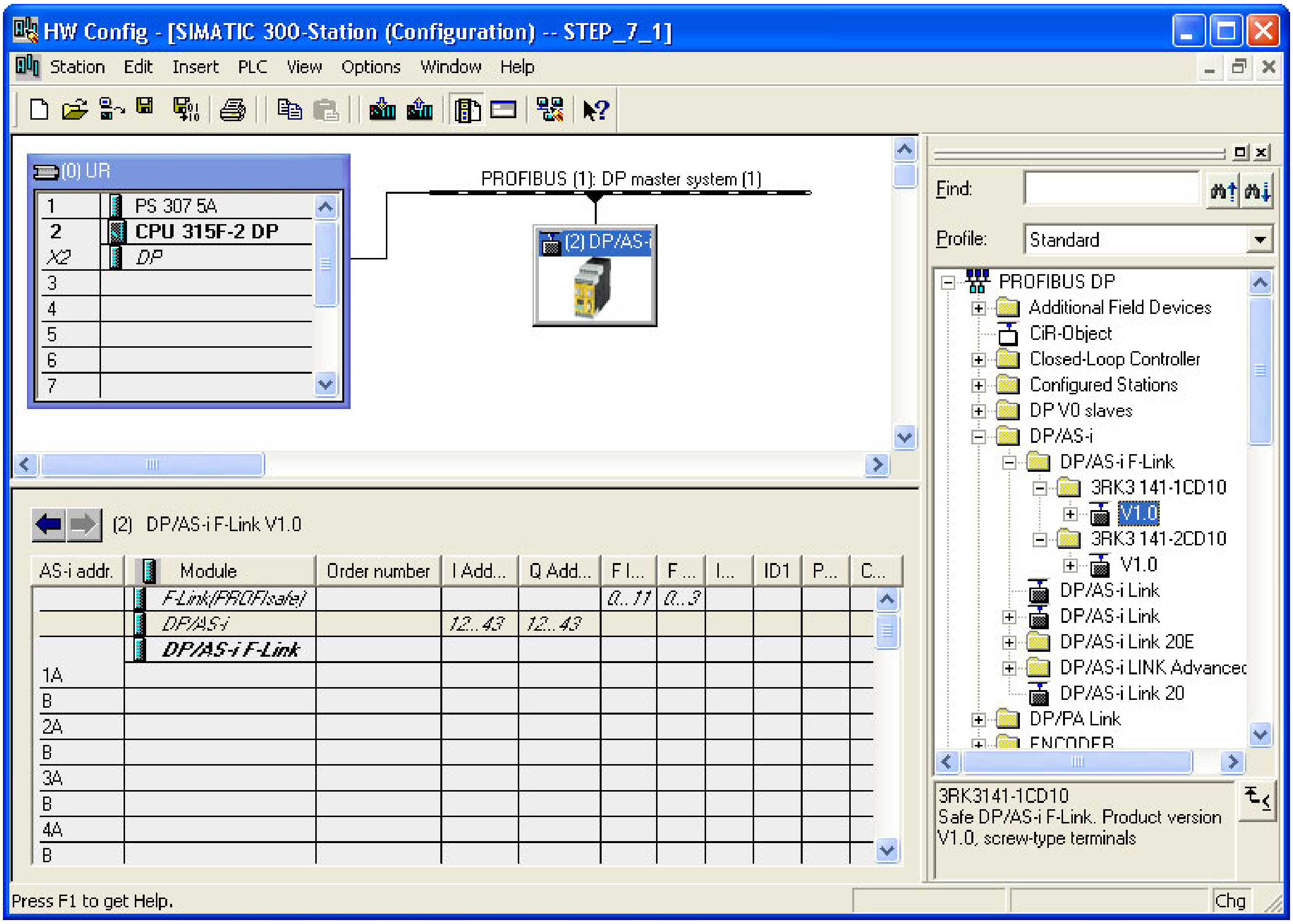
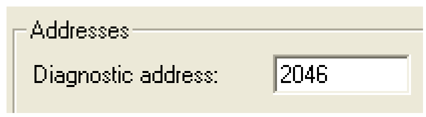


Figure 11-19 Configuration of DP/AS-i F-Link on the DP master system

DP/AS-i F-Link is attached to the DP master system as an icon. A detailed view of DP/AS-i F-Link along with its possible slots and DP IDs is displayed in the lower part of the station window. This is followed by the lines for the AS-i address table, which has yet to be maintained.

11.9.4 Parameterizing DP/AS-i F-Link as a PROFIBUS DP slave

Parameterize DP/AS-i F-Link as a PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

Step		Action
1		Double-click the icon for the DP/AS-i F-Link on the DP master system. A window is displayed with the "Properties - DP Slave" dialog, which contains the "General", "Identification", "PROFIsafe", and "F Address" tabs.
2		On the "General" tab, set the properties of DP/AS-i F-Link as a node on the PROFIBUS DP.
	2.1	Enter the diagnostics address or use the displayed value. If you enter an invalid address, the system proposes a new one.  The PROFIBUS DP master uses the diagnostics address to find out about a failure or return of a PROFIBUS DP slave and starts the OB 86. You can also call up the full diagnosis of the slave under this address with SFC 13 DPNRM_DG and include it in your user program.
	2.2	Activate response monitoring so that DP/AS-i F-Link can respond to errors in the PROFIBUS DP master or if bus data traffic is interrupted.  If the PROFIBUS DP master does not address DP/AS-i F-Link within the configured monitoring time, the PROFIBUS DP slave switches to safe mode and sets all the outputs to "0".
3		You can also maintain the following optional input fields on the "Identification" tab: • Plant identifier • Location ID • Installation date • Additional information This describes the assignment of DP/AS-i F-Link within the plant as a whole.

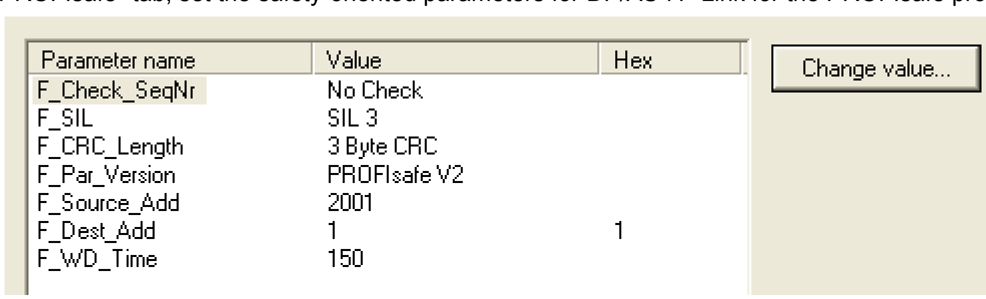
11.9.5 Parameterizing PROFIsafe communication

Parameterize PROFIsafe communication for DP/AS-i F-Link on the "PROFIsafe" and "F Addresses" tabs.

NOTICE
Setting for the parameter "F_Par_Version"
If the network comprises PROFIBUS DP and PROFINET IO subnets, set "PROFIsafe V2".

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Enter the password for the safety program.
When you access the PROFIsafe parameters in DP/AS-i F-Link for the first time, STEP 7 prompts you to create a new password.

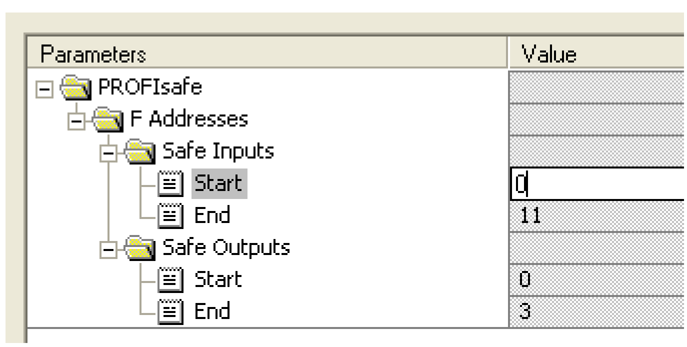
You must enter a password if you want to make any changes to the PROFIsafe settings. The last password entered is valid for one hour. Subsequent password changes can be made in the SIMATIC Manager > menu: "Tools" > "Edit safety program" dialog > "Authorization" pushbutton.</td></tr>
<tr><td>2</td><td colspan="2">On the "PROFIsafe" tab, set the safety-oriented parameters for DP/AS-i F-Link for the PROFIsafe protocol.



Parameter name	Value	Hex
F_Check_SeqNr	No Check	
F_SIL	SIL 3	
F_CRC_Length	3 Byte CRC	
F_Par_Version	PROFIsafe V2	
F_Source_Add	2001	
F_Dest_Add	1	1
F_WD_Time	150	

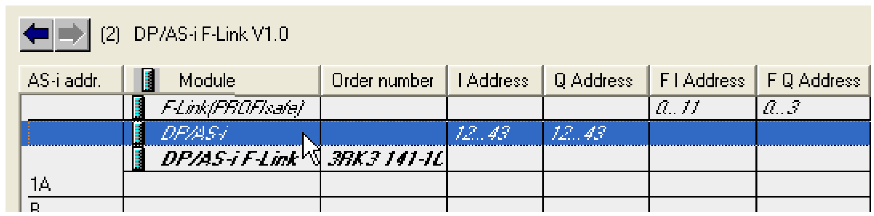
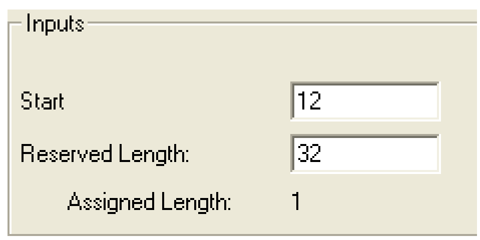
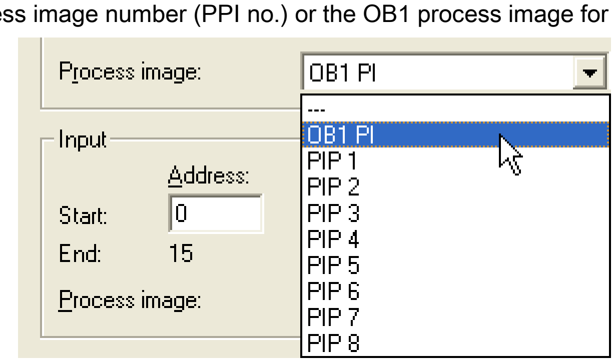
Change value...

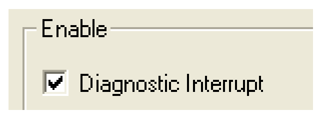
Change the parameter values by double-clicking the parameter name or by choosing "Change value...".</td></tr>
<tr><td></td><td>2.1</td><td>Parameter "F_Check_SeqNr":
This parameter defines whether the consistency check (CRC calculation) of the failsafe user data telegram takes into account the sequence number.
• In PROFIsafe V1 mode, this parameter is set permanently to "No Check".
• In PROFIsafe V2 mode, "F_Check_SeqNr" is irrelevant.
Note here the setting of the PROFIsafe mode in the parameter "F_Par_Version".</td></tr>
<tr><td></td><td>2.2</td><td>Parameter "F_SIL":
this parameter indicates the safety class of DP/AS-i F-Link and cannot be changed.</td></tr>
</table>

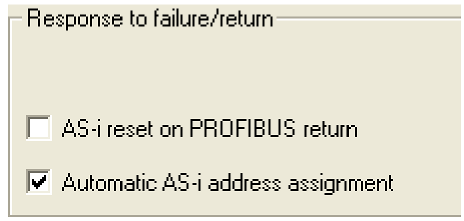
	2.3	Parameter "F_CRC_Length" Set the following for the "F_CRC_Length" parameter: • In PROFIsafe V1 mode: "2 Byte CRC" • In PROFIsafe V2 mode: "3 Byte CRC" (default) Note here the setting of the PROFIsafe mode in the parameter "F_Par_Version".
	2.4	Parameter "F_Par_Version" The following selection can be made: • "PROFIsafe V1": If the F CPU only supports PROFIsafe V1, choose this setting. • "PROFIsafe V2" (default) If the network comprises PROFIBUS DP and PROFINET IO subnets, set "PROFIsafe V2".
	2.5	Parameter "F_Source_Add" The "F_Source_Add" parameter uniquely identifies the PROFIsafe source (PROFIBUS DP Master). The system assigns this parameter automatically. The value range is from 1 to 65534.
	2.6	Parameter "F_Dest_Add" The "F_Dest_Add" parameter uniquely identifies the PROFIsafe target (DP/AS-i F-Link). The parameter is unique across the network and stations. The value range for "F_Dest_Add" is from 1 to 9999. This address must match the F-DP (PROFIsafe address) that you set on the device.
	2.7	Parameter "F_WD_Time" In the "F_WD_Time" field, you can set the monitoring time for safety-oriented communication between the failsafe CPU and failsafe I/O. DP/AS-i F-Link expects a valid safety message frame from the failsafe CPU within the monitoring time. As a result, DP/AS-i F-Link can safely respond to failures and errors by either keeping the system in safe mode or by switching it to a safe mode. When you choose the monitoring time, make sure that, on the one hand, it is long enough to ensure that telegram delays caused by communication are tolerated while, on the other hand, the system can still respond in good time if an error occurs (e.g. interruption of communication connection). The "F_WD_Time" parameter can be set to anywhere between 10 ms and 10000 ms in 1 ms increments (default: 150 ms).
3	On the "F Addresses" tab, set the I/O address of the safe input data or accept the value displayed. If you enter an invalid address, the system proposes a new one.  The safe input data requires 12 bytes of memory space. The end address appears automatically. Depending on the system, the I/O addresses of the safe outputs match the I/O addresses of the safe inputs. The process image of safe outputs has a fixed length of 4 bytes and only contains administrative data, but no user data.	

11.9.6 Parameterizing AS-Interface

Parameterize the properties and behavior of DP/AS-i F-Link as an AS-i master in the "Properties - DP/AS-i -..." dialog.

Step	Action	
1	In the AS-i address table, double-click the second line with the "DP/AS-i" module.  A window is displayed containing the "Properties - DP/AS-i - ..." dialog, which contains "General", "Digital Addresses", "Operating Parameters", and "AS-i Slave Options" tabs.	
2	If required, enter the name and a comment for the AS-i line on the "General" tab.	
3	To configure the binary I/O address spaces for the AS-i slaves, choose the "Digital Addresses" tab.	
	3.1	Set the I/O address for the binary input data or accept the displayed value. If you enter an invalid address, the system proposes a new one.  Digital input addresses relate to a max. 32 byte memory area in which the binary input values of the AS-i slaves are stored. For the digital output addresses, the same starting value as for the input addresses applies depending on the system.
	3.2	If you use the CLASSIC sort type for the I/O addresses (default setting), you can set the "Reserved lengths" value. You can use this parameter to suppress unassigned I/O addresses at the lower end of the table or fix an associated address space for future extensions on AS-Interface. The "Assigned length" shows the amount of memory currently occupied by the AS-i slaves in bytes.
	3.3	If the "Process Image" drop-down list contains selection data, this means that the PROFIBUS DP master is a CPU that manages partial process images (e.g. CPU 416F). Choose a partial process image number (PPI no.) or the OB1 process image for cyclic updates. 

Step	Action	
	3.4	Choose a sort type for the I/O addresses of the AS-i slaves (default: "CLASSIC").  The "Pack" button moves the I/O addresses of the AS-i modules in the AS-i address table in such a way that they require less room in the address space. In addition, the "Reserved length" is optimized. The "CLASSIC sorting" pushbutton sorts the I/O addresses according to AS-i address. The standard / A slaves are at the beginning, followed by the B slaves. The "LINEAR sorting" pushbutton sorts the I/O addresses in ascending order. Standard / A slaves and B slaves with the same AS-i address are combined in one byte (standard / A slave in the low nibble, B slave in the high nibble).
4	On the "Operating Parameters" tab, set the behavior of DP/AS-i F-Link as an AS-i master.	
	4.1	Activate the alarm enable for diagnostic interrupts (OB82).  Diagnostic interrupts are triggered if the following faults occur: • Code sequence error • Group fault (SF) • Internal fault (= device fault) • External fault (e.g. AS-i slave failed) • At least one AS-i slave does not match the target specification. • Voltage on AS-i bus too low (AS-i Power Fail, APF) • Hardware fault (internal watchdog) • EEPROM defective

Step	Action	
	4.2	Choose the options for the behavior of DP/AS-i F-Link when PROFIBUS fails and is then restored.  If PROFIBUS fails (BUS fault), DP/AS-i F-Link continues running as the AS-i master. The inputs are interrogated cyclically, but the outputs shut down. When the PROFIBUS is restored, DP/AS-i F-Link is supplied with the start-up parameters again and switches to protected mode. When you activate the "AS-i reset on PROFIBUS return" option, a PROFIBUS restart always resets AS-Interface. The receipt of message frames for parameterization and configuration data from the PROFIBUS DP master causes AS-i message frame traffic to stop completely and then restart. Upon deactivation (default), DP/AS-i F-Link checks the discrepancies between the data in the parameterization and configuration message frame and the actual data when the PROFIBUS restarts. The comparison is used as a basis for the following responses: • If all the data is identical, no reset is performed on AS-Interface. • If certain parameter bits of the AS-i slaves are not identical, just these ones are updated. • If any other discrepancies are identified, a reset is performed on AS-Interface. When you choose the option "Automatic AS-i address assignment" (default), an AS-i slave that has failed can be replaced by a new, identical slave with the address "0" (as-delivered state). DP/AS-i F-Link automatically assigns the new slave the address of the old one. If this option is deactivated, you have to program the address into the new slave when the slave is replaced.

11.9.7 Configuring AS-i slaves

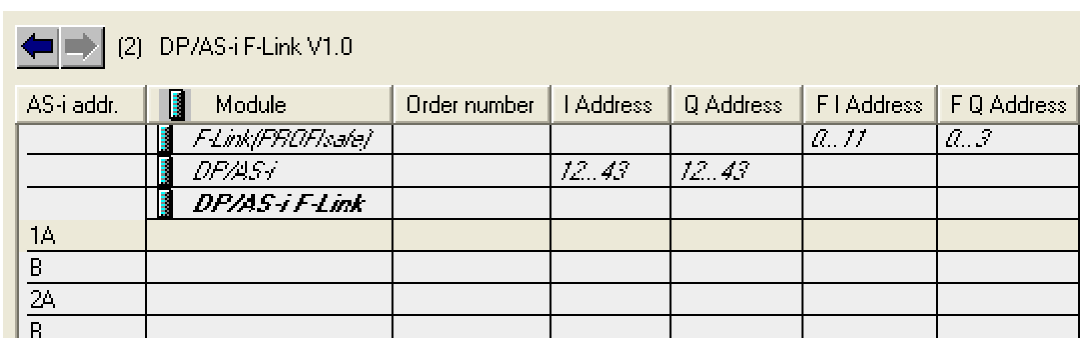
Configure the AS-i slaves in accordance with the address table.

Note

Reading the pending actual configuration to the AS-i address table

If an online connection has been established, you can read an existing AS-i configuration to the AS-i address table.

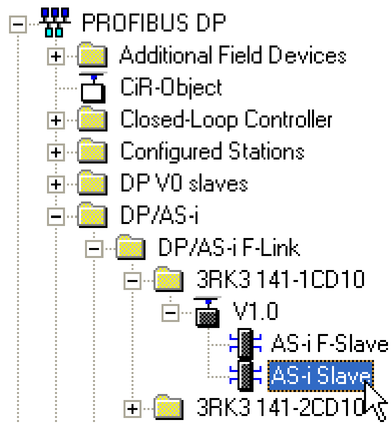
1. Skip the integration procedure until you reach Completing configuration (Page 544).
2. Follow the integration procedure until Copying starting data blocks (Page 547).
3. Then copy the current configuration with the command "Download to PG".
   "AS-i Slave Options" tab in the "Properties - DP/AS-i - ..." dialog.
4. Parameterize the AS-i slaves subsequently in STEP 7.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Click the DP/AS-i F-Link icon on the DP master system.


A detailed view of DP/AS-i F-Link is displayed in the lower part of the station window. The first line of the table contains address space information for the safety-related binary signals. The second line contains address information for the binary signals.
The "DP/AS-i F-Link" module is followed by the lines for the AS-i address table, which has yet to be maintained. One line for standard / A slaves and one line for B slaves are provided for each AS-i address.</td></tr>
</table>

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>2</td><td>
First enter dummy modules in the lines. You can then specify these later on.
The following dummy modules are available:

AS-i F slave modules for ASIsafe slaves
AS-i slave modules for all the other AS-i slaves

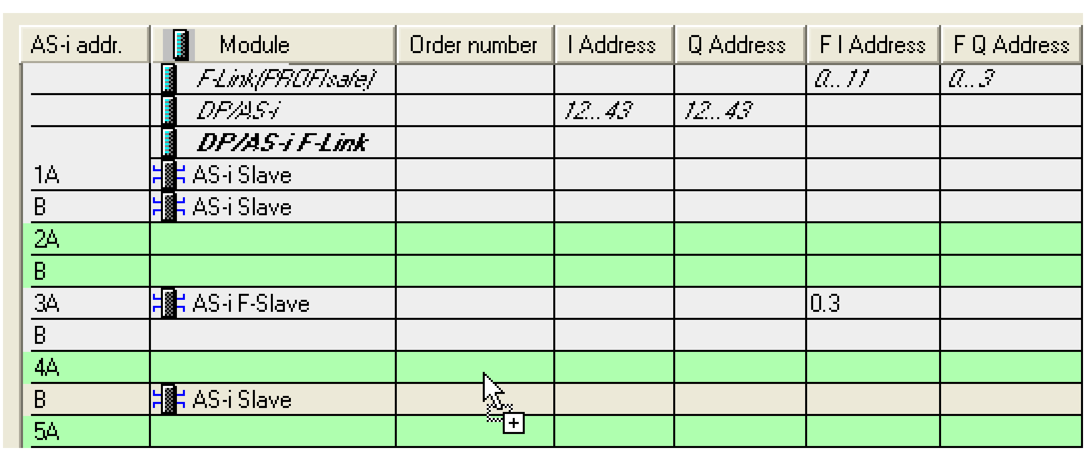


You have the following options for assigning the AS-i address lines:

Drag and drop an AS-i slave from the hardware catalog
Path: PROFIBUS-DP > DP/AS-i > DP/AS-i F-Link > 3RK3141-xCD10 > V1.0
Select an AS-i slave via the context menu "Insert Object..."
Path: V1.0 > AS-i F slave or AS-i slave
Copy and insert via the clipboard.
Move the line content by pressing down the left mouse button.
A configured slave changes its AS-i address as a result.

</td></tr>
<tr><td>3</td><td>
Note the following rules for assigning addresses:

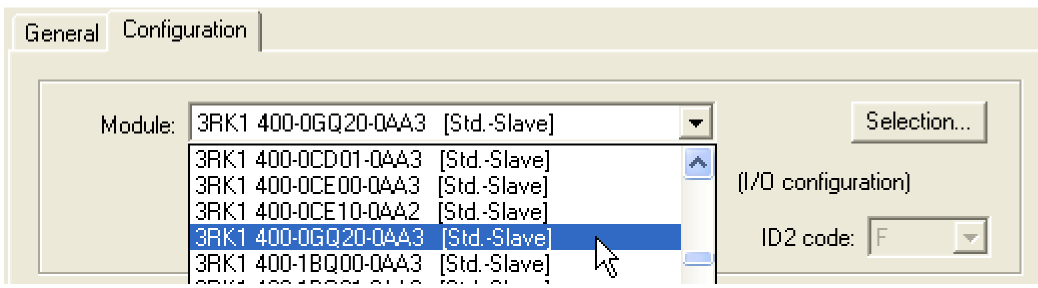
The lines containing potential target addresses are highlighted in green.
Standard slaves, ASIsafe slaves, and certain analog slaves use a full AS-i address (A and B address line).
Some AS-i slaves (e.g. CTT5) require the following full addresses, depending on whether the slaves are of type 2, 3, or 4. Make sure that the following addresses remain free.


<table>
<tr><th>AS-i addr.</th><th>Module</th><th>Order number</th><th>I Address</th><th>Q Address</th><th>F I Address</th><th>F Q Address</th></tr>
<tr><td></td><td>F-Link(PROFIsafe)</td><td></td><td></td><td></td><td>0..11</td><td>0..3</td></tr>
<tr><td></td><td>DP/AS-i</td><td></td><td>12..43</td><td>12..43</td><td></td><td></td></tr>
<tr><td></td><td>DP/AS-i F-Link</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1A</td><td>AS-i Slave</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>B</td><td>AS-i Slave</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2A</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>B</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3A</td><td>AS-i F-Slave</td><td></td><td></td><td></td><td>0.3</td><td></td></tr>
<tr><td>B</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4A</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>B</td><td>AS-i Slave</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5A</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
</table>

11.9.8 Specifying AS-i slaves

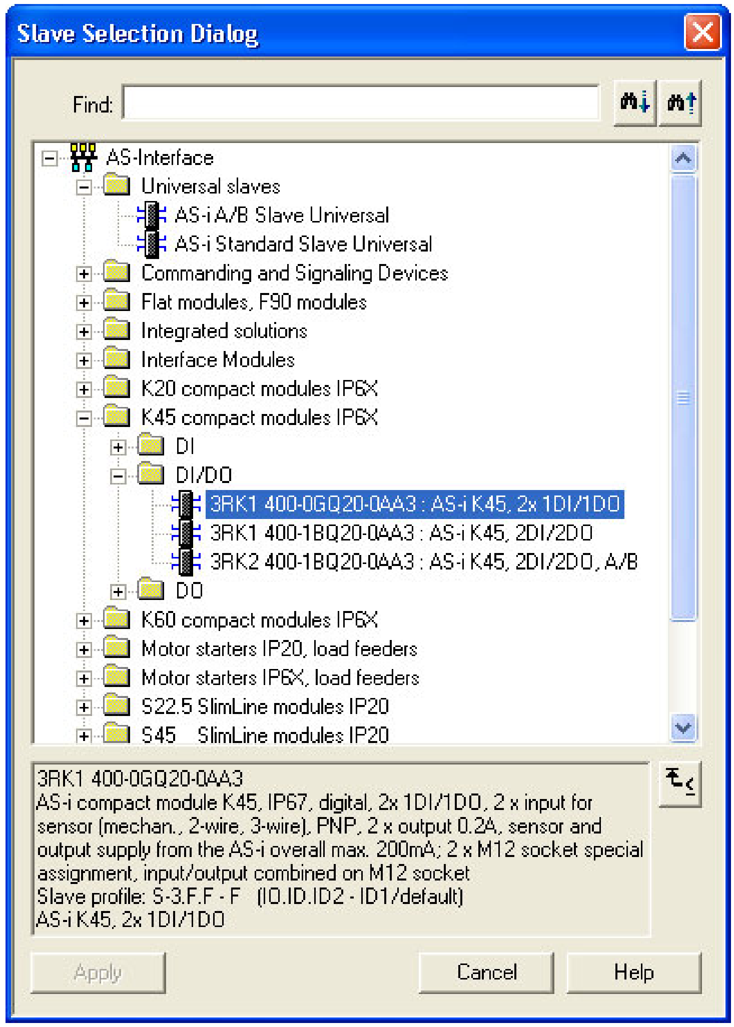
Specify the AS-i slaves in the "Properties - AS-i Slave - ..." or "Properties - AS-i F-Slave - ..." dialog.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Double-click an occupied address line in the AS-i address table.
• For an AS-i slave module, the window containing the "Properties - AS-i Slave - ..." dialog is displayed.
• For an AS-i F slave module, the window containing the "Properties - AS-i F Slave - ..." dialog is displayed.</td></tr>
<tr><td>2</td><td colspan="2">You can specify the AS-i slaves on the "Configuration" tab in one of the following ways:</td></tr>
<tr><td></td><td>A</td><td>In the "Module" drop-down list, select a Siemens module via its order number.



The IO, ID, and ID2 codes are permanently defined by the properties of the Siemens modules. On the other hand, the ID1 code can be variable on certain modules.</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td></td><td>B</td><td>Choose a Siemens module from the AS-Interface catalog. To do so, click "Selection...".

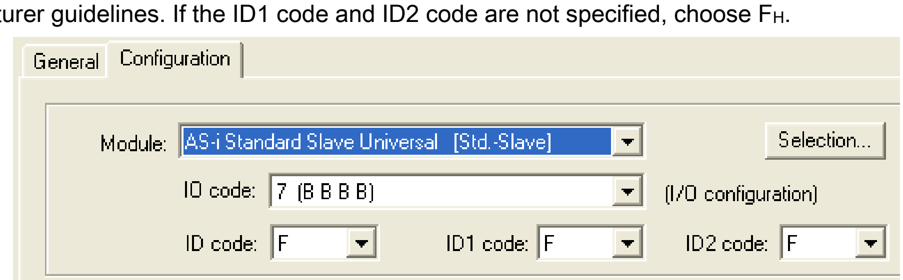


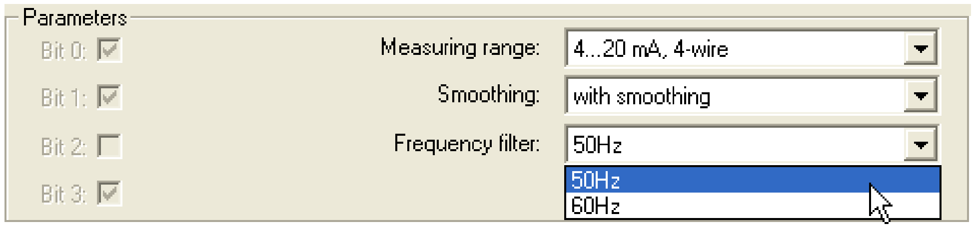
The following selection options are available for AS-i slaves:

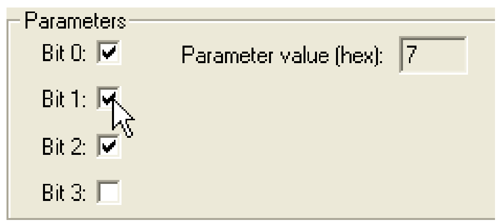
- Navigation through the hierarchic folder structure according to module type
- Search function using a keyword from the infotext

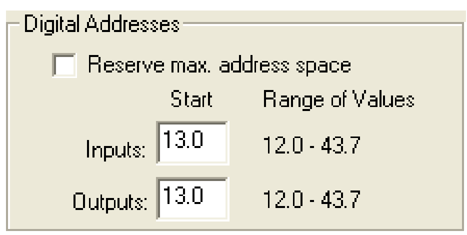
Transfer the module you have selected to the configuration by double-clicking it or selecting it and clicking "Accept".

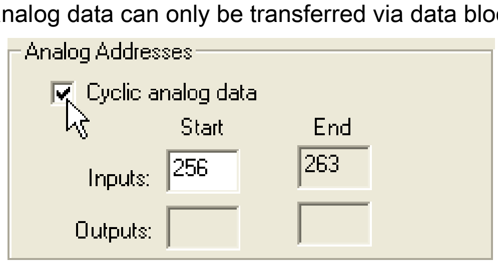
The IO code, ID code and ID2 code are fixed by the properties of the Siemens modules. On the other hand, the ID1 code can be variable on certain modules.</td></tr>
<tr><td></td><td>C</td><td>For AS-i slaves that are not available for selection, set the IO and ID codes in accordance with the manufacturer guidelines. If the ID1 code and ID2 code are not specified, choose FH.


</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td rowspan="3">3</td><td colspan="2">Parameterize the AS-i slaves.</td></tr>
<tr><td>3.1</td><td>If the selected Siemens modules support special parameter settings, you can select them from a range of drop-down lists.


The bit checkboxes cannot be changed separately. Their assignment is predefined by the modules or results from the entries in the adjacent fields.</td></tr>
<tr><td>3.2</td><td>If the AS-i slaves are not available for selection, set the parameter bits in accordance with the manufacturer guidelines.


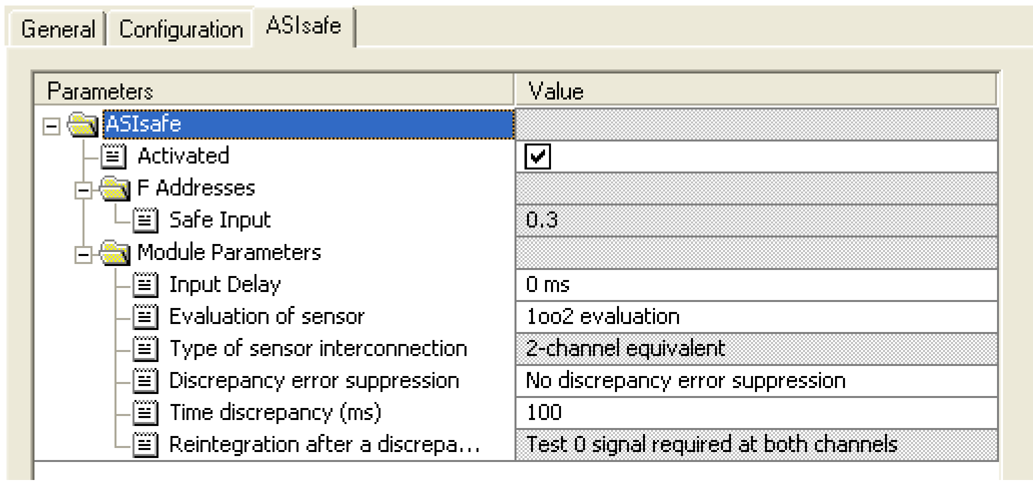
With an A/B module, the checkbox for parameter bit 3 is not displayed.</td></tr>
<tr><td>4</td><td colspan="2">If you activate the "Reserve max. address space" checkbox, the system makes the 4-bit input addresses and 4-bit output addresses available for the AS-i slave in the I/O memory.


The system displays an input and output address range for digital data exchange. If a digital AS-i slave has not been assigned any inputs or outputs, the corresponding field is empty.</td></tr>
<tr><td>5</td><td colspan="2">If you intend to transfer analog data for an analog AS-i slave via cyclic PROFIBUS DP services, activate the appropriate option. Otherwise, analog data can only be transferred via data blocks.


The system proposes an input and output address space. The values can be changed. The system reports incorrect values.</td></tr>
<tr><td>6</td><td colspan="2">If required, enter the name and a comment for an AS-i slave on the "General" tab. When you close the dialog, your entries appear in the AS-i address table.</td></tr>
<tr><td>7</td><td colspan="2">If you enter safety-oriented parameters for ASIsafe slaves on the "ASIsafe" tab, continue with the configuration procedure described in the next section "Parameterizing ASIsafe slaves".</td></tr>
</table>

11.9.9 Parameterizing ASIsafe slaves

Parameterize the safety settings of ASIsafe slaves on the "ASIsafe" tab.

Step	Action
1	Call up the "ASIsafe" tab in the "Properties - AS-i F-Slave" dialog.  The folder structure for the safety parameters is opened. In the "Value" column, variable parameters are highlighted in white.
2	Activate the "Activated" checkbox so that the ASIsafe slave is enabled for signal processing in the safety program. If you do not do this, the ASIsafe slave is deactivated from a safety point of view in DP/AS-i F-Link and none of the other parameters can be edited. It may need to be deactivated, for example, for an ASIsafe slave that is assigned to an additional safety monitor in AS-Interface.
3	To suppress coupled-in interference, you can set a module-wide input delay for an ASIsafe slave. This suppresses burst interference from 0 ms to 150 ms The input delay can be subject to a tolerance value. Refer to the operating instructions of the failsafe modules. A long input delay will suppress longer interference pulses; a short input delay will suppress shorter interference pulses. The default value is 0 ms. The input delay has a cumulative effect on the system response time.
4	Choose one of the following options for evaluating the sensors: • For the "1v1 evaluation", the sensor exists once and is connected on one channel to the first input of the ASIsafe slave. To do so, jumper the second input of the ASIsafe slave. Instead of the jumper, you can also connect a second single-channel sensor to the second input. DP/AS-i F-Link does not forward a resulting ON signal to the PLC until both inputs return ON signals. • For the "2v2 evaluation", both inputs on the ASIsafe slave are occupied by a two-channel sensor or by two one-channel sensors. Functionally, the two single-channel sensors belong together as a pair.

Step	Action
5	If you have set a 2v2 sensor evaluation, choose a parameter for discrepancy fault suppression. If you use one two-channel or two one-channel sensors that acquire the same physical process variables, the sensors address each other with a delay. This delay results from the sensor arrangement or the limited accuracy. The discrepancy analysis examines the variation over time of two failsafe input signals with the same functionality. The discrepancy analysis starts as soon as the system identifies a discrepancy. The following conditions are available: • No discrepancy error suppression (default) The discrepancy analysis starts as soon as different signals are present on channels 1 and 2. • Discrepancy fault suppression "For 0 signal at channel 1" The discrepancy analysis starts as soon as a 1 signal is present on channel 1 and a 0 signal is present on channel 2. • Discrepancy fault suppression "For 0 signal at channel 2" The discrepancy analysis starts as soon as a 1 signal is present on channel 2 and a 0 signal is present on channel 1. During the module-internal expiration of the parameterized discrepancy time, the value "0" for the affected ASIsafe slaves is made available to the safety program in the F-CPU. If the discrepancy remains even after the parameterizable discrepancy time has elapsed, a discrepancy error is present and a diagnostic interrupt is triggered.
6	If you have set a 2v2 sensor evaluation, enter a parameter for the discrepancy time. When you choose a discrepancy time for a channel pair, make sure that it is long enough for the difference between the two signals to disappear before the discrepancy time has elapsed. The values are within the range 100 ms (default) to 2500 ms with an increment of 10 ms.

11.9.10 Completing configuration

To complete the project and download it to the CPU, carry out the following steps.

Step	Action
1	Save and compile the configuration in the current project.
2	Download the hardware configuration to the module.
3	Note that you must regenerate and download the safety program once you have changed the F parameters.

11.9.11 Switching on the AS-i power supply

Switch on the AS-i power supply unit for supplying AS-Interface.

Step	Action
1	Switch on the voltage for the 30 V AS-i power supply unit.

11.9.12 Switching on the DP/AS-i F-Link power supply

Note

Only set addresses on the device when PROFIBUS communication has been interrupted

When you make the required settings on DP/AS-i F-Link, you must ensure that no communication is currently taking place with the PROFIBUS DP master. If necessary, switch off the CPU or disconnect the PROFIBUS plug.

Switch on the PELV power supply unit to provide a power supply for DP/AS-i F-Link.

Step	Action
1	Switch on the voltage for the 24 V power supply unit. When started for the first time, DP/AS-i F-Link performs a self-test. All LEDs light up for 3 s. The two-color LEDs light up yellow. When the system is commissioned for the first time or after the factory settings have been restored, the first line of the display shows "F-DP" and the second line shows "ADR▫▫".

11.9.13 Setting the PROFIsafe address on the DP/AS-i F-Link

Set the PROFIsafe address of DP/AS-i F-Link as specified in the configuration directly on the device.

Step	Action
1	Confirm the display "F-DP" / "ADR▫▫" with "SET". The display shows the existing PROFIsafe address in the second line.
2	Set the new PROFIsafe address using the combination lock (select with "MODE", continue with "SET"). Use the same PROFIsafe address as in the configuration F_Dest_Add).
3	Confirm with "SET". The first line shows your input. The message "F-OK▫" appears in the second line.
4	Confirm with "SET". When the system is commissioned for the first time, the first line of the display shows "DP▫▫" and the second line shows "ADR▫▫".

11.9.14 Setting the PROFIBUS address on DP/AS-i F-Link

Set the PROFIBUS address of DP/AS-i F-Link as specified in the configuration directly on the device.

Step	Action
1	Confirm the display "DP▫▫" / "ADR▫▫" with "SET". The display shows the existing PROFIBUS address in the second line.
2	Set the new PROFIBUS address using the combination lock (select with "MODE", continue with "SET"). Use the same PROFIBUS address as in the configuration.
3	Confirm with "SET". The first line shows "DP" and your input. The message "OK▫▫▫" appears in the second line.
4	Confirm with "SET". The display changes to status mode. A new DP/AS-i F-Link (with factory settings) adopts the PROFIBUS address, again without being switched off and then on again.

11.9.15 Addressing AS-i slaves

Address the AS-i slaves in accordance with the configuration.

Step	Action
1	If you use DP/AS-i F-Link for assigning addresses, no AS-i slaves with the same address must be connected to AS-Interface. Remove any AS-i slaves with the same address. New AS-i slaves have the address "0".
2	Switch to menu mode of the display with the "SET" key.
3	Choose "MODE" to select the menu option "ASI▫".
4	Confirm twice with "SET".
5	Connect an AS-i slave to AS-Interface. Note the relevant operating instructions.
6	In the following menu, choose the existing AS-i address with the "MODE" button. A new AS-i slave has the address "0".
7	Confirm with "SET". Your selection appears in the first line and in "NEW▫" appears in the second line.
8	Confirm with "SET".
9	In the following menu, choose the new AS-i address with the "MODE" button.
10	Confirm with "SET". The message "OK▫▫▫" appears in the second line once the address has been successfully changed.
11	Confirm with "SET". The display changes to status mode.
12	To address another AS-i slave, repeat steps 2 to 11.

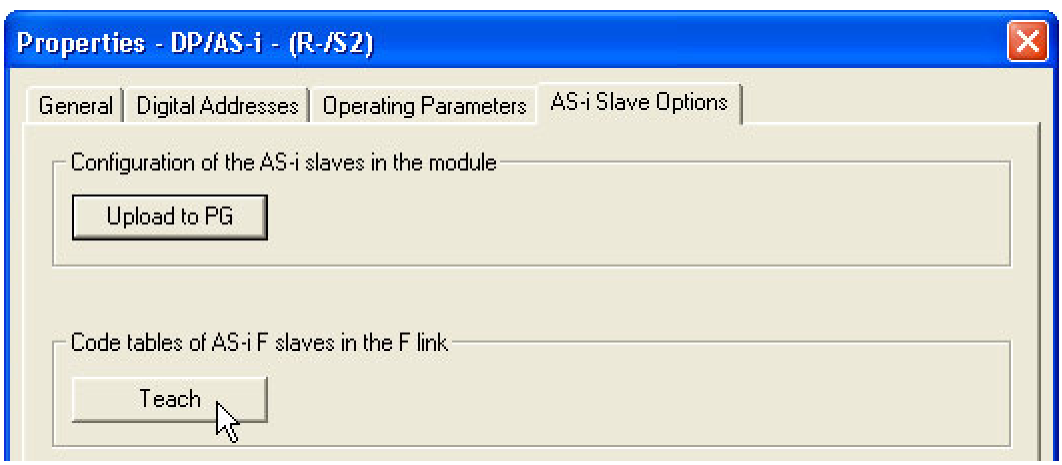
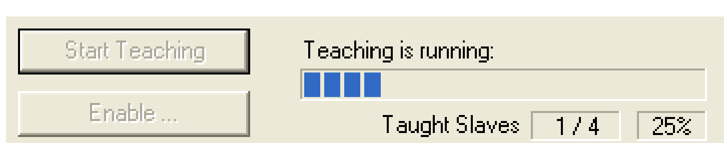
11.9.16 Copying starting data blocks

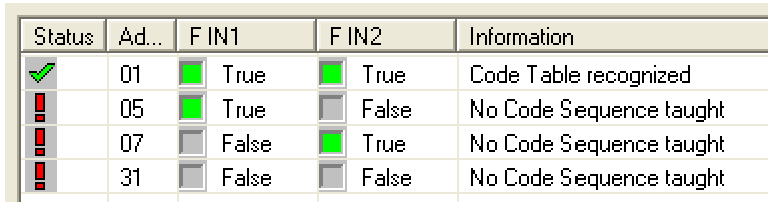
Copy the starting data blocks from the STEP 7 configuration to DP/AS-i F-Link.

Step	Action
1	Switch on the CPU or connect the device to PROFIBUS. DP/AS-i F-Link receives its starting data blocks from the CPU and switches to "protected" mode. The display shows "RUN▫". When the system is commissioned for the first time, the display switches to "ASI▫" / "CT▫▫▫".

11.9.17 Teaching in code tables for ASIsafe slaves

Teach in the code sequences of the ASIsafe slaves on DP/AS-i F-Link.

Step	Action
1	Close all input contacts of the ASIsafe slaves for teaching in the code sequences.
2	Establish an online connection from the PC / PG to DP/AS-i F-Link.
3	Click the "Teach" button on the "AS-i Slave Options" tab in the "Properties - DP/AS-i - ..." dialog.  The "Teach in code tables" dialog is displayed.
4	Start teaching in the code sequences of the ASIsafe slaves. To do so, click "Start teaching".  A progress bar shows how much time remains. The ratio of the taught-in slaves to the total number of ASIsafe slaves is displayed. During this operation, PROFIsafe communication is quasi passivated.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>5</td><td>In the information table, note the status information and switch positions of the ASIsafe slaves.


Rectify any errors displayed.</td></tr>
<tr><td>6</td><td>Once the teach-in process has been successfully completed, acknowledge the dialog by choosing "End teach-in".
The code sequences are stored in DP/AS-i F-Link. PROFIsafe communication is resumed.</td></tr>
<tr><td>7</td><td>Once the code sequences have been successfully taught in, reopen all the input contacts of the ASIsafe slaves.</td></tr>
</table>

11.9.18 Information about the user program

When creating the user program, note the following information:

- DP/AS-i F-Link only starts when the following modules have been created:
  - OB 82, diagnostic interrupt
  - OB 85, program execution error
  - OB 86, rack failure of failure of a station in distributed I/O
- Call up the safety program with F-CALL from an OB.
  The benefit of F-CALLs from a time interrupt OB (e.g. OB 35) is that they interrupt cyclic program processing in the OB 1 at fixed intervals.
  Once the safety program has been processed, the system returns to the standard user program.
- When programming and commissioning safety technology, note the special regulations regarding the plant acceptance inspection.

11.10 DP/AS-i F-Link - integration with GSD

11.10.1 Prerequisites

Before you use DP/AS-i F-Link, the following additional devices and bus systems must be assembled, wired, and set up in accordance with their application documentation:

- Failsafe CPU with PROFIBUS DP master and PROFIBUS cable
  A standard PROFIBUS DP master, however, can be used for non-safe communication with non-safe AS-i slaves.
- AS-i cable with AS-i power supply and AS-i slaves or ASIsafe slaves
- PELV power supply unit (24 V DC) for DP/AS-i F-Link
- PC / PG with the following equipment:
  - PLC-specific configuration tool (e.g. STEP 7)
    For configuration with STEP 7, you also require the S7 F Configuration-Pack, as of version 5.5 (e.g. for SINUMERIK 840D) or the Options Pack S7 Distributed Safety, as of version 5.4 with Service Pack 1 (for S7-300 / 416 F-CPU).
  - GSD file for DP/AS-i F-Link
    The GSD file for DP/AS-i F-Link (http://support.automation.siemens.com/WW/view/en/24063754) can be downloaded free of charge from the Internet. Choose the "Downloads" tab.
  - PC / PG connected to failsafe CPU

11.10.2 Integration procedure

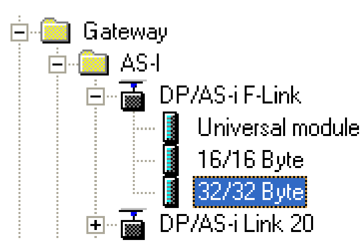
The table below describes a potential procedure for integrating AS-Interface in your system via the AS-i master.

Step	Procedure
1	Configuring the PROFIBUS DP master system (Page 550)
2	Parameterizing DP/AS-i F-Link as a PROFIBUS DP slave (Page 552)
3	Parameterizing AS-Interface (Page 553)
4	Paremeterizing ASIsafe slaves (Page 554)
5	Parameterizing PROFIsafe communication (Page 556)
6	Parameterizing binary AS-i slaves (Page 558)
7	Completing configuration (Page 559)
8	Switching on the AS-i power supply (Page 559)
9	Switching on the DP/AS-i F-Link power supply (Page 560)
10	Setting the PROFIsafe address on the DP/AS-i F-Link (Page 560)
11	Setting the PROFIBUS address on DP/AS-i F-Link (Page 561)
12	Addressing AS-i slaves (Page 561)
13	Saving the configuration (Page 562)
14	Copying starting data blocks (Page 562)

Step	Procedure
15	Teaching in code tables for ASIsafe slaves (Page 563)
16	Information about the user program (Page 563)

11.10.3 Configuring the PROFIBUS DP master system

Configure DP/AS-i F-Link as a modular PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

Step	Action
1	Open your STEP 7 project with a failsafe CPU with the PROFIBUS DP master (e.g. CPU 315F-2 DP).
2	Open HW Config for the PROFIBUS DP master.
3	If the DP master system is not yet available on the CPU, you have to create it. To do so, insert the DP master system in slot X2 (DP) of the CPU (e.g. via the "Insert master system" context menu).
4	Select the DP / AS-i F-Link in the "Hardware Catalog" window. Path: PROFIBUS-DP > Other FIELD DEVICES > Gateway > AS-I > DP/AS-i F-Link
5	Drag & drop the selected DP/AS-i F-Link to the DP master system. The "Properties - PROFIBUS Interface..." dialog opens.
6	Choose the PROFIBUS address for DP/AS-i F-Link and close the dialog.
7	Drag & drop the module "16/16 byte" or "32/32 byte" to the free slot 5 in the lower part of the station window. • "16/16 Byte" also allows a safety-oriented maximum configuration with 31 ASIsafe slaves. B slaves cannot be used. • "32/32 Byte" allows A/B slaves to be used whose B addresses are set. In this case, the entire binary data interface of DP / AS-i F-Link can be used. • The universal module cannot be used. 

Result

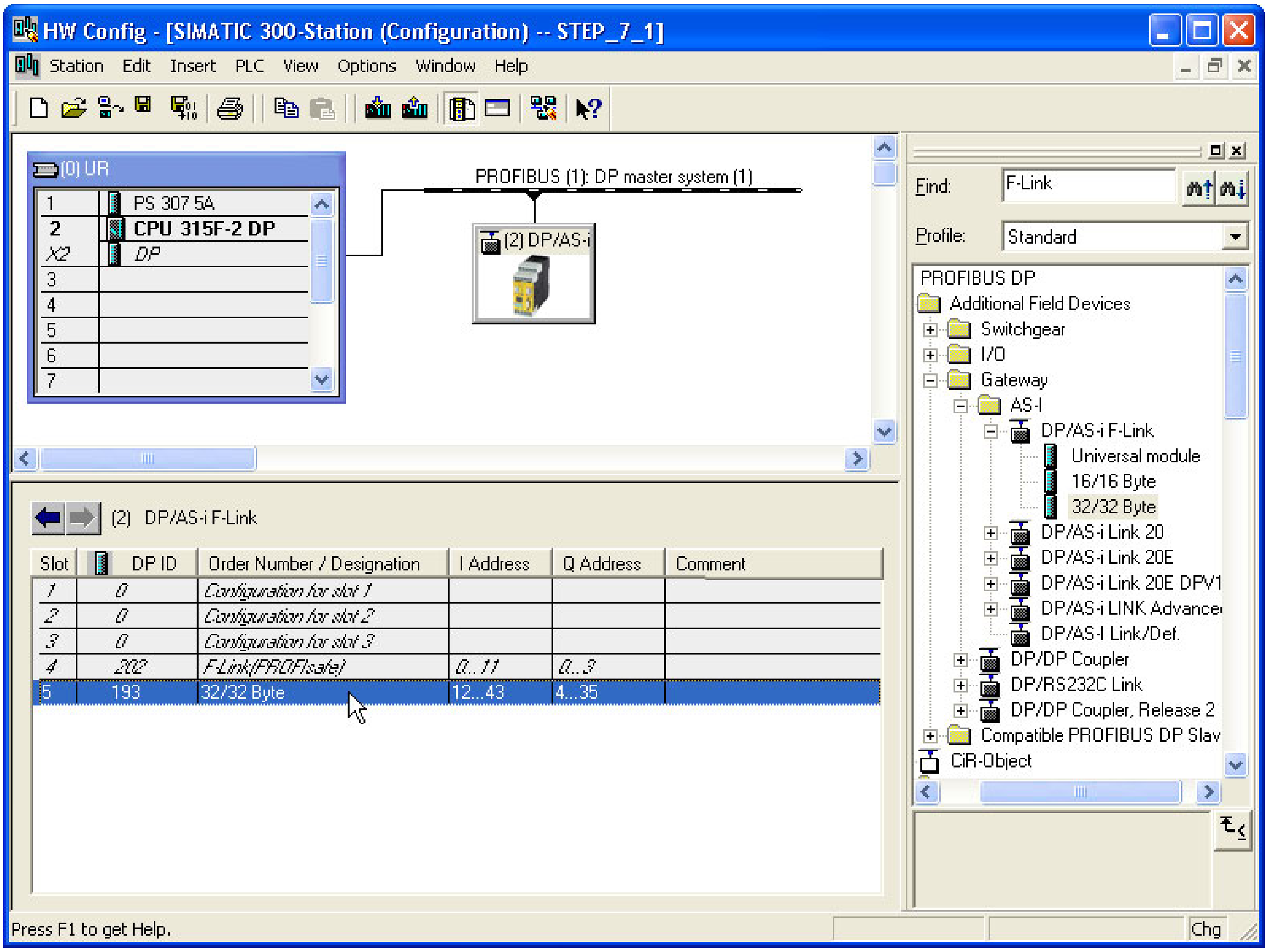
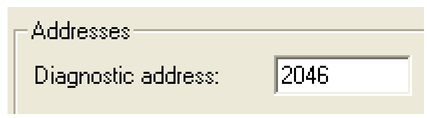
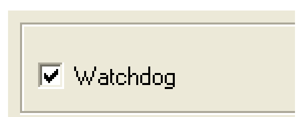


Figure 11-20 Configuration of DP/AS-i F-Link on the DP master system

DP/AS-i F-Link is attached to the DP master system as an icon. A detailed view of DP/AS-i F-Link along with the DP IDs and the occupied slot 5 is displayed in the lower part of the station window.

11.10.4 Parameterizing DP/AS-i F-Link as a PROFIBUS DP slave

Parameterize DP/AS-i F-Link as a PROFIBUS DP slave in HW Config of the PROFIBUS DP master.

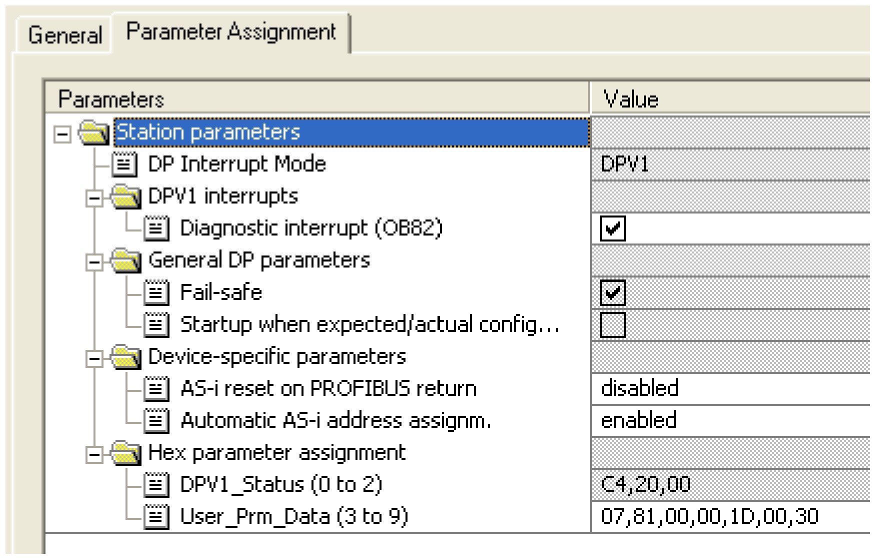
Step		Action
1		Double-click the DP/AS-i F-Link icon on the DP master system. A window is displayed containing the "Properties - DP Slave" dialog, which contains the "General" and "Parameterization" tabs.
2		On the "General" tab, set the properties of DP/AS-i F-Link as a node on the PROFIBUS DP.
	2.1	Enter the diagnostics address or use the system proposal. If you enter an invalid address, the system proposes a new one.  The PROFIBUS DP master uses the diagnostics address to find out about a failure or return of a PROFIBUS DP slave and starts the OB 86. You can also call up the full diagnosis of the slave under this address with SFC 13 DPNRM_DG and include it in your user program.
	2.2	Activate response monitoring so that DP/AS-i F-Link can respond to errors in the PROFIBUS DP master or if bus data traffic is interrupted.  If the PROFIBUS DP master does not address DP/AS-i F-Link within the configured monitoring time, the PROFIBUS DP slave switches to safe mode and sets all the outputs to "0".

11.10.5 Parameterizing AS-Interface

Parameterize the properties and behavior of DP/AS-i F-Link as a PROFIBUS DP slave and AS-i Master on the "Parameterization" tab.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>

Call up the "Parameterize" tab in the "Properties - DP-Slave" dialog.



</td></tr>
<tr><td>2</td><td>

In the relevant option box, activate the alarm enable for diagnostic interrupts (OB82).

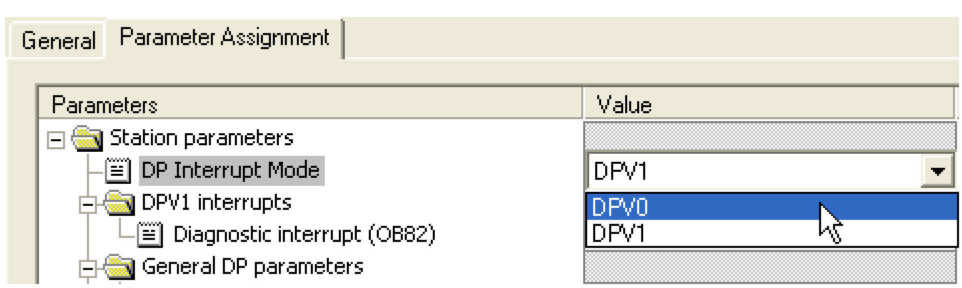
Diagnostic interrupts are triggered if the following faults occur:

- Code sequence error
- Group fault (SF)
- Internal fault (= device fault)
- External fault (e.g. AS-i slave failed)
- At least one AS-i slave does not match the target specification.
- Voltage on AS-i bus too low (AS-i Power Fail, APF)
- Hardware fault (internal watchdog)
- EEPROM defective

The DP/AS-i F-Link firmware does not support or generate any process alarms, even though the parameter can be selected.

</td></tr>
<tr><td>3</td><td>

When you change the operating mode of the PROFIBUS DP master from DPV1 to DPV0, you first have to deactivate the options for the diagnostic and process interrupts.
Then choose the operating mode from the "DP alarm mode" drop-down list.



</td></tr>
</table>

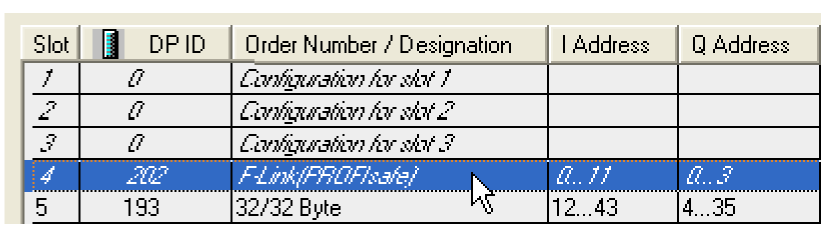
Step	Action
4	When you activate the "AS-i Reset at PROFIBUS Restore", a PROFIBUS restart always resets AS-Interface. The receipt of telegrams for parameterization and configuration data from the PROFIBUS DP master causes the AS-i telegram traffic to stop completely and then restart. If this option is deactivated (default), DP/AS-i F-Link checks the discrepancies between the data in the parameterization and configuration telegram and the actual data when the PROFIBUS restarts. The comparison is used as a basis for the following responses: • If identical, DP/AS-i F-Link does not reset AS-Interface. • If certain parameter bits of the AS-i slaves are not identical, just these ones are updated. • If any other discrepancies are identified, a reset is performed on the AS-Interface.
5	When the "Automatic AS-i addressing" is active (default), an AS-i slave that has failed can be replaced by a new, identical slave (same IO, ID, ID1, and ID2 code) with the address "0" (on delivery). DP/AS-i F-Link automatically assigns the new slave the address of the old one.
6	Use only the parameters described above to make changes to the parameterization telegram. To prevent any unforeseen events, do not change any values in the "Hex parameterization" folder.

11.10.6 Parameterizing ASIsafe slaves

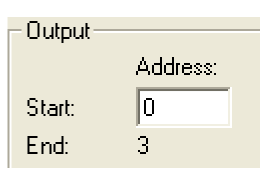
Configure the ASIsafe slaves via:

- The "Properties - DP Slave" dialog for slot 4 with the designation "F-Link(PROFIsafe)".
- The AS-i addresses to which certain parameters are assigned.

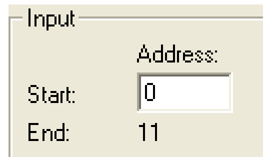
<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Double-click line 4 in the configuration table with the description "F-Link(PROFIsafe)".



A window is displayed containing the "Properties - DP Slave" dialog, which contains the "Address / ID", "Parameterization" tabs, and "PROFIsafe" tabs.</td></tr>
<tr><td>2</td><td>On this tab, set the I/O address of the safe output data or accept the system proposal.



The safe output data requires 4 bytes of memory space and only contains administration information, no user data. The system calculates the end address and signals any errors that occur.</td></tr>
</table>

Step	Action
3	Set the I/O address for the safe input data or accept the system proposal.  If the start addresses change, note that the start addresses for safe inputs and outputs must be identical. The safe input data require 12 bytes of memory space. The system calculates the end addresses and signals any errors that occur.

3	Note that the safety-oriented parameters of ASIsafe slaves are defined via their AS-i addresses. This assignment is important for setting the device-specific parameters and for assigning addresses during commissioning.
	A maximum of 31 ASIsafe slaves can be connected on DP/AS-i F-Link. When configuration is carried out with the GSD file, the functional scope for the safety-oriented evaluation is predefined.
	• The following applies to all ASIsafe slaves:
	  – Input delay: 0 ms
	By placing the ASIsafe slave in a specific address range, you decide about the evaluation of the following input signals:
	• AS-i addresses 1 ... 16
	  – Encoder evaluation: 1v1 evaluation
	• AS-i addresses 17 ... 31
	  – Encoder evaluation: 1v1 evaluation
	  – Type of encoder interconnection: 2-channel (equivalent)
	  – Discrepancy time: 2500 ms
	  – No discrepancy error suppression
	  – Reintegration after discrepancy error: test 0 signal required on both channels
	Note the explanations about the safety-oriented parameters in the relevant section Paremeterizing ASIsafe slaves (Page 543) of the STEP 7 configuration.

4	Note that you cannot make any changes on the "Parameter Assignment" tab.

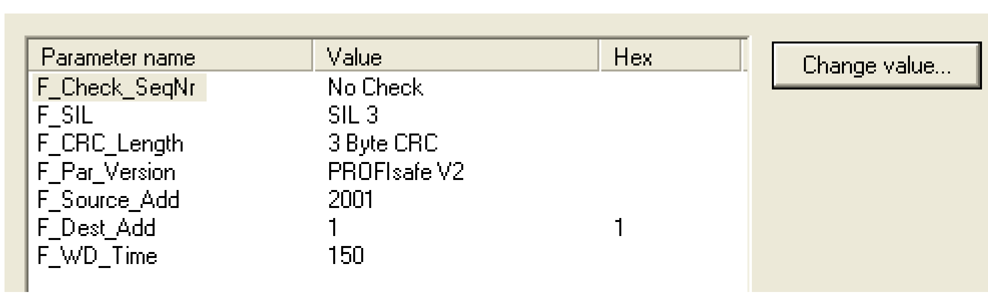
11.10.7 Parameterizing PROFIsafe communication

Parameterize PROFIsafe communication of DP/AS-i F-Link on the "PROFIsafe" tab.

NOTICE
Setting for the parameter "F_Par_Version"
If the network comprises PROFIBUS DP and PROFINET IO subnets, set "PROFIsafe V2".

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Enter the password for the safety program.
When you access the PROFIsafe parameters in DP/AS-i F-Link for the first time, STEP 7 prompts you to create a new password.

You must enter a password if you want to make any changes to the PROFIsafe settings. The last password entered is valid for one hour. Subsequent password changes can be made in the SIMATIC Manager > menu: "Tools" > "Edit Safety Program" dialog > "Authorization" pushbutton.</td></tr>
<tr><td rowspan="3">2</td><td colspan="2">On the "PROFIsafe" tab, set the safety-oriented parameters for DP/AS-i F-Link for the PROFIsafe protocol.



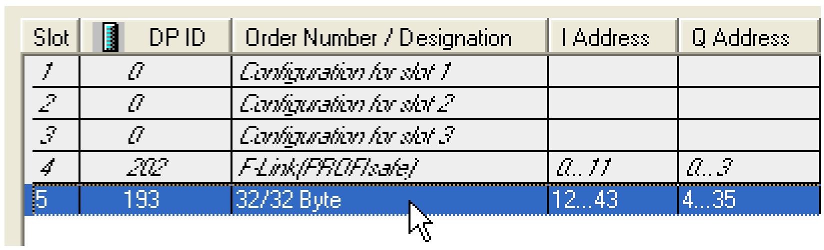
Change the parameter values by double-clicking the parameter name or by choosing "Change value...".</td></tr>
<tr><td>2.1</td><td>Parameter "F_Check_SeqNr":
This parameter defines whether the consistency check (CRC calculation) of the failsafe user data telegram takes into account the sequence number.
In PROFIsafe V1 mode, this parameter is set permanently to "No Check".
In PROFIsafe V2 mode, "F_Check_SeqNr" is irrelevant.
Note here the setting of the PROFIsafe mode in the parameter "F_Par_Version".</td></tr>
<tr><td>2.2</td><td>Parameter "F_SIL":
this "F_SIL" indicates the safety class of DP/AS-i F-Link and cannot be changed.</td></tr>
</table>

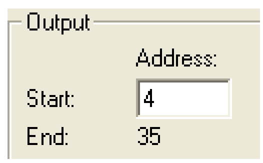
	2.3	Parameter "F_CRC_Length" set the following for the "F_CRC_Length" parameter: • In PROFIsafe V1 mode: "2 Byte CRC" • In PROFIsafe V2 mode: "3 Byte CRC" (default) Note here the setting of the PROFIsafe mode in the parameter "F_Par_Version".
	2.4	Parameter "F_Par_Version" the following selection can be made: • "PROFIsafe V1": If the F CPU only supports PROFIsafe V1, choose this setting. • "PROFIsafe V2" (default) If the network comprises PROFIBUS DP and PROFINET IO subnets, set "PROFIsafe V2".
	2.5	Parameter "F_Source_Add" the "F_Source_Add" parameter uniquely identifies the PROFIsafe source (PROFIBUS DP-Master). The system assigns this parameter automatically. The value range is from 1 to 65534.
	2.6	Parameter "F_Dest_Add" the "F_Dest_Add" parameter uniquely identifies the PROFIsafe target (DP/AS-i F-Link). The parameter is unique across the network and stations. The value range for "F_Dest_Add" is from 1 to 9999. This address must match the F DP (PROFIsafe address) that you set on the device.
	2.7	Parameter "F_WD_Time": in the "F_WD_Time" field, you can set the monitoring time for safety-oriented communication between the failsafe CPU and failsafe I/O. DP/AS-i F-Link expects a valid safety telegram from the CPU within the monitoring time. As a result, DP/AS-i F-Link can safely respond to failures and errors by either keeping the system in safe mode or by switching it to a safe mode. When you choose the monitoring time, make sure that, on the one hand, it is long enough to ensure that telegram delays caused by communication are tolerated while, on the other hand, the system can still respond in good time if an error occurs (e.g. interruption of communication connection). The "F_WD_Time" parameter can be set to anywhere between 10 ms and 10000 ms in 1 ms increments (default: 150 ms).

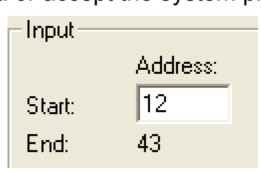
11.10.8 Parameterizing binary AS-i slaves

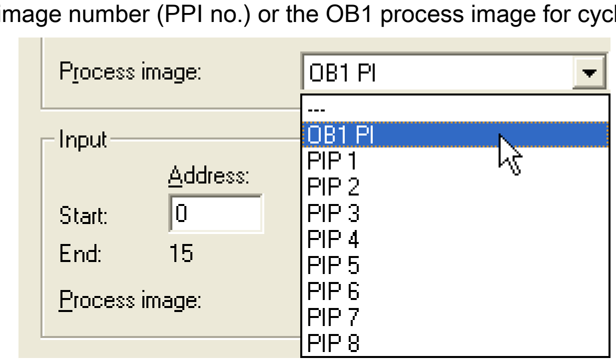
Parameterize the AS-i slaves in the "Properties - DP Slave" dialog for slot 5.

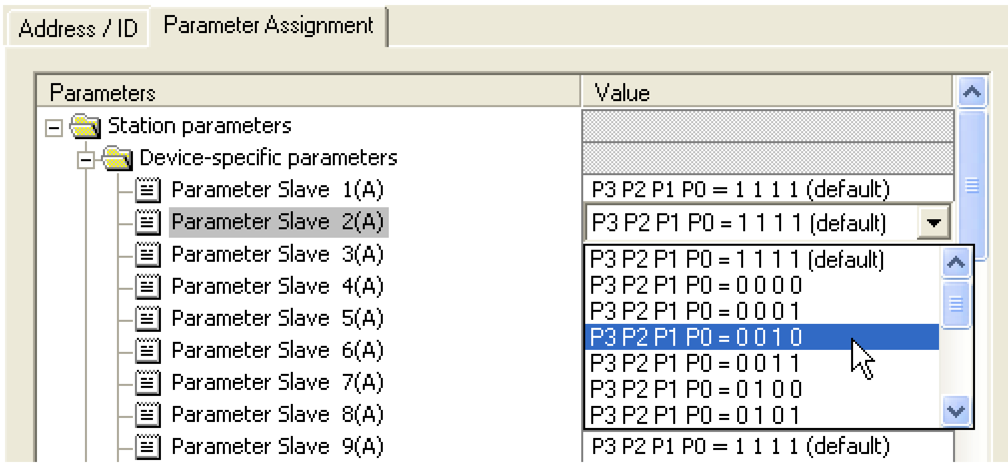
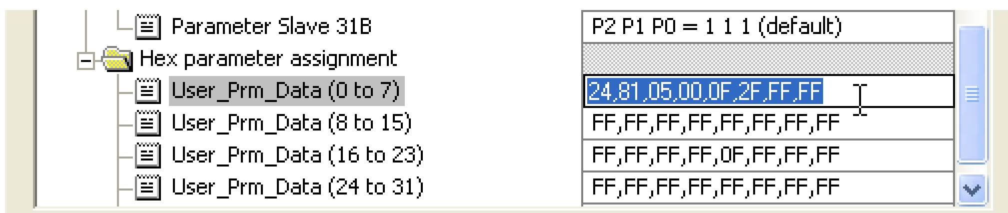
The parameters must match the configuration of the AS-i slaves, which you can set on DP/AS-i F-Link later on during commissioning.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Double-click line 5 in the configuration table with the selected module (16/16 bytes or 32/32 bytes).


A window is displayed containing the "Properties - DP Slave" dialog, which contains the "Address / ID" and "Parameterization" tabs.</td></tr>
<tr><td>2</td><td>On this tab, set the I/O address of the binary output data or accept the system proposal.


Depending on the selected module, the system calculates the end address and signals any errors that occur. When configuration is carried out using the GSD file, the I/O data of the AS-i slaves are arranged in the CLASSIC sorting.</td></tr>
<tr><td>3</td><td>Set the I/O address for the binary input data or accept the system proposal.


Depending on the selected module, the system calculates the end address and signals any errors that occur.</td></tr>
<tr><td>4</td><td>If the "Process Image" drop-down list contains selection data, this means that the PROFIBUS DP master is a CPU that manages partial process images (e.g. CPU 416F).
Choose a partial process image number (PPI no.) or the OB1 process image for cyclic updates.

</td></tr>
<tr><td>5</td><td>Choose the "Parameterization" tab.</td></tr>
</table>

Step	Action
6	In the "Device-specific parameters" folder, choose the parameter bits of the AS-i slaves from the drop-down lists.  For explanations of the individual parameters, consult the AS-i slave manuals.
7	If you make changes in the "Hex Parameterization" folder, you need to know how the parameterization telegram is structured. Note EN 50170 or IEC 61158 here.  The data for the parameterization telegram is specified in hexadecimal format.

11.10.9 Completing configuration

To complete the project and download it to the CPU, carry out the following steps.

Step	Action
1	Save and compile the configuration in the current project.
2	Download the hardware configuration to the module.
3	Note that you must regenerate and download the safety program once you have changed the F parameters.

11.10.10 Switching on the AS-i power supply

Switch on the AS-i power supply unit for supplying AS-Interface.

Step	Action
1	Switch on the voltage for the 30 V AS-i power supply unit.

11.10.11 Switching on the DP/AS-i F-Link power supply

Note

Only set addresses on the device when PROFIBUS communication has been interrupted

When you make the required settings on DP/AS-i F-Link, you must ensure that no communication is currently taking place with the PROFIBUS DP master. If necessary, switch off the CPU or disconnect the PROFIBUS plug.

Switch on the PELV power supply unit to provide a power supply for DP/AS-i F-Link.

Step	Action
1	Switch on the voltage for the 24 V power supply unit. When started for the first time, DP/AS-i F-Link performs a self-test. All LEDs light up for 3 s. The two-color LEDs light up yellow. When the system is commissioned for the first time or after the factory settings have been restored, the first line of the display shows "F-DP" and the second line shows "ADR▫▫".

11.10.12 Setting the PROFIsafe address on the DP/AS-i F-Link

Set the PROFIsafe address of DP/AS-i F-Link as specified in the configuration directly on the device.

Step	Action
1	Confirm the display "F-DP" / "ADR▫▫" with "SET". The display shows the existing PROFIsafe address in the second line.
2	Set the new PROFIsafe address using the combination lock (select with "MODE", continue with "SET"). Use the same PROFIsafe address as in the configuration F_Dest_Add).
3	Confirm with "SET". The first line shows your input. The message "F-OK▫" appears in the second line.
4	Confirm with "SET". When the system is commissioned for the first time, the first line of the display shows "DP▫▫" and the second line shows "ADR▫▫".

11.10.13 Setting the PROFIBUS address on DP/AS-i F-Link

Set the PROFIBUS address of DP/AS-i F-Link as specified in the configuration directly on the device.

Step	Action
1	Confirm the display "DP▫▫" / "ADR▫▫" with "SET". The display shows the existing PROFIBUS address in the second line.
2	Set the new PROFIBUS address using the combination lock (select with "MODE", continue with "SET"). Use the same PROFIBUS address as in the configuration.
3	Confirm with "SET". The first line shows "DP" and your input. The message "OK▫▫▫" appears in the second line.
4	Confirm with "SET". The display changes to status mode. A new DP/AS-i F-Link (with factory settings) adopts the PROFIBUS address, again without being switched off and then on again.

11.10.14 Addressing AS-i slaves

Address the AS-i slaves in accordance with the configuration.

Step	Action
1	If you use DP/AS-i F-Link for assigning addresses, no AS-i slaves with the same address must be connected to AS-Interface. Remove any AS-i slaves with the same address. New AS-i slaves have the address "0".
2	Switch to menu mode of the display with the "SET" key.
3	Choose "MODE" to select the menu option "ASI▫".
4	Confirm twice with "SET".
5	Connect an AS-i slave to AS-Interface. Note the relevant operating instructions.
6	In the following menu, choose the existing AS-i address with the "MODE" button. A new AS-i slave has the address "0".
7	Confirm with "SET". Your selection appears in the first line and in "NEW▫" appears in the second line.
8	Confirm with "SET".
9	In the following menu, choose the new AS-i address with the "MODE" button.
10	Confirm with "SET". The message "OK▫▫▫" appears in the second line once the address has been successfully changed.
11	Confirm with "SET". The display changes to status mode.
12	To address another AS-i slave, repeat steps 2 to 11.

11.10.15 Saving the configuration

Save the pending configuration recognized by DP/AS-i F-Link.
In "configuration" mode, DP/AS-i F-Link exchanges data with every connected AS-i slave. DP/AS-i F-Link instantly recognizes new AS-i slaves, activates them, and includes them in cyclic data exchange (except AS-i slaves with the address "0" or if an AS-i address has been assigned more than once). DP/AS-i F-Link saves the the following AS-i slave data to a non-volatile memory:

- Addresses
- ID codes
- I/O configuration

Step		Action
1	Switch to menu mode of the display with the "SET" key.	
2	Check whether all the connected AS-i slaves have been detected.	
	2.1	Use the MODE key to select the menu option "LIST" and confirm with "SET". The message "OKAY" and the AS-i address is displayed for each detected AS-i slave.
	2.2	Use the MODE key to scroll through the other AS-i addresses.
	2.3	Confirm the "EXIT" menu option by pressing "SET". The display returns to status mode.
3	Switch to menu mode of the display with the "SET" key.	
4	If the "MODE" menu option does not appear (e.g. during STEP 7 configuration), you must interrupt PROFIBUS communication. Remove the PROFIBUS connector from DP/AS-i F-Link or set the PROFIBUS DP master to "STOP".	
5	Confirm the "MODE" menu option twice with "SET".	
6	In the second line, use the "MODE" button to choose the "PSET" menu option.	
7	Save the configuration. Confirm "PSET" with "SET". DP/AS-i F-Link switches to "protected mode". The display shows "RUN▫". When the system is commissioned for the first time, the display switches to "ASI▫" / "CT▫▫▫".	

11.10.16 Copying starting data blocks

Copy the starting data blocks from the configuration to DP/AS-i F-Link.

Step	Action
1	Switch on the CPU or connect the device to PROFIBUS. DP/AS-i F-Link receives its starting data blocks from the CPU and switches to "protected" mode. The display shows "RUN▫".

11.10.17 Teaching in code tables for ASIsafe slaves

Teach in the code sequences of the ASIsafe slaves via the menu on DP/AS-i F-Link.

Step	Action
1	Close all input contacts of the ASIsafe slaves for teaching in the code sequences.
2	Confirm the display "ASI▫" / "CT▫▫▫" with "SET". The teach-in process begins. During this operation, PROFIsafe communication is quasi passivated. In the second line, "c" appears on the left with the next highest AS-i address (right justified) of the slave whose code sequence is taught in.
3	If slaves with open input contacts still exist, the display shows the associated addresses. Close the contacts. The teach-in process continues.
4	Once the teach-in process is complete, acknowledge the display "▫OK▫▫" with "SET". The display changes to status mode. The code sequences are stored in DP/AS-i F-Link. PROFIsafe communication is resumed.
5	Once the code sequences have been successfully taught in, reopen all the input contacts of the ASIsafe slaves.

11.10.18 Information about the user program

When creating the user program, note the following information:

- DP/AS-i F-Link only starts when the following modules have been created:
  - OB 82, diagnostic interrupt
  - OB 85, program execution error
  - OB 86, rack failure of failure of a station in distributed I/O
- Call up the safety program with F-CALL from an OB.
  The benefit of F-CALLs from a time interrupt OB (e.g. OB 35) is that they interrupt cyclic program processing in the OB 1 at fixed intervals.
  Once the safety program has been processed, the system returns to the standard user program.
- When programming and commissioning safety technology, note the special regulations regarding the plant acceptance inspection.

11.11 IE/AS-i LINK PN IO - integration with STEP 7

11.11.1 Prerequisites

Before you use IE/AS-i LINK PN IO, the following additional devices and bus systems must be assembled, wired, and set up in accordance with their application documentation:

- SIMATIC S7-CPU with PROFINET IO controller and Industrial Ethernet cable
- AS-i cable with AS-i power supply and AS-i slaves
  When you use IE/AS-i LINK PN IO as a double master, two independent AS-i networks can be connected.
- PC / PG with the following equipment:
  - STEP 7, as of version 5.4 Service Pack 3
  - PC / PG connected to CPU

IE/AS-i LINK PN IO Version V1.0 is supported as of STEP 7 Version 5.4 Service Pack 2.
IE/AS-i LINK PN IO Version V2.0 is supported as of STEP 7 Version 5.4 Service Pack 3.

The following descriptions explain how to use IE/AS-i LINK PN IO Version V2.0. An older device can be upgraded to the new firmware free of charge; see http://support.automation.siemens.com/WW/view/de/26204210

Note

Power supply for IE/AS-i LINK PN IO

The AS-i shaped cable (line 1) supplies IE/AS-i LINK PN IO with voltage. Alternatively, a 24 V DC power supply can be provided via the power supply unit.

11.11.2 Integration procedure

The table below describes a potential procedure for integrating AS-Interface in your system via the AS-i master.

Step	Procedure
1	Configuring the PROFINET IO system (Page 565)
2	Parameterizing the IE/AS-i LINK PN IO as an IO device (Page 567)
3	Parameterizing AS-Interface (Page 569)
4	Configuring AS-i slaves (Page 570)
5	Specifying AS-i slaves (Page 573)
6	Completing configuration (Page 576)
7	Switching on the AS-i power supply (Page 576)
8	Switching on the optional power supply for IE/AS-i LINK PN IO (Page 576)
9	Transferring the device name to IE/AS-i LINK PN IO (Page 576)
10	Addressing AS-i slaves (Page 577)

11.11.3 Configuring the PROFINET IO system

Configure IE/AS-i LINK PN IO as a modular IO device in HW Config of the PROFINET IO controller.

Step	Action
1	Open your STEP 7 project with a SIMATIC S7-CPU with the PROFINET IO controller (e.g. CPU 315-2 PN/DP). Whenever possible, always use the latest firmware version on the CPU and IE/AS-i LINK PN IO to leverage the complete functionality.
2	Open HW Config for the PROFINET IO controller.
3	If the PROFINET IO system is not yet available on the CPU, you have to create it. To do so, insert the PRIFINET IO system in slot X2 (PN-IO) of the CPU (e.g. via the "Insert PROFINET IO system" context menu (right click)).
4	Select the IE/AS-i LINK PN IO in the "Hardware Catalog" window. Path: PROFINET IO > Router > IE/AS-i Link PN IO > 6GK1411-2AB10 > V2.0 (or as double master 6GK1411-2AB20 > V2.0)
5	Drag & drop the selected IE/AS-i LINK PN IO to the PROFINET IO system.

Results for single and double master

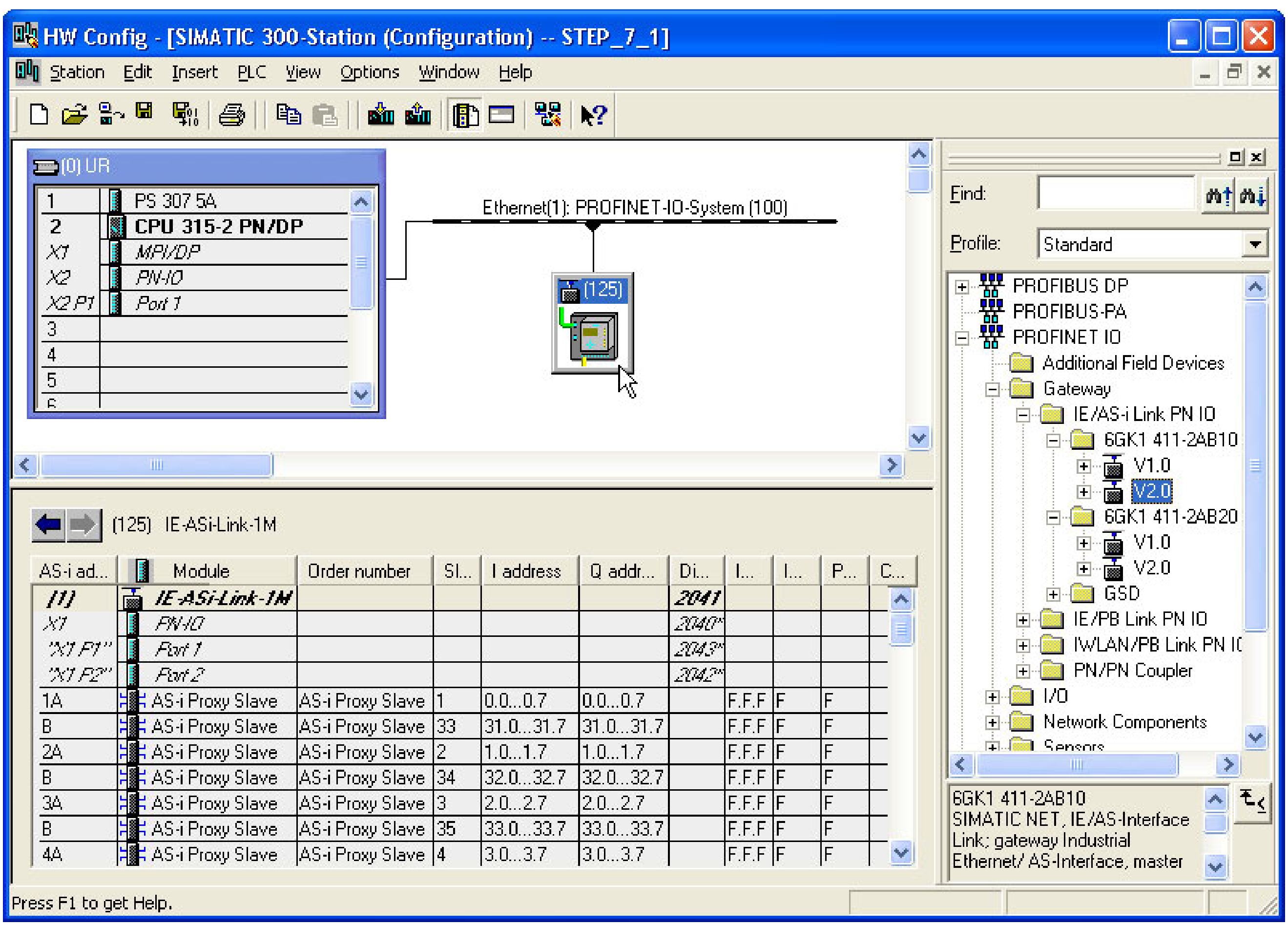


Figure 11-21 Configuration of IE/AS-i LINK PN IO as single master on the PROFINET IO system

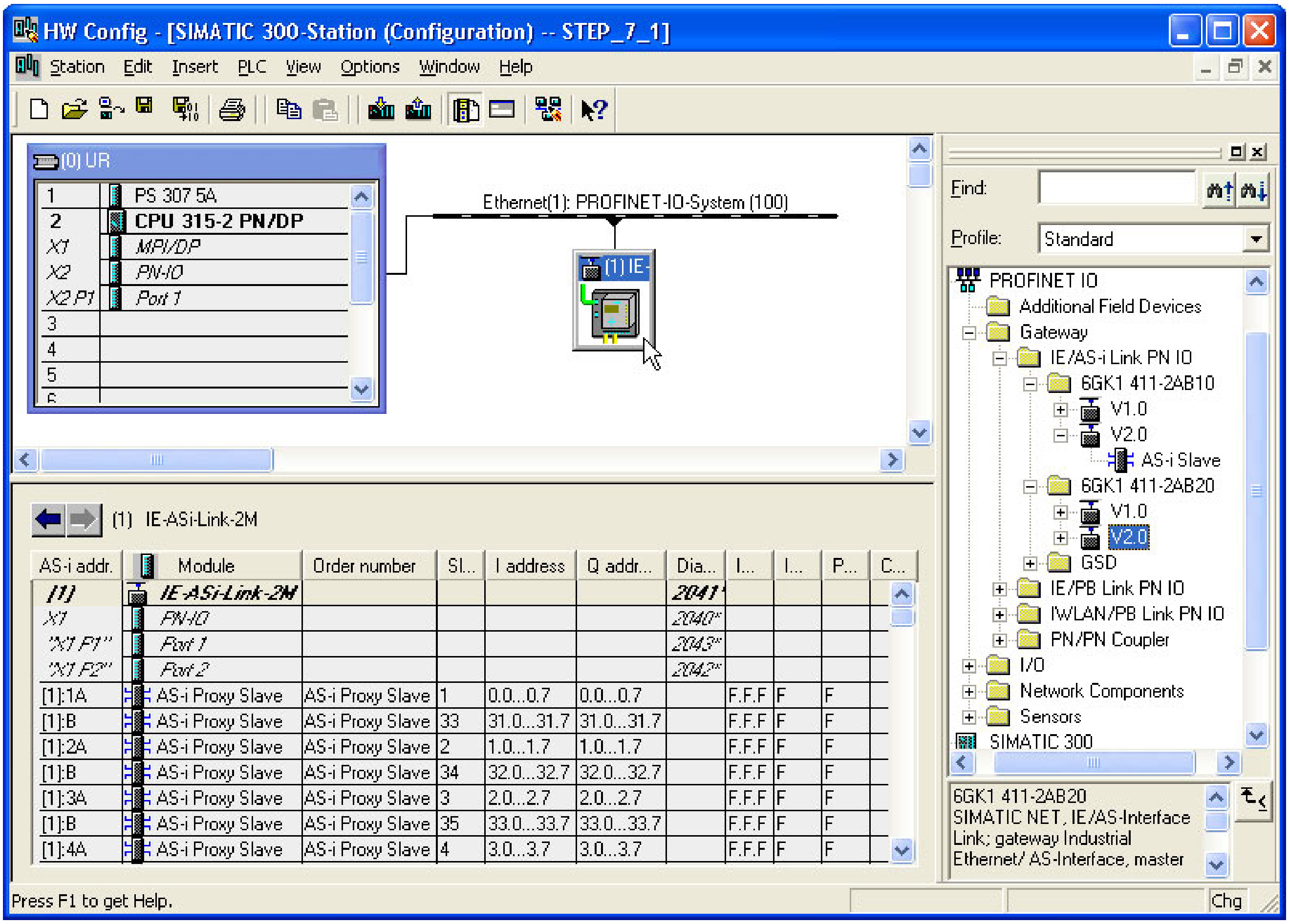
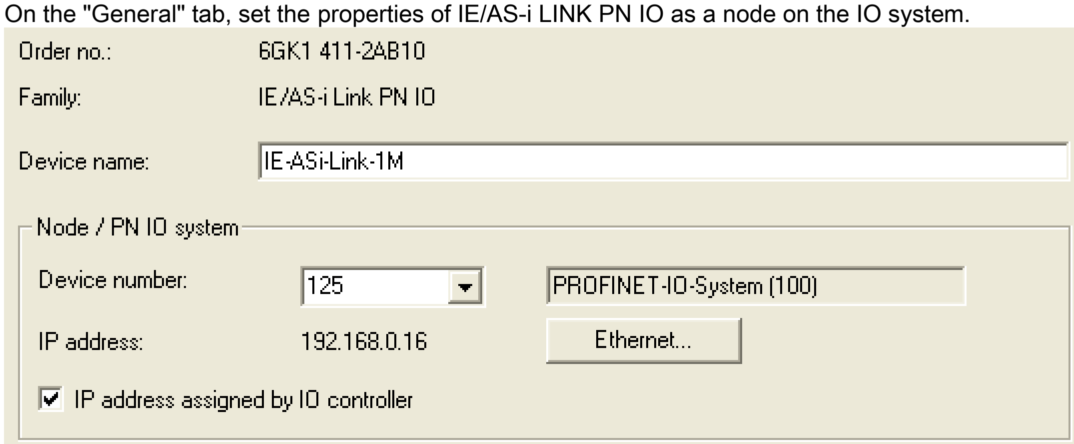


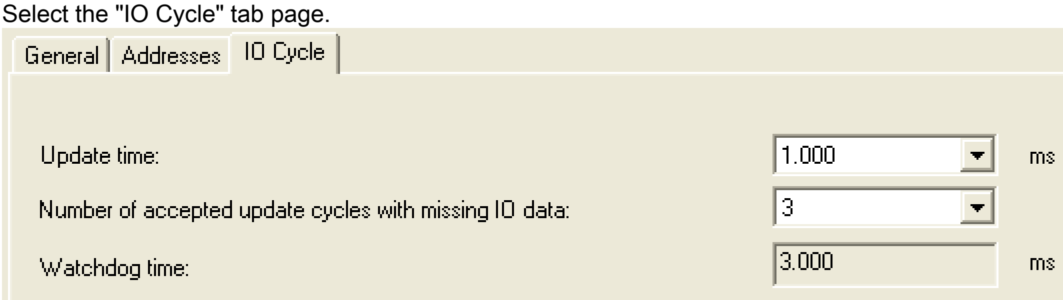
Figure 11-22 Configuration of IE/AS-i LINK PN IO as double master on the PROFINET IO system

IE/AS-i LINK PN IO is attached to the PROFINET IO system as an icon. A detailed view of IE/AS-i LINK PN IO along with its possible slots is displayed in the lower part of the station window. This is followed by the lines for the AS-i address table, which contains dummy modules (AS-i proxy slave).

11.11.4 Parameterizing the IE/AS-i LINK PN IO as an IO device

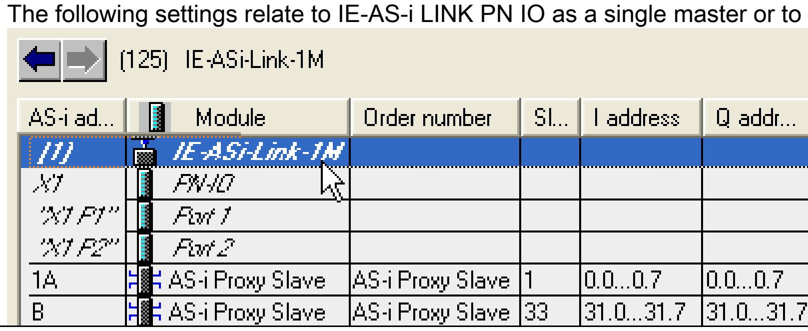
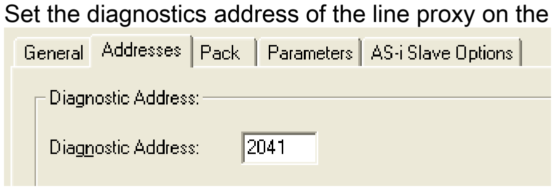
Parameterize IE/AS-i LINK PN IO as an IO device in HW Config of the IO controller.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td rowspan="6">1</td><td colspan="2">Parameterize the diagnosis address in the "Properties - IE-ASi-Link" dialog for slot "0".</td></tr>
<tr><td>1.1</td><td>Double-click the icon for IE/AS-i LINK PN IO on the IO system.
A window is displayed containing the "Properties - IE/AS i Link ..." dialog, which contains the "General", "IO Cycle", and "Diagnostics" tab pages.</td></tr>
<tr><td>1.2</td><td>On the "General" tab, set the properties of IE/AS-i LINK PN IO as a node on the IO system.

</td></tr>
<tr><td>1.3</td><td>Enter a device name of use the system proposal.
When it is shipped, an IO device does not have a device name. An IO controller cannot address an IO device until it has been assigned a device name. The IP address is assigned permanently to the device name. Unlike the complex IP addresses, device names are much more user friendly. The process of assigning a name for an individual IO device is similar to that for setting the PROFIBUS address for a PROFIBUS DP slave.</td></tr>
<tr><td>1.4</td><td>Choose a device number from the drop-down list or use the system proposal.
In addition to the device name, STEP 7 assigns a device number when an IO device is connected.
This device number is used to identify an IO device in the user program.
Unlike the device number, the device name is not visible in the user program.</td></tr>
<tr><td>1.5</td><td>For an isolated Ethernet subnet, use the IP address and subnet mask proposed by STEP 7.
If the subnet is part an existing Ethernet company network, ask your network administrator for this data. Open the "Properties - Ethernet Interface IE ASi Link" dialog by choosing "Ethernet..." and enter the network data.</td></tr>
<tr><td rowspan="2">2</td><td colspan="2">Define the properties of the PN IO interface.</td></tr>
<tr><td>2.1</td><td>Double-click the line "X1" in the AS-i address table.
A window is displayed containing the "Properties - PN-IO" dialog, which contains the "General", "Addresses", and "IO Cycle" tab pages.
The name "PN-IO" can be changed on the "General" tab page.</td></tr>
</table>

Step		Action
	2.2	Select the "IO Cycle" tab page. 
	2.3	In the "IO Cycle" tab, choose the updating time for an individual IO device. During the updating time, a PROFINET IO device exchanges its user data with the associated IO controller. STEP 7 automatically calculates updating times from the existing hardware configuration and the resulting cyclic data. The updating time applies to either an entire bus segment of an IO controller or just to one IO device. The shortest possible updating time in a PROFINET system depends on the following factors: • No. of PROFINET IO devices • Volume of configured user data • PROFINET IO communication share (compared with the PROFINET CBA communication share) • Additional cyclic PROFINET services • Properties (performance) of the IO controller If you increase the updating times of individual IO device that supply user data (non-time-critical), shorter updating times can be set for other IO devices. If you change the hardware configuration (e.g. add new IO devices), the updating time may change. A change message appears the next time you open the dialog.
	2.4	Configure the response monitoring time. The response monitoring time cannot be set directly but instead as a "No. of accepted updating times with missing IO data". Multiplying the updating time results in the response monitoring time. If the IO controller does not supply the IO device with I/O data within the response monitoring time, the IO device switches to safe mode. Only change the default setting in an emergency (e.g. during the commissioning phase).

11.11.5 Parameterizing AS-Interface

Parameterize the properties and behavior of IE/AS-i LINK PN IO as an AS-i master in the "Properties - IE/AS-i ..." dialog.

Step	Action
1	Double-click the line "[1]" in the AS-i address table. A window is displayed containing the "Properties - IE-ASi-Link-1M" (for single master) or "Properties - IE-ASi-Link-2M" (for double master), which contains the "General", "Addresses", and "Pack" tab pages. The following settings relate to IE-AS-i LINK PN IO as a single master or to AS i line 1 of a double master. 
2	If required, enter the name and a comment for the AS-i line on the "General" tab. The name for line 1 is identical to the device name of the IE-AS-i LINK (can be set by double-clicking the IE-AS-i LINK PN IO icon on the IO system; see description above).
3	Set the diagnostics address of the line proxy on the "Addresses" tab page.  This diagnostics address is used to indicate an incoming/outgoing line-specific diagnostic alarm (e.g. AS-i power failure, ground fault, redundant slave) via the OB82 diagnostics block. The system function block SFB54 "RALRM" can be used to call up additional diagnostic information. This procedure is described in the IE/AS-i LINK PN IO Manual under section 9.2.2 "Diagnostic alarms".
4	On the "Parameters" tab page, set the IE-AS-i LINK PN IO as an AS-i master. In particular, the diagnostic alarms must be enabled so that the OB82 can be called up if an error occurs. When you choose the "Automatic address programming" option (default), an AS-i slave that has failed can be replaced by a new, identical slave with the address "0" (as-delivered condition) and the IE-AS-i LINK PN IO automatically assigns the address of the slave that has failed to the new slave. If this option is deactivated, you have to assign the address manually to the new slave when the slave is replaced.
5	When a double master is used, double-click the line "[2]" in the AS-i address table and repeat steps 1 to 4 for AS-i line 2.

11.11.6 Configuring AS-i slaves

Configure the AS-i slaves within the address table.

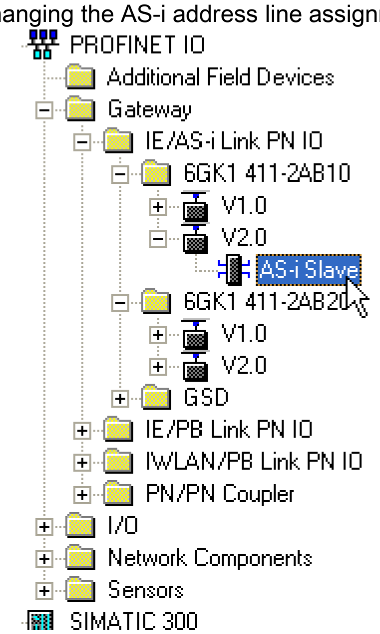
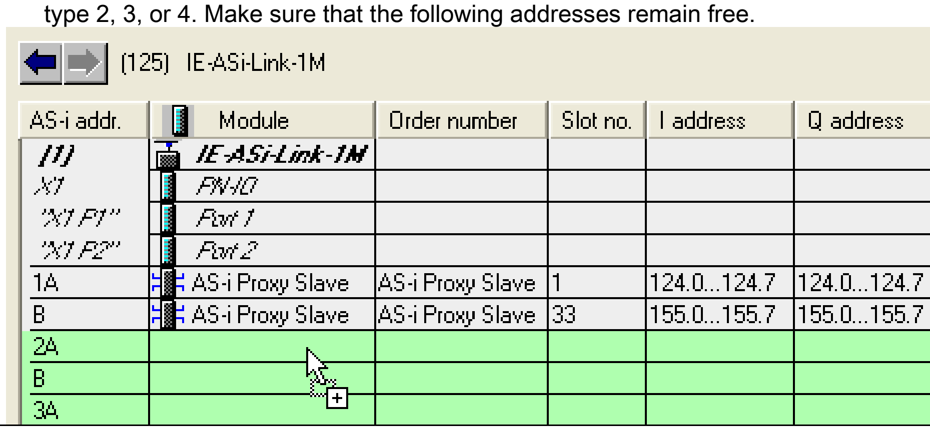
Note

Reading the actual configuration to the AS-i address table

If an online connection has been established, you can read an existing AS-i configuration to the AS-i address table.

1. Skip the integration procedure until you reach Completing configuration (Page 576).
2. Follow the integration procedure until Addressing AS-i slaves (Page 577).
3. Then copy the current configuration for each connected AS-i line with the command "Download to PG".
   "AS-i Slave Optionss" tab in the "Properties - IE/AS-i ..." dialog.
4. Parameterize the AS-i slaves subsequently in STEP 7.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>
Click the icon for IE/AS-i LINK PN IO on the IO system.
A detailed view of IE-AS i LINK PN IO is displayed in the lower part of the station window. An AS-i slave can be configured for each AS-i address (1A, B, 2A, B, and so on).
(125) IE-ASi-Link-1M
<table>
<tr><th>AS-i addr.</th><th>Module</th><th>Order number</th><th>Slot no.</th><th>I address</th><th>Q address</th></tr>
<tr><td>[1]</td><td>IE-ASi-Link-1M</td><td></td><td></td><td></td><td></td></tr>
<tr><td>X1</td><td>PN-IO</td><td></td><td></td><td></td><td></td></tr>
<tr><td>"X1 P1"</td><td>Port 1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>"X1 P2"</td><td>Port 2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>1A</td><td>AS-i Proxy Slave</td><td>AS-i Proxy Slave</td><td>1</td><td>124.0...124.7</td><td>124.0...124.7</td></tr>
<tr><td>B</td><td>AS-i Proxy Slave</td><td>AS-i Proxy Slave</td><td>33</td><td>155.0...155.7</td><td>155.0...155.7</td></tr>
<tr><td>2A</td><td>AS-i Proxy Slave</td><td>AS-i Proxy Slave</td><td>2</td><td>125.0...125.7</td><td>125.0...125.7</td></tr>
</table>
When you use IE/AS-i LINK PN IO as a double master, the following detailed view is displayed: The number of the AS-i line ("[1]:..." or "[2]:...") is also displayed in square parentheses next to each AS-i address:
(1) IE-ASi-Link-2M
<table>
<tr><th>AS-i addr.</th><th>Module</th><th>Order number</th><th>Slot no.</th><th>I address</th><th>Q address</th></tr>
<tr><td>[1]</td><td>IE-ASi-Link-2M</td><td></td><td></td><td></td><td></td></tr>
<tr><td>X1</td><td>PN-IO</td><td></td><td></td><td></td><td></td></tr>
<tr><td>"X1 P1"</td><td>Port 1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>"X1 P2"</td><td>Port 2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>[1]:1A</td><td>AS-i Proxy Slave</td><td>AS-i Proxy Slave</td><td>1</td><td>0.0...0.7</td><td>0.0...0.7</td></tr>
<tr><td>[1]:B</td><td>AS-i Proxy Slave</td><td>AS-i Proxy Slave</td><td>33</td><td>31.0...31.7</td><td>31.0...31.7</td></tr>
<tr><td>[1]:2A</td><td>AS-i Proxy Slave</td><td>AS-i Proxy Slave</td><td>2</td><td>1.0...1.7</td><td>1.0...1.7</td></tr>
<tr><td>[1]:B</td><td>AS-i Proxy Slave</td><td>AS-i Proxy Slave</td><td>34</td><td>32.0...32.7</td><td>32.0...32.7</td></tr>
</table>
All the AS-i address lines contain dummy modules (AS-i proxy slave) as standard.
</td></tr>
</table>

Step	Action
2	You have the following options for changing the AS-i address line assignments:  • Drag and drop an AS-i slave from the hardware catalog Path: PROFINET IO → Gateway → IE/AS i Link PN IO → 6GK1411 2AB10 → V2.0 • Select an AS-i slave via the context menu "Insert Object..." Path: PROFINET IO → 6GK1411 2AB10 → V2.0 → AS i Slave • Copy and insert via the clipboard. • Move the line content by pressing down the left mouse button. This changes the AS-i address of a configured slave.
3	Note the following rules for assigning addresses: • The lines containing potential target addresses are highlighted in green. • Standard slaves and certain analog slaves use a full AS-i address (A and B address line). • Some AS-i slaves (e.g. CTT5) require the following full addresses, depending on whether the slaves are of type 2, 3, or 4. Make sure that the following addresses remain free. 

(125) IE-ASi-Link-1M

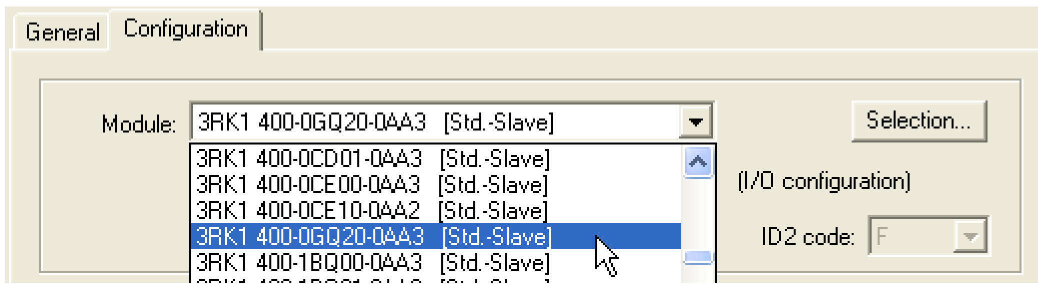
AS-i addr.	Module	Order number	Slot no.	I address	Q address
(1)	IE-ASi-Link-1M				
X1	PN-IO				
"X1 P1"	Port 1				
"X1 P2"	Port 2				
1A	AS-i Proxy Slave	AS-i Proxy Slave	1	124.0...124.7	124.0...124.7
B	AS-i Proxy Slave	AS-i Proxy Slave	33	155.0...155.7	155.0...155.7
2A					
B					
3A					

Step	Action
4	**Selecting Dummy Modules** A dummy module has the profile ID IO.ID.ID2 = F.F.F / ID1 = F and only exists as a virtual module in HW Config. A physical AS-i module, however, always has a profile ID with IO <> F. The dummy module acts as a proxy for any physical AS-i module and, within the CPU, provides a digital input/output range (1 input byte / 1 output byte) for this module. In this case, the configuration (profile ID) of the physical AS-i module is set via the IE/AS-i LINK display or via Web Based Management (WBM). An actual configuration can also be used as a target configuration. Alternatively, the configuration can be downloaded to the IE/AS-i Link via the data block interface using the PLC program (e.g. by calling "Configure complete configuration" (RecordDataWrite index 86). This means that an AS-i configuration can be changed while the PLC is in operation ("variable AS-i" for systems with more than one configuration option). When a dummy module is used, the configuration that was last saved to the EEPROM of the IE/AS-i Link (regardless of which method was used) is always retained for the physical AS-i module. This is also the case for the parameter settings of the physical module. If no physical AS-i module is configured, the digital input byte only returns zero values; the values in the digital output byte are ignored. If an analog module is configured as a physical AS-i module, the analog data can be exchanged between the PLC program and the analog module via the data block interface (see call "Write AS-i slave analog output data"" (RecordDataWrite index 82) or "Read AS-i slave analog input data"" (RecordDataRead index 83)). The same applies to CTTx module data (combined transaction types CTT 1-5 to AS-i Specification V3.0). If a dummy module in HW-Config is replaced by a different AS-i slave, the configuration (profile ID) of the physical AS-i module must be identical to the configuration of the set AS-i slave module so that data can be exchanged. A blank line in the AS-i address table indicates that a slave is not used in the AS-i address in question. If a physical slave is entered in the EEPROM of the IE/AS-i LINK by calling "Configure complete configuration" (in the AS-i address in the blank line), for example, data still cannot be exchanged because no input/output address space has been defined for this slave.
5	**Diagnostics in the event of an AS-i module failure:** When a physical AS-i module fails/is recovered, a disconnect/connect alarm (OB83) is triggered. The module that triggered the alarm can be identified by evaluating the local data of the OB83: Variable OB83_MDL_ADDR indicates the I/O address of the module. The AS-i address can be determined from this using the system function SFC 49 "LGC_GADR". Variable OB83_EV_CLASS indicates whether the module has failed/been disconnected (B#16#39) or has been recovered/connected (B#16#38). Variable OB83_FLT_ID also indicates whether the module is correct (actual configuration/profile ID matches the target configuration).

11.11.7 Specifying AS-i slaves

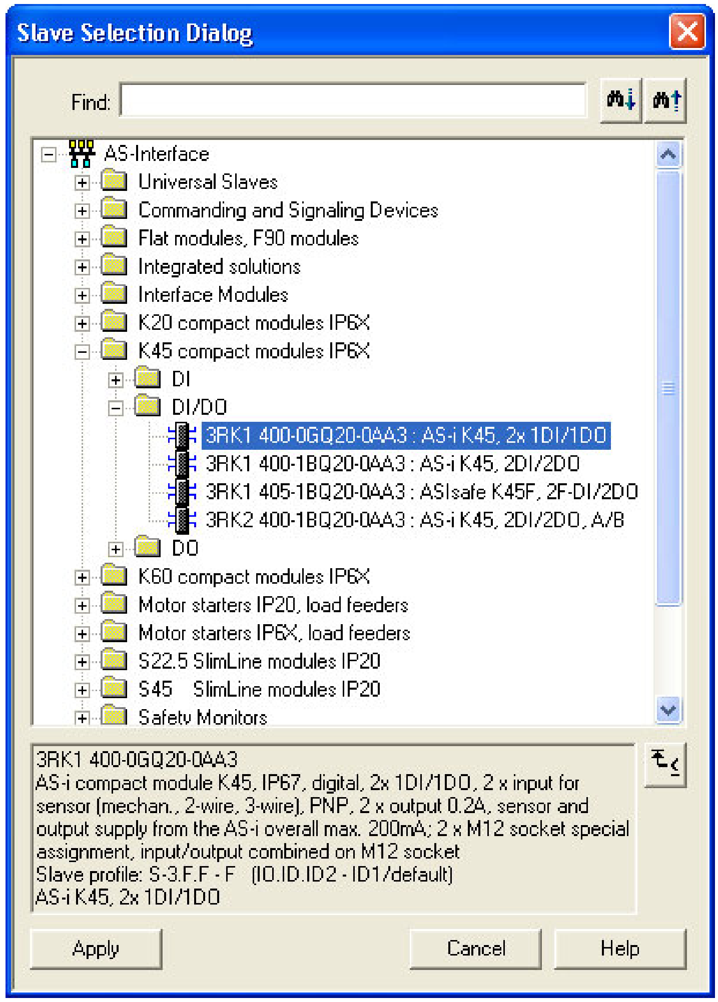
Specify the AS-i slaves in the "Properties - AS-i Slave - ..." dialog.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Double-click an occupied address line in the AS-i address table.
For an AS-i slave module, the window containing the "Properties - AS-i Slave - ..." dialog is displayed.</td></tr>
<tr><td>2</td><td colspan="2">You can specify the AS-i slaves on the "Configuration" tab in one of the following ways:</td></tr>
<tr><td></td><td>A</td><td>In the "Module" drop-down list, select a Siemens module via its order number.



The IO, ID, and ID2 codes are permanently defined by the properties of the Siemens modules. On the other hand, the ID1 code can be variable on certain modules.</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td></td><td>B</td><td>Choose a Siemens module from the AS-Interface catalog. To do so, click "Selection...".

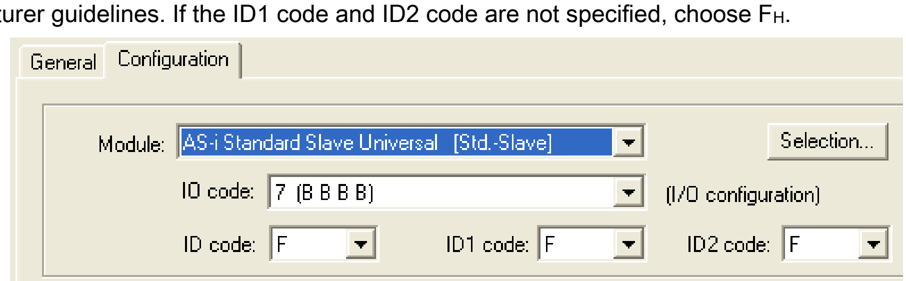


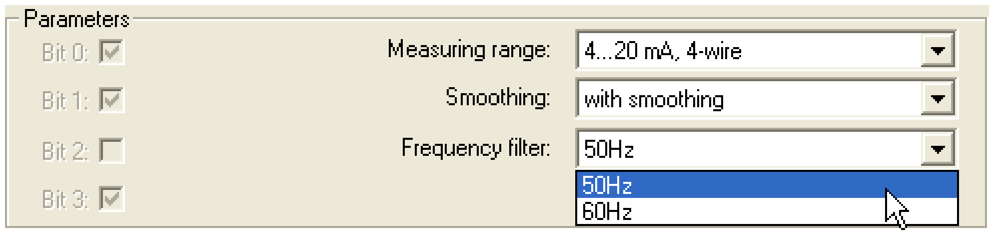
The following selection options are available for AS-i slaves:

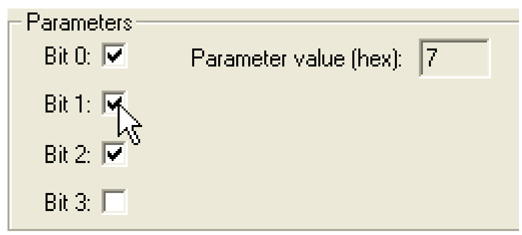
- Navigation through the hierarchical folder structure according to module type
- Search function using a keyword from the infotext

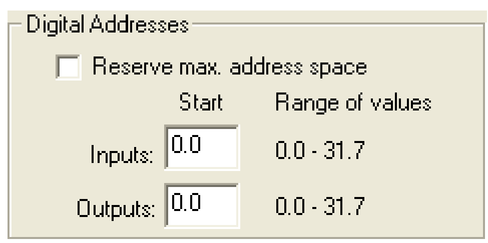
Transfer the module you have selected to the configuration by double-clicking it or selecting it and clicking "Apply".

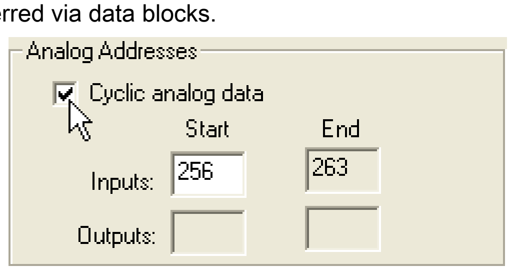
The IO code, ID code and ID2 code are fixed by the properties of the Siemens modules. On the other hand, the ID1 code can be variable on certain modules.</td></tr>
<tr><td></td><td>C</td><td>For AS-i slaves that are not available for selection, set the IO and ID codes in accordance with the manufacturer guidelines. If the ID1 code and ID2 code are not specified, choose F_H.


</td></tr>
</table>

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td rowspan="3">3</td><td colspan="2">Parameterize the AS-i slaves.</td></tr>
<tr><td>3.1</td><td>If the selected Siemens modules support special parameter settings, you can select them from a range of drop-down lists.


The bit checkboxes cannot be changed separately. Their assignment is predefined by the modules or results from the entries in the adjacent fields.</td></tr>
<tr><td>3.2</td><td>If the AS-i slaves are not available for selection, set the parameter bits in accordance with the manufacturer guidelines.


With an A/B module, the checkbox for parameter bit 3 is not displayed.</td></tr>
<tr><td>4</td><td colspan="2">If you activate the "Reserve max. address space" checkbox, the system makes the 4-bit input addresses and 4-bit output addresses available for the AS-i slave in the I/O memory.


The system displays an input and output address range for digital data exchange. If a digital AS-i slave has not been assigned any inputs or outputs, the corresponding field is empty.</td></tr>
<tr><td>5</td><td colspan="2">If you intend to transfer analog data for an analog AS-i slave, activate the appropriate option. Otherwise, analog data can only be transferred via data blocks.


The system proposes an input and output address space. The values can be changed. The system reports incorrect values.</td></tr>
<tr><td>6</td><td colspan="2">If required, enter the name and a comment for an AS-i slave on the "General" tab. When you close the dialog, your entries appear in the AS-i address table.</td></tr>
</table>

11.11.8 Completing configuration

To complete the project and download it to the CPU, carry out the following steps.

Step	Action
1	Save and compile the configuration in the current project.
2	Download the hardware configuration to the module.

11.11.9 Switching on the AS-i power supply

Switch on the AS-i power supply unit for supplying AS-Interface.

Step	Action
1	Switch on the voltage for the 30 V AS-i power supply unit. When started for the first time, IE/AS-i Link PN IO performs a self-test. All LEDs light up for 15 s.

11.11.10 Switching on the optional power supply for IE/AS-i LINK PN IO

Switch on the 24 V DC power supply unit to provide an optional power supply for IE/AS-i LINK PN IO.

Step	Action
1	If you use an optional power supply for IE/AS-i LINK PN IO, switch on the voltage for the additional 24 V DC power supply unit.

11.11.11 Transferring the device name to IE/AS-i LINK PN IO

Transfer the device name of IE/AS-i LINK PN IO from the configuration to the device.

Step	Action
1	If the device name set in the device does not match the configuration, the display signals the missing connection to the IO controller and the BF LED starts flashing.
2	In HW Config, open the dialog for transferring the device name. Path: Target System > Ethernet > Assign Device Name... This dialog is only displayed when an online connection to IE/AS-i LINK PN IO has been established via the TCP / IP interface card.
3	Choose IE/AS-i LINK PN IO from the list of connected devices.
4	Choose a device name for IE/AS-i LINK PN IO.
5	Assign the device name to IE/AS-i LINK PN IO. PROFINET communication begins and the BF LED is extinguished.

11.11.12 Addressing AS-i slaves

Address the AS-i slaves in accordance with the configuration.

Step	Action
1	If the addresses of the AS-i slaves do not match the configuration, error message "AS-i Config. Error" is displayed. The CER LED and SF LEDs light up. Confirm the message with "OK".
2	If you use IE/AS-i Link PN IO for assigning addresses, no AS-i slaves with the same address must be connected to an AS-i line. Remove any AS-i slaves with the same address. New AS-i slaves have the address "0".
3	Remove the LAN connector from IE/AS-i Link PN IO. AS-i addresses can only be changed via the device once PROFINET communication has been interrupted.
4	Press the "OK" button. The IE/AS-i Link PN IO display switches to the menu view.
5	Use the arrow keys to select the menu option "AS-i" for a single master and confirm with "OK". The menu options "AS-i line 1" and "AS-i line 2" are available for a double master.
6	Use the arrow keys to select the menu option "Change address" and confirm with "OK". The lowest AS-i address found is displayed.
7	Use the arrow pointing right to go to the field "New".
8	Use the arrow keys to choose the new AS-i address in accordance with the configuration.
9	When all the existing AS-i slaves have been addressed, connect the next configured AS-i slave to AS-Interface.
10	If you address another AS-i slave on this AS-i line, repeat steps 6 to 9.
11	If you change the AS-i line when using a double master, press "ESC". Repeat steps 5 to 10.
12	Reconnect IE/AS-i Link PN IO to the IO controller using the LAN cable.

11.12 IE/AS-i LINK PN IO - integration with GSD

11.12.1 Prerequisites

Before you use IE/AS-i LINK PN IO, the following additional devices and bus systems must be assembled, wired, and set up in accordance with their application documentation:

- CPU with PROFINET IO controller and Industrial Ethernet cable
- AS-i cable with AS-i power supply and AS-i slaves
  When you use IE/AS-i LINK PN IO as a double master, two independent AS-i networks can be connected.
- PC / PG with the following equipment:
  - SPS-specific configuration tool (e.g. STEP 7)
  - GSD file for IE/AS-i LINK PN IO
    The GSD file for IE/AS-i LINK PN IO (http://support.automation.siemens.com/WW/view/en/23742537) can be downloaded free of charge from the Internet.
  - PC / PG connected to CPU

Note

Power supply for IE/AS-i LINK PN IO

The AS-i shaped cable (line 1) supplies IE/AS-i LINK PN IO with voltage. Alternatively, a 24 V DC power supply can be provided via the power supply unit.

11.12.2 Integration procedure

The table below describes a potential procedure for integrating AS-Interface in your system via the AS-i master.

Step	Procedure
1	Configuring the PROFINET IO system (Page 579)
2	Parameterizing the IE/AS-i LINK PN IO as an IO device (Page 581)
3	Parameterizing AS-Interface (Page 583)
4	Configuring AS-i slaves (Page 584)
5	Completing configuration (Page 588)
6	Switching on the AS-i power supply (Page 588)
7	Switching on the optional power supply for IE/AS-i LINK PN IO (Page 588)
8	Transferring the device name to IE/AS-i LINK PN IO (Page 588)
9	Addressing AS-i slaves (Page 589)
10	Saving the configuration (Page 589)

11.12.3 Configuring the PROFINET IO system

Configure IE/AS-i LINK PN IO as a modular IO device in HW Config of the PROFINET IO controller.

Step	Action
1	Open your STEP 7 project with a CPU with the PROFINET IO controller (e.g. CPU 315-2 PN/DP).
2	Open HW Config for the PROFINET IO controller.
3	If the PROFINET IO system is not yet available on the CPU, you have to create it. To do so, insert the PRIFINET IO system in slot X2 (PN-IO) of the CPU (e.g. via the "Insert PROFINET IO system" context menu).
4	Select the IE/AS-i LINK PN IO in the "Hardware Catalog" window. Path: PROFINET IO > Gateway > IE/AS-i LINK PN IO > Single Master > V1.0 (or Double Master > V1.0)
5	Drag & drop the selected IE/AS-i LINK PN IO to the PROFINET IO system.

Results for single and double master

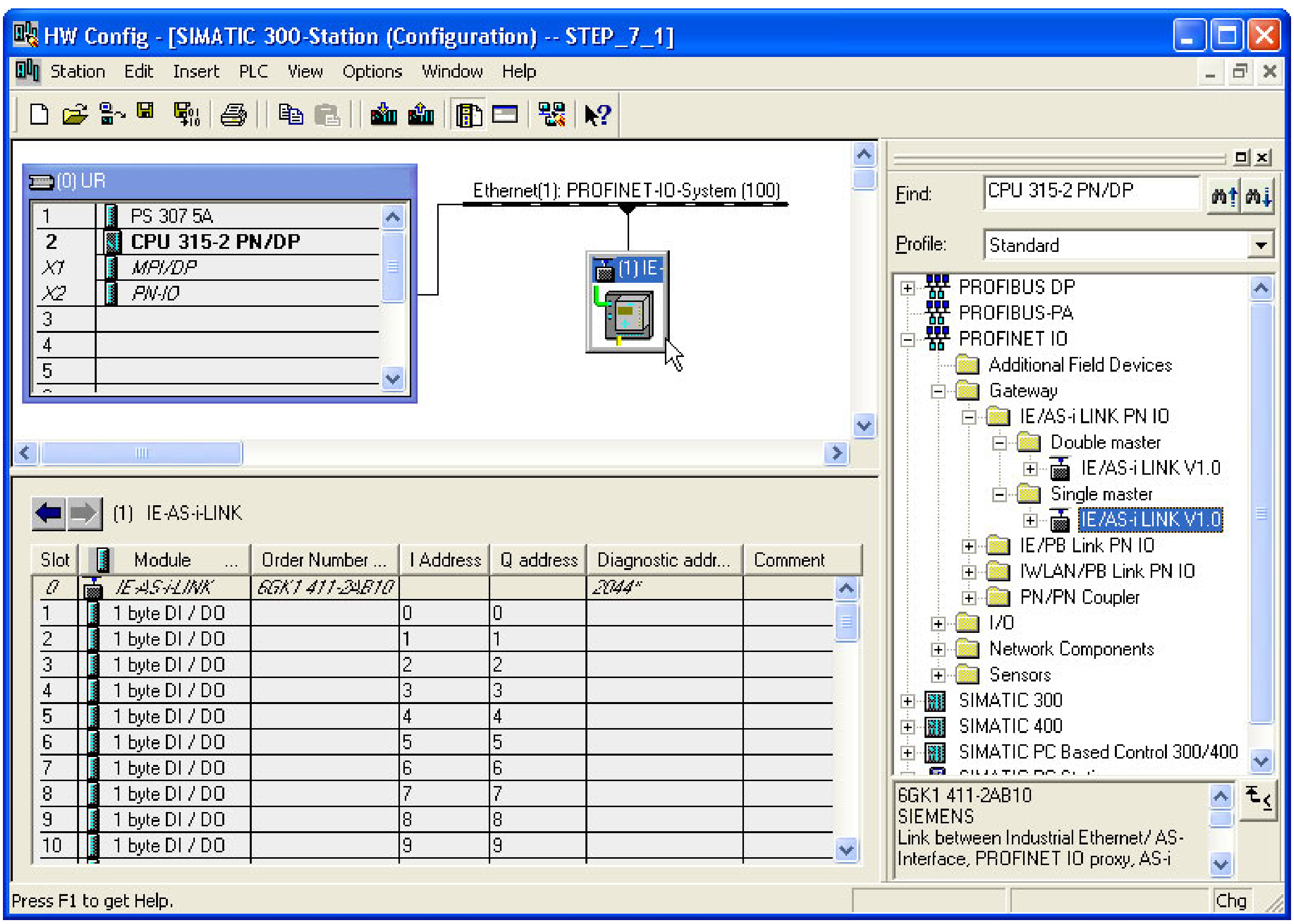


Figure 11-23 Configuration of IE/AS-i LINK PN IO as single master on the PROFINET IO system

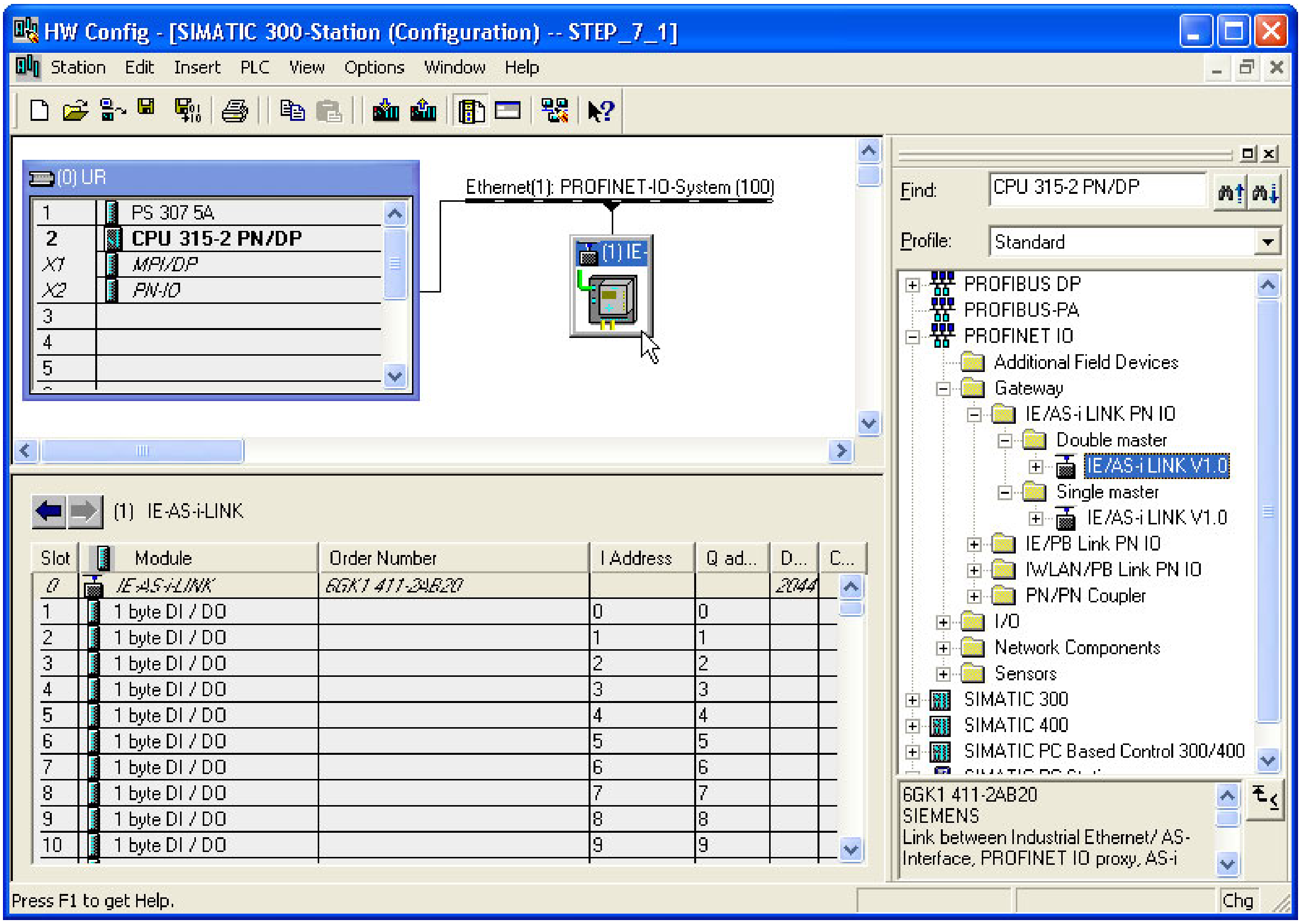


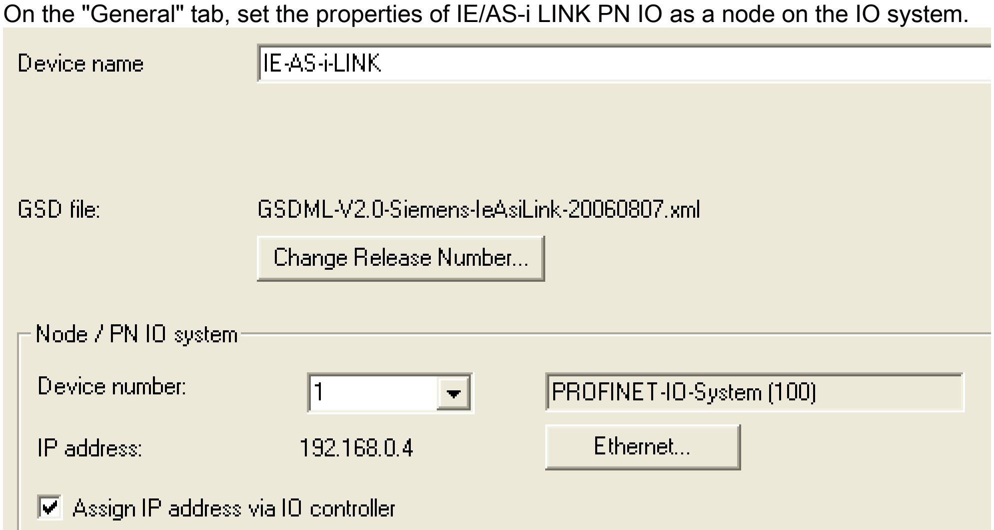
Figure 11-24 Configuration of IE/AS-i LINK PN IO as double master on the PROFINET IO system

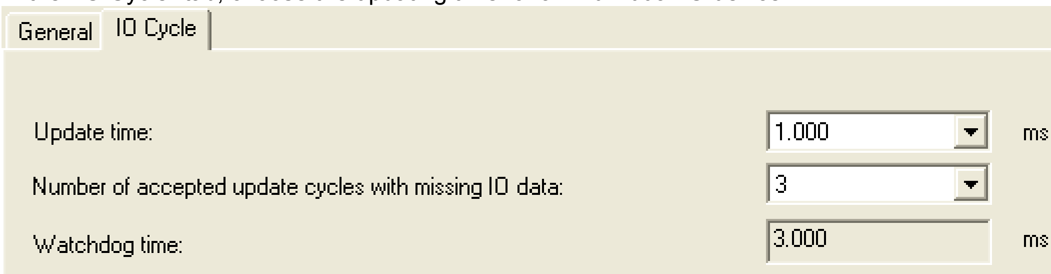
IE/AS-i LINK PN IO is attached to the PROFINET IO system as an icon. A detailed view of IE/AS-i LINK PN IO along with its possible slots is displayed in the lower part of the station window. The slots assigned to the AS-i slaves are already occupied by digital modules. The assignment of the slots is listed in the following table.

Slot	Meaning
0	PROFINET interface for AS-i line 1
1 ... 31	AS-i addresses 1 ... 31 or 1A ... 31A (AS-i line 1)
33 ... 63	AS-i addresses 1B ... 31B (AS-i line 1)
100	PROFINET interface for AS-i line 2
101 ... 131	AS-i addresses 1 ... 31 or 1A ... 31A (AS-i line 2)
133 ... 163	AS-i addresses 1B ... 31B (AS-i line 2)

11.12.4 Parameterizing the IE/AS-i LINK PN IO as an IO device

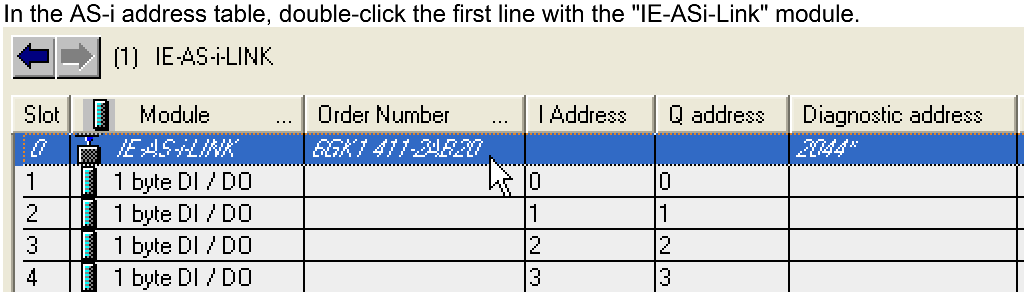
Parameterize IE/AS-i LINK PN IO as an IO device in HW Config of the IO controller.

Step	Action	
1	Double-click the icon for IE/AS-i LINK PN IO on the IO system. A window is displayed containing the "Properties - V1.0" dialog, which contains the "General" and "IO Cycle" tabs.	
2	On the "General" tab, set the properties of IE/AS-i LINK PN IO as a node on the IO system.  	
	2.1	Enter a device name of use the system proposal. When delivered, an IO device does not have a device name. An IO controller cannot address an IO device until it has been assigned a device name. The IP address is assigned permanently to the device name. Unlike the complex IP addresses, device names are much more user friendly. The process of assigning a name for an individual IO device is similar to that for setting the PROFIBUS address for a PROFIBUS DP slave.
	2.2	If you are not using the latest GSD file for the configuration (e.g. you are using one for a predecessor version), change the version. You can select the appropriate version in STEP 7 data management by means of a dialog.
	2.3	Choose a device number from the drop-down list or accept the system proposal. In addition to the device name, STEP 7 assigns a device number when an IO device is connected. This device number is used to identify an IO device in the user program. Unlike the device number, the device name is nor visible in the user program.
	2.4	For an isolated Ethernet subnet, use the IP address and subnet mask proposed by STEP 7. If the subnet is part an existing Ethernet company network, ask your network administrator for this data. Open the "Properties - Ethernet Interface IE ASi Link" dialog by choosing "Ethernet...".
	2.5	If you want to prevent the IO controller from overwriting the IP address in IE/AS-i LINK PN IO, deactivate the corresponding option. You must set the IP address on the device or assign it via a DHCP server, for example. Otherwise, the IO controller downloads the IP address from the configuration to the IO device when it is started.

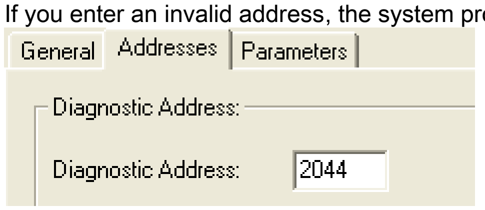
<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>3</td><td colspan="2">In the "IO Cycle" tab, choose the updating time for an individual IO device.


During the updating time, a PROFINET IO device exchanges its user data with the associated IO controller. STEP 7 automatically calculates updating times from the existing hardware configuration and the resulting cyclic data. The updating time applies to either an entire bus segment of an IO controller or just to one IO device. The shortest possible updating time in a PROFINET system depends on the following factors:

No. of PROFINET IO devices
Volume of configured user data
PROFINET IO communication share (compared with the PROFINET CBA communication share)
Additional cyclic PROFINET services
Properties (performance) of the IO controller

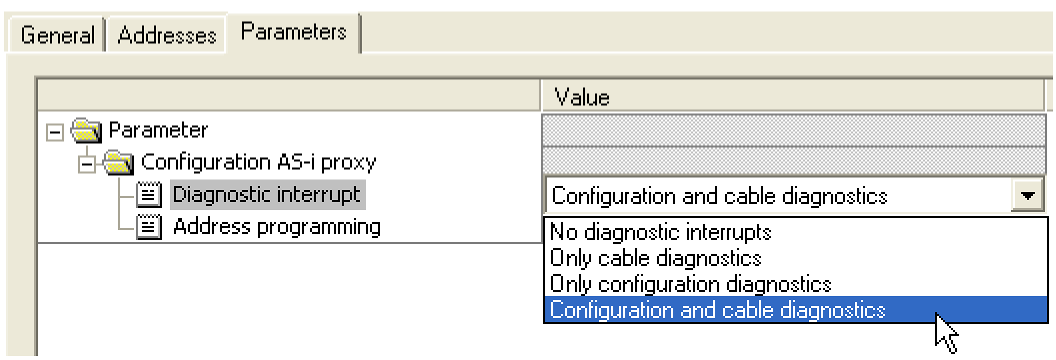
If you increase the updating times of individual IO device that supply user data (non-time-critical), shorter updating times can be set for other IO devices.
If you change the hardware configuration (e.g. add new IO devices), the updating time may change. A change message appears the next time you open the dialog.</td></tr>
<tr><td>4</td><td colspan="2">Configure the response monitoring time.
The response monitoring time cannot be set directly but instead as a "No. of accepted updating times with missing IO data". Multiplying the updating time results in the response monitoring time.
If the IO controller does not supply the IO device with I/O data within the response monitoring time, the IO device switches to safe mode.
Only change the default setting in an emergency (e.g. during the commissioning phase).</td></tr>
<tr><td rowspan="2">5</td><td colspan="2">Parameterize the diagnosis address in the "Properties - IE-ASi-Link" dialog for slot "0".</td></tr>
<tr><td>5.1</td><td>In the AS-i address table, double-click the first line with the "IE-ASi-Link" module.


A window is displayed containing the "Properties - IE-ASi-LINK" dialog, which contains the "General", "Addresses", and "Parameters" tab.</td></tr>
</table>

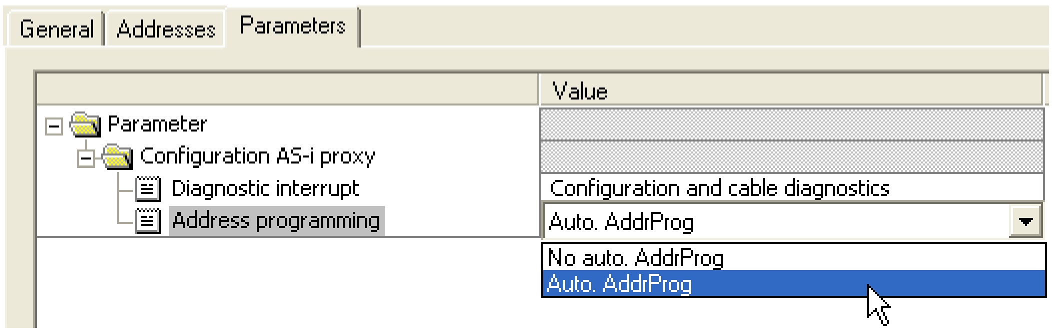
Step		Action
	5.2	On the "Addresses" tab page, enter the diagnostics address or use the system proposal. If you enter an invalid address, the system proposes a new one.  The IO controller uses the diagnostics address to find out about the failure or return of an IO device and starts the OB 86. You can also read the diagnosis of the IO device under this address with SFB 52 and include it in your user program.

11.12.5 Parameterizing AS-Interface

Parameterize the properties and behavior of IE/AS-i LINK PN IO as an AS-i master in the "Parameters" tab.

Step	Action
1	Call up the "Parameter" tab in the "Properties - IE-AS-i-LINK" dialog.
2	In the relevant option box, activate the alarm enable for diagnostic interrupts.  These alarms trigger channel diagnoses (PROFINET IO format ID 8000_H). • Line-specific diagnostic interrupts (e.g. AS-i Power Fail) are signaled via the logical I/O address or diagnosis address of the line proxy module (slot "0" or "100"). • Slave-specific diagnostic interrupts (e.g. slave I/O fault) are signaled via the logical I/O address or diagnosis address of the relevant slot (slot 1 ... 63, 101 ... 163).

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>3</td><td>When the "Address programming" option is active, an AS-i slave that has failed can be replaced by a new, identical slave (same IO, ID, ID1, and ID2 code) with the address "0" (on delivery). IE/AS-i LINK PN IO automatically assigns the new slave the address of the old one.



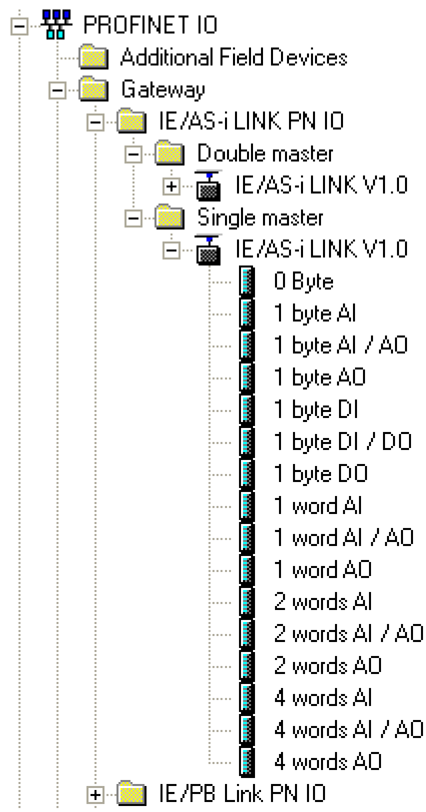
</td></tr>
</table>

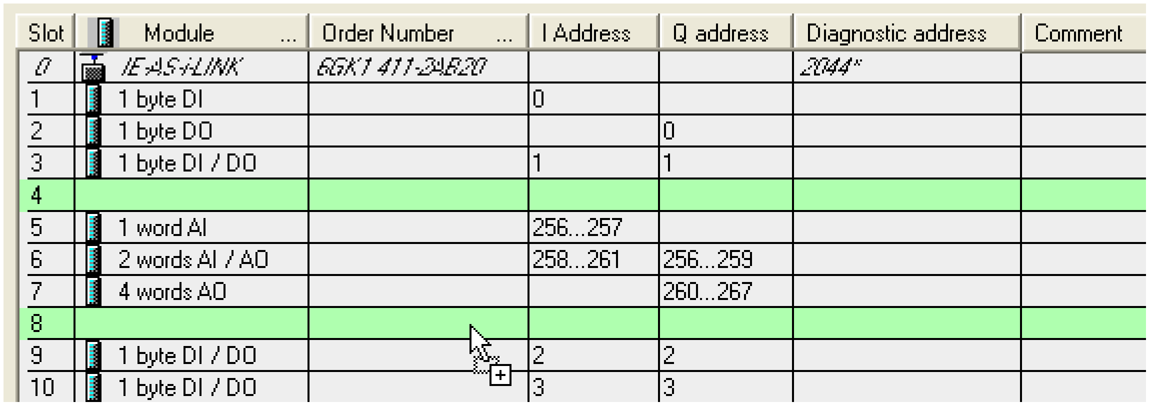
11.12.6 Configuring AS-i slaves

Configure the AS-i slaves via the slot assignment in the station window.

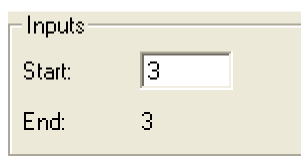
The individual configuration of the AS-i slaves has the following benefit:
the IO controller transfers the default settings from the configuration to IE/AS-i LINK PN IO every time the device is started.

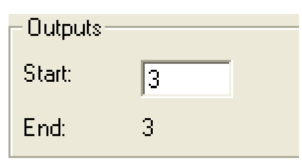
Step	Action
1	If you require a different memory capacity for an AS-i address, delete the default I/O module. If there are certain AS-i addresses that you do not use, delete the I/O modules (optional).

Step	Action
2	For each AS-i slave in the hardware catalog, choose a memory module for the relevant slot. To choose the module, you have the following options: • Drag and drop a module from the hardware catalog. Path: PROFINET IO > Gateway > IE/AS-i LINK PN IO > Einfachmaster > V1.0 • Select a module via the context menu "Insert Object..." Path: Single Master > V1.0 • Copy and insert via the clipboard. • Move the line content by pressing down the left mouse button.  The modules that can be selected differ with respect to their memory capacity requirements. • "0 Byte": an additional dummy module for AS-i slaves that require more than one AS-i address. • "1 byte" for AS-i slaves that require up to 1 byte of address space. • "1 word" for AS-i slaves that require up to 2 bytes of address space. • "2 words"/"4 words" for AS-i slaves that require more than 2 bytes of address space. • "DI" / "AI" for AS-i slaves that require an input address space. • "DO" / "AO" for AS-i slaves that require an output address space. Example: the analog module "2 words AI", for example, is suitable for a two-channel analog input slave.

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>3</td><td colspan="2">Position the selected modules in the free lines in the configuration table.


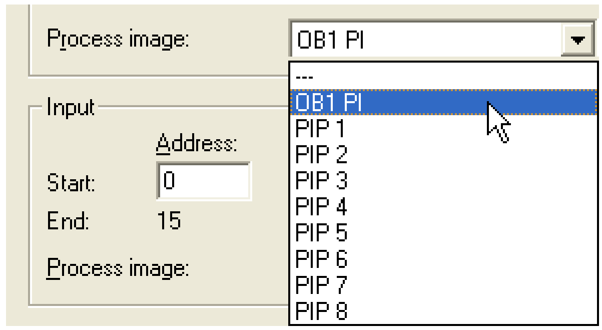
Slot	Module	Order Number	I Address	Q address	Diagnostic address	Comment
0	IE-AS-i-LINK	6GK1 411-2AB20			2044*	
1	1 byte DI		0			
2	1 byte DO			0		
3	1 byte DI / DO		1	1		
4						
5	1 word AI		256...257			
6	2 words AI / AO		258...261	256...259		
7	4 words AO			260...267		
8						
9	1 byte DI / DO		2	2		
10	1 byte DI / DO		3	3		

The default I/O addresses are displayed for each module in the detailed view in the station window.</td></tr>
<tr><td>4</td><td colspan="2">Parameterizing the selected memory modules.</td></tr>
<tr><td></td><td>4.1</td><td>Double-click the line with the selected module in the configuration table.
A window is displayed containing the "Properties - ..." dialog, which contains the "General", "Addresses", and "Parameters" tabs.</td></tr>
<tr><td></td><td>4.2</td><td>If required, enter a name and a comment for the AS-i slave on the "General" tab.</td></tr>
<tr><td></td><td>4.3</td><td>On the "Addresses" tab, set the start address of the input data or accept the system proposal.


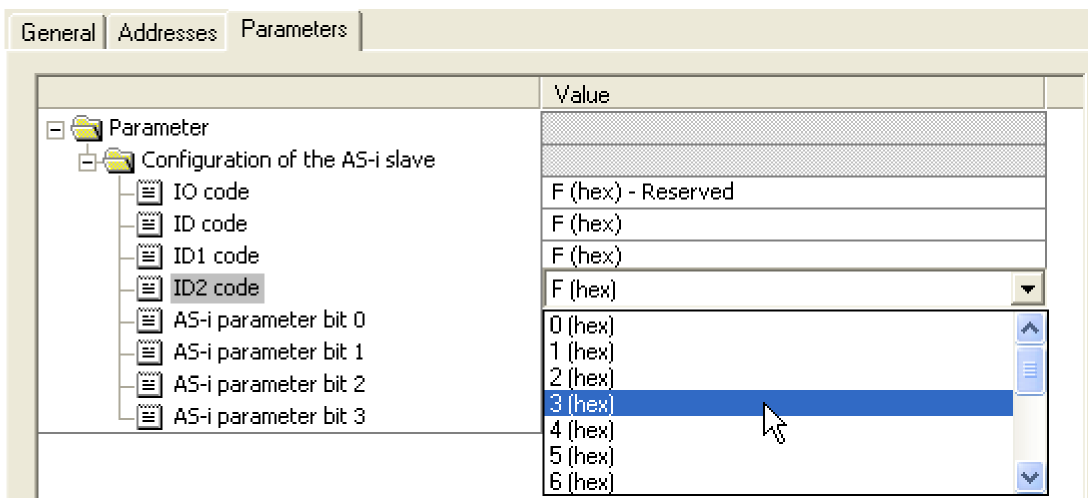
Depending on the selected module, the system calculates the end address and signals any errors that occur.</td></tr>
<tr><td></td><td>4.4</td><td>Set the start address for the output data or copy the system proposal.


Depending on the selected module, the system calculates the end address and signals any errors that occur.</td></tr>
<tr><td></td><td>4.5</td><td>If the "Process Image" drop-down list contains the entry "- - -", this means that no process image is available for the specified address space.
If the CPU allows the address space to be shifted, choose a lower address in the area of the process images.</td></tr>
</table>

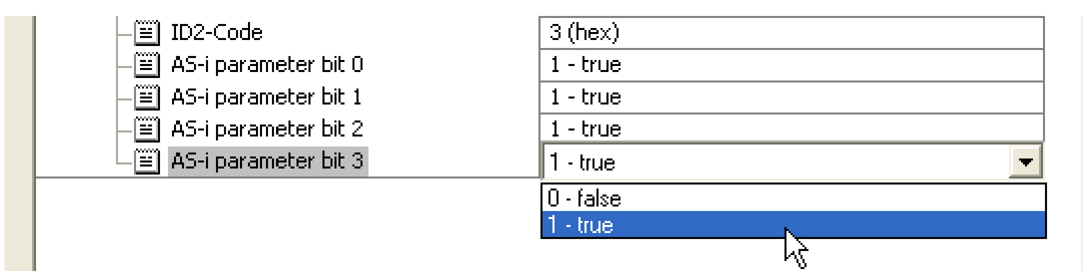
<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td></td><td>4.6</td><td>If the "Process Image" drop-down list contains selection data, this means that the PROFIBUS DP master is a CPU that manages partial process images (e.g. CPU 416).
Choose a partial process image number (PPI no.) or the OB1 process image for cyclic updates.



</td></tr>
<tr><td></td><td>4.7</td><td>Choose the IO and ID codes for the AS-i slaves from the drop-down lists.



The codes can be found in the manufacturer documentation. If ID1 and ID2 code are not specified, choose F_H.
If you change the default setting "F_H" of a code, the IO controller overwrites the configuration data stored in IE/AS-i LINK PN IO when it starts. Otherwise, the values stored in IE/AS-i LINK PN IO are valid for the configuration. Subsequent setting of the parameter bits is, therefore, irrelevant.</td></tr>
<tr><td></td><td>4.8</td><td>Choose the parameter bits of the AS-i slaves from the drop-down lists.



For explanations of the parameter bits, consult the manufacturer documentation for the AS-i slaves.</td></tr>
</table>

11.12.7 Completing configuration

To complete the project and download it to the CPU, carry out the following steps.

Step	Action
1	Save and compile the configuration in the current project.
2	Download the hardware configuration to the module.

11.12.8 Switching on the AS-i power supply

Switch on the AS-i power supply unit for supplying AS-Interface.

Step	Action
1	Switch on the voltage for the 30 V AS-i power supply unit. When started for the first time, IE/AS-i LINK PN IO performs a self-test. All LEDs light up for 15 s.

11.12.9 Switching on the optional power supply for IE/AS-i LINK PN IO

Switch on the 24 V DC power supply unit to provide an optional power supply for IE/AS-i LINK PN IO.

Step	Action
1	If you use an optional power supply for IE/AS-i LINK PN IO, switch on the voltage for the additional 24 V DC power supply unit.

11.12.10 Transferring the device name to IE/AS-i LINK PN IO

Transfer the device name of IE/AS-i LINK PN IO from the configuration to the device.

Step	Action
1	If the device name set in the device does not match the configuration, the display signals the missing connection to the IO controller and the BF LED starts flashing.
2	In HW Config, open the dialog for transferring the device name. Path: Target System > Ethernet > Assign Device Name... This dialog is only displayed when an online connection to IE/AS-i LINK PN IO has been established via the TCP / IP interface card.
3	Choose IE/AS-i LINK PN IO from the list of connected devices.
4	Choose a device name for IE/AS-i LINK PN IO.
5	Assign the device name to IE/AS-i LINK PN IO. PROFINET communication begins and the BF LED is extinguished.

11.12.11 Addressing AS-i slaves

Address the AS-i slaves in accordance with the configuration.

Step	Action
1	If the addresses of the AS-i slaves do not match the configuration, error message "AS-i Config. Error" is displayed. The CER LED and SF LEDs light up. Confirm the message with "OK".
2	If you use IE/AS-i Link PN IO for assigning addresses, no AS-i slaves with the same address must be connected to an AS-i line. Remove any AS-i slaves with the same address. New AS-i slaves have the address "0".
3	Remove the LAN connector from IE/AS-i Link PN IO. AS-i addresses can only be changed via the device once PROFINET communication has been interrupted.
4	Press the "OK" button. The IE/AS-i Link PN IO display switches to the menu view.
5	Use the arrow keys to select the menu option "AS-i" for a single master and confirm with "OK". The menu options "AS-i line 1" and "AS-i line 2" are available for a double master.
6	Use the arrow keys to select the menu option "Change address" and confirm with "OK". The lowest AS-i address found is displayed.
7	Use the arrow pointing right to go to the "New" field.
8	Use the arrow keys to choose the new AS-i address in accordance with the configuration.
9	When all the existing AS-i slaves have been addressed, connect the next configured AS-i slave to AS-Interface.
10	If you address another AS-i slave on this AS-i line, repeat steps 6 to 9.
11	If you change the AS-i line when using a double master, press "ESC". Repeat steps 5 to 10.
12	Reconnect IE/AS-i Link PN IO to the IO controller using the LAN cable.

11.12.12 Saving the configuration

If you do not configure all the AS-i slaves using your development tool, save the configuration of the AS-i slaves in IE/AS-i LINK PN IO.

In "configuration" mode, IE/AS-i LINK PN IO exchanges data with all the connected AS-i slaves. IE/AS-i LINK PN IO instantly recognizes new AS-i slaves, activates them, and includes them in cyclic data exchange (except AS-i slaves with the address "0" or if an AS-i address has been assigned more than once). IE/AS-i LINK PN IO saves the the following AS-i slave data to a non-volatile memory:

- Addresses
- ID codes
- I/O configuration

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Remove the LAN connector from IE/AS-i LINK PN IO.
AS-i configuration on the device (pushbutton configuration) can only be carried out once PROFINET communication has been interrupted.</td></tr>
<tr><td>2</td><td colspan="2">Press the "OK" button.
The IE/AS-i LINK PN IO display switches to the menu view.</td></tr>
<tr><td>3</td><td colspan="2">Use the arrow keys to select the menu option "AS-i" for a single master and confirm with "OK".
The menu options "AS-i line 1" and "AS-i line 2" are available for a double master.</td></tr>
<tr><td rowspan="4">4</td><td colspan="2">Check whether all the connected AS-i slaves have been detected.</td></tr>
<tr><td>4.1</td><td>Use the arrow keys to select the menu option "Lifelist" and confirm with "OK".</td></tr>
<tr><td>4.2</td><td>Switch the address spaces using the arrow keys.</td></tr>
<tr><td>4.3</td><td>End the check with "ESC".</td></tr>
<tr><td>5</td><td colspan="2">Use the arrow keys to select the menu option "Detect -> New" and confirm with "OK".</td></tr>
<tr><td>6</td><td colspan="2">Confirm the prompt with "OK".
IE/AS-i LINK PN IO saves the recognized configuration in the internal EEPROM.</td></tr>
<tr><td>7</td><td colspan="2">If you change the AS-i line when using a double master, press "ESC". Repeat steps 3 to 6.</td></tr>
</table>

12 System diagnosis

12.1 Overview of diagnostic options

System diagnosis

System diagnosis can only be carried out when AS-Interface is integrated in an automation system with a joint database. The main benefit of system diagnoses is that you gain a comprehensive and standardized diagnostic view of the system components:

- Automatic signaling of system errors
- Automatic hardware diagnosis
- Diagnosis of all the system components from any point in the plant
- Localization of the error source
- Preparation of the process diagnosis even while the user program is still being created
- Use of the integrated diagnostic functions for the user program (e.g. for programming plain-text messages or for transfer to HMI (Human Machine Interface))

Diagnostics data can be exchanged in the following ways:

- Displaying messages in the engineering tool interface
- Reading diagnostic telegrams from cyclic data exchange (e.g. DP slave diagnosis, system status lists)
- Reading diagnostic data blocks via acyclic commands
- Integrating diagnostic blocks in the user program

Device-related diagnosis

Device-related diagnosis involves local diagnosis or independent remote diagnosis (Web-based management). AS-Interface does not need to be integrated in an automation system for this purpose.
Device-related diagnosis offers the following options:

- Display LEDs on CP and gateways
  - Status display
  - AS-i voltage
  - Bus fault
  - System error
  - Configuration error

- DP/AS-i F-Link: two-line display for display and operation
  - Status display
  - AS-i voltage
  - Bus fault
  - System error
  - Configuration error
  - Code sequence error
  - Fault list for AS-i slaves
- DP/AS-i LINK Advanced and IE/AS-i LINK PN IO: graphic display for user-friendly display and operation
  - System error
  - Bus fault
  - Fault list for AS-i line
  - Line statistics with error counter
  - Line status
  - AS-i slave data with IO test of digital and analog slaves
- Web-based management; operation of DP/AS-i LINK Advanced and IE/AS-i LINK PN IO via Java Script with an Internet browser
  - Device diagnosis
  - Complete diagnosis of the lower-level AS-i network
  - Detailed status display for each individual AS-i slave
  - Comprehensive statistics counter
  - Diagnostic buffer updates the plant history and assigns events chronologically
  - Complete pre-IO test of digital and analog AS-i slaves
  - E-mail message sent if a fault occurs
- AS-Interface analyzer; external diagnostic and test unit
  - Complements local diagnosis
  - Quality and functional test on AS-Interface installations
  - Systematic commissioning and documentation of the plant status via automatically-generated test reports
  - Simple remote diagnosis by sending all settings via e-mail
  - Detailed plant diagnosis by means of comprehensive view filters and trigger functions with physical inputs and outputs

Basic information about device-related diagnostic options is provided in the sections "Master (Page 83)", "Routers (Page 100)", and "Slaves (Page 163)". Detailed information is provided in the relevant device manuals.

12.2 Diagnostics with SIMATIC

If the diagnostics-capable AS-i master identifies external or internal errors during operation, it triggers a diagnostic interrupt (DAL) on the S7 I/O bus.

Note

Diagnostic interrupt enable

Diagnostic interrupts must be enabled (e.g. on the "Operating Parameters" tab in the STEP 7 dialog of the AS-i master).
If the PROFIBUS DP master or IO controller does not support diagnostic interrupts, it sends a status message as a device-related diagnosis instead.
In the user program, you can tell that the diagnostic interrupt has been deactivated in OB 82 by the module address in question:

- OB82_MDL_ADDR = I/O address of AS-i binary module -> Diagnostic interrupt present.
- OB82_MDL_ADDR = diagnostic address of the AS-i master -> Diagnostic interrupt is not available; a status message signals the alarm event.

Note

No AS-i diagnostic message with insufficient power supply

If the power supply for the AS-i master falls below 14 V, no diagnostic messages can be output. The PROFIBUS DP master or IO controller, however, informs the user program that the AS-i master has failed.

- External alarm events
  - Configuration errors in protected mode (e.g. missing, incorrect, or unconfigured AS-i slaves)
  - AS-i power fail in protected mode

  In configuration mode, diagnostic alarms are not output for external alarm events.
- Internal alarm events
  - EEPROM errors

The S7-CPU determines the alarm source and reads data block 0 from the AS-i master. It then interrupts the cyclic user program, enters the diagnostic event in the system status list and diagnostic buffer, and then behaves as follows:

- If organizational block OB 82 is not programmed, the CPU switches to the STOP status.
- Otherwise, the CPU operating system starts OB 82.

The local data area of OB 82 (bytes 8 to 11) contains the logical basic address and 4-byte diagnostics data from data block 0 of the defective module. Additional diagnostics data from other data blocks can be called up via the user program.

Once OB 82 has ended, the CPU acknowledges the diagnostic interrupt in the AS-i master and resumes the cyclic program (OB 1) at the point where it was interrupted.

Incoming and outgoing alarm events

- If an external alarm event results in a fault-free status being set, this is followed by an outgoing diagnostic interrupt. In OB 82, bit "OB82_MDL_DEFECT" = 0.
- All other alarm events result in an incoming diagnostic interrupt. In OB 82, bit "OB82_MDL_DEFECT" = 1. Internal alarm events are always incoming.

Alarm behavior depending on the system status

Alarm events do not trigger diagnostic interrupts in the following system statuses:

- STOP status of the CPU:
  When the CPU switches to the STOP status, this causes the external and internal alarm events to be deleted. Bit "OB82_MDL_DEFECT" and the error bits in DB 0 are reset.
- AS-i master in configuration mode:
  When the AS-i master switches from protected mode to configuration mode, this causes the external alarm events to be deleted.
- Previous, unacknowledged diagnostic interrupts

The error messages remain in the diagnostic buffer, however.
When the diagnostic interrupts can be triggered again, a comparison of the current overall configuration in the AS-i master (AS-i slave configuration and internal, alarm-relevant status) and the configuration signaled beforehand by means of a diagnostic interrupt causes the AS-i master to behave as follows:

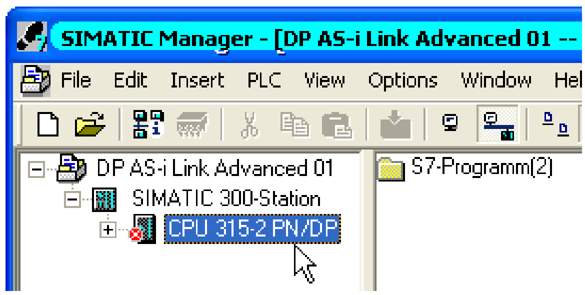
- Not equal to: the AS-i master triggers a diagnostic interrupt with the current configuration data.
- Equal to: the AS-i master does not trigger a new diagnostic interrupt.

12.3 Reading the diagnosis with SIMATIC

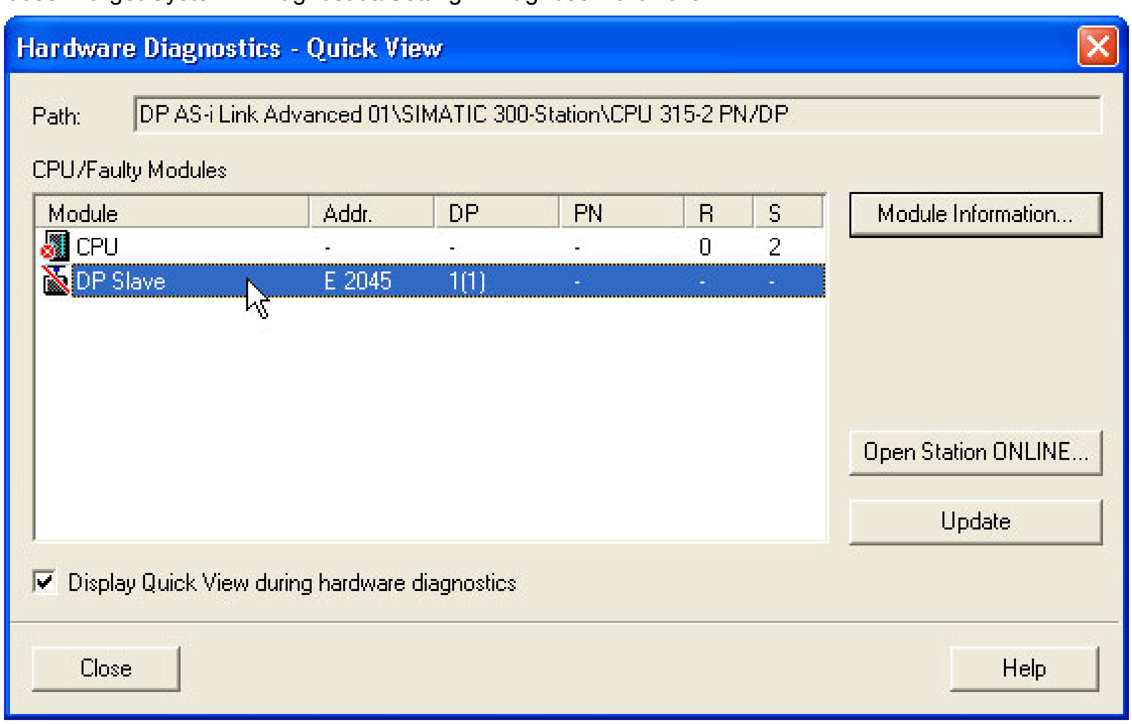
12.3.1 Diagnostic messages in the STEP 7 interface

You can retrieve AS-i diagnostics data by accessing the associated CPU of the AS-i master.

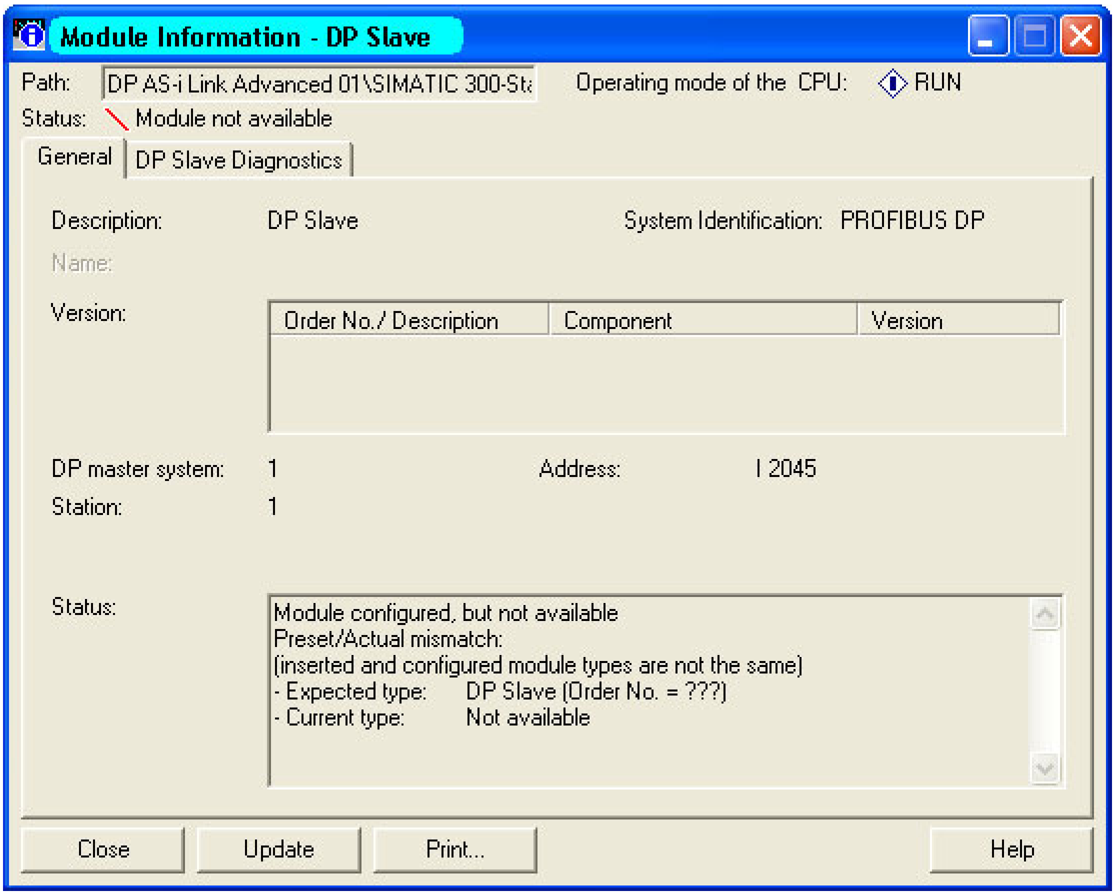
<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Open the online window of the project by choosing "View > Online".</td></tr>
<tr><td>2</td><td>Open all the stations.
All the configured, programmable modules are displayed.</td></tr>
<tr><td>3</td><td>Determine which CPU is displayed with a diagnostics icon that indicates an error or fault.

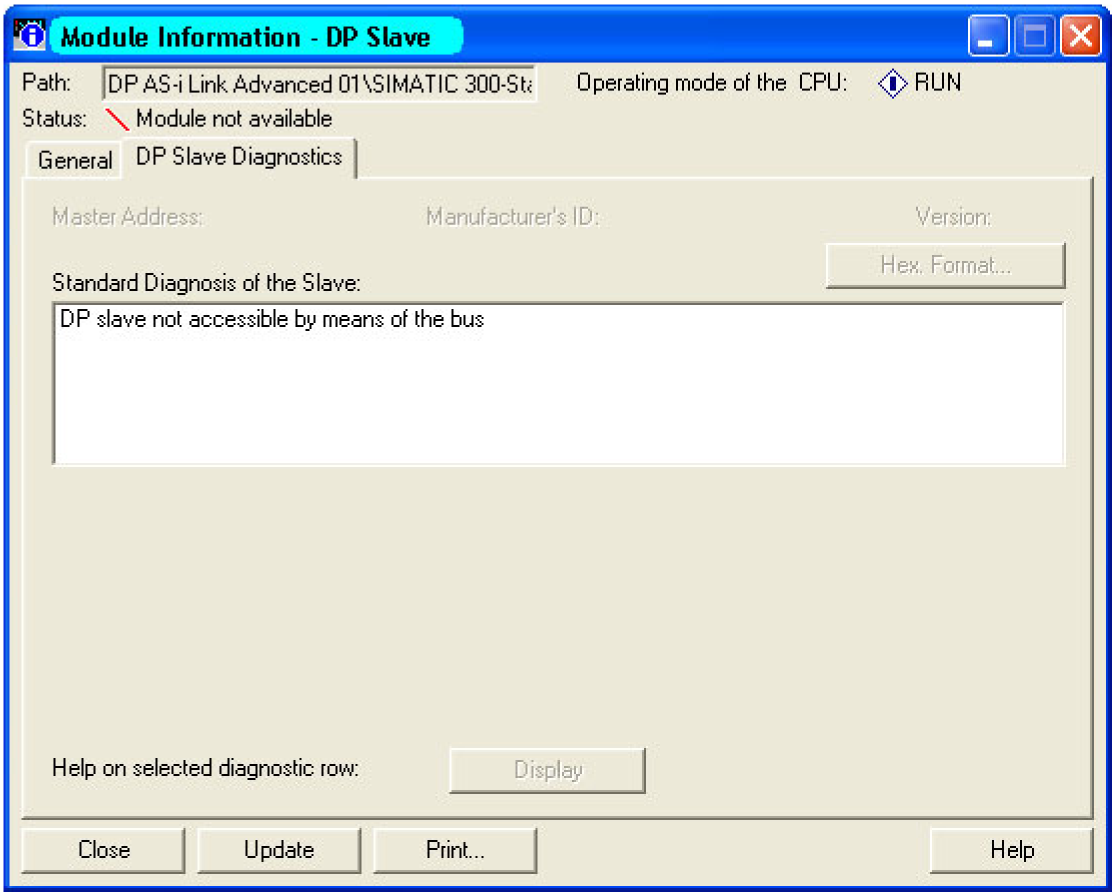


To call up a help page explaining the diagnostics icons, press F1.</td></tr>
<tr><td>4</td><td>Select the station that you want to analyze.</td></tr>
<tr><td>5</td><td>When you choose "Target System > Diagnostics/Setting> Module Status", a dialog is displayed indicating the CPU module status.</td></tr>
<tr><td>6</td><td>Choose "Target System > Diagnostics/Setting > Diagnose Hardware".



The "Quick View" window showing the CPU and the defective modules in this station is displayed.
The quick view display is defaulted ("Tools > Settings", "View" tab).</td></tr>
</table>

Step	Action
7	In the quick view, select one of the defective modules.
8	Click "Module Information" to call up the data for this module. The "Module Information..." dialog, which contains the "General" and "DP Slave Diagnostics" and "PN-IO Device Diagnostics", is displayed.  When you click "ONLINE" in the quick view, a diagnostic view of the station with all the modules in the slot arrangement is displayed. When you double-click a module, the "Module Information ..." dialog is displayed.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>9</td><td>Choose the "DP Slave Diagnostics" or " PN-IO Device Diagnostics" tab.
The diagnostic message appears in plain text in the corresponding window.

</td></tr>
</table>

12.3.2 DP slave diagnosis

SFC13 "DPNRM_DG" is used to read the current cyclic diagnostics data of a PROFIBUS DP slave in a format defined in accordance with EN 50170 Volume 2, PROFIBUS. The asynchronous read operation can take place across a number of SFC calls. Once it has been successfully transferred, the data that is read is entered in a parameterized target area. The structures of the diagnostic telegrams are described in the following device-specific sections.

Step	Action
1	Read the diagnostic telegram via SFC13 "DPNRM_DG" within OB82. For parameterization, refer to the STEP 7 documentation.
2	Store the diagnostics data in a data block in the user program.

12.3.3 System status lists

The CPU for the SIMATIC modules saves the current status of the automation system cyclically in the "system status list". The data in the system status list can only be read and not changed. It is a virtual list that is only compiled on request. In addition to the menu options in STEP 7, you can read sub-lists of the system status list by means of SFC51 "RDSYSST". Sub-lists for diagnosing PROFINET IO or PROFIBUS DP systems can be called up when you specify the sub-list number. The following sub-lists can be used for processing AS-i error messages further:

- System data:
  system data is fixed or parameterized characteristic data for a CPU.
  - Alarm error assignment: assignment of alarms/errors to OBs
  - Alarm status: current status of alarm processing/generation
  - Status of priority classes: Which OB is being processed? Which priority class has been blocked by means of parameterization?
  - Operating status and operating status switchover: possible operating statuses, last switchover, current operating status
- Diagnostic status data in the CPU:
  this describes the current status of the components monitored by system diagnosis.
  - Diagnosis nodes: diagnostics-capable modules registered on the CPU
  - Start event list: start events and priority classes of the OBs
  - Module status data: status data for all the plugged-in, defective, process-alarm-generating, assigned modules
- Diagnostics data on modules:
  apart from the CPU, other diagnostics-capable modules (SMs, CPs, FMs) exist whose diagnostics data is entered in the system status list.
  - Module diagnosis info: module start address, internal/external errors, channel errors, parameter errors (4 bytes)
  - Module diagnostics data: all the diagnostics data of a particular module
- Entries in the diagnostic buffer:
  the maximum number of entries depends on the S7-CPU.
  - S7-300-CPUs return max. 10 data blocks
  - S7-400-CPUs return max. 21 data blocks

Step	Action
1	You can read sub-lists of the system status list with SFC51 "RDSYSST". For parameterization, refer to the STEP 7 documentation.
2	Store the diagnostics data in a data block in the user program.
3	Use SFC52 "WR_USMSG" to forward diagnostics data to other registered system nodes.

12.3.4 Diagnostic data blocks

The AS-i masters provide diagnostic data blocks on request. The structures of the diagnostic data blocks are described in the following device-specific sections.

Step	Action
1	Read the data blocks of the AS-i master. The following STEP 7 program blocks are available: • SFC59 "RD_REC" (not for IO devices) This system function has been replaced by SFB52. • SFB52 "RDREC" • SFB54 "RALRM" SFB54 "RALRM" receives an alarm with the associated data from the AS-i master and makes this available with its output parameters. The data in the output parameters contains both the start data for the OB called up and data from the alarm source. Call up SFB 54 within OB82. To parameterize the program blocks, refer to the STEP 7 documentation.
2	Store the diagnostics data in a data block in the user program.

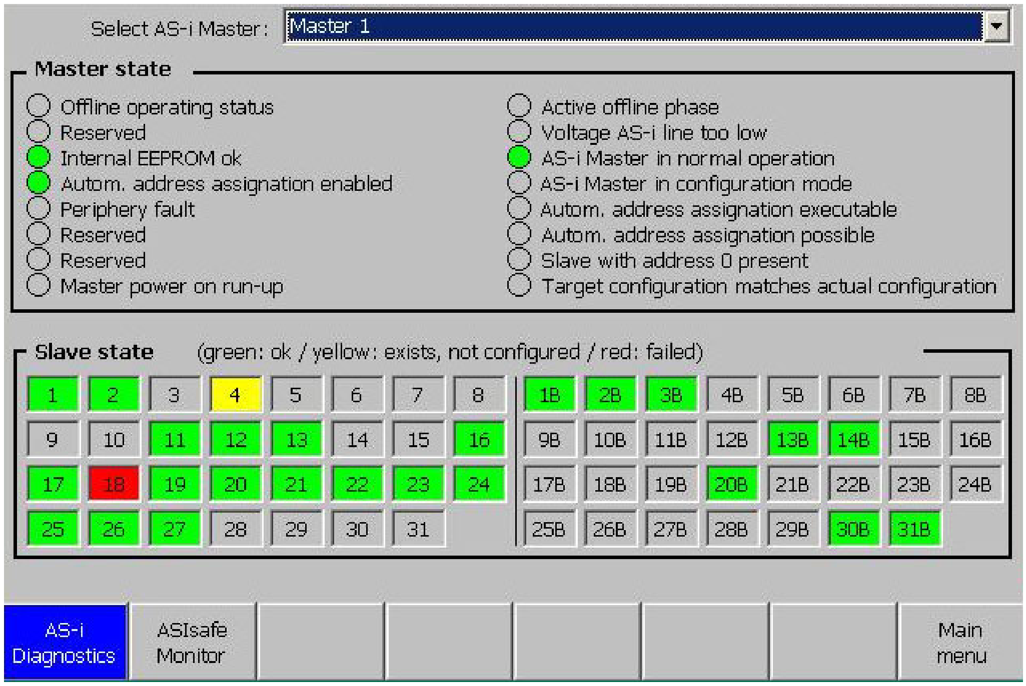
12.3.5 Diagnostics blocks for the user program

Software blocks, which you can use to access AS-Interface diagnostics data, are available for STEP 7. In a user program, the data can be evaluated, archived, and/or output for displaying errors on an operator panel (e.g. WinCC flexible / ProTool).

FC107 "FC_HMICE_ASI" for standard AS-i diagnosis

The function FC107 "FC_HMICE_ASI" reads diagnostics data from the AS-i master and returns status data that is forwarded to other program sections. The diagnosis can take place across several AS-i bus systems. The function can also be used for standard AS/i networks independently of a safety monitor.

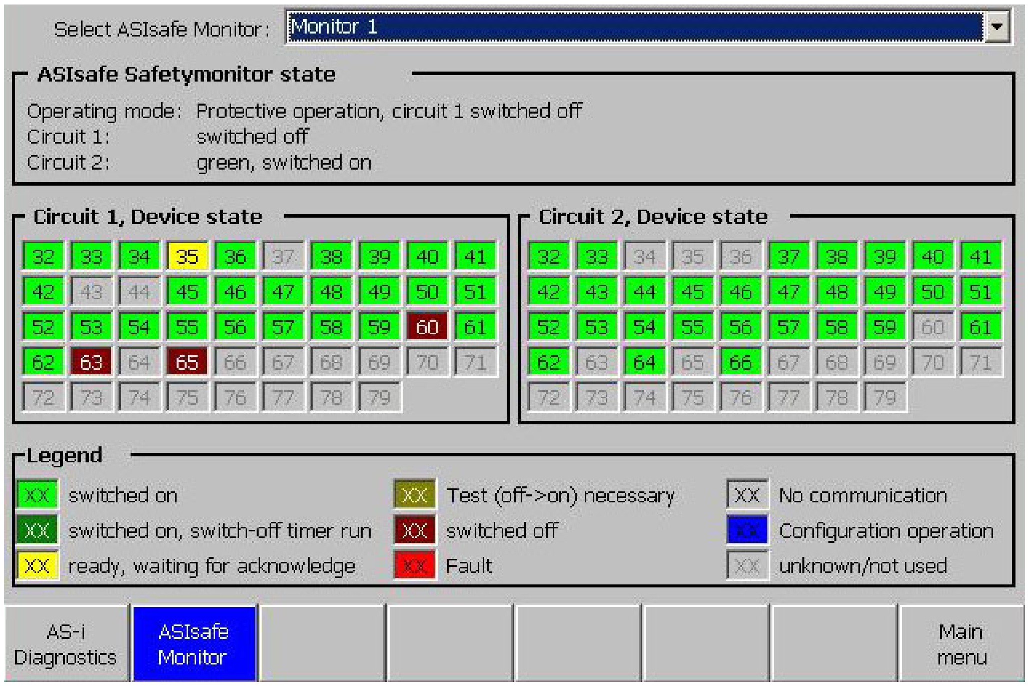
Step	Action
1	Enter each configured AS-i Master in the "SO_51_ASIIndex" text list.
2	Call up the function FC107 in the cyclic OB1 for each AS-i master once.
3	For the diagnosis, call up the function FC107 directly in OB82.
4	For parameterization and forwarding data, refer to the documentation for FC107 "FC_HMICE_ASI".

Step	Action
5	Note the structure of the interface for the standard AS-i diagnosis.  • You can choose the appropriate AS-i masters from the drop-down list. Each AS-i master represents a separate bus. • The status data of the CP for the selected AS-i master corresponds to the AS-i specification. • The address overview of the AS-i slaves displays max. 62 A/B slaves. Various background colors are used to indicate the status of the AS-i slaves: – Green: Available – Yellow: Available but not configured – Red: Faulty – Gray: Not configured

FB102 "ASIMON2D" for ASIsafe diagnosis

Function block FB102 reads diagnostics data and switching statuses of the logic blocks from one or more AS-i safety monitors via the AS-i bus. As a result, the status data of the ASIsafe diagnosis is available for other program sections.

Step	Action
1	Enter each configured AS-i safety monitor in the "SO_53_ASIMonitor" text list.
2	Call up function block FB102 in the cyclic OB1 for each AS-i safety monitor once.
3	Copy the diagnostics data to data block DB69 "DB_ASI_DIAGNOSIS" in the DB area DBW154 "DIAGNOSTICS_DATA".
4	For parameterization and forwarding data, refer to the documentation for FB102 "ASIMON2D".

Step	Action
5	Note the structure of the interface for the ASIsafe diagnosis.  • You can choose the appropriate AS-i safety monitors in the drop-down list. • The operating mode and switching status of the max. two safety circuits indicate the status of the safety monitor. • An overview field visualizes the status data for the data blocks (32 ... 79) for each circuit in a safety monitor. • The different background colors are explained in the key.

12.4 Special features of diagnosis via CP 343-2 and CP 343-2P

The CP 343-2 or CP 343-2P continuously updates a "delta list", which contains all the AS-i slaves that differ from the configuration. Discrepancies occur in the following cases:

- Missing AS-i slaves
- Incorrect AS-i slaves
- AS-i slaves that exist but have yet to be configured

The delta list is part of diagnostic data block DR 1. In the event of diagnostic interrupts, it provides detailed troubleshooting information. The content of DR 1 can be read via SFB52 "RDREC" or SFC59 "RD_REC". The content of DR 1 can also be accessed via the SFC51 "RDSYSST" from the system status list.

SFC51 is recommended for reading DR 1 (time optimized).

The length of DR 1 is always 16 bytes. Bytes 0 to 3 represent the content of DR 0 as well as the local data bytes 8 to 11 in OB82.

The following applies to the individual error bits:

- 0 : No error
- 1 : Error

Byte	Coding	Value / meaning
0	Bit 0	Group fault 0 = outgoing alarm 1 = incoming alarm
	Bit 1 = 1	Internal fault (device fault, e.g. EEPROM defective)
	Bit 2 = 1	External fault (e.g. AS-i slave failed or APF)
	Bit 3 = 1	At least one AS-i slave does not match the target specification.
	Bit 4 = 1	AS-Interface voltage too low (APF)
	Bit 5...7 = 0	Reserved
1	$1C_{H}$	Fixed value
2	Bit 0 = 1	At least one AS-i slave does not match the target specification.
	Bit 1 = 0	Reserved
	Bit 2 = 0 Bit 2 = 1	Normal status CP 343-2P is offline
	Bit 3 = 1	Hardware fault (internal watchdog)
	Bit 4...7 = 0	Reserved
3	Bit 0...1 = 0	Reserved
	Bit 2 = 1	EEPROM defective
	Bit 3...7 = 0	Reserved
4	60_{H}	Fixed value
5	00_{H}	Fixed value
6	40_{H}	Fixed value
7	Fault on AS-i slave 0 / 0A ... 7 / 7A The error bit in byte 7... 15 is set if: • Configured AS-i slave is either not available or not active on AS-Interface • AS-i slave available on AS-Interface, but not configured	
	Bit 0 = 1	Fault on AS-i slave 0
	Bit 1 = 1	Fault on AS-i slave 1 / 1A
	...	...
	Bit 7 = 1	Fault on AS-i slave 7 / 7A
8	Bit 0 … 7	Fault on AS-i slave 8 / 8A ... 15 / 15A
9	Bit 0 … 7	Fault on AS-i slave 16 / 16A ... 23 / 23A
10	Bit 0 … 7	Fault on AS-i slave 24 / 24A ... 31 / 31A
11	Bit 0 … 7	Fault on AS-i slave 0B ... 7B
12	Bit 0 … 7	Fault on AS-i slave 8B ... 15B
13	Bit 0 … 7	Fault on AS-i slave 16B ... 23B
14	Bit 0 … 7	Fault on AS-i slave 24B ... 31B
15	Bit 0 … 7	Reserved

12.5 Special features of diagnosis via DP/AS-Interface Link 20E

DP slave diagnosis

Read the content of the diagnosis telegram via the SFC13 "DPNRM_DG" within the OB82. The content of the diagnosis telegram can also be accessed via the SFC51 "RDSYSST" from the system status list.

The diagnostic telegram is divided into three parts:

Telegram constituent	Byte	Note
Header	0 ... 5	Station status 1 ... 3, master address, PNO ID no. Data about the status of the PROFIBUS DP slave
ID-related diagnosis	6 ... 8	The ID-related diagnosis indicates for which of the configured address spaces in the transfer memory an entry has been made.
Device-related diagnostics	9 ... 28	Error on AS-Interface

The following applies to the individual error bits:

- 0 : No error
- 1 : Error

Byte	Coding	Meaning / remedial measures	
0	Bit 0 = 1	DP/AS-Interface Link 20E cannot be addressed by the PROFIBUS DP master	• Is the correct PROFIBUS address set on DP/AS-Interface Link 20E? • Is the bus connector connected? • RS485 repeater properly set? • External auxiliary voltage on DP/AS-Interface Link 20E?
	Bit 1 = 1	DP/AS-Interface Link 20E is not yet ready to exchange data.	Has DP/AS-Interface Link 20E already started?
	Bit 2 = 1	Incorrect configuration data from PROFIBUS DP master. Configuration not supported by DP/AS-Interface Link 20E.	Check the configuration.
	Bit 3 = 1	Fault on AS-Interface, slave has external diagnostics data.	Evaluate the device-related diagnosis.
	Bit 4 = 1	The required function is not supported by DP/AS-Interface Link 20E (e.g. DP address changed by the PROFIBUS DP master)	Check the configuration.
	Bit 5 = 1	The PROFIBUS DP master cannot interpret the response from DP/AS-Interface Link 20E.	Check PROFIBUS DP.
	Bit 6 = 1	DP/AS-Interface Link 20E has detected an incorrect parameter assignment message (e.g. incorrect length / ID number / parameters)	Check the configuration.
	Bit 7 = 1	DP/AS-Interface Link 20E was parameterized by a different PROFIBUS DP master to the one currently accessing it.	The bit is always 1 when the PG or another PROFIBUS DP master accesses DP/AS-Interface Link 20E. The PROFIBUS address of the parameterization master is located in the diagnostics byte "Master address"

Byte	Coding	Meaning / remedial measures
1	Bit 0 = 1	DP/AS-Interface Link 20E must be parameterized again.
	Bit 1 = 1	Static diagnosis exists.
	Bit 2 = 1	Reserved
	Bit 3 = 1	DP/AS-Interface Link 20E watchdog is active.
	Bit 4 = 0	DP/AS-Interface Link 20E has received the control command "FREEZE".
	Bit 5 = 0	DP/AS-Interface Link 20E has received the control command "SYNC".
	Bit 6 = 0	Reserved
	Bit 7 = 1	DP/AS-Interface Link 20E is deactivated

Byte	Coding	Meaning
2	Bit 0...7	Reserved

Byte	Coding	Meaning
3	00_H...$7E_H$	PROFIBUS address (0 ... 126) of the PROFIBUS DP master that parameterized DP/AS-Interface Link 20E.
	FF_H	Slave is not parameterized by this PROFIBUS DP master

Byte	Coding	Meaning
4	80_H	Manufacturer ID (PNO ID no.)
5	98_H	

Byte	Coding	Meaning
6	43_H	Fixed value
7	00_H	Fixed value
8	00_H	Fixed value

Byte	Coding	Value / meaning
9	13_H	Length of the device-related diagnosis including length specification
10	01_H	Fixed value
11	04_H	Fixed value
12	00_H	Fixed value
13	Module status 1	
	Bit 0 = 1	Group fault
	Bit 1 = 1	Internal fault (device fault, e.g. EEPROM defective)
	Bit 2 = 1	External fault (e.g. AS-i slave failed or APF)
	Bit 3 = 1	At least one AS-i slave does not match the target specification.
	Bit 4 = 1	AS-Interface voltage too low (APF)
	Bit 5...7 = 0	Reserved
14	$1C_H$:	Fixed value

Byte	Coding	Value / meaning
15	Module status 2	
	Bit 0 = 1	At least one AS-i slave does not match the target specification.
	Bit 1 = 0	Reserved
	Bit 2 = 0 Bit 2 = 1	Normal status DP/AS-Interface Link 20E is offline
	Bit 3 = 1	Hardware fault (internal watchdog)
	Bit 4...7 = 0	Reserved
16	Module status 3	
	Bit 0...1 = 0	Reserved
	Bit 2 = 1	EEPROM defective
	Bit 3...7 = 0	Reserved
17	60_H	Fixed value
18	00_H	Fixed value
19	40_H	Fixed value
20	Fault on AS-i Slave 0 / 0A ... 7 / 7A The fault bit in byte 20... 27 is set if: • Configured AS-i slave is either not available or not active on AS-Interface • AS-i slave available on AS-Interface, but not configured	
	Bit 0 = 1	Fault on AS-i slave 0
	Bit 1 = 1	Fault on AS-i slave 1 / 1A
	...	...
	Bit 7 = 1	Fault on AS-i slave 7 / 7A
21	Bit 0 … 7	Fault on AS-i Slave 8 / 8A ... 15 / 15A
22	Bit 0 … 7	Fault on AS-i Slave 16 / 16A ... 23 / 23A
23	Bit 0 … 7	Fault on AS-i Slave 24 / 24A ... 31 / 31A
24	Bit 0 … 7	Fault on AS-i slave 0B ... 7B
25	Bit 0 … 7	Fault on AS-i slave 8B ... 15B
26	Bit 0 … 7	Fault on AS-i slave 16B ... 23B
27	Bit 0 … 7	Fault on AS-i slave 24B ... 31B

Command interface

Further diagnostics data can be accessed via the command interface. To do so, use the call Read_data_block (SFC59 or dpc*_read) to authorize AS-i commands. Suitable AS-i commands include "Read_extended_lists_and_flags" (0030_H) or "Read_I/O_error_list" ($003E_H$).

When a SIMATIC S7 is used as a PROFIBUS DP master, a special function (FC ASI_3422) is available for using the AS-i commands. This function processes the report for AS-i commands independently.

12.6 Features of diagnosis via DP/AS-i LINK Advanced

DP slave diagnosis

Read the content of the diagnosis telegram via the SFC13 "DPNRM_DG" within the OB82. The content of the diagnosis telegram can also be accessed via the SFC51 "RDSYSST" from the system status list.

The diagnostic telegram is divided into three parts:

Telegram constituent	Byte	Note
Header	0 ... 5	Station status 1 ... 3, master address, PNO ID no. Data about the status of the PROFIBUS DP slave
ID-related diagnosis	6 ... 8	The length of the ID-related diagnosis depends on the application of DP/AS-i LINK Advanced. Short ID-related diagnosis (3 bytes), e.g. for: • Configuration with STEP 7 as single master and without analog slaves • Configuration as single master for binary line "ASi-1" with GSD file The ID-related diagnosis indicates for which of the configured address spaces in the transfer memory an entry has been made.
	(6 ... 22)	Long ID-related diagnosis (17 bytes)
Device-related diagnostics	9 ... 27	Fault on AS-Interface Assignment with short ID-related diagnosis
	(23 ... 41)	Fault on AS-Interface Assignment with long ID-related diagnosis

The following applies to the individual error bits:

- 0 : No error
- 1 : Error

Byte	Coding	Meaning / remedial measures	
0	Bit 0 = 1	DP/AS-i LINK Advanced cannot be addressed by the PROFIBUS DP master	• Is the correct PROFIBUS address set on DP/AS-i LINK Advanced? • Is the bus connector connected? • RS485 repeater properly set?
	Bit 1 = 1	DP/AS-i LINK Advanced is not yet ready to exchange data.	Has DP/AS-i LINK Advanced already started?
	Bit 2 = 1	Incorrect configuration data from PROFIBUS DP master. Configuration not supported by DP/AS-i LINK Advanced.	Check the configuration.
	Bit 3 = 1	Fault on AS-Interface, slave has external diagnostics data.	Evaluate the device-related diagnosis.
	Bit 4 = 1	The required function is not supported by DP/AS-i LINK Advanced (e.g. DP address changed by the PROFIBUS DP master)	Check the configuration.
	Bit 5 = 1	The PROFIBUS DP master cannot interpret the response from DP/AS-i LINK Advanced.	Check PROFIBUS DP.

Byte	Coding	Meaning / remedial measures	
	Bit 6 = 1	DP/AS-i LINK Advanced has detected an incorrect parameterization telegram (e.g. incorrect length / ID number / parameters)	Check the configuration.
	Bit 7 = 1	DP/AS-i LINK Advanced was parameterized by a different PROFIBUS DP master to the one currently accessing it.	The bit is always 1 when the PG or another PROFIBUS DP master accesses DP/AS-i LINK Advanced. The PROFIBUS address of the parameterization master is located in the diagnostics byte "Master address"

Byte	Coding	Meaning / remedial measures
1	Bit 0 = 1	DP/AS-i LINK Advanced must be parameterized again.
	Bit 1 = 1	Static diagnosis exists.
	Bit 2 = 1	Reserved
	Bit 3 = 1	DP/AS-i LINK Advanced response monitoring is active.
	Bit 4 = 0	DP/AS-i LINK Advanced has received the control command "FREEZE".
	Bit 5 = 0	DP/AS-i LINK Advanced has received the control command "SYNC".
	Bit 6 = 0	Reserved
	Bit 7 = 1	DP/AS-i LINK Advanced is deactivated.

Byte	Coding	Meaning
2	Bits 0...7	Reserved

Byte	Coding	Meaning
3	00_H...$7E_H$	PROFIBUS address (0 ... 126) of the PROFIBUS DP master that parameterized DP/AS-i LINK Advanced.
	FF_H	Slave is not parameterized by this PROFIBUS DP master

Byte	Coding	Meaning
4	80_H	Manufacturer ID (PNO ID no.)
5	98_H	

Byte	Coding	Meaning
6	43_H	Fixed value for short ID-related diagnosis
	51_H	Fixed value for long ID-related diagnosis
7 8 (9...22)	XX_H	Each bit addresses a slot (0: slot OK, 1: slot not OK) • Byte 7, bit 0: Irrelevant • Byte 7, bit 1: AS-i line 1 (always with STEP 7 configuration, slot 1 recommended for GSD configuration) • Byte 7, bit 2: AS-i line 2 (always with STEP 7 configuration, slot 2 recommended for GSD configuration when used as double master) Byte 9 ... 22 only for **long** ID-related diagnosis

Byte	Coding	Value / meaning
9 (23)	13_H	Length of the device-related diagnosis including length specification
10 (24)	01_H	Diagnostic interrupt
	81_H	Status message
11 (25)	XX_H	Alarm from slot XX_H. AS-i line faults are signaled via the associated binary module.
12 (26)	00_H	Fixed value
13 (27)	Module status 1	
	Bit 0 = 1	Group fault
	Bit 1 = 1	Internal fault (device fault, e.g. EEPROM defective)
	Bit 2 = 1	External fault (e.g. AS-i slave failed or APF)
	Bit 3 = 1	At least one AS-i slave does not match the target specification.
	Bit 4 = 1	AS-Interface voltage too low (APF) or ground fault
	Bit 5...7 = 0	Reserved
14 (28)	$1C_H$:	Fixed value
15 (29)	Module status 2	
	Bit 0 = 1	At least one AS-i slave does not match the target specification.
	Bit 1 = 0	Reserved
	Bit 2 = 0 Bit 2 = 1	Normal status DP/AS-i LINK Advanced is offline
	Bit 3 = 1	Hardware fault (internal watchdog)
	Bit 4...7 = 0	Reserved
16 (30)	Module status 3	
	Bit 0...1 = 0	Reserved
	Bit 2 = 1	EEPROM defective
	Bit 3...7 = 0	Reserved
17 (31)	60_H	Fixed value
18 (32)	00_H	Fixed value
19 (33)	40_H	Fixed value
20 (34)	Fault on AS-i Slave 0 / 0A ... 7 / 7A The fault bit in byte 20... 27 (34 ... 41) is set if: • Configured AS-i slave is either not available or not active on AS-Interface • AS-i slave available on AS-Interface, but not configured	
	Bit 0 = 1	Fault on AS-i slave 0
	Bit 1 = 1	Fault on AS-i slave 1 / 1A
	...	...
	Bit 7 = 1	Fault on AS-i slave 7 / 7A
21 (35)	Bit 0 … 7	Fault on AS-i Slave 8 / 8A ... 15 / 15A

Byte	Coding	Value / meaning
22 (36)	Bit 0 … 7	Fault on AS-i Slave 16 / 16A ... 23 / 23A
23 (37)	Bit 0 … 7	Fault on AS-i Slave 24 / 24A ... 31 / 31A
24 (38)	Bit 0 … 7	Fault on AS-i slave 0B ... 7B
25 (39)	Bit 0 … 7	Fault on AS-i slave 8B ... 15B
26 (40)	Bit 0 … 7	Fault on AS-i slave 16B ... 23B
27 (41)	Bit 0 … 7	Fault on AS-i slave 24B ... 31B

Command interface

Further diagnostics data can be accessed via the command interface. To do so, use the call Read_data_block (SFC59 or dpc*_read) to authorize the AS-i commands. Suitable AS-i commands include "Read_extended_lists_and_flags" (0030_H) or "Read_AS-i_line_error_counter" ($004A_H$).

When SIMATIC S7 is used as a PROFIBUS DP master, a special function (FC ASI_3422) is available for using the AS-i commands. This function processes the report for AS-i commands independently.

12.7 Special features of diagnosis via DP/AS-i F-Link

DP slave diagnosis

Read the content of the diagnosis telegram via the SFC13 "DPNRM_DG" within the OB 82. The content of the diagnosis telegram can also be accessed via the SFC51 "RDSYSST" from the system status list.
The diagnostic telegram is divided into three parts:

Telegram constituent	Byte	Note
Header	0 ... 5	Station status 1 ... 3, master address, PNO ID no. Data about the status of the PROFIBUS DP slave
ID-related diagnosis	6 ... 8	The ID-related diagnosis indicates for which of the configured address spaces in the transfer memory an entry has been made.
Device-related diagnostics	9 ... 28	Error on AS-Interface

The following applies to the individual error bits:

- 0 : No error
- 1 : Error

Byte	Coding	Meaning / remedial measures	
0	Bit 0 = 1	DP/AS-i F-Link cannot be addressed by the PROFIBUS DP master	• Is the correct PROFIBUS address set on DP/AS-i F-Link? • Is the bus connector connected? • RS485 repeater properly set?
	Bit 1 = 1	DP/AS-i F-Link is not yet ready to exchange data.	Has DP/AS-i F-Link already started?
	Bit 2 = 1	Incorrect configuration data from PROFIBUS DP master. Configuration not supported by DP/AS-i LINK Advanced.	Check the configuration.
	Bit 3 = 1	Fault on AS-Interface, slave has external diagnostics data.	Evaluate the device-related diagnosis.
	Bit 4 = 1	Required function not supported by DP/AS-i F-Link.	Check the configuration.
	Bit 5 = 1	The PROFIBUS DP master cannot interpret the response from DP/AS-i F-Link.	Check PROFIBUS DP.
	Bit 6 = 1	DP/AS-i F-Link has detected an incorrect parameterization telegram (e.g. incorrect length / ID number / parameters)	Check the configuration.
	Bit 7 = 1	DP/AS-i F-Link was parameterized by a different PROFIBUS DP master to the one currently accessing it.	The bit is always 1 when the PG or another PROFIBUS DP master accesses DP/AS-i F-Link. The PROFIBUS address of the parameterization master is located in the diagnostics byte "Master address"

Byte	Coding	Meaning / remedial measures
1	Bit 0 = 1	DP/AS-i F-Link must be parameterized again.
	Bit 1 = 1	Static diagnosis exists.
	Bit 2 = 1	Reserved
	Bit 3 = 1	DP/AS-i F-Link response monitoring is active.
	Bit 4 = 0	Reserved
	Bit 5 = 0	Reserved
	Bit 6 = 0	Reserved
	Bit 7 = 1	DP/AS-i F-Link is deactivated.

Byte	Coding	Meaning
2	Bits 0...7	Reserved

Byte	Coding	Meaning
3	00_H...$7E_H$	PROFIBUS address (0 ... 126) of the PROFIBUS DP master that parameterized DP/AS-i F-Link.
	FF_H	Slave is not parameterized by this PROFIBUS DP master

Byte	Coding	Meaning
4	81_H	Manufacturer ID (PNO ID no.)
5	$4E_H$	

Byte	Coding	Meaning
6	43_H	Fixed value
7		Bit structure of the slot number
	Bit 0 = 1	Group error bit
	Bit 1 = 0	Fixed value
	Bit 2 = 0	Fixed value
	Bit 3 = 0	Fixed value
	Bit 4 = 1	Diagnosis slot F-link (PROFIsafe)
	Bit 5 = 1	Diagnosis slot DP/AS-i (16/16 Byte or 32/32 Byte)
	Bit 6 = 0	Fixed value
	Bit 7 = 0	Fixed value
8	00_H	Fixed value

Byte	Coding	Value / meaning
9	14_H	Length of the device-related diagnosis including length specification
10	01_H	Diagnostic interrupt
11	03_H	Interrupt from slot F link (PROFIsafe)
	04_H	Interrupt from slot DP/AS-i
12		Specifier
	Bit 0 … 1	Interrupt specifier 00 = No further information 01 = Incoming fault on slot 10 = Outgoing fault slot, no fault 11 = Outgoing fault slot, not yet fault-free
13		Module status 1
	Bit 0 = 1	Group fault
	Bit 1 = 1	Internal fault (device fault, e.g. EEPROM defective)
	Bit 2 = 1	External fault (e.g. AS-i slave failed or APF)
	Bit 3 = 1	At least one AS-i slave does not match the target specification.
	Bit 4 = 1	AS-Interface voltage too low (APF)
	Bit 5...7 = 0	Reserved
14	$1C_H$:	Fixed value
15		Module status 2
	Bit 0 = 1	At least one AS-i slave does not match the target specification.
	Bit 1 = 0	Reserved
	Bit 2 = 0 Bit 2 = 1	Normal status DP/AS-i F-Link is offline
	Bit 3 = 1	Hardware fault (internal watchdog)
	Bit 4...7 = 0	Reserved
16		Module status 3
	Bit 0...1 = 0	Reserved
	Bit 2 = 1	EEPROM defective
	Bit 3...7 = 0	Reserved
17	$7F_H$	Fixed value

Byte	Coding	Value / meaning
18	40_H	Fixed value
19	01_H	Fixed value
20	01_H	Fixed value
21	Fault on AS-i Slave 0 / 0A ... 7 / 7A The fault bit in byte 21... 28 is set if: • Configured AS-i slave is either not available or not active on AS-Interface • AS-i slave available on AS-Interface, but not configured	
	Bit 0 = 1	Fault on AS-i slave 0
	Bit 1 = 1	Fault on AS-i slave 1 / 1A
	...	...
	Bit 7 = 1	Fault on AS-i slave 7 / 7A
22	Bit 0 … 7	Fault on AS-i Slave 8 / 8A ... 15 / 15A
23	Bit 0 … 7	Fault on AS-i Slave 16 / 16A ... 23 / 23A
24	Bit 0 … 7	Fault on AS-i Slave 24 / 24A ... 31 / 31A
25	Bit 0 … 7	Fault on AS-i slave 0B ... 7B
26	Bit 0 … 7	Fault on AS-i slave 8B ... 15B
27	Bit 0 … 7	Fault on AS-i slave 16B ... 23B
28	Bit 0 … 7	Fault on AS-i slave 24B ... 31B

Diagnostic data block (DB 92)

In the event of diagnostic interrupts, data block 92 provides more detailed information for troubleshooting. The content of DB 92 can be read via SFB52 "RDREC" or SFC59 "RD_REC".

Other data blocks (e.g. data record 150 - binary image of I/O data) are described in the documentation for DP/AS-i F-Link.

When SIMATIC NET programming interface is used, the block "dpc*_read" corresponds to SFC59.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Meaning							
0	Reserved							
1	Reserved							
2	Reserved							
3	Reserved							
4	Reserved	Reserved	0 = Teach-in of code sequences not required 1 = Teach-in required	00 = No code sequences taught in 01 = Code sequences taught in 10 = Code sequences taught in and others available for teaching in 11 = All code sequences taught in		0 = Master not in protected mode 1 = Master in protected mode	0 = Master offline 1 = Master online	0 = Teaching in not active 1 = Teaching in active
5	Reserved							
6	Reserved							
7	Reserved							

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
8	Slave 1 / 1A diagnostics byte 1							
9	Slave 1 / 1A diagnostics byte 2							
10	Slave 2 / 2A diagnostics byte 1							
11	Slave 2 / 2A diagnostics byte 2							
...	...							
68	Slave 31 / 31A diagnostics byte 1							
69	Slave 31 / 31A diagnostics byte 2							
70	Reserved							
71	Reserved							
72	Slave 1B diagnostics byte 1							
73	Slave 1B diagnostics byte 2							
...	...							
132	Slave 31B diagnostics byte 1							
133	Slave 31B diagnostics byte 2							
134	Flag 1							
135	Flag 2							

Bit	Diagnostics byte 1	Diagnostics byte 2
0	1 = I/O fault	1 = F-DI 1 closed
1	1 = Slave active	1 = F-DI 2 closed
2	1 = Slave is F slave	1 = Discrepancy violation
3	1 = Code sequence error during operation	1 = Power-up condition not met
4	1 = Error in code sequence during teach-in	1 = target <> actual
5	1 = Code sequence not unique	Reserved
6	1 = No code sequence taught in	Reserved
7	Reserved	Reserved

Bit	Meaning	Description
0	OFFLINE_READY	The flag is set if the offline phase is active.
1	APF	The flag is set if the voltage on the AS-i cable is too low.
2	NORMAL_MODE	The flag is set when DP/AS-i F-Link is in normal mode.
3	OPERATING MODE	The flag is set in configuration mode and reset in protected mode.
4	AUTO_ADDR_AVAIL	The flag is set when automatic address programming can be carried out (i.e. exactly **one** AS-i slave has currently failed).
5	AUTO_ADDR_ASSIGN	The flag is set when automatic address programming is possible (i.e. AUTO_ADDR_ENABLE = 1 **and** no "incorrect" AS-i slave is connected to AS-Interface).
6	LDS_0	The flag is set if an AS-i slave with operating address "0" is available.
7	CONFIG_OK	The flag is set when the planned configuration and the actual configuration match.

Bit	Meaning	Description
0	OFFLINE	The flag is set if the operating status "OFFLINE" is to be adopted or has already been adopted.
1	INTERNAL	The flag is always set.
2	EEPROM_OK	The flag is set if the test of the internal EEPROM was successful.
3	AUTO_ADDR_ENABLE	The flag indicates whether automatic address programming by the user is disabled (BIT = 0) or enabled (BIT = 1).
4	PERIPHERY_FAULT	The flag is set if at least one AS-i slave signals an I/O fault.
5	Reserved	-
6	Reserved	-
7	MPO startup	The flag "Master_Power_on-startup" is set after the supply voltage of the AS-i slave master has been switched on. The bit is reset when the master changes later to OFFLINE.

Command interface

Further diagnostics data can be accessed via the command interface. To do so, use the call Read_data_block (SFC59 or dpc*_read) to authorize the AS-i commands. Suitable AS-i commands include "Read_extended_lists_and_flags" (0030_H) or "AS-i_status/diag_of_F_slaves" (0051_H).

When SIMATIC S7 is used as a PROFIBUS DP master, a special function (FC ASI_3422) is available for using the AS-i commands. This function processes the report for AS-i commands independently.

12.8 Special features of diagnosis via IE/AS-i LINK PN IO

PROFINET IO uses a manufacturer-independent data block structure with diagnostics data. Diagnostic interrupts trigger channel diagnoses (PROFINET IO format ID 8000_H) for defective channels only. STEP 7 allows channel diagnoses for all sub-modules of PROFINET IO devices to be read.

AS-i slave-specific diagnostic interrupts (e.g. I/O errors) are assigned to the logical I/O address or diagnosis address of the relevant slot (1 ... 63, 101 ... 163).
Line-specific diagnostic interrupts (e.g. AS-i Power Fail) are assigned to the logical I/O address or diagnosis address of the line proxy module (slot 0 or 100).

Evaluating the diagnostics data with SFB54

With SIMATIC S7, detailed diagnostics data can be accessed with SFB54 "RALRM" via the block parameter "AINFO". The alarm structure is provided in the documentation or help for SFB54. The specific meanings of the fault types (AINFO, bytes 32 ... 33) for IE/AS-i LINK PN IO are described in the following table.

Fault type	Fault description	Slot	Channel number	Cause
0010_H	Redundant slave	Line proxy (slot 0 / 100)	AS-i address of redundant slave: 0...31, 33...63	An AS-i slave that has not been configured has been detected. Fault with a configured (entered in LPS) AS-i slave for which no I/O module was positioned in HW Config.
0011_H	Fault with the power supply	Line proxy (slot 0 / 100)	8000_H (complete line)	AS-i master detects Power Fail (e.g. wire breakage)
$001A_H$	External fault (I/O error)	0...63 or 100...163	8000_H (complete line)	The AS-i slave signals a fault on the slave I/O.
0180_H	Ground fault	Line proxy (slot 0 / 100)	8000_H (complete line)	AS-i master detects ground fault on AS-i line.

Data block interface

Further diagnostics data can be accessed via the data block interface. To do so, use the call Read_data_block (SFB52) to authorize AS-i commands. Suitable AS-i commands include "Read_lists_and_flags" (0054_H) or "Read_AS-i_line_error_counter" (0060_H).

When an IO-Base programming interface is used, the block "pnio_rec_read_rec()" corresponds to SFB52 .

Special diagnostics

Even if the "Diagnostics" tab with the "Special Diagnostics" button for IE/AS-i LINK PN IO is displayed in your STEP 7 version, this selection has no function.

Planning and configuration 13

13.1 Checklist for beginners

This checklist aims to make it easier for you to use AS-Interface.

1. How many inputs and outputs are required?

The number of inputs and outputs determines how many AS-Interface networks are required.

2. How much power do the I/Os require?

The total power requirements of the required modules determine which AS-Interface power supply unit is selected. Since power supply units cannot be connected in parallel, a power supply unit dimensioned in line with the power requirements must be used.

3. Are any special cables required?

Both flat and round cables can be used. External influences determine whether rubber, TPE, or PUR cables are required. Repeaters or extenders must always be used when cable lengths exceed 100 m.

4. Have the addresses been correctly assigned?

For reasons of clarity, an overview must be created that clearly shows which addresses are assigned to which slaves. Duplicate addresses, for example, may not be recognized as errors by the master.

5. Which modules belong to which addresses?

The modules and slaves that have been addressed must be carefully labeled.

6. When are the modules installed?

The modules must not be installed until the activities described in rules 4 and 5 have been completed. The cable itself can be routed at any time, however.

7. How is the entire system configured?

The configuration is simply read by entering the AS-Interface profile for each slave in the master. This normally occurs automatically, but can also take place via the controller software.

8. Are the slaves detected?

You first have to check whether the master has detected all of its slaves. Only then can the system be set to protected mode and the controller switched to RUN.

9. How is the system tested?

As with the PLC, input/output tests are carried out, that is, the sensors are actuated locally and checked in the PLC.

10. How is the entire system launched?

You can either create the controller software as usual, or use existing software. If you use existing software, the symbolic assignment of the addresses may have to be adjusted.

13.2 Configuration

With AS-Interface, configuration simply means that a list of configured slaves is created and then stored in the master. Configuration is normally carried via the master, that is, the master reads the network configuration automatically. (Requirements for special applications can also be created in the PLC.)

During configuration, the slave address and slave type (ID code), the I/O configuration (I/O code), and the parameters (for intelligent sensors), are defined (if available). The master uses the list to check whether the actual configuration matches the target configuration. The master can only carry this out, however, provided that the slaves have already been addressed.

13.3 Addressing the I/O modules

Unique addressing

In the factory setting, each I/O module (slave) has the address 0. It is detected by the master as a new slave that has not yet been addressed and, in this condition, has not yet been integrated in standard communication/data exchange.

To enable data to be exchanged between the master and slaves, you have to assign a **unique address** for all the slaves before creating the interface network.

You can choose the address of the slave as required:

- In address space 1 to 31
- In extended addressing mode (as of AS-i version 2.0/2.1) in the address space 1A to 31A and 1B to 31B.

Addressing the slave

You can address a slave in different ways:

- Offline using an addressing unit (Page 40)
- Online via the AS-Interface system master

13.4 Parameterization

You do not normally have to parameterize slaves.

Only intelligent slaves for which the relevant option is also available are parameterized. The datasheet for the corresponding slave specifies whether or not it needs to be parameterized and the functions of the parameters.

While the address of a slave never changes during normal operation, parameters are subject to change. For this reason, a distinction is made between variable and fixed parameters.

Fixed parameters are defined once (during configuration).

An example of this is an analog input module that is set via a parameter to a current range of 0 to 20 mA or 4 to 20 mA. The parameters themselves are bits of which four are available for each module and which are each set to either 0 or 1. They are transferred from the master to the slaves when the system is started.

13.5 Operation

The AS-Interface system has been set up

The AS-Interface system can be commissioned as soon as it has been fully set up:

- All the components have been installed
- The slaves have been addressed and (if necessary) parameterized
- Configuration is complete
- Commissioning can now begin

AS-Interface system in normal operation

The system switches to normal operation and the master runs in protected mode. Only the slaves that have been configured are activated. Slaves that have not been configured (e.g. new ones) simply cause an error message to be output. You must include these in the list of configured slaves.

The system is continuously monitored both when it is restarted and during normal operation. The higher-level controller receives the data required for this (e.g. voltage, mode, incorrect configuration, etc.) from the AS-Interface master (e.g. in the form of a diagnosis).

Configuring new slaves

To include slaves that have not been configured in the communication network, they need to be configured:

1. Switch to configuration mode.
2. Use the "Configure slaves" to include new slaves in the communication network.

13.6 AS-Interface acceptance certificate

Acceptance Report AS-Interface

Acceptance Report AS-Interface

An acceptance report is to be prepared for each ASi network or ASi master.

All measurements must be taken under normal operating conditions (e.g. production).

Time of measurement Date: ________ Time: from______ to ______

1. Set-up

For setting up the ASi network, fulfillment of the following requirements must be confirmed:

As a general principle, the SIEMENS set-up guidelines for the AS-Interface (Documentation Order No. 3RK1703 2AB02-0AA1) must be complied with.

1.1. Overall bus

The connection from the master to the most remote slave without an extension plug must be made using no more than two repeaters (corresponding to 3 segments), or with an extension plug using no more than one repeater (corresponding to two segments).
The requirement is met: Yes (_) / No (_)

Comments: ____

1.2. Bus segment

The segment length without extension plug must be no more than 100 m, and with extension plug no more than 200 m. (The segment length is the total of all sub-lengths (spur lines) in one segment.)
The requirement is met: Yes (_) / No (_)

What is the length of the segment?

S 1: ________ m S 2: ________ m S 3: ________ m etc.

Comments: ____

1.3. Power supply

The ground connection of the ASi power supply must be connected with the system mass for the purpose of symmetrization.

The requirement is met: Yes (_) / No (_)

Comments: ____

1.4. Cable

The ASi cables and load voltage cables (e.g. 230V/400V) must always be laid separately.

Between AS-i cables or sensor cables and medium-range sources of interference, e.g. controllers with an inductive load or low-radiation power supply units, a distance of 10 to 20 cm must be observed.

Between AS-i cables or sensor cables and strong sources of interference, e.g. welding robots, switched-mode power supplies, and frequency converters, a spacing of more than 50 m must be observed.

Wherever possible, the yellow shaped AS-Interface cable should be laid, otherwise twisted 2-core 2 x 1.5 mm² cables.

The requirement is met: Yes (_) / No (_)

Comments: ____

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Acceptance Report AS-Interface

1.5. Grounding

The ground terminal of the AS-i modules must be connected to the plant mass if devices with PE in the M12 connector are connected to AS-i modules.

The requirement is met: Yes (_) / No (_)

Comments: ____

1.6. Branches / insulation displacement method

The current load via T-distributor or terminal distributor must not exceed 2 A.

The requirement is met: Yes (_) / No (_)

Comments: ____

1.7. Degree of protection IP67

Unused connections are to be sealed with protective caps; in the case of cable ducts, seals are to be placed at the appropriate locations.

The requirement is met: Yes (_) / No (_)

Comments: ____

1.8. ASIsafe, sensor cables

The sensor cable to a safe input is to be kept as short as possible and must not exceed 20 m.

The requirement is met: Yes (_) / No (_)

Comments: ____

1.9. ASIsafe, safety monitor

The service key and the configuration interface are to be protected against unauthorized access by attaching and sealing the transparent cover.

The requirement is met: Yes (_) / No (_)

Comments: ____

2. Configuration

The following information must be provided for configuring the AS-i network:

2.1. Bus configuration

How is the bus configured for the AS-i master?

(_) in the master by pressing a button.

(_) in the control system (SIMATIC S7) by means of hardware configuration .

(_) in the control system (SIMATIC S7) by means of user program (STEP7).

Comments: ____

2.2. Slaves

How are the slaves connected to the network documented (type, node number and ID)?

(_) by the circuit diagram of the electrical design.

(_) manually generated according to table.

(_) according to table as printout of the hardware configuration from SIMATIC STEP7 Object Manager (with CP343-2 P or DP/ASi-Link 20E).

(_) by means of table as printout of data that has been read via the command interface of the ASi master of the "extended overall configuration“.

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Acceptance Report AS-Interface

(_) not at all

Comments: ____

2.3. Topology

How is the network topology documented?

The documentation should have a structure such as: Linear, tree, star, spur, etc. and show the segmentation with the actual lengths of cables laid in the AS-i network. AS-i power supplies, slaves with node numbers and, if present, repeaters, extenders or extension plugs should be entered.

(_) by circuit diagram of the electrical design.

(_) by means of diagram

(_) not at all

Comments: ____

2.4. Power budget of the AS-i network and the 24V auxiliary voltage

How great is the power demand to be expected in the AS-i network per segment in comparison with maximum permissible current load of the AS-i power supply?

Where applicable, corresponding observations should be made for the 24V auxiliary voltage.

Theoretical maximum power demand:

(270 mA may be regarded for the demand of one slave without auxiliary voltage supply.) If the slave currents differ by a large amount, the actual consumption should be taken into consideration.

I theo1: ________ A I theo2: ________ A I theo3: ________ A etc.

Maximum permissible AS-i current load on power supply unit:

I max1: ________ A I max2: ________ A I max3: ________ A etc.

Comments: ____

2.5. Safety technology, ASIsafe

How is the programming of the safety monitor documented?

(_) Safety report

(_) Password in sealed envelope

Comments: ____

3. Electrical values

The following electrical values are to be measured.

3.1. AS-I voltage

What is the value of the AS-i voltage at the end of the segment that is furthest from the AS-i power supply? The measuring point (M) is to be entered in the network topology. The value is to be determined for all segments.

AS-i voltage between ASi+ und ASi- (permissible value, U+/- = 26.5 to 31.6 V)

U+/- 1: ________ V U+/- 2: ________ V U+/- 3: ________ V etc.

AS-i voltage between ASi and ASi plant mass (U -/m) (all values not equal to 0 V are permissible)?

U-/m 1: ________ V U-/m 2: ________ V U-/m 3: ________ V etc.

Comments: ____

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Acceptance Report AS-Interface

3.2. AS-i current

What is the value of the AS-i current that is taken from the power supply unit and how high is the maximum current load at the power supply unit? The value is to be determined for all segments.

AS-i current taken from power supply unit: (recommended value is 90% of the max. power supply unit load)

I 1: ________ A I 2: ________ A I 3: ________ A etc.

Maximum permissible AS-i current load on power supply unit:

I max1: ________ A I max2: ________ A I max3: ________ A etc.

Comments: ____

4. Qualitative values

The following qualitative values are to be determined.

4.1. Message frame error for slaves

Where do most message frame errors occur and how many are there?

This can be measured and documented with an AS-i analyzer in the "Online statistics"/ "Extended statistics" menu. At least 100,000 message frames must be measured (in the case of 31 slaves this corresponds to about 9 minutes of measuring time).

With which three slaves do the most message frame errors occur?

Slave 1: ________ Number of errors: ________

Slave 2: ________ Number of errors: ________

Slave 3: ________ Number of errors: ________

How many message frames were the measurements taken on? Number of message frames: ____________________

Comments: ____

4.2. Message frame error with slaves

What is the percentage of message frames with errors? (permissible error rate < 0.1 %) The measurement must take place over a period of at least 30 minutes.

Measurement time: ________ min. message frame errors: ________ Number of message frames: ________

Error rate = (message frames with errors * 100) / number of message frames = ________ %

Comments: ____

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Acceptance Report AS-Interface

5. Functions

5.1. Slave diagnostics

How are failed slaves indicated?

(_) by reading out and interpreting the flag lists via the command interface of the AS-i master.

(_) by means of AS-i diagnostics package

(_) not at all

Comments: ______________________________

5.2. ASIsafe diagnostics

How is the operating data of the AS-i safety monitors displayed?

(_) by means of AS-i monitor diagnostics package

(_) not at all

Comments: ______________________________

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Appendix

A

A.1 References

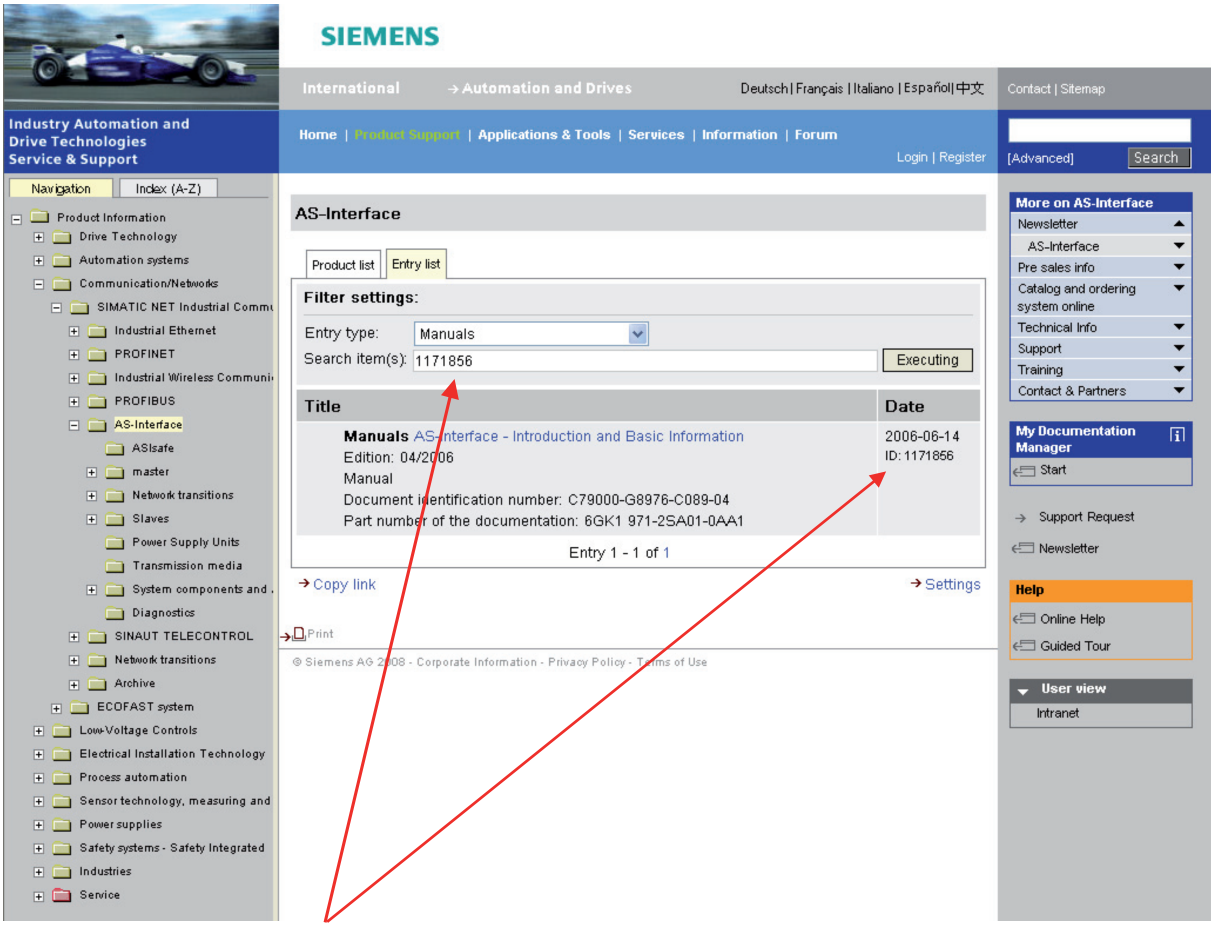
Documentation for AS-Interface at a glance

All the documents in this overview are available for download at:

www.siemens.de/as-interface

In **All about AS-Interface**, choose:

Technical info ▲ ➔ Manuals / Operating instructions



Each document has a **doc. ID**, which you can use to search for a specific document.

The following tables list a selection of available AS-i documents.

Topic	ASIsafe
Document title	System Manual Safety Integrated (The Safety System for Industry) as well as Supplement to the System Manual
Publication date	07.04.2006
Edition	5.
Doc. ID:	17711888
Doc. class	System Manual in De as well as Supplement
Drawing number	—
Order no.	6ZB5000-0AA01-0BA1
For products	ET 200; 3RA7; 3RG78; 3RK1105-1.E04-0CA0; 3RK1405-.BQ00-0AA3

Topic	Masters for SIMATIC S7
Document title	CP 142-2
Publication date	08.02.2000
Edition	02
Doc. ID:	1889227
Doc. class	Manual
Drawing number	C79000-B8900-C111-02
Order no.	6GK7142-2AH00-8AA0
For products	6GK7142-2AH00-0XA0
Document title	CP 243-2 AS-Interface Master
Publication date	30.01.2001
Edition	07/2000
Doc. ID:	2659515
Doc. class	Manual
Drawing number	C79000-G8900-C142-02
Order no.	6GK7243-2AX00-8AA0
For products	6GK7243-2AX00-0XA0; 6GK7243-2AX01-0XA0
Document title	CP 343-2 / CP 343-2 P AS-Interface Master
Publication date	28.01.2003
Edition	11/2002
Doc. ID:	5581657
Doc. class	Manual
Drawing number	C79000-G8900-C149-02
Order no.	6GK7343-2AH00-8AA0
For products	6GK7343-2AH00-0XA0; 6GK7343-2AH10-0XA0

Topic	Network transitions
Document title	Distributed I/O System DP/AS-i Link
Publication date	16.09.1999
Edition	3
Doc. ID:	1144898
Doc. class	Manual
Drawing number	EWA 4NEB 7106055-01b
Order no.	6ES7 156-0AA00-8AA0
For products	6GK1415-2AA00; 6GK1415-2AA01
Document title	ASiSafe DP/AS-i F-Link
Publication date	14.11.2006
Edition	10/2006
Doc. ID:	24196041
Doc. class	Manual
Drawing number	926253101000
Order no.	GWA 4NEB926253101-01
For products	3RK3141-1CD10; 3RK3141-2CD10

Topic	Network transitions
Document title	Manual DP/AS-Interface Link Advanced
Publication date	25.04.2006
Edition	04/2006
Doc. ID:	22710305
Doc. class	Manual
Drawing number	C79000-G8900-C209-01
Order no.	—
For products	6GK1415-BA10; 6GK1415-2BA20
Document title	Manual DP/AS-Interface Link 20E
Publication date	17.12.2002
Edition	11/2002
Doc. ID:	5281638
Doc. class	Manual
Drawing number	C79000-G8900-C138-04
Order no.	6GK1971-2DS01-0AA0
For products	6GK1415-2AA01

Topic	Motor starter
Document title	ECOFAST Motor Starters
Publication date	22.04.2005
Edition	05/2004
Doc. ID:	21465498
Doc. class	Manual
Drawing number	950522112000
Order no.	3RK1702-2GB18-0AA1
For products	3RK1323-2AS54-1AA0; 3RK1323-2AS54-1AA3
Document title	ECOFAST Motor Starters High Feature
Publication date	09.05.2007
Edition	03/2007
Doc. ID:	19065401
Doc. class	Manual
Drawing number	950522201000
Order no.	3RK1702-3AB18-1AA1
For products	3RK1303-2AS54-1AA0; 3RK1303-2AS54-1AA3; 3RK1303-5BS44-3AA0; 3RK1303-5BS44-3AA3; 3RK1303-5CS44-3AA0; 3RK1303-5CS44-3AA3; 3RK1303-6BS74-3AA0; 3RK1303-6BS74-3AA3; 3RK1303-6DS74-3AA0; 3RK1303-6DS74-3AA3; 3RK1303-6ES84-3AA3; 3RK1323-5BS44-3AA0; 3RK1323-5BS44-3AA3; 3RK1323-5CS44-3AA0; 3RK1323-5CS44-3AA3; 3RK1323-6BS74-3AA0; 3RK1323-6BS74-3AA3; 3RK1323-6DS74-3AA0; 3RK1323-6DS74-3AA3; 3RK1323-6ES84-3AA3

Topic	Motor starter
Document title	Manual AS-Interface Compact Starter DS2E/RS2E (electromechanical) and EDS2E/ERS2E (electronic)
Publication date	28.01.2004
Edition	2004
Doc. ID:	6008647
Doc. class	Manual
Drawing number	640090932000
Order no.	3RK1702-2GB10-2AA0
For products	3RK1322; 3RK1902

Topic	LOGO!
Document title	LOGO!
Publication date	09.10.2006
Edition	05/2006
Doc. ID:	21221909
Doc. class	Manual
Drawing number	A5E00380834-02
Order no.	6ED1050-1AA00-0AE6
For products	6ED105.-. LOGO! - allgemein

Topic	Addressing and analyzing
Document title	Addressing and Diagnosis Instrument for AS-i Modules
Publication date	24.01.2007
Edition	2007
Doc. ID:	18314730
Doc. class	Operating instructions
Drawing number	333076110000
Order no.	3RK1703-2WB02-1CA1
For products	3RK1904-2AB01
Document title	AS-Interface Analyzer
Publication date	08.08.2005
Edition	2005
Doc. ID:	14899091
Doc. class	Operating instructions
Drawing number	333079410000
Order no.	3RK1701-2MB01-1CA1
For products	3RK1904-3AB01

Topic	Further information
Document title	SIMATIC ET 200 X Distributed I/O Device
Publication date	13.03.2003
Edition	02/2003
Doc. ID:	1142469
Doc. class	Manual
Drawing number	EWA-4NEB780601601-06
Order no.	6ES7198-8FA01-8AA0
For products	6ES7141-1BF12-0XB0; 6ES7141-1BF01-0AB0; 6ES7141-1BF40-0AB0; 6ES7142-1BD22-0XB0; 6ES7143-1BF00-0XB0; 6ES7143-1BF00-0AB0; 6ES7141-1BD31-0XA0; 6ES7141-1BF31-0XA0; 6ES7141-1BF30-0XB0; 6ES7141-1BF41-0XA0; 6ES7142-1BD30-0XA0; 6ES7142-1BD40-0XA0
Document title	S7-200 Automation System
Publication date	13.12.2005
Edition	08/2005
Doc. ID:	1109582
Doc. class	System Manual
Drawing number	A5E00307986-02
Order no.	6ES7298-8FA24-8AH0
For products	6ES7214; 6ES7221-1BF00-0XA0; 6ES7221-1EF00-0XA0; 6ES7221-1BF10-0XA0; 6ES7221-1JF00-0XA0; 6ES7222-1BF00-0XA0; 6ES7222-1HF00-0XA0; 6ES7222-1EF00-0XA0; 6ES7223-1BF00-0XA0; 6ES7215; 6ES7216; 6ES7223-1HF00-0XA0; 6ES7223-1EF00-0XA0; 6ES7223-1PH00-0XA0
Document title	SIMATIC NET PROFIBUS Networks
Publication date	13.07.2000
Edition	05/2000
Doc. ID:	1971286
Doc. class	Manual
Drawing number	—
Order no.	6GK1970-5CA20-0AA0
For products	—

3RK2703-3BB02-1AA1

Siemens AG

Automation and Drives
Low-Voltage Controls and Distribution
Postfach 48 48
90327 NUERNBERG
GERMANY

www.siemens.com/as-interface

SIEMENS

Supplements to system manual

System Manual

09/2010

A5E03003228020-01

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

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Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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Siemens AG
Industry Sector
Postfach 48 48
90026 NÜRNBERG
GERMANY

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Ⓟ 09/2010

Table of contents

System Expansions

1

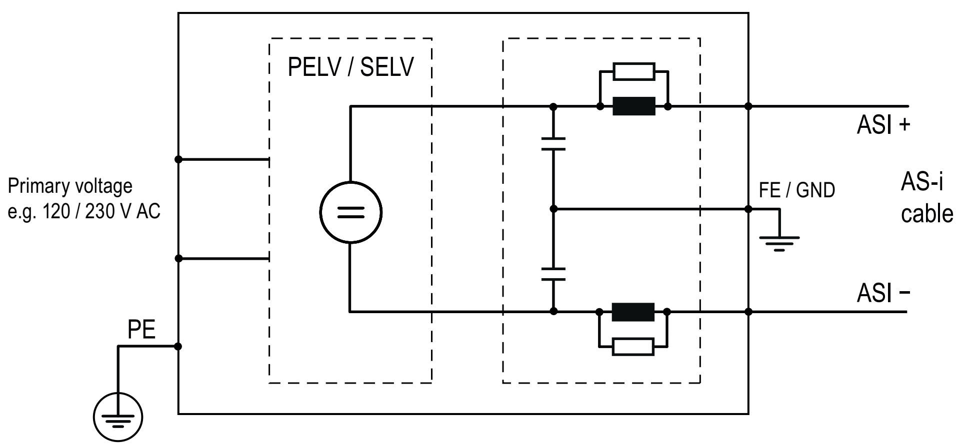
1.1 AS-i Power24V and data decoupling units

1.1.1 Overview

AS-i Power24V is an enhancement of the AS-Interface specification. This enhancement specifies that an AS-Interface network can alternatively also be supplied with the nominal voltage of 24 V DC instead of the nominal voltage of 30 V DC that is typical for AS-i power supply units. This makes it possible to use a standard 24 V power supply unit for supplying an AS-Interface network.

AS-i Power24V is not a new bus system. The data communication remains the same so that all AS-i components work the same at operating voltages of 30 V and 24 V if they are approved for the respective voltage.

The basic change in AS-i Power24V relates to the power supply unit:

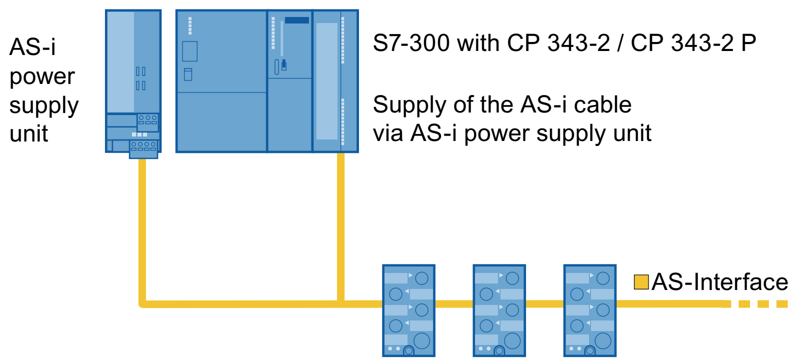


In addition to DC power generation, an AS-i power supply unit contains a data decoupling circuit, which is absolutely necessary for data communication.

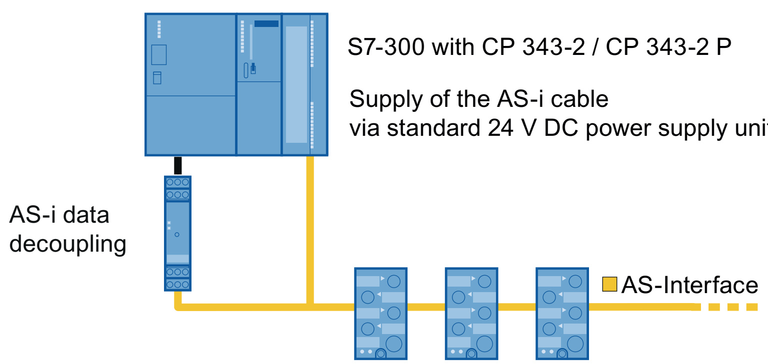
As is evident from the picture, all of the operating current of the AS-Interface power supply flows through the data decoupling unit, which needs to be sized for the required current.

In an AS-i power supply unit with integrated data decoupling, the nominal currents of the DC power generation and data decoupling need to be harmonized.

The following picture shows a typical network structure with an AS-i power supply unit:



If an AS-i power supply unit is replaced with a standard power supply, the data decoupling needs to be looped into the AS-i cable as a separate device:



The possibility of using an existing 24 V power supply unit reduces costs and enables AS-Interface to be employed also for small applications. As a result, the advantages of AS-Interface are also of benefit for these applications.

The AS-i data quality is equally high in both operating modes. Up to 31 standard slaves or 62 A/B slaves can be connected to each, including safe slaves.

As is the case with all voltage supplies, it must be ensured that the voltage at the location of the load is high enough, i.e. the voltage drop on the AS-I cable needs to be considered. Therefore, in AS-i Power24V, the AS-i cable length is limited to 50 m.

The AS-i master, the AS-i slaves and the sensors or actuators must be suitable for low voltage.

1.1.2 The AS-Interface cable for AS-i Power24V

Shaped cable

- For AS-i Power24V, the same yellow AS-i shaped cable is used as in standard AS-i.
- The shaped cable transmits data and power.
  As with standard AS-i, the data are transported over the cable as an alternating-current component (alternating pulse modulation with 167 kHz sin² pulses), the power as a direct-current component.
  The user does not need to perform any settings for this functionality.

Number of nodes

- Up to 62 slaves, one master, and up to four additional passive nodes (without their own AS-i address) can be connected to a network.

Cable length

- The total length of the AS-i cable is limited to 50 m for AS-i Power24V.
  This limitation was set in order to limit the voltage drop on the cable so that even at the lower feed voltage a sufficiently high DC voltage level is applied to slaves and sensors.

Transmission quality

- The quality of the data signal is equally high in AS-i Power24V and standard AS-i.
  The amplitude of the alternating-current component on the cable and the transmission procedure are identical in the two versions.

Other cables

- If a round cable is used instead of the AS-i shaped cable, then in AS-i Power24V a correction factor is normally not needed for the cable length.

  The data signal (i.e. the alternating-current component) is normally high enough with a maximum cable length of 50 m.

  However, when the core cross-section is small, a greater voltage drop involving the direct current component must be taken into account.

Expansion options

- Repeater and extension plug cannot be used with AS-i Power24V.

  For the enlargement of the network span, an AS-i Power24V network structure can in principle be updated to a standard AS-i network (with nominal voltage 30 V DC) by replacing the power supply unit.

1.1.3 Voltage level on AS-i module and sensor

The voltage supplied by the power supply unit runs through several sections until it arrives at the sensor. The supply voltage level to be expected at the sensor is shown below.

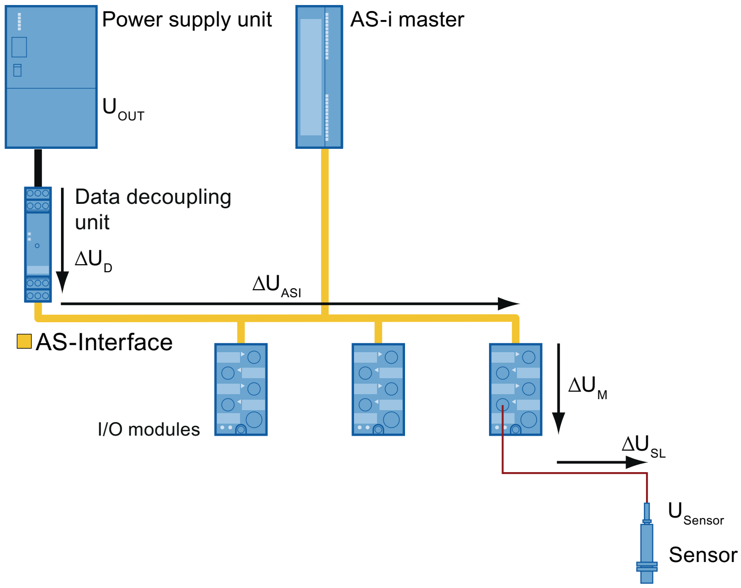


Figure 1-1 Voltage level on AS-i module and sensor

1.1.3.1 Voltage drop due to the data decoupling

The data decoupling circuit downstream from the DC power supply unit reduces the voltage fed into the AS-i cable by a maximum of 0.5 V (at maximum current):

$\Delta U_D \approx 0{,}5$ V

ΔU_D Voltage drop of the data decoupling

1.1.3.2 Voltage drop on the AS-i shaped cable

The resistance of the AS-i shaped cable (2 x 1.5 mm²) is 0.025 Ω/m (incl. return wire).

The formula for the voltage drop ΔU on the AS-i cable generally reads:

$\Delta U = I$ x 0,025 Ω/m x ℓ

ΔU Voltage drop

I Current

ℓ Cable length

The voltage drop at a current of 1 A and a cable length of 10 m is therefore calculated to be 0.25 V.

Because the slaves are normally arranged in a spatially distributed manner along the AS-i cable, the current at the beginning of the cable (infeed) is higher than at the end of the cable (at the most distant slave). The actual voltage drop is therefore less than the value that is determined in a single calculation with total current and total cable length using the aforementioned formula.

If the slaves are evenly distributed over the linear cable and the current drain of any slave is equally high, the following formula can be used for the voltage drop ΔU_{ASI}:

$$\Delta U_{ASI} = (n+1) \times 0{,}0125\ \text{V} \times \frac{I_M}{100\ \text{mA}} \times \frac{\ell_{ASI}}{10\ \text{m}}$$

ΔU_{ASI} Voltage drop at the end of the AS-i cable

n no. of slaves

I_M current per slave module (including station service of a slave ≈ 50 mA)

ℓ_{ASI} total cable length of the AS-i cable

A network having 20 slaves equally distributed over the 50 m cable length with 150 mA current per slave therefore has a voltage drop of 21 x 0.0125 V x 1.5 x 5 ≈ 2 V on the AS-i cable.

1.1.3.3 Voltage reduction in the slave module

The AS-i module provides the supply voltage for the connected sensors. This supply voltage is drawn from the AS-i cable. For circuitry design reasons, the voltage is reduced here by approximately 4 V.

The voltage difference ΔU_M between AS-i cable and sensor supply depends on the module type and on the sensor current.

The voltage difference ΔU_M in the slave can be calculated as follows:

Module	Slave type	Voltage difference ΔU_M (type)
K45 module	Standard slave	$2{,}7\ \text{V} + (1{,}4\ \text{V} \times \frac{I_{SM}}{100\ \text{mA}})$
Other module	Standard slave	$2{,}0\ \text{V} + (1{,}4\ \text{V} \times \frac{I_{SM}}{100\ \text{mA}})$
K45 module	A/B slave	$2{,}7\ \text{V} + (2{,}7\ \text{V} \times \frac{I_{SM}}{100\ \text{mA}})$
Other module	A/B slave	$2{,}0\ \text{V} + (2{,}7\ \text{V} \times \frac{I_{SM}}{100\ \text{mA}})$

I_{SM}: Sensor current (total) of all sensors that are supplied by the module

Thus, a voltage difference of 2.7 V + 1.4 V ≈ 4 V can be estimated for a K45 module type standard slave at 100 mA aggregate sensor current.

1.1.3.4 Voltage drop on the sensor cable

The resistance of a conventional sensor cable (2 x 0.34 mm²) is 0.11 Ω/m (incl. return wire).

The following formula yields the voltage drop ΔU_{SL} on the sensor cable:

$$\Delta U_{SL} = 0{,}011\ \text{V} \times \frac{I_S}{10\ \text{mA}} \times \frac{\ell_{SL}}{10\ \text{m}}$$

ΔU_{SL}	Voltage drop of the sensor cable
I_S	Supply current of the individual sensor
ℓ_{SL}	Length of sensor supply cable

The voltage drop on the sensor cable at 25 mA current and at a sensor cable length of 10 m is therefore calculated to be ΔU_{SL} ≈ 0.03 V and is therefore for the most part negligible.

1.1.3.5 Voltage across the sensor

The value of the DC voltage U_{Sensor}, with which the "last sensor" is supplied results from the supplied output voltage U_{Out} of the power supply unit minus all voltage differences between power supply unit and sensor:

$$U_{Sensor} = U_{Out} - \Delta U_D - \Delta U_{ASI} - \Delta U_M - \Delta U_{SL}$$

U_{Out}	Voltage supplied by the power supply unit
ΔU_D	Voltage drop of the data decoupling
ΔU_{ASI}	Voltage drop at the end of the AS-i cable
ΔU_M	Voltage difference in the slave
ΔU_{SL}	Voltage drop of the sensor cable

The voltage drop due to contact resistance is disregarded here.

1.1.3.6 Calculation examples

Example 1:

10 AS-i slaves (K45 modules type A/B slave) are installed equally distributed over the 50 m cable. 150 mA are needed for each slave (including approx. 100 mA sensor supply). The 24 V power supply unit is located at the beginning of the cable.

Approximate calculation:

Total current from the power supply unit at the beginning of the cable: 1.5 A (plus power consumption of the AS-i master, with CP343-2 max. 100 mA)

Total voltage drop at the end of the AS-i cable:	approximately 0.5 V + 1.0 V = 1.5 V
Voltage across the last slave:	24.0 V – 1.5 V = 22.5 V
Voltage across the last sensor:	22.5 V – 5.4 V = 17.1 V

Example 2:

20 slaves (K45 modules type A/B slave) are installed equally distributed over the 50 m cable. 150 mA are needed for each slave (including approx. 100 mA sensor supply). The 24 V power supply unit is located at the beginning of the cable.

Approximate calculation:

Total current from the power supply unit at the beginning of the cable: 3.0 A (plus power consumption of the AS-i master, with CP343-2 max. 100 mA)

Voltage drop at the end of the cable:	approximately 0.5 V + 2.0 V = 2.5 V
Voltage across the last slave:	24.0 V – 2.5 V = 21.5 V
Voltage across the last sensor:	21.5 V – 5.4 V = 16.1 V

Example 3:

30 slaves (K45 modules type A/B slave) are installed equally distributed over the 50 m cable. 120 mA are needed for each slave (including approx. 70 mA sensor supply). The 24 V power supply unit is located at the beginning of the cable.

Approximate calculation:

Total current from the power supply unit at the beginning of the cable: 3.6 A (plus power consumption of the AS-i master, with CP343-2 max. 100 mA)

Voltage drop at the end of the cable:	approximately 0.5 V + 2.3 V = 2.8 V
Voltage across the last slave:	24.0 V – 2.8 V = 21.2 V
Voltage across the last sensor:	21.2 V – 4.6 V = 16.6 V

1.1.3.7 Practical tips

- The sensors must be selected in such a way that the real sensor voltage is within the acceptable range of the sensor operating voltage. In practice, sensors with the standard voltage range of 10 to 30 V can be used.
- With many power supplies, the output voltage can be set slightly higher than the nominal voltage of 24 V DC, so that the voltage drop on the cable can be compensated. This setting option can also be used for AS-i Power24V.
- All AS-i Power24V components function within the overall voltage range between the nominal voltages of 24 V and 30 V. (Any exceptions are explained in the operating instructions.)
- The AS-i voltage on the Power24V-capable slave must be at least 18 V.

1.1.4 Masters and links for AS-i Power24V

The current list of masters and links that are suitable for AS-i Power24V are available in the Internet (http://support.automation.siemens.com/WW/view/en/42806066).

The following properties are important for the AS-i masters and links:

If the voltage on the AS-Interface is less than 22.5 V (+/-1 V)

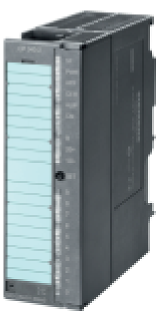
- and voltage monitoring is active (delivery condition), the master generates the message "AS-i POWER FAIL" (APF) and
- stops the operation of the AS-Interface network

The slaves on the AS-Interface network switch off automatically if there is an undervoltage.

In order to ensure flawless operation of the AS-i master in an AS-i Power24V network, the voltage monitoring of the master must be deactivated.

In the delivery condition, the voltage monitoring is activated and the master is thereby preset for operation at a 30 V supply voltage.

1.1.4.1 AS-i Power24V operation of the AS-i master CP 343-2 / CP 343-2P



The modules

- CP 343−2 (6GK7 343-2AH01-0XA0) and
- CP 343−2 P (6GK7 343-2AH11-0XA0)

are released for operation with 24 V DC and 30 V DC starting with product version 02.

Voltage monitoring of the AS-i master must be deactivated for operation in an AS-i Power24V network.

The procedure is as follows:

Deactivation of the voltage monitoring on the CP 343−2 / CP 343−2 P:
(only with 6GK7 343-2AH01-0XA0 and 6GK7 343-2AH11-0XA0 with product version 02)

Step	Action	Meaning
1	Install the CP as described in the CP 343−2 / CP 343−2 P manual.	
2	Switch the power supply to the SIMATIC station off and then on again.	The CP performs a self-test when it powers up. All the LEDs on the CP light up while it is powering up. Then the LEDs go out.
3	Check the status of the voltage monitoring by the LED indicators.	There are two different cases: • Voltage monitoring is activated (delivery condition): The LEDs immediately show the operating state according to the CP 343−2 / CP 343−2 P manual • Voltage monitoring is deactivated (for AS-i Power24V operation): The two LEDs **APF** and **0** flash for approximately 2 s; then the LEDs indicate the normal operating state.
4	Keep the **SET** button depressed (approx. 5 s), until the **APF** LED flashes. **Note**: This action is only possible within 30 seconds of switching on the SIMATIC station.	Pushbutton operation detected. The device is in setting mode.
5	Release the **SET** button.	The **APF** LED flashes. Voltage monitoring status indication: • LED **1** lights up: Voltage monitoring is activated (delivery condition): • LED **0** lights up: Voltage monitoring is deactivated (AS-i Power24V mode):
6	Press the SET button briefly to change the monitoring setting (several possibilities).	The APF LED flashes. Voltage monitoring switchover: • LED **1** lights up: Voltage monitoring activated • LED **0** lights up: Voltage monitoring deactivated
7	Keep the **SET** button depressed (approx. 5 s), until the **APF** LED goes out. Heed the safety information at the end of the table.	The setting of the voltage monitoring was stored in non-volatile memory in the CP.
8	Transition to normal operation	—

NOTICE

Note regarding step 2: Canceling the power-up by pressing the SET button:

While the CP is powering up, do **not** press the **SET** button; if you press the **SET** button, the CP switches into an internal special state: A running light is started (LED **SF** - **PWR** - **APF** - **CER** - **AUP** - **CM**). Normal operation is not possible in this special state.

To cancel this special state, you must switch off the power supply of the SIMATIC station.

NOTICE
Note regarding step 7 (storing the setting in memory):
If you would like to cancel the setting of the voltage monitoring without saving it, you must shut off the SIMATIC station power supply instead of performing step 7.

NOTICE
Note regarding steps 4 to 8:
Perform steps 4 to 8 only if you would like to change the setting of the voltage monitoring.

The CP is ready for immediate operation after powering up (normal operation).
After power-up, the CP briefly indicates the setting for voltage monitoring:

Checking the setting for voltage monitoring on the CP 343−2 / CP 343−2 P:
(only with 6GK7 343-2AH01-0XA0 and 6GK7 343-2AH11-0XA0 with product version 02)

Step	Action	Meaning
1	Install the CP as described in the CP 343−2 / CP 343−2 P manual.	
2	Switch the power supply to the SIMATIC station off and then on again.	The CP performs a self-test when it powers up. All the LEDs on the CP light up while it is powering up. Then the LEDs go out.
3	Check the status of the voltage monitoring by the LED indicators.	There are two different cases: • Voltage monitoring is activated (delivery condition): The LEDs immediately indicate the operating state • Voltage monitoring is deactivated (for AS-i Power24V operation): The two LEDs **APF** and **0** flash for approximately 2 s; then the LEDs indicate the normal operating state according to CP 343−2 / CP 343−2 P manual.

Manual CP 343−2 / CP 343−2 P AS−Interface Master

The manual for the AS−Interface Master CP 343−2 / CP 343−2 P is available in the Internet: (http://support.automation.siemens.com/WW/view/en/5581657).

1.1.5 Slaves for AS-i Power24V

The current list of slaves that are suitable for AS-i Power24V are available in the Internet (http://support.automation.siemens.com/WW/view/en/42806066).

Here you can obtain additional information (FAQ) about the compatibility of AS-i Power24V.

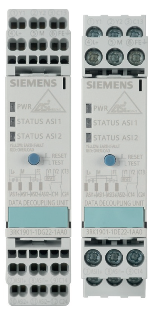
No settings need to be made on the slaves with regard to AS-i Power24V.

All the Power24V slaves need to be supplied with at least 18 V AS-i voltage.

1.2 AS-i data decoupling units

1.2.1 Function overview

Using the data decoupling units



In order to supply AS-Interface from a standard power supply unit, a data decoupling unit must be connected between the voltage supply and AS-i network.

The data decoupling generates the specific signal shape of the AS-i data signals and prevents the AC voltage pulses of the data signals from being short-circuited by the DC voltage supply.

A DC voltage supply can feed several data decoupling units so that multiple AS-i networks can be operated on a single DC voltage supply.

A single data decoupling unit contains a data decoupling circuit for operating one AS-i network.

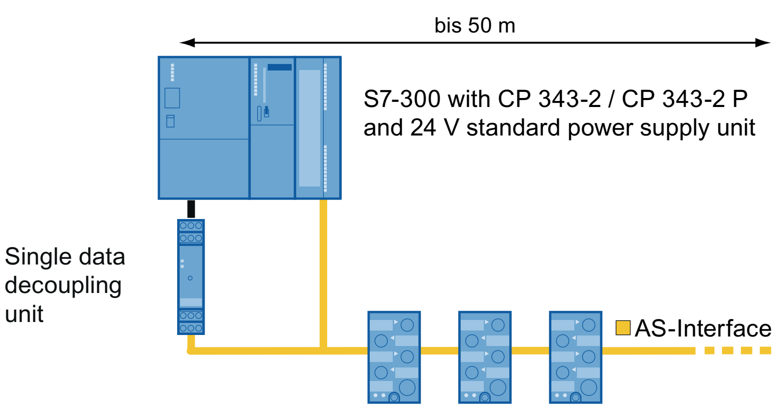


Figure 1-2 AS-i Power24V single network

A double decoupling unit contains two data decoupling circuits for the operation of two AS-i networks:

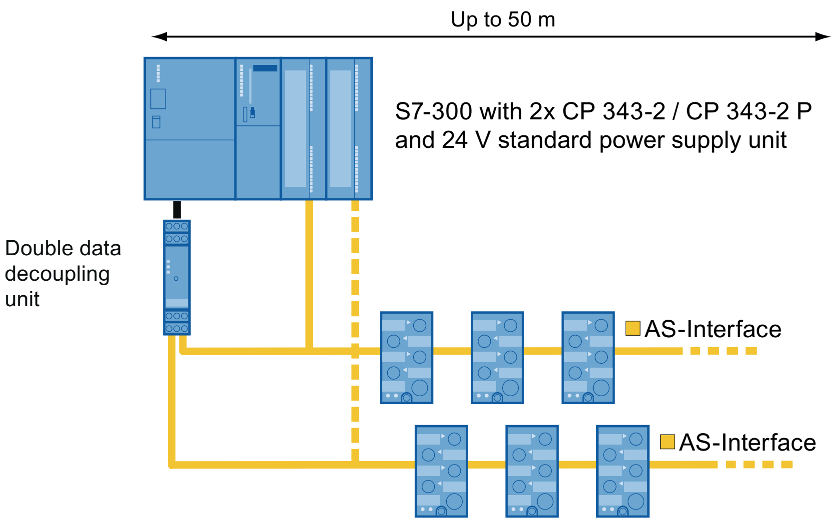


Figure 1-3 AS-i Power24V double network

As many data decoupling units as desired can be connected in parallel to a DC voltage supply in order to operate a corresponding number of AS-i networks.

The input side of the data decoupling unit is typically connected to a standard power supply with a nominal voltage of 24 V or 30 V.

Operation of the AS-Interface network on a 24 V DC voltage supply falls within the AS-i Power24V category. Because a standard 24 V power supply unit does not include a data decoupling circuit, with Power24V an additional data decoupling unit is absolutely necessary. The DC voltage supply can simultaneously supply the 24 V control voltage for the system controller (PLC) or the entire system. Obviously, the DC voltage supply must be large enough to supply all connected AS-i networks and other loads with power.

For an AS-i network with unlimited AS-i properties, a 30 V DC voltage supply must be used. This is especially necessary if the voltage level of the sensor supply is insufficient due to a voltage drop on a (longer) AS-i cable, or slaves and other AS-i components are used that are not suitable for AS-i Power24V. An AS-i power supply unit supplies a voltage of 30 V and simultaneously includes integrated data decoupling. A standard 30 V power supply requires an additional data decoupling.

If the data decoupling unit is connected to an AS-i power supply (i.e. 30 V DC voltage supply with integrated data decoupling), the data decoupling circuit integrated in the AS-i power supply becomes inactive. It is not technically possible to produce a second AS-i network by connecting a single data decoupling unit to an existing AS-i network. If a double data decoupling unit is connected to an AS-i power supply unit, two AS-i networks can be operated separately from each other on the two outputs of the double data decoupling unit.

Requirements of the DC voltage supply

The DC voltage supply needs to produce an extra low voltage according to **PELV** Standard (Protective Extra Low Voltage) or **SELV** Standard (Safety Extra Low Voltage).

The nominal voltage must be within the **24 … 30 V DC** range.

For trouble-free communication in the AS-i network, it is necessary for the DC voltage supply to have a low residual ripple:

Residual ripple $V_{ppnoise}$ < 250 mV

Modern switched mode power supplies can easily satisfy this requirement; check the residual ripple in the power supply data sheet.

Industrial power supplies from the Siemens SITOP product range are recommended.

Note

If high spurious peaks due to switching operations on the control voltage are expected, a separate power supply unit should be provided to supply the AS-i networks.

Grounded and ungrounded DC voltage

The relevant standard (EN 60204 part 1, DIN VDE 0113) prescribes a grounding or corresponding measures for control voltages (e.g. ground fault detection) to prevent dangerous movements etc. when a ground fault occurs.

Therefore, the 24 V control voltage is normally grounded, i.e., the negative pole of the DC voltage supply is connected to the system ground.

Although an AS-i network cannot have any connection to the system ground, a grounded DC voltage can be used for AS-i Power24V. This can be explained as follows:

The data decoupling separates the DC voltage from the communication signal. For fault-tolerant communication, the communication signal is transmitted symmetrically, i.e. the AC voltage signal is transmitted both to the positive pole and as a reversed-polarity signal to the negative lead. Any noise is injected equally on both conductor wires. By calculating the difference in the two transmitted signals, the desired communication signal is recaptured while the interference signals cancel each other out.

The "FE" terminal represents the reference potential for both transmitted AC voltage signals and must be connected to the system's ground in order to obtain an optimal symmetry of the AC voltage signals. An additional grounding of the supplying DC voltage, does not effect the symmetry - provided that this grounding occurs on the supply side of the data decoupling unit (terminals L+ / M). A grounding on the side of the AS-i network (terminals ASI1+ / ASI1- and ASI2+ / ASI2-) subtly disturbs the symmetry and must not be carried out.

Reverse polarity and undervoltage protection

If supply voltage (L+ / M) is connected with reversed polarity or if the supply voltage is too low (below 21 V), both outputs ASI1 and ASI2 are switched off (only with the double data decoupling unit). A supply voltage connected with reversed polarity is not transmitted to the outputs.

If the input voltage is correct, the outputs are automatically switched on.

The two outputs of the double data decoupling unit switch on with a 200 ms time differential in order to reduce the starting current for the supplying power supply.

Overload and short-circuit protection

The data decoupling unit limits the current in the AS-i network and is short-circuit proof.

When there is a short circuit or overload on an AS-i cable, the involved output ASI1 or ASI2 is switched off (electronic transistor output) and is thereby decoupled from the power source (selectivity). In the double data decoupling unit, a short circuit on one AS-i network has no effect on the other AS-i network, if the supplying power supply unit has sufficient capacity reserves.

The restart occurs automatically after about 5 seconds.

The absence of the AS-i voltage can be detected and signaled by the connected AS-i master.

The signaling contacts are not affected by a short circuit/overload.

The overload current value can be set in four stages: 2.5 A – 3.0 A – 3.5 A – 4.0 A. (with a tolerance of approx. +0.1 A). The maximum value on delivery is preset at 4.0 A. The reduction of the overload current value is only required if the supplying power supply does not yield the required output for the maximum total current of the module.

Example:

Use of a double data decoupling unit on a 24 V power supply with a nominal current of 10 A. The AS-i networks on ASI1 and ASI2 each require a maximum of 3 A, the remaining controller a max. of 4 A.

The overload current value is set by the user at 2 x 3 A for ASI1 and ASI2. When there is an overload on an AS-i cable, the supplying power supply is not overloaded, so the rest of the system continues to operate.

The shutdown in the event of an overload occurs after a delay of up to 3 s, in order to take into account starting currents. Starting at 130 % overload, the shutdown comes after just 500 ms; in the event of a short circuit, it comes after approx. 100 ms.

The supplying power supply must have corresponding reserve capacity.

Integrated ground fault detection with error log

The AC voltage signal of the data communication is symmetrically aligned with the system ground, so that interference pulses (e.g. due to switching operations) have an equal effect on the positive cable and the negative cable and as a result are automatically compensated. This noise suppression functions in principle only under the following assumptions:

- The ground terminal on the data decoupling unit must be connected to the system ground. This connection produces the required balancing.
- The AS-i cable must not be connected at any point to the system ground. Because the sensor supply is transferred from the AS-i cable, the sensor cable also must not be connected to the system ground. A capacitive connection (capacitor for the ground) is not allowed.

If any of these assumptions is not satisfied, the AS-Interface system becomes susceptible to disturbances. Depending on the impedance of a ground fault, sporadic communication faults or complete failure can occur on an AS-i cable or a sensor cable.

Note

The functionality described above regarding the system ground also applies analogously for AS-i networks that are operated with a conventional AS-i power supply (with integrated data decoupling): The ground terminal (GND) on the AS-i power supply unit must be connected to the system ground in order to suppress faults.

In order to reliably detect a ground fault, the data decoupling unit has an integrated ground fault detection. If a ground fault is detected, an internal error log is set and a relay signaling contact is closed, which is routed to the outside via terminals. The status LED on the module indicates via a yellow flashing light that the error log is set. A yellow continuous light indicates that the ground fault is currently still present. Short-term ground faults which occur, for example, when the cable insulation gets crushed, are also recorded via the error log.

The error log must be reset by the user after the ground fault has been eliminated. After the reset, the relay contact is opened again. Resetting is not possible when the ground fault is still present. Resetting can be done by pressing the button (RESET/TEST) on the module or via potential-free terminal input (Y1, Y2).

The ground fault detection of the data decoupling unit functions both with an ungrounded voltage and if the DC voltage supply of the data decoupling unit (terminals L+ and M) is grounded. The detection circuit detects only ground faults on the wiring system that is connected to the ASI terminals. Because the ground fault detection evaluates the communication signals, it is absolutely necessary for the function of the ground fault detection that an AS-i master be connected and turned on.

In order to ensure the availability of the system, a ground fault should be eliminated immediately.

By appropriate external wiring of the signaling contacts, the supply of the AS-i network can be interrupted in the event of a ground fault. The provisions of the relevant standard are to be heeded here; see for instance EN 60204 part 1, DIN VDE 0113:
"Ground faults in any control circuit must not lead to inadvertent start-up or potentially hazardous movements or prevent the stoppage of the machine."

Note

The ground fault detection module 3RK1408-8KE00-0AA2 or 3RK1408-8KG00-0AA2 that is still provided can only be used in AS-i networks with ungrounded DC voltage supply. For AS-i Power24V, this separate ground fault detection module is not necessary because the data decoupling unit has integrated ground fault detection.

Setting the AS-i address

The AS-i data decoupling unit does not have an AS-i address.

1.2.2 Order numbers

Data decoupling unit

Version	Order number
Single data decoupling unit, screw-type connection, 1 x 4 A	3RK1901-1DE12-1AA0
Single data decoupling unit, spring-loaded connection, 1 x 4 A	3RK1901-1DG12-1AA0
Double data decoupling unit, screw-type connection, 2 x 4 A	3RK1901-1DE22-1AA0
Double data decoupling unit, spring-loaded connection, 2 x 4 A	3RK1901-1DG22-1AA0

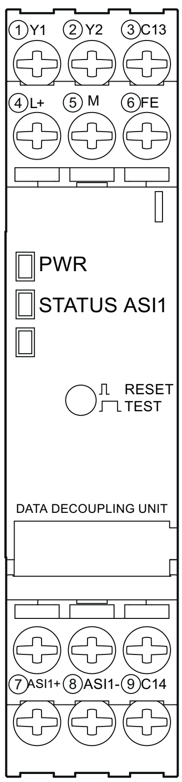
Accessories

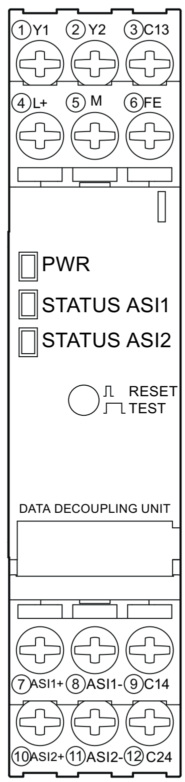
Designation	Order number
Plug-in lugs for screw mounting	3RP1903

1.2.3 Connecting

Terminal assignment of the data decoupling unit

Order number		Connections		
3RK1901-1DE12-1AA0 3RK1901-1DG12-1AA0	3RK1901-1DE22-1AA0 3RK1901-1DG22-1AA0	Screw Spring-loaded		Designation
		4	L+	Supply voltage 24 V DC (24 … 32 V, PELV, SELV, $V_{ppnoise}$ < 250 mV)
		5	M	
		1	Y1	Remote Reset Y1 = +, Y2 = –
		2	Y2	
		7	ASI1+	AS-Interface network1 terminal
		8	ASI1–	
		10	ASI2+	AS-Interface network 2 terminal (only with double data decoupling unit 3RK1901-1D.22)
		11	ASI2–	
		3	C13	Ground fault detection signaling contact: C13-C14 for AS-Interface network 1 C13-C24 for AS-Interface network 2 (closed contact = ground fault detected)
		9	C14	
		12	C24	
		6	FE	Terminal for system ground

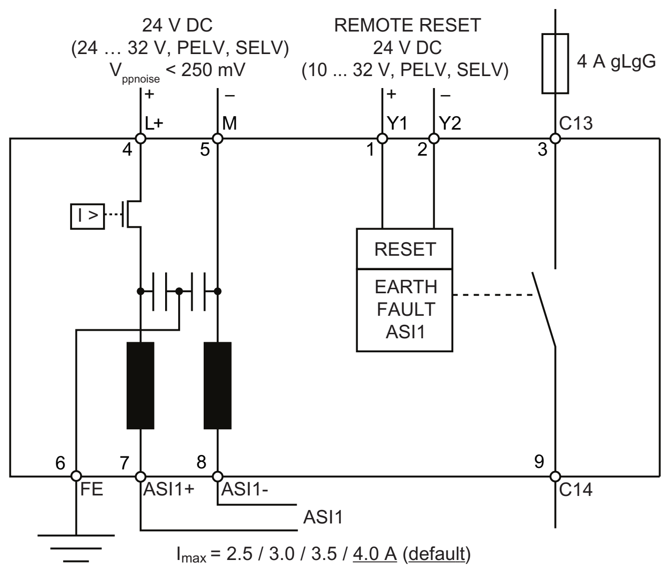




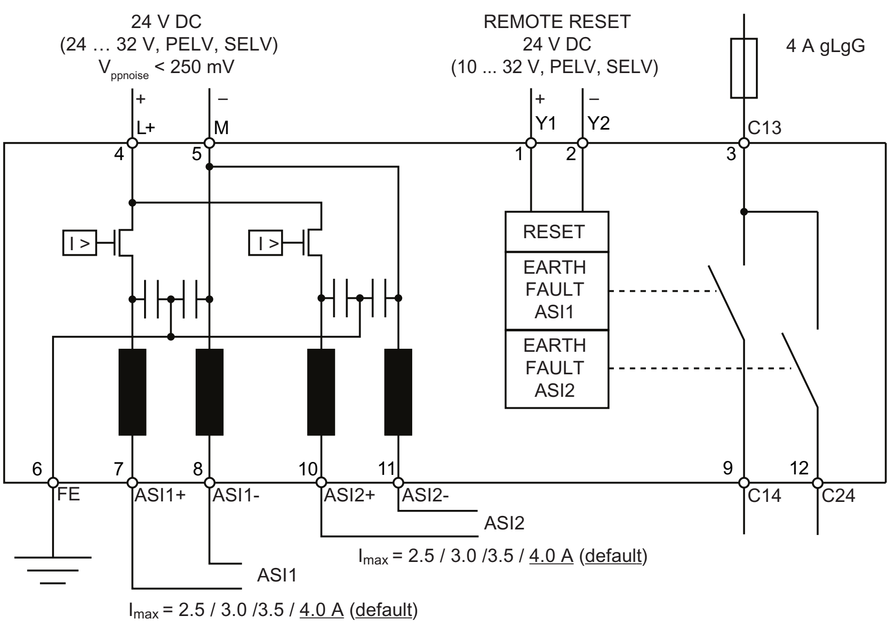
Note

The connection of the "FE" terminal to the system ground is absolutely necessary for trouble-free operation.

Wiring of the single data decoupling unit



Wiring of the double data decoupling unit



1.2.4 Configuration and operation

Overload current value setting

The set overload current value can only be changed when the supply voltage is turned on. Carry out the following steps:

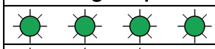
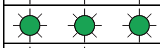
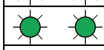
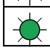
Step	Action / Reaction
1	Activate setting mode by holding down the button (approximately 3 … 5 seconds) while the voltage L+ is switching on; the **PWR** LED rapidly flashes green (4 Hz)
2	LED **ASI1** flashes green one to four times, then once red. This sequence is continuously repeated. The number of green flashing signals represents the current value according to the table below.
3	Change the current value by pressing the button (approximately 0.5 s) briefly: 4.0 A → 3.5 A → 3.0 A → 2.5 A → 4.0 A etc.
4	Save the new current value for ASI1 by pressing and holding down the button (approximately 3 … 5 s).
In the double data decoupling unit, the LED **ASI2** then begins to flash, and you can set the new current value for ASI2 as described in steps 2 to 4.	
Completion	Then the program exits setting mode and normal operation is started.

Flashing sequence STATUS ASI1 / ASI2		I_{max} for ASI1 or ASI2
	green/red	**4.0 A** (delivery condition)
	green/red	3.5 A
	green/red	3.0 A
	green/red	2.5 A

Checking the set overload current value

Checking the set overload current value is possible during operation.
Proceed as follows:

Step	Action / Reaction
1	Make sure that there are no ground fault signals (no yellow LED indications; see Diagnostics below. Press the button briefly (approximately 0.5 s) during operation to activate display mode:
2	Observe the flashing behavior of the LEDs: LED **ASI1** flashes green 1 to 4 times. The number of green flashing signals represents the current value according to the table below
In the double data decoupling unit, the LED **ASI2** then begins to flash, and you can read the current value for ASI2 as described under step 2.	
Completion	Then the program exits display mode. If necessary, the setting can be checked again; see step 1.

Flashing sequence STATUS ASI1 / ASI2		I_{max} for ASI1 or ASI2
	Green	**4.0 A** (delivery condition)
	Green	3.5 A
	Green	3.0 A
	Green	2.5 A

Testing the signaling contacts

The relay contacts C13 / C14 and C13 / C24 (only with double data decoupling unit) can be switched on manually for testing the external wiring.
To do this press the button in normal operation (after powering up) and keep it pressed for 3 to 5 s. Inside the device, a ground fault is simulated on an AS-i network and the error log is set. The AS-i network itself is **not** grounded here. Just like after a real ground fault, the status LED flashes yellow and the signaling contact is closed.

To reset the error log, the button must be pressed briefly or a remote reset is activated. If a real ground fault is present, the error log cannot be reset.

In the double data decoupling unit, the button must be pressed a second time and held down in order to also simulate a ground fault on the second AS-i network. The associated status LED flashes yellow, and the associated signaling contact is closed. The status of the other error log or signaling contact is irrelevant here. The signaling contacts in this context can be switched on individually (by interim reset) or else together.

Remote reset

In addition to the button on the device, the error log can be reset via a pulse on the remote reset input (terminals Y1 / Y2).

The remote reset pulse must be present as a HIGH signal for at least 100 ms in order to execute a reset. In order to be able to trigger a new remote reset, a LOW signal must be present on the remote reset input for at least 100 ms.

1.2.5 Diagnostics

LED indication: PWR

PWR	Possible cause	Possible remedial measures
Green	Normal operation, input voltage OK	—
Flashing green (1 Hz)	Input voltage at L+ / M too low, AS-i outputs switched off	Check input voltage
Rapidly flashing green (4 Hz)	Mode for current setting active, (activation only possible while powering up)	Terminate setting mode and switch to normal operation
Off	No voltage at L+ / M, voltage at L+ / M with reversed polarity	Switch on, correctly connect input voltage

Display LEDs: STATUS ASI 1,
STATUS ASI 2 (only 3RK1901-1DE22-1AA0, 3RK1901-1DG22-1AA0)

STATUS ASI 1 STATUS ASI 2	Signaling contact switch position C13 / C14 or C13 / C24	Possible cause	Possible remedial measures
Off	Signaling contact open	Normal operation, everything OK	—
Yellow	Signaling contact closed	Ground fault is present	Check wiring, check insulation of the AS-i- and sensor cables for damage
Flashing yellow (1 Hz)	Signaling contact closed	Ground fault eliminated, memory has not yet been reset	Briefly press **TEST / RESET** button (approx. 0.5 s) or activate remote reset
Red	Signaling contact open	Overload / short circuit on AS-i cable AS-i output switched off, (automatic restarting)	Check power requirement of the modules and sensors; Check AS-i cable for short circuit
Flashing red/yellow (1 Hz)	Signaling contact closed	Overload/short circuit and ground fault stored	Check power requirement of the modules and sensors. Check AS-i cable for short circuit. Briefly press **TEST / RESET** button (approx. 0.5 s) or activate remote reset.

Table applies only for normal operation (LED **PWR** continuous lit green)

Signaling contacts

The single data decoupling unit has a relay contact (terminals C13 / C14) in order to signal a ground fault on the AS-i network.

The double data decoupling unit has two relay contacts (terminals C13 / C14 for ASI1 and C13 / C24 for ASI2) for separate signaling of a ground fault on the respective AS-i network. The contacts (C13) have a common root.

The signaling contact is closed if a ground fault has been identified.

The signaling contact is only reopened once the ground fault is no longer present and the button has been briefly pressed (resetting the error log) or the supply voltage has been switched off.

The button acts on both signaling contacts or error logs.

TEST/RESET button

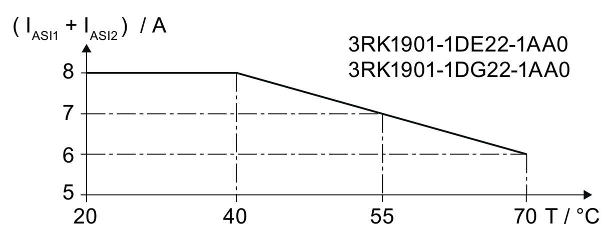
Pressing briefly (approx. 0.5 s) in normal operation

With ground fault signal (status LED yellow):	• stored ground fault is reset (only possible if ground fault is no longer present)
Without ground fault signal:	• check of the set overload current values (see above)

Pressing and holding (approx. 3 ... 5 s)

	• simulation of a ground fault signal, separately for ASI1 and ASI2 (sequentially by pressing repeatedly), no physical ground fault is produced on AS-i here (see above)
During power-up:	• setting the overload current values (see above)

1.2.6 Technical data

Order number	3RK1901-1DE12-1AA0	3RK1901-1DG12-1AA0	3RK1901-1DE22-1AA0	3RK1901-1DG22-1AA0
Version	Single data decoupling unit		Double data decoupling unit	
Type of connection	Screw-type connection	Spring-loaded connection	Screw-type connection	Spring-loaded connection
Enclosure design	SlimLine 22.5			
Electrical data				
Input voltage (L+, M) Voltage range Residual ripple $V_{ppnoise}$	24 V DC PELV, SELV 24 … 32 V < 250 mV			
Load current I_{max} (per AS-i network), adjustable	2.5 / 3.0 /3.5 / 4.0 A (default)			
Signaling contacts: External fuse max.	4 A gL/gG			
Signaling contacts: Switching capacity I_e at U_e DC-13 AC-15	24 V 1.0 A 3.0 A			
Overload protection (ASI1, ASI2)	✓			
Short-circuit protection (ASI1, ASI2)	✓			
Polarity reversal protection (L+, M)	✓			
Undervoltage protection (L+, M)	✓			
Derating curve				

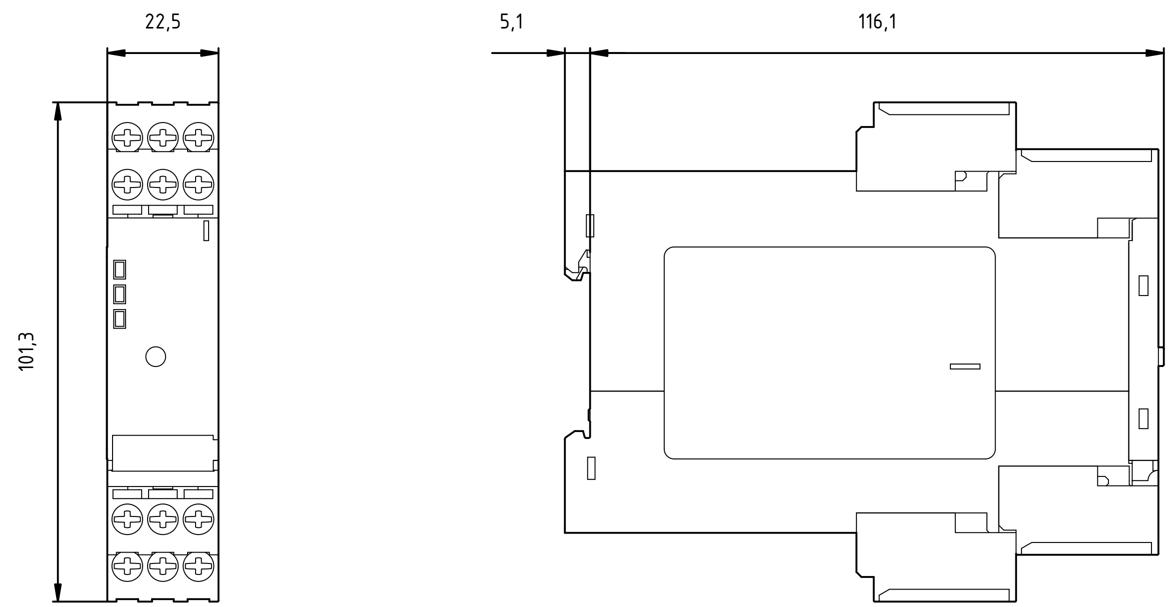
Order number	3RK1901-1DE12-1AA0	3RK1901-1DG12-1AA0	3RK1901-1DE22-1AA0	3RK1901-1DG22-1AA0
Mechanical data				
Degree of protection	IP20			
Dimensions (WxHxD) in mm	22.5 x 101.3 x 116.1	22.5 x 104.9 x 116.1	22.5 x 101.3 x 116.1	22.5 x 104.9 x 116.1
Shock stressing (IEC 60068-2-6)	15 g / 11 ms			
Shock stressing (IEC 60068-2-27)	5 ... 500 Hz 5 ... 26 Hz: 0.75 mm amplitude 26 ... 500 Hz: 2 g			
Rated temperature T_a	25 °C			
Ambient temperature T_a	-25 ... +70 °C			
Storage temperature T_s	-40 ... +85 °C			
Ground connection	✓			
Approvals	CE: available soon UL, CSA			

For information on additional properties, please refer to the current data sheet which is available in the Internet:

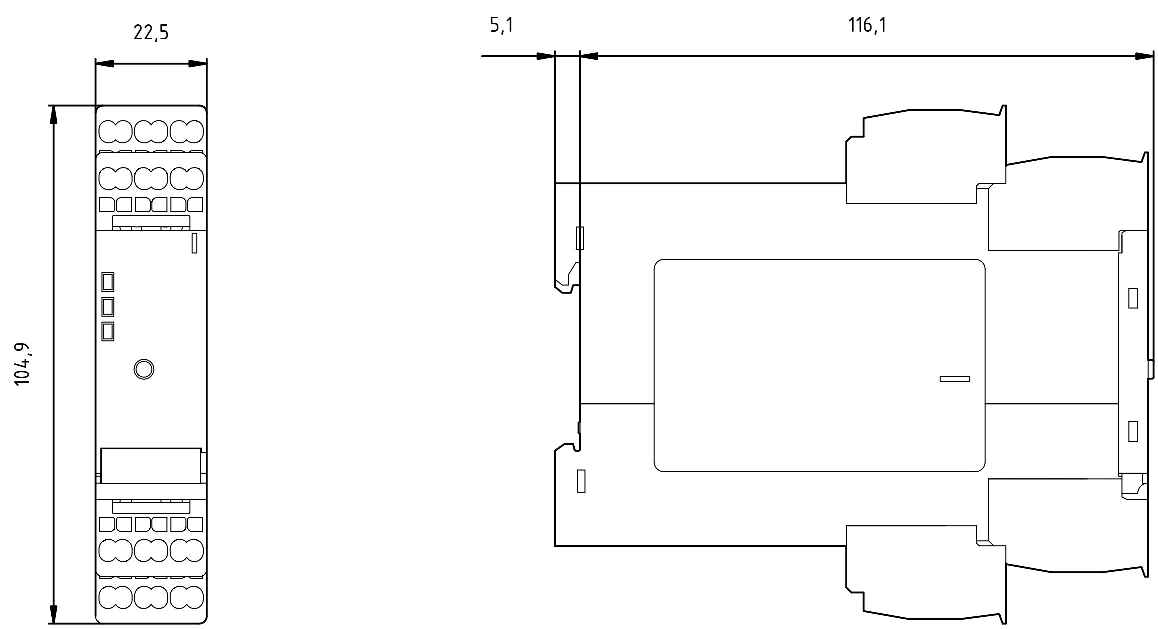
Order No.:
3RK1901-1DE12-1AA0 (http://support.automation.siemens.com/WW/view/en/3RK1901-1DE12-1AA0/td)
3RK1901-1DG12-1AA0 (http://support.automation.siemens.com/WW/view/en/3RK1901-1DG12-1AA0/td)
3RK1901-1DE22-1AA0 (http://support.automation.siemens.com/WW/view/en/3RK1901-1DG12-1AA0/td)
3RK1901-1DG22-1AA0 (http://support.automation.siemens.com/WW/view/en/3RK1901-1DG22-1AA0/td)

1.2.7 Dimension drawings

Dimensions of the data decoupling unit with screw-type connection



Dimensions of the data decoupling unit with screw-loaded connection



ASIsafe: Safe AS-i outputs 2

2.1 Safe SlimLine module S45F

The ASIsafe concept enables the integration of safety-oriented components like EMERGENCY STOP operator panels, protective door switches or safety light arrays in an AS-Interface network. These are fully compatible with the standard AS-Interface components (master, slaves, power supply unit, repeater, etc.) in accordance with IEC 62062/EN 50295 and are operated together on the yellow AS-Interface cable. The technology of the safe AS-i outputs enhances ASIsafe.

In addition to the acquisition and evaluation of safe signals, now a safety-oriented decentralized shutdown is possible directly via AS-Interface.

A fail-safe controller or special master is not required. The evaluation of the safe signals is performed in the AS-i safety monitor. The master treats safety slaves like all the other slaves and receives safety data for information purposes only. This means that all existing AS-Interface networks can also be enhanced. ASIsafe ensures that a maximum response time of 40 ms can be achieved. This is the time between the signal being applied to the input of the safe slave and the output on the safety monitor being switched off. In decentralized shutdown via a safe AS-i output, the response time is extended by the time that the safe AS-i output needs in addition to the shutdown. The maximum response time is then at 70 ms.

Tested safety

The system has been tested and approved for use by TÜV (Germany), NRTL (USA), and INRS (France). The transmission procedure for safety-oriented signals is designed in such a way that the applications up to Category 4 in accordance with EN 954-1, up to PL e in accordance with EN ISO 13849-1 and up to SIL 3 in accordance with IEC 61508 can be implemented.

Configuration

The configuration of safety technology is identical to the installation of AS-Interface that is known today. The family of the safe AS-Interface products consists of the safety monitor, which monitors or shuts down the safe nodes. The spectrum of safe nodes consists of the safe modules and the safety-oriented sensors with integrated interface. Sensors, monitors and safe AS-i outputs can be connected at any points of the AS-Interface network. More than one monitor can also be used in a network.

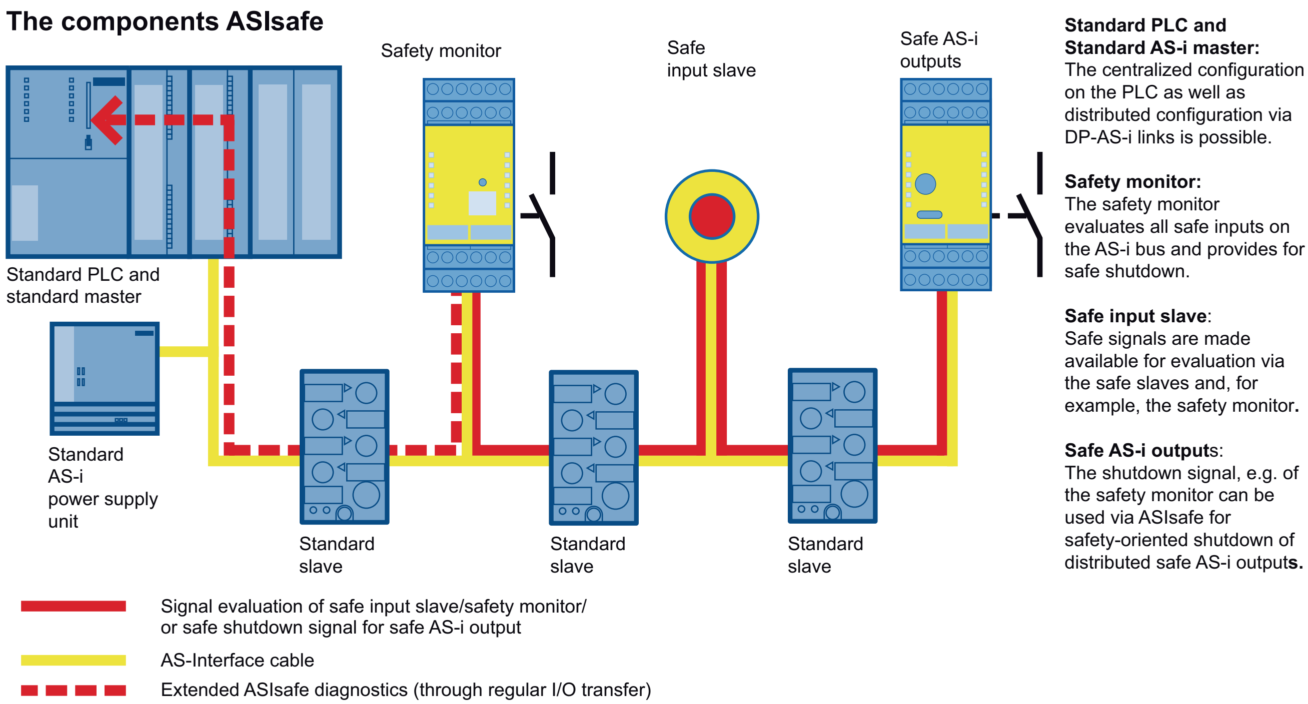


Figure 2-1 The ASIsafe components and their signal flows

Function

The safe nodes transmit their information according to the master call, like the standard nodes, to the master. The safety monitor monitors this transmission from the safe nodes to the master and switches into the safe state or transmits a shutdown signal to one or more decentralized safe AS-i outputs, which on their part switch into the safe state. The safety monitor enables various functions, such as OR logic, AND logic, timer functions, buffers, etc.

Software

With the ASIMON configuration software, the safety-oriented applications can be configured and transferred to the monitor. The configuration consists of the input signals of the safe nodes, the internal functions of the safety monitor as well as the assignment of the address for the control of a safe decentralized output. The software also supports online diagnostics.

Integration

For the integration of the safety technology into AS-Interface, the existing infrastructure, like the master and the power supply unit, can still be used. For the safety technology, the safety monitor is integrated as a monitoring element and the safe nodes as an interface between the safe sensors and the system. The safe sensors can be used as before. With ready-to-use function blocks that are supplied with the ASIMON configuration software, a detailed diagnosis of all parameterized blocks is possible. To do this, an AS-i address needs to be assigned to the safety monitor via the configuration software. The evaluation is done via function blocks in the PLC. Using preconfigured WinCC flexible blocks, this evaluation can then be visualized on a system-wide basis on existing HMI devices (starting with OP/TP 270).

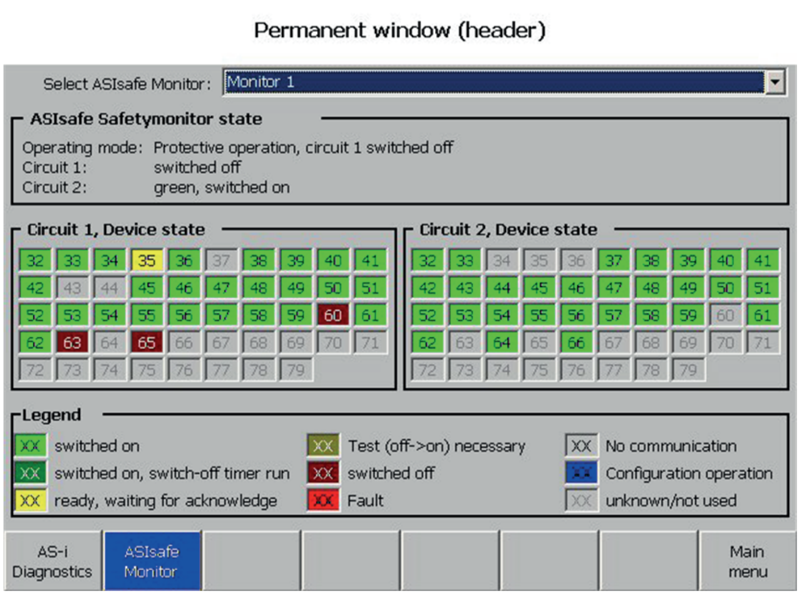


Figure 2-2 Diagnostics interface for ASIsafe components via S7-200 or S7-300

2.1.1 Functional principle

The basis for the safe switching of an actuator is the safety monitor. The functional principle of the safety monitor is described in the AS-Interface System Manual, Edition 11/2008 Chapter 9.1. You can view or download the system manual here (http://support.automation.siemens.com/WW/view/en/26250840).

The functional principle for safe switching of an actuator via a decentralized AS-i output comprises four steps:

1. Acquisition of the safe signals via a safe input slave (e.g. Emergency Stop):

   The safe slave transmits a safe code sequence (8x4 bit). For a safety-oriented transmission of information, each safe input slave has a unique code sequence, which is saved (by teaching) in the safety monitor during commissioning.

2. Evaluation of the safe signals by the safety monitor:

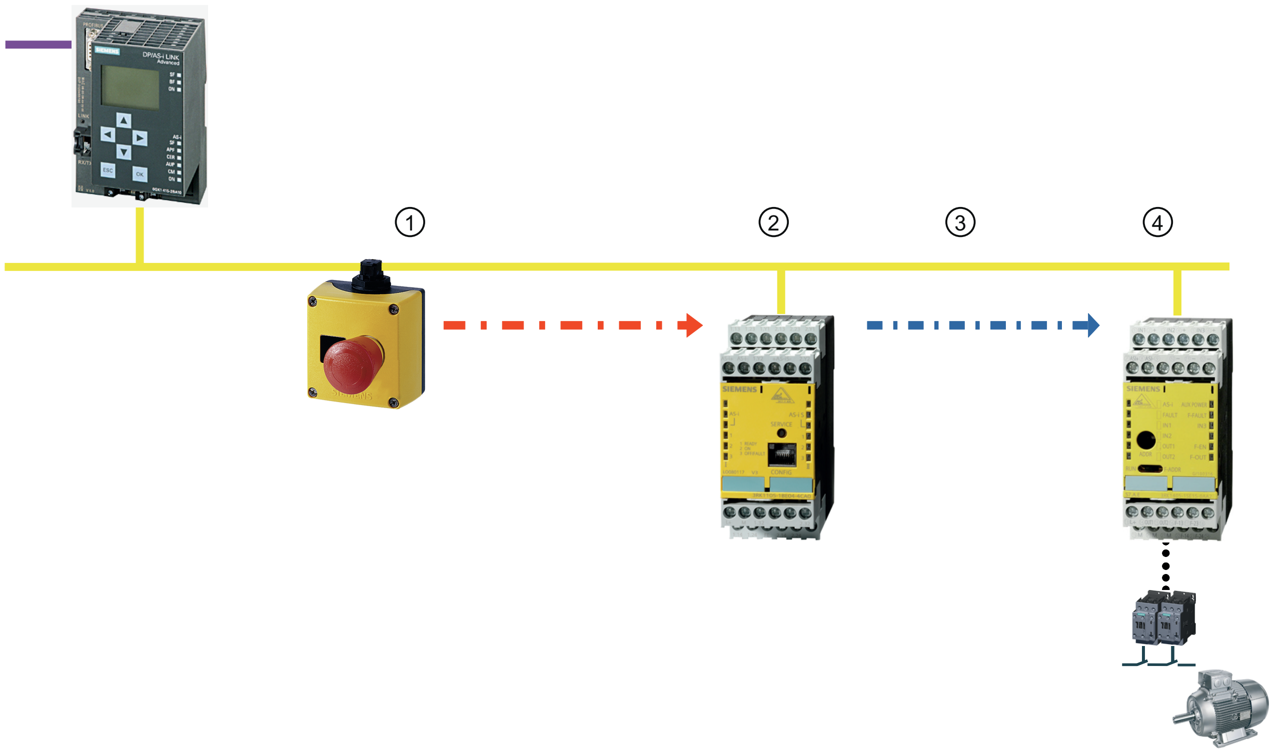
   The function of the safety monitor is parameterized using the ASIMON configuration software. During operation, the safety monitor compares the actual state of the received code tables of all assigned safe input slaves with the stored desired state. According to the evaluation of this safety information, the safety monitor switches its enabling circuit on or off in a safety-oriented manner.

3. Forwarding the enabling or shutdown information to a decentralized safe output:

   The enhanced safety monitor with integrated safe slave 3RK1105-1BE04-4CA0 or 3RK1105-1BG04-4CA0 is required for the forwarding of the enabling or shutdown information. This optionally controls a safe AS-i output according to the switching state of its second enabling circuit. For this purpose, the safety monitor emulates a safe slave, which transmits a specific code sequence (7x4 bit) as a function of the state of the second enabling circuit. In contrast to the code sequences of the safe input slaves, which differ for each slave, the 7x4 bit code sequence for controlling a decentralized safe output depends exclusively on the address assigned to the emulated slave. Teaching of the code sequences as in the case of the safe input slaves is thus not necessary for safe outputs.

4. Decentralized switching of the actuators via safe output slave:

   The safe output slave evaluates as a passive listener the 7x4 bit code sequence which the slave emulated in the safety monitor transmits. The address of the slave emulated in the safety monitor is set in the safe output slave. This ensures a unique assignment between safe output slave and safety monitor. If the safety monitor has enabled the second enabling circuit, the safe output slave receives this information via the 7x4 bit code sequence. If it is correctly received, the safe output slave activates the connected actuator via its safe output. Thus, the safe output slave always assumes the same state as the second enabling circuit of the assigned safety monitor.



1 Acquisition of the safe signals via a safe input slave (e.g. Emergency Stop)
2 Evaluation of the safe signals by the safety monitor
3 Forwarding the enabling or shutdown information to a decentralized safe output
4 Decentralized switching of the actuators via safe output slave

Figure 2-3 Functional principle ASIsafe with safe output slave

Behavior during communication faults

If, as a result of a communication fault, the enabling signal does not arrive or does not arrive correctly at the safe output slave, it shuts down its output as a safety measure. A fault tolerance provided in the system thereby prevents the shutdown of the output during very brief faults. After a fault, the user needs to acknowledge the fault for safety reasons.

In order to signal a shutdown after a fault to the user, the safe output slave also has an integrated A/B slave. Via this slave, the waiting for an acknowledgment after a shutdown because of a fault is communicated over the bus. If the user does the acknowledgment, the safety monitor produces acknowledgment signals (help signals 1 and 2), which are transmitted by specific modification of the 7x4 bit code sequence to the safe output slave. It switches the actuator back on after receipt of the acknowledgment.

Generating the acknowledgment signals

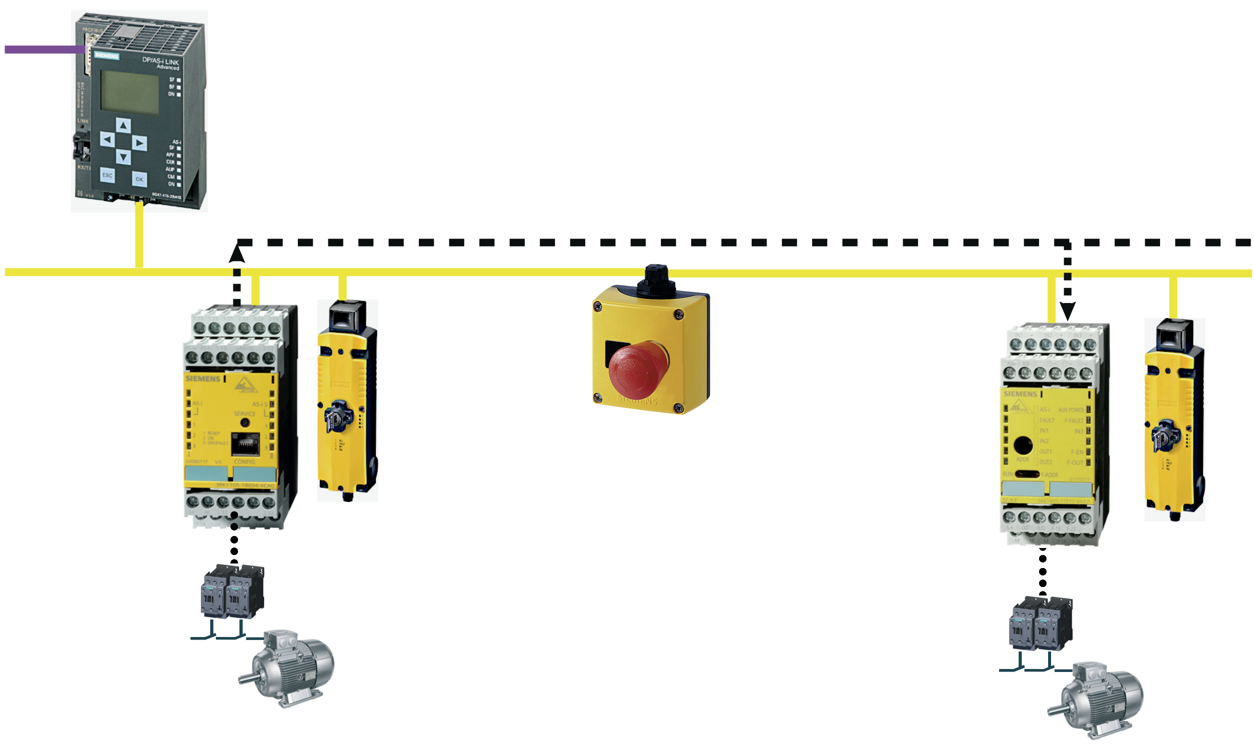
For the acknowledgment after a communication fault, two different help signals are available. In this context, a distinction is made according to the duration of the communication fault:

- Communication faults >140 ms require help signal 1 (reset of error condition) as an acknowledgment
- Brief communication faults <140 ms require help signal 2 (restart) as an acknowledgment

This distinction enables the auto-acknowledgment of brief faults, because help signal 2 (restart) can also be transmitted continuously during operation. The conditions for transmitting the help signals are parameterized in the ASIMON configuration software.

Configuration examples

With an enhanced safety monitor with integrated safe slave, a safe output slave can be activated. In addition, the two relay outputs of the safety monitor can be used for local shutdown.

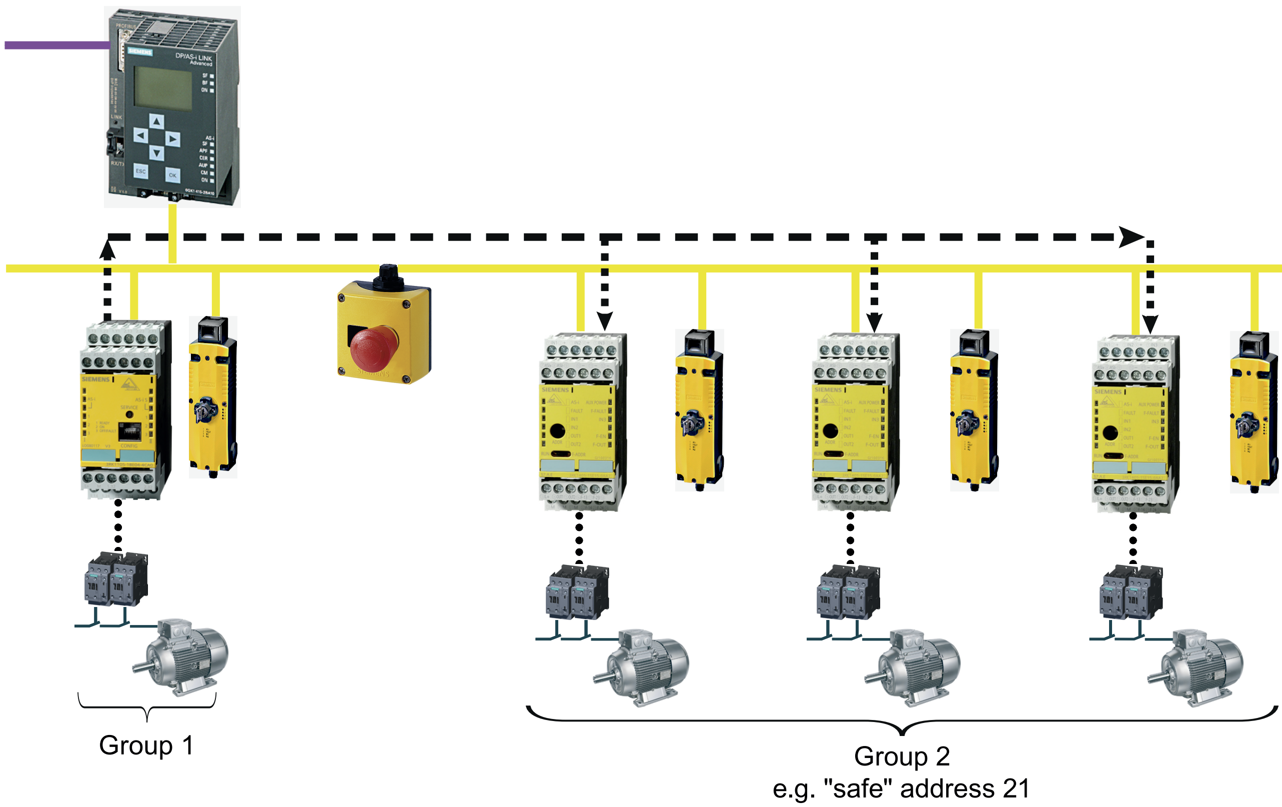


OSSD 1: local shutdown

OSSD 2: decentralized shutdown via safe output and/or local shutdown

Figure 2-4 Activation of a safe output slave with a safety monitor

To be sure any safety monitor can transmit only one shutdown or enabling signal for decentralized safe shutdown. However, multiple safe output modules can also evaluate this information together. Therefore, a safety monitor can jointly switch a group of safe output slaves.

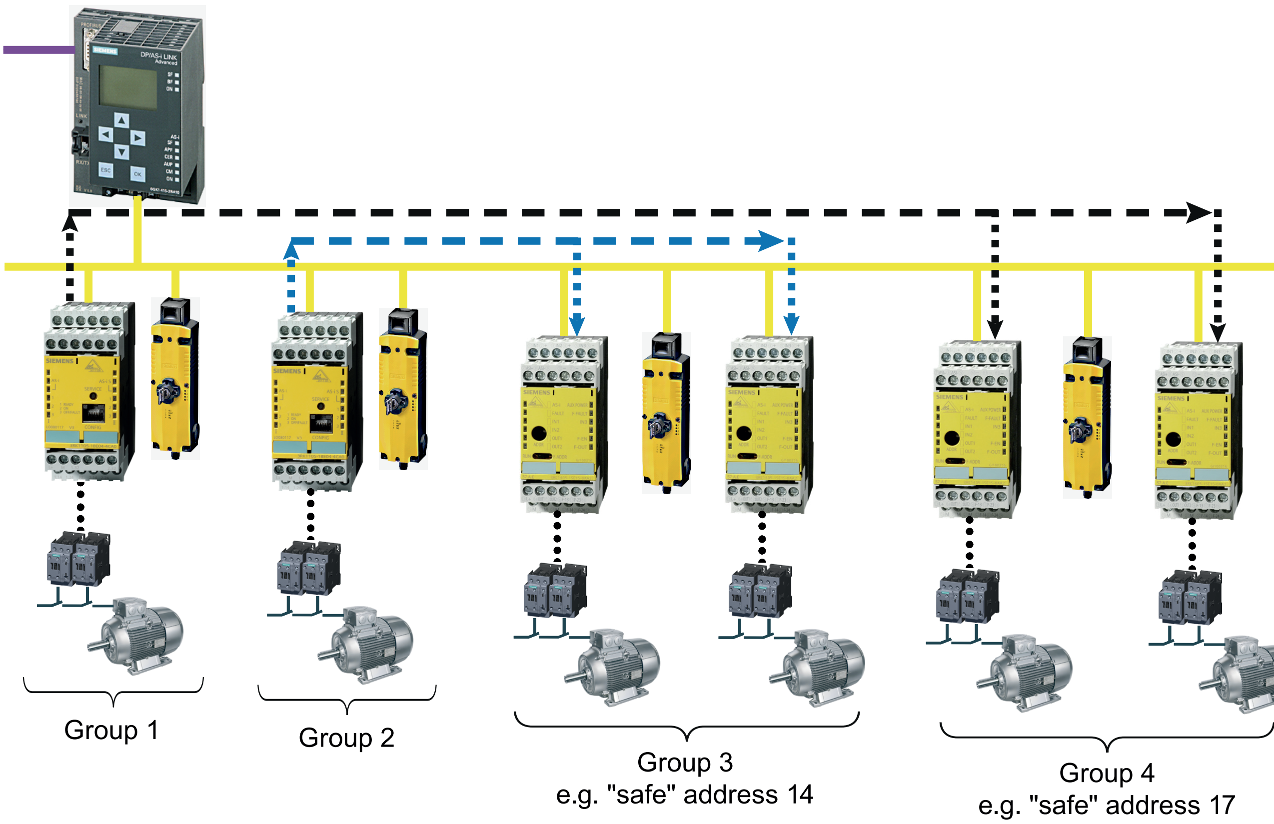


OSSD 1: local shutdown

OSSD 2: decentralized shutdown of all safe outputs together and/or local shutdown

Figure 2-5 Activation of a group of safe output slaves with a safety monitor

If two or more safe output slaves are to be controlled independently of each other, two or more safety monitors are needed. This applies accordingly for groups of safe output slaves.



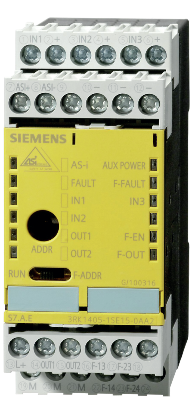
OSSD 1: local shutdown for each (groups 1 and 2)

Monitor 1 OSSD 2: decentralized shutdown of safe outputs group 3

Monitor 2 OSSD 2: decentralized shutdown of safe outputs group 4

Figure 2-6 Activation of two groups of safe output slaves with two safety monitors

2.1.2 Overview



The safe ASIsafe SlimLine module S45F is used for safe switching of an actuator. For this purpose, the device has a 2-channel safe output with which a safety-oriented shutdown up to Category 4, SIL3 or PLe can be achieved. The device receives the enabling or shutdown signal from the enhanced safety monitor with integrated slave. It simulates a safe slave, which transmits a corresponding code sequence independently of the state of its enabling circuit 2. The safe ASIsafe module S45F evaluates this code information and switches the safe output accordingly.

In addition, the module has an integrated A/B slave. In addition to the diagnostics feedback, this slave enables the functional switching of the enabling circuit and beyond that provides 3 digital inputs and 2 digital outputs.

2.1.3 Function

2 addresses are assigned to the S45F ASIsafe module for its operation. The safety-related address is used for the assignment of the simulated slave of the safety monitor to which the enabling circuit of the module is to react. The second address is needed for the standard inputs and outputs, for the functional switching and for the device diagnostics. The address is set according to the following sequence:

1. Setting the safety-related address. For this purpose set the switch on the front of the device to F-ADDR.
2. Set the desired safety-related address via AS-i addressing device or AS-i master.
3. Check the set safety-related address:
   - Read the profile via AS-i addressing device or AS-i master.
   - The ID code must be "F".
   - The ID1 code must correspond to the tens digit of the address.
   - The ID2 code must correspond to the units digit of the address.
   - The IO code must be "7".

   Example: Address 24 is set as a safety-related address.
   The profile that is read must then be as follows:

   ID-Code = F, ID1-Code = 2, ID2-Code = 4, IO-Code = 7
4. If the codes do not match, repeat steps 2 and 3. If the codes again do not match, replace the device.
5. Set the device switch on RUN
6. Set the standard address (switch in position RUN):
   - Set the desired address via AS-i addressing device or AS-i master. No checking of the set address is required.

The safety function is parameterized via the safety monitor using the ASIMON configuration software. The ASIsafe module S45F always switches the enabling circuit identically to the state of the enabling circuit OSSD 2 of the safety monitor. The S45F ASIsafe module is assigned to the safety monitor via setting of the safety-related address. The response time of the entire system (from the moment of the shutdown request on the safe input to the moment at which the output has switched off) is at a max. of 70 ms (worst case). For the assignment of the S45F ASIsafe module to the respective safety monitor, the same safety-related address is set via the ASIMON configuration software in the safety monitor.

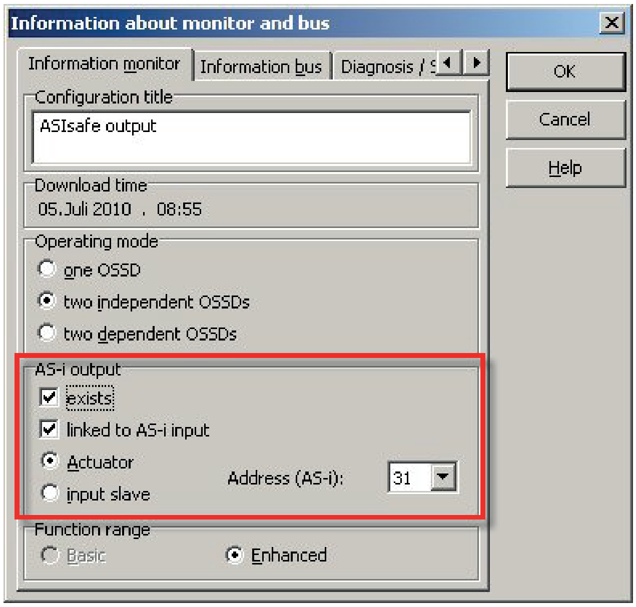


Figure 2-7 Setting the safety-related address (F-Addr.) in the ASIMON configuration software

In addition, the enabling circuit of the S45F module can also be switched during operation. The functional switching is activated via the parameter bit P1. Where:

- P1 = 0 functional switching activated
- P1 = 1 functional switching deactivated
  (Default = deactivated)

If functional switching is activated, the enabling circuit via the output OUT3 of the integrated A/B slave can be controlled via the AS-i master (the requirement is that the safe enabling information from the safety monitor is correctly received).

If the transmission of the enabling information is disrupted by the safety monitor, the module safely shuts down the output. For a restart, a corresponding help signal is needed independent of the duration of the communication fault. The following is applicable:

- Duration of a communication fault >140 ms requires help signal 1 ("reset of error condition")
- Duration of a communication fault <140 ms requires help signal 2 ("restart")

The help signals are transmitted via the safety monitor using the code sequence of the simulated safe slave. The conditions for transmitting the help signals are set during the parameterization of the safety monitor in the ASIMON configuration software. In so doing, it is possible to transmit the help signal 1 ("restart") continuously. Therefore, communication faults up to 140 ms in duration can be automatically acknowledged.

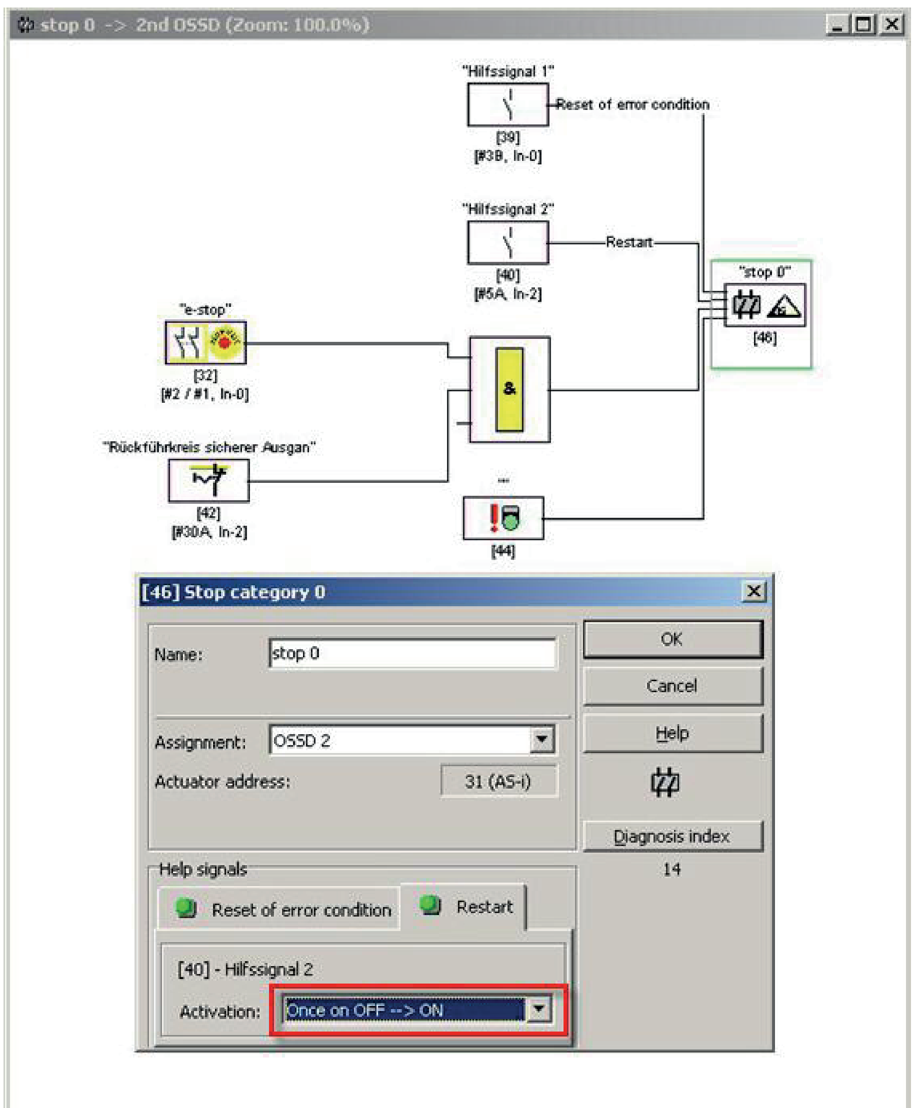


Figure 2-8 Setting the conditions for the acknowledgment signals using the ASIMON configuration software

The safe S45F SlimLine module has in addition to the safe output another 3 digital standard inputs and 2 digital standard outputs. Mechanical contact elements and both 2- and 3-conductor sensors can be connected to the digital inputs. One of the standard inputs can be used for monitoring the protective feedback circuit. Actuators can be controlled independently of the safety function via the digital standard outputs. The standard inputs and standard outputs are controlled via the integrated A/B slave.

Note

In an AS-Interface network, which is controlled by the DP/AS-i F-Link 3RK3141.CD10, the use of the S45F ASIsafe module is not permissible.

2.1.4 Order numbers

S45F ASI safe module

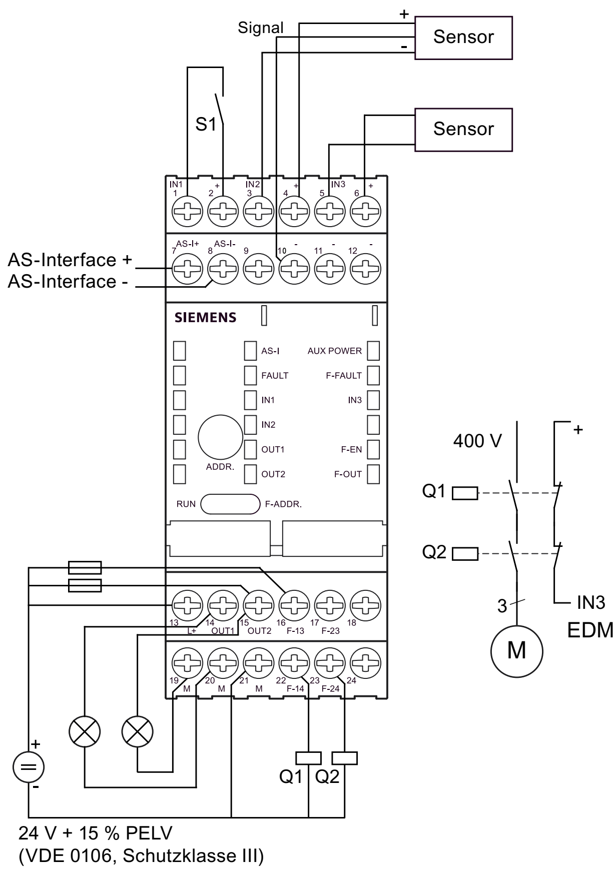
Connection	I/O type	U_{AUX}	Order number
Screw-type connection	1F-RO / 3DI / 2DO	✓	3RK1405-1SE15-0AA2
Spring-loaded connection	1F-RO / 3DI / 2DO	✓	3RK1405-1SG15-0AA2

Accessories

Designation	Order number
Plug-in lug for screw mounting	3RP1903

2.1.5 Connecting

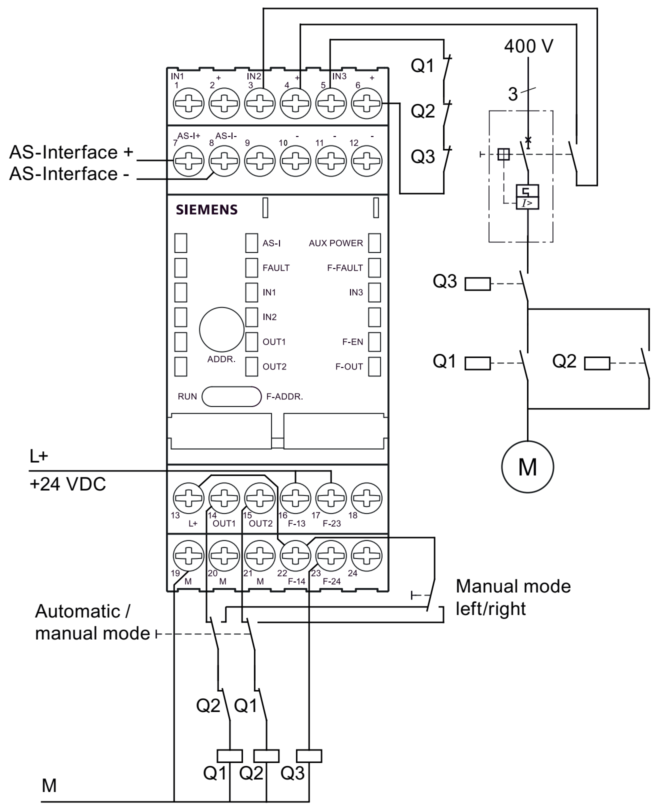
Connection and terminal assignment



AS-I + , AS-I –	AS-Interface - connection
IN1, IN2, IN3	Standard inputs
L+	+24 V DC / supply voltage
M	GND / ground reference
F-13, F-14	Switching output relay contact 1
F-23, F-24	Switching output relay contact 2
OUT1, OUT2	Standard outputs

Figure 2-9 Connections of the safe S45F SlimLine module

Connection example of safe reversing starter



2.1.6 Diagnostics

The safe S45F SlimLine module provides the following diagnostic information:

- Local diagnostic information via LED on the device
- AS-i diagnostics of the integrated A/B slave
- Diagnostic bit IN4 (DI3)
- Online diagnostics in ASIMON configuration software

2.1.6.1 Local diagnostics via LED on the device

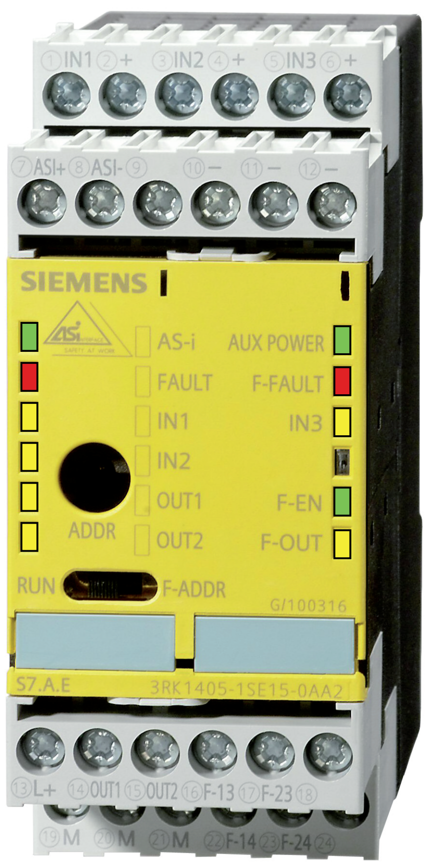


Figure 2-10 Arrangement of the LEDs

LED indicator for AS-i communication: AS-i FAULT

AS-i	FAULT	Possible cause	Possible remedial measures
Green	Off	Normal operation, AS-i communication OK	—
Green	Red	No AS-i communication: • The master is switched off or offline. • The slave is not configured in the master. • The incorrect slave type is connected. • The slave has the wrong address.	Ensure AS-i communication: • Switch on the master or switch it to online mode. • Reconfigure the master. • Connect the correct module. • Check/correct the slave address.
Green	Flashing red	Sensor supply overload and/or overload of the outputs	Unplug the sensor/actuator cables, use sensors with a lower overall current consumption, check the sensors/actuators and cables.
Flashing green	Red	Standard address is set for address 0 (delivery condition)	Assign an address that is not 0.
		Output overload (the slave switches off all the outputs)	Unplug the actuator cables from the output sockets, check the actuators and cables.
Off	Off	• No AS-Interface supply, • AS-i voltage connected with incorrect polarity, • AS-i voltage too low	• Check the cable connections. • Check the AS-Interface power supply unit. • Measure AS-i voltage

Display LED for the 24 V DC auxiliary voltage: AUX POWER

AUX POWER	Possible cause	Possible remedial measures
Green	Normal operation, 24 V DC auxiliary voltage OK	—
Off	• No auxiliary voltage • Auxiliary voltage connected with incorrect polarity • Auxiliary voltage too low	• Activate 24 V DC auxiliary voltage, • Connect it properly • Measure the auxiliary voltage (approx. 24 V DC)

LED indicator for the switching state of the standard inputs: INx

INx	Meaning
Yellow	Standard input on
Off	Standard input off

LED indicator for the switching state of the standard outputs: OUTx

INx	Meaning
Yellow	Standard output on
Off	Standard output off

LED indicator for ASIsafe communication: F-FAULT, F-EN, F-OUT

F-FAULT	F-EN	F-OUT	Possible cause	Possible remedial measures
Off	Green	Yellow	Normal ASIsafe operation, safety-oriented enable by the safety monitor is correctly received, F-OUT output is enabled	—
Off	Green	Off	Normal ASIsafe operation, safety-oriented enable by the safety monitor is correctly received, but F-OUT output is not connected during operation	• Set output OUT3 to switch on **F-OUT** during normal operation • If necessary, deactivate functional switching (set parameter bit P1 to 1)
Off	Off	Off	Normal ASIsafe operation, no enable or incorrect safety-oriented enable of safety monitor received	• Bring safe slaves into the state so that safety monitor enable is sent • check correct assignment to the safety-related address (**F-ADDR**.)
Red	Off	Off	F-Out switched off, communication fault must be acknowledged	Send acknowledgment by help signals (reset of error condition, restart) via safety monitor
Flashing red	Flashing green	Flashing yellow	Address switch not in the RUN position	Move address switch to the RUN position
(running light)				
Flashing red	Flashing green	Flashing yellow	Device error	Restart or replace defective device
(rapid flashing in unison)				

2.1.6.2 AS-i diagnostics of the integrated A/B slave

When there is an overload on the standard outputs and/or when there is an overload of the sensor current supply of the standard inputs, the module sets the I/O error bit.

The safe S45 SlimLine module also maintains communication in the event of a sensor power supply overload. In the event of a sensor overload, the substitute value zero is transmitted for the inputs.

Note

This behavior ensures that an overload of the sensor power supply for the standard inputs has no effect on the safety function of the device. Therefore, this is a departure from the normal behavior of AS-i slaves, which revert to the reset state and then no longer communicate via AS-Interface when there is an overload of the sensor power supply.

2.1.6.3 Diagnostic bit IN4 (DI3)

If the safe S45F SlimLine module has shut down the enabling circuit because of a communication fault and is waiting for an acknowledgment in order to restart (help signal 1 or 2), the fourth input (input bit D3) of the integrated A/B slave assumes state 1. The request for the acknowledgment signal is thereby transmitted to the controller and the safety monitor.

2.1.6.4 Diagnostics via ASIMON configuration software

In the ASIMON configuration software, the state of the safe output module can be displayed in the online diagnostics via the "actuator diagnostics" diagnostics device. For this purpose, a corresponding diagnostics device needs to be added in the ASIMON configuration for each safe output module. The address of the integrated A/B slave of the safe S45F SlimLine module as well as the diagnostics type need to be entered in it. Diagnostics type 4 is to be selected for the safe S45F SlimLine module.

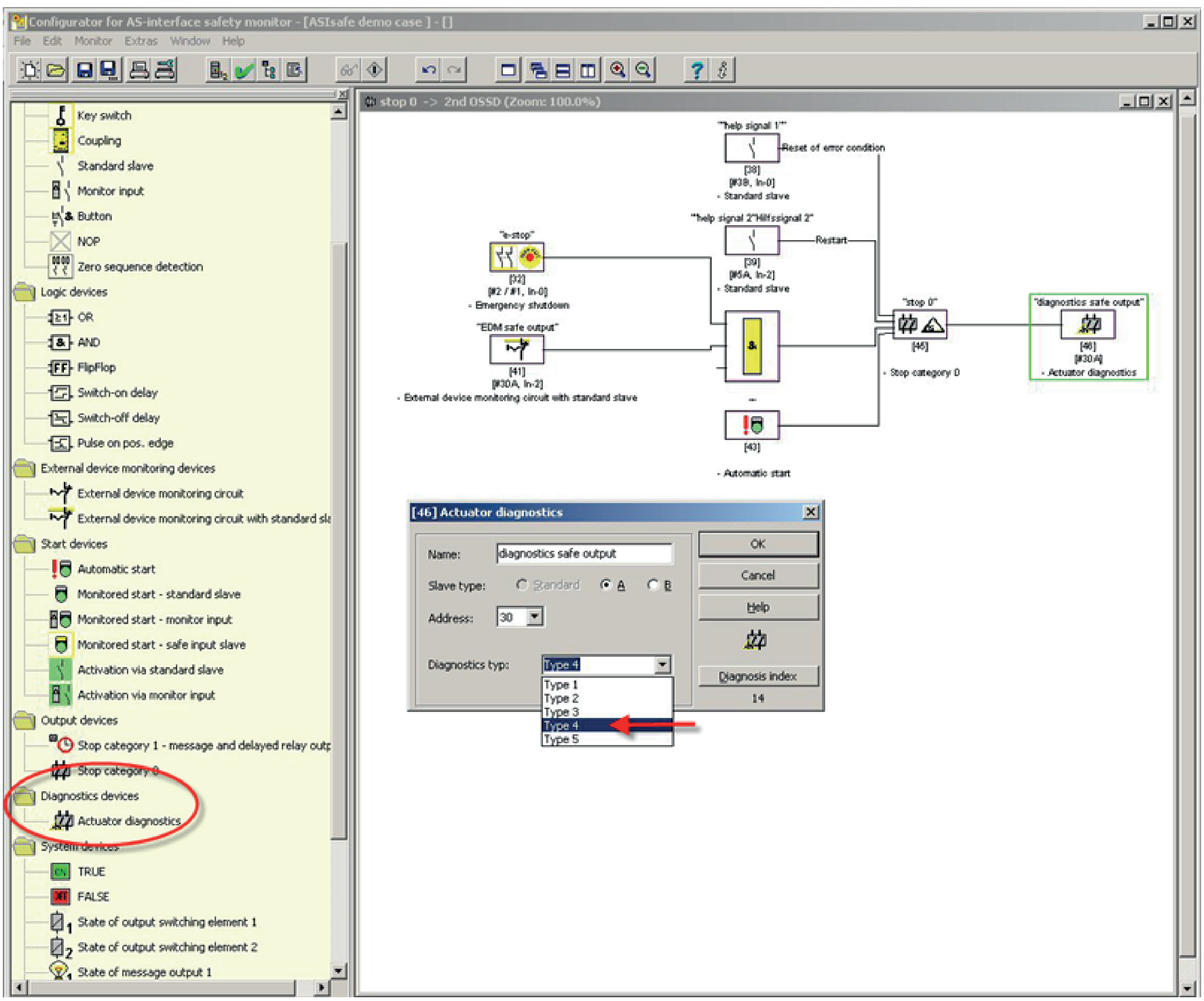


Figure 2-11 Selecting ASIMON diagnostics device

2.1.7 Technical data

Order number	3RK1405-1SE15-0AA2	3RK1405-1SG15-0AA2
Type of connection	Screw-type connection	Spring-loaded connection
Slave type	Standard slave	
Suitable for AS-i Master acc. to spec. ... (or higher)	AS-i Spec. 2.1	
AS-i slave profile IO.ID.ID2	S-7.A.E (ID1 is variable, default setting: 7_{hex})	
PFH value	2.14 x 10-8 [1/h]	
No. of inputs/outputs	1 safe output / 3 inputs digital / 2 outputs digital	
Electrical data		
Total power consumption	≤ 200 mA	
Reverse polarity protection	Integrated	
Total system response time (from the moment of the shutdown request to the moment at which the output has switched off)	< 70 ms	
On-delay time (Power On)	< 3 s	
Digital inputs		
For signal "0" I_{in}	≤ 1.5 mA	
For signal "1" U_{in}, I_{in}	≥ 10 V, ≥ 5 mA	
Digital outputs (short-circuit-proof, with induction protection)		
Operating voltage U_{AUX} (PELV)	24 V ± 15 %	
Current-carrying capacity per output I_{out}	≤ 0.7 A, short-circuit-proof and overload-proof	
Voltage drop Δ U_{type}	0.8 V	
Safe output		
Max. contact load	24 V DC, 3 A	
Protection	external with 4 A MT, max.	
Mechanical data		
Degree of protection	IP20	
Rated temperature T_a	25 °C	
Ambient temperature T_a	-25 ... +70 °C	
Storage temperature T_s	-40 ... +85 °C	
Approvals	UL, CSA applied for	

For information on additional properties, please refer to the current data sheet which is available in the Internet:

Order No.:
3RK1405-1SE15-0AA2 (http://support.automation.siemens.com/WW/view/en/3RK1405-1SE15-0AA2/td)
3RK1405-1SG15-0AA2 (http://support.automation.siemens.com/WW/view/en/3RK1405-1SG15-0AA2/td)

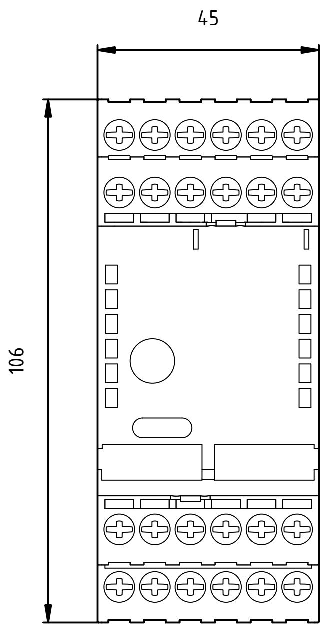
Assignment of inputs and outputs

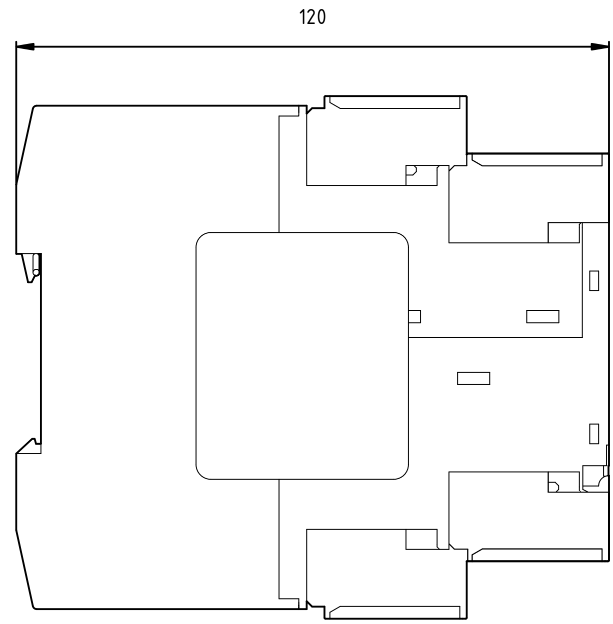
Bit	AS-i Input
DI 0	IN 1
DI 1	IN 2
DI 2	IN 3 (EDM)
DI 3	Diagnostics 0: ok 1: Error HS1 or HS2 required (HS = help signal) or fatal error

<table>
<tr><th>Bit</th><th colspan="2">AS-i output</th></tr>
<tr><td>DO 0</td><td colspan="2">OUT 1</td></tr>
<tr><td>DO 1</td><td colspan="2">OUT 2</td></tr>
<tr><td>DO 2</td><td>P1 = 1: Functional switching deactivated;
F-OUT OFF, if no safety-oriented enable
F-OUT ON, if safety-oriented enable</td><td>P1 = 0: Functional switching activated;
0: F-OUT OFF
1: F-OUT ON, if safety-oriented enable received</td></tr>
<tr><td>DO 3</td><td>—</td><td>—</td></tr>
</table>

2.1.8 Dimension drawings

Safe S45F SlimLine module, screw-type connection





Safe S45F SlimLine module, spring-type connection