Operating Instructions

IO-Link Master with AS-Interface Interface
StandardLine
4 Ports
IP 65 / IP 66 / IP 67 / IP 69K

AC6001

Firmware: 2.4.x or higher

English

Contents

1 Preliminary note

Content

33203

1.1 Legal and copyright information

33117

© All rights reserved by ifm electronic gmbh. No part of this manual may be reproduced and used without the consent of ifm electronic gmbh.

All product names, pictures, companies or other brands used on our pages are the property of the respective rights owners:

- AS-i is the property of the AS-International Association, (→ www.as-interface.net)

- CAN is the property of the CiA (CAN in Automation e.V.), Germany (→ www.can-cia.org)

- CODESYS™ is the property of the 3S – Smart Software Solutions GmbH, Germany (→ www.codesys.com)

- DeviceNet™ is the property of the ODVA™ (Open DeviceNet Vendor Association), USA (→ www.odva.org)

- EtherNet/IP® is the property of the → ODVA™

- EtherCAT® is a registered trade mark and patented technology, licensed by Beckhoff Automation GmbH, Germany

- IO-Link® is the property of the → PROFIBUS Nutzerorganisation e.V., Germany (→ www.io-link.com)

- ISOBUS is the property of the AEF – Agricultural Industry Electronics Foundation e.V., Deutschland (→ www.aef-online.org)

- Microsoft® is the property of the Microsoft Corporation, USA (→ www.microsoft.com)

- Modbus® is the property of the Schneider Electric SE, France (→ www.schneider-electric.com)

- PROFIBUS® is the property of the PROFIBUS Nutzerorganisation e.V., Germany (→ www.profibus.com)

- PROFINET® is the property of the → PROFIBUS Nutzerorganisation e.V., Germany

- Windows® is the property of the → Microsoft Corporation, USA

1.2　Symbols used

58277

	Important note Non-compliance can result in malfunction or interference
	Information Supplementary note
►　...	Request for action
>　...	Reaction, result
→　...	"see"
abc	Cross-reference
123 0x123 0b010	Decimal number Hexadecimal number Binary number
[...]	Designation of pushbuttons, buttons or indications

1.3　Warnings used

58278

WARNING

Warning of serious personal injury.

Death or serious irreversible injuries may result.

CAUTION

Warning of personaly injury.

Slight reversible injuries may result.

NOTICE!

Warning of damage to property

1.4   User documentation for this device

59298

Available user manuals for this device:

Name	Description
Operating instructions	- Installation, electrical connection - Set-up - Parameter setting and command interface - Maintenance, repair, disposal
Programming manual	Parameter setting with CODESYS function library

ifm provides the documents for download on its website: → www.ifm.com

1.5   Modification history

34492

Version	Topic	Date
00	New creation of document	04/2020

2 Safety instructions

Content

28333

2.1 General

59299

- The device described is a subcomponent for integration into a system. The system architect is responsible for the safety of the system. The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.

- Read this document before setting up the product and keep it during the entire service life.

- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.

- Only use the product for its intended purpose (→ **Bestimmungsgemäße Verwendung**).

- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.

- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the device or incorrect use by the operator.

- Installation, electrical connection, set-up, programming, configuration, operation and maintenance of the product must be carried out by personnel qualified and authorised for the respective activity.

- Protect units and cables against damage.

42680

The device may only be used for the following purposes:

- as IO-Link master to configure and control the connected IO-Link devices

- as gateway between IO-Link devices and the AS-Interface network.

The device is designed for use without a control cabinet in the food industry.

► Only use the device within the limits of the technical data.

3 Function

Content

33836

3.1 IO-Link

59301

The device offers the following IO-Link functions:

- IO-Link master (IO-Link revision 1.0 and 1.1)
- 4 IO-Link ports to connect IO-Link devices
- IO-Link ports X01...X04
    - Pin 4: configurable as deactivated, digital input (DI), digital output (DO), IO-Link
    - Pin 2: additional digital input (supply voltage: AUX)

3.1.1 IO-Link supply

59302

The device offers 4 supplies for IO-Link devices (sensors, actuators).

The ports IO-Link ports X01...X04 are Ports Class A.

The following IO-Link ports have common short-circuit monitoring: X01 and X02, X03 and X04

The device ensures fire protection for connected IO-Link devices by providing an energy-limited circuit at the IO-Link ports (to IEC61010-1 and Class 2 to UL1310).

3.2 AS-interface

51953

The device offers the following AS-Interface functions:

- providing the functions of a AS-i Slave
- Supported AS-i version: 3.0
- Gateway to transfer the process and parameter data between the connected IO-Link devices and the higher-level AS-i master

3.3 Parameter setting

51954

The device offers the following configuration options:

- Addressing and parameter setting of the integrated AS-i slaves via AS-i master
- Parameter setting of the IO-Link master via command interface or using CODESYS programming software
- Parameter setting of the connected IO-Link devices via command interface or using CODESYS programming software
- Storage of parameter sets of the connected IO-Link devices for automatic recovery (data storage)

3.4   Visual indication

51955

The device displays the following indications:

- Status and error indication of the gateway and the AS-Interface connection
- Status indication of the supply voltages AS-i and AUX
- Status, error and short circuit/overload indication of the IO-Link ports
- Status indication of the additional digital inputs (pin 2)

4　Mounting

Content

34058

4.1　Mounting the device

34059

> ► Disconnect the system from power before installation.
> ► For installation choose a flat mounting surface.
> ► Please observe the maximum tightening torque.

► Fix the unit to the mounting surface using 2 M5 mounting screws and washers.
- Tightening torque: 1.8 Nm

5 Electrical connection

Content

<div style="text-align: right">33805</div>

5.1 Notes

<div style="text-align: right">51957</div>

A qualified electrician must connect the unit.

► The national and international for regulations setting up electrical equipment must be complied with.

The unit is only suitable for operation using SELV/PELV voltages.

► Please note the information concerning IO-Link wiring!

This unit contains components that may be damaged or destroyed by electrostatic discharge (ESD).

► Please observe the required precautions against electrostatic discharge!

The IP rating of the overall system depends on the protection ratings of the individual devices, the applied connection elements and the corresponding protective caps.

► Provide cables with a strain relief depending on the mounting conditions to avoid excessive strain on the installation points and the M12 connections.

► Ensure correct fit and proper assembly of the M12 connecting parts. If these instructions are not complied with, the specified protection rating cannot be guaranteed.

For UL applications:

► To connect the IO-Link master and the IO-Link devices, only use UL-certified cables of the CYJV or PVVA category with a minimum temperature of 80 °C (75 °C in case of maximum ambient temperature of 40 °C).

Wiring: → **Technical data** (→ p. 39)

By means of basic insulation according to EN61010-1, the circuits are separated from each other and from device surfaces that could be touched (secondary circuit with 30 V DC maximum, supplied from mains circuit up to 300 V overvoltage category II).

By means of basic insulation according to EN61010-1, the communication interfaces are separated from each other and from device surfaces that could be touched (secondary circuit with 30 V DC maximum, supplied from mains circuit up to 300 V overvoltage category II). They are designed for network environment 0 according to IEC TR62102.

5.2 IO-Link ports

The IO-Link ports of the AC6001 meet the requirements of the IO-Link specifications 1.0 to 1.1.2.

► Please note the information concerning IO-Link wiring!

► Cover unused sockets with M12 protective caps (art. no.: E12542).

  ▪ Tightening torque 0.6...0.8 Nm

5.2.1 Connecting IO-Link devices for Class A operation

Wiring information:

- The connected IO-Link devices must be supplied exclusively via the IO-Link master.
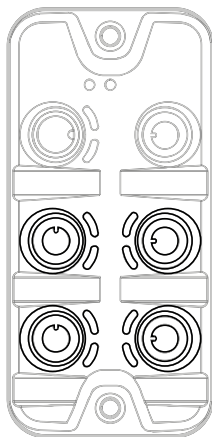
► Connect the connectors of the IO-Link devices with the M12 sockets of the IO-Link ports X01...X04.

  ▪ Tightening torque: 0.6...0.8 Nm
  ▪ Maximum cable length per IO-Link port: 20 m

► To connect the devices, use M12 connectors with protection rating IP 65 / IP 66 / IP 67 / IP 69K or higher (→ **Accessories** (→ p. 37)).

5.2.2   Connecting IO-Link devices for Class B operation

51960

Notes on wiring:

- For Class B operation, the IO-Link device must be supplied with an additional auxiliary voltage UA using a Y connection cable.

⚠ **WARNING**

Non-compliance with the electrical separation of the circuits

> Risk of fire!

► Ensure that the external supply UA is galvanically separated from the circuit of the IO-Link Master by assuring basic insulation (according to IEC 61010-1, secondary circuit with 30 V DC maximum, supplied from mains circuit up to 300 V of overvoltage category II).

► Ensure that the IO-Link devices and the connection technology support the galvanic separation.

ⓘ In case of operation as port class B, the additional digital input of the IO-Link port (pin 2) is not available!
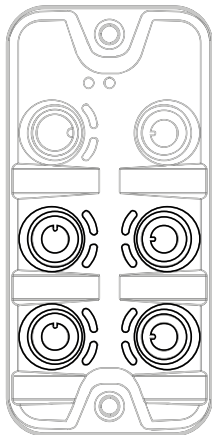
► Connect the connectors of the IO-Link devices via a Y connection cable with the M12 sockets of the IO-Link ports X01...X04.

► Connect the Y cable to 24 V DC (20...30 V SELV/PELV)
   ▪ Tightening torque: 0.6...0.8 Nm

► To connect the devices, use M12 connectors with protection rating IP 65 / IP 66 / IP 67 / IP 69K or higher (→ **Accessories** (→ p. 37))!

5.3   Connecting the unit

51961

!   The AS-i voltage supplies the communication electronics.
   ►   Connect the AS-i voltage input to AS-i power supplies only!
   The AUX voltage supplies the IO-Link master.
   ►   In case of cables that are longer than 25 m, take the voltage drop and the necessary minimum supply voltage of 20 V into consideration!
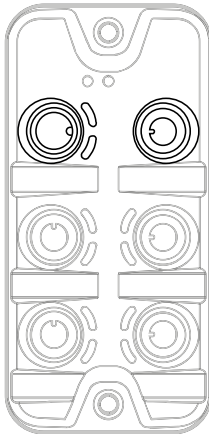
►   Disconnect power.

►   Connect the device via the M12 socket to the AS-i supply voltages AS-i (18...31,6 V DC) and AUX (24 V DC (20...300 V SELV/PELV)).
   ▪   Tightening torque: 0.6...0.8 Nm.
   ▪   Recommended maximum cable length: 25 m

►   To connect the device, use M12 connectors with at least protection rating IP 65 / IP 66 / IP 67 / IP 69K (→ **Accessories** (→ p. 37)).

Optional: Supply of an additional AS-i device (daisy chain)

►   Connect an additional AS-i device to the M12 socket   X22 of the AC6001 (loop-through function).
   ▪   Tightening torque: 0.6...0.8 Nm
   ▪   Recommended maximum cable length: 25 m

►   To connect the device, use M12 connectors with at least protection rating IP 65 / IP 66 / IP 67 / IP 69K (→ **Accessories** (→ p. 37)).

6 Operating and display elements

Content

34063

6.1 Overview

51963
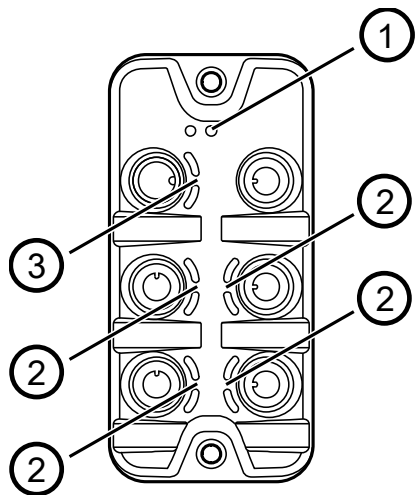
① Status LEDs RDY and FLT (→ **Status LEDs** (→ p. 16))

② IOL and DI status LEDs of the IO-Link port (X01...X04) (→ **IO-Link ports (Class A)** (→ p. 17))

③ Status LEDs AS-i and AUX of the voltage supply (X21) (→ **Voltage supply** (→ p. 16))

6.2 LED indicators

The device only has the following LED indicators:

6.2.1 Status LEDs

The RDY LED indicates the status of the gateway.
The FLT LED shows the status of the AS-Interfaceconnection.

Status LED			Description
RDY	green	on	Status: OK
		flashes 5 Hz	Status: Error
		flashes (200 ms on, 800 ms off)	Status: Firmware update is running
		off	Status: Gateway not running or gateway booting
FLT	red	on	AS-i connection error or AS-i default address is set
		off	error-free

6.2.2 Voltage supply

The port for the voltage supply (X21) has the AS-i and AUX LEDs. The LEDs indicate the status of the voltage supply:

Status LED			Description
AS-i	green	on	AS-i voltage supply is connected
		off	no supply voltage or connected supply voltage is too low
AUX	green	on	Voltage supply AUX is connected
		off	no supply voltage or connected supply voltage is too low

6.2.3 IO-Link ports (Class A)

52923

Each IO-Link port Class A has 2 LEDs marked as IOL and DI. The LEDs indicate the status of the IO-Link port.

Status LED			Description
IOL	yellow	off	Port configured as DI / DO: pin 4 (C/Q) = OFF
		on	Port configured as DI / DO: pin 4 (C/Q) =ON
	green	flashes 1 Hz	Port configured as IO-Link: no IO-Link device detected
		flashes 2 Hz	Port configured as IO-Link: PROOPERATE state
		on	Port configured as IO-Link: OPERATE state
	red	flashes 1.2 Hz	Port configuration error or short circuit or overload
		on	Transmission error
DI	yellow	off	Digital input : pin 2 (DI) = OFF
		on	Digital input: pin 2 (DI) = ON

7 Set-up

When the supply voltage has been switched on, the AC6001 starts with the factory settings. The display elements signal the current operating status (→ **Operating and display elements** (→ p. 15)).

To enable configuration of the gateway and IO-Link functions, the device must be integrated into the AS-i network.

► Addressing the basic AS-i slave of the AC6001 (→ **Addressing the AS-i slave of the AC6001** (→ p. 23)).

► Connect the addressed AC6001 with the AS-i network.

> AS-i master shows configuration error.

► Re-configure the AS-i network.

> AC6001 has a valid AS-i address.

> AS-i master switches to operating mode "Protected mode".

After successful configuration, the IO-Link master transfers the process data of the factory set gateway profile (mapping of the process data: **ID1 = 0xF** (→ p. 58)). The AS-i master can access the AC6001 via the set AS-i address.

Further steps:

• Setting the gateway profile of the AC6001.

• Configuring the IO-Link master and the IO-Link ports.

8 Configuration

Content

33858

8.1　Notes

51968

8.1.1　Device structure

59306

① The AS-i slave component of the AC6001 sets the following features:

- Address range of the AC6001 in the AS-i network (max. 5 related AS-i addresses)
- Type and scope of the process data transferred between the AS-i master and IO-Link ports

② The IO-Link component of the AC6001 includes the IO-Link master as well as the IO-Link ports.

8.1.2　Options for parameter setting

59307

The AS-i slave of the AC6001 is configured via functions of the AS-i master. This includes the following settings:

- Addressing the AS-i slave
- Setting the gateway profile (= setting the ID1 code of the basic AS-i slave)

To set the parameters of the IO-Link master and the IO-Link ports of the AC6001 and the connected IO-Link devices, the access to process and diagnostic data as well as maintenance functions, the following options are available:

- Command interface (→ **Using the command interface** (→ p. 21)
- Function library for CODESYS (→ programming manual)

8.1.3 Using the command interface

51971

The AC6001 has a command interface. Via the interface and using acyclic commands, the user can access parameters, process and diagnostic data as well as events of the IO-Link master. In addition, the command interface offers simple maintenance functions.

> Documentation of the command interface: → **Command interface** (→ p. 61)

Requirements for access to the command interface of the AC6001:

• AC6001 is integrated in the AS-i network.
• AS-i master is in the operating mode "Protected mode".

Principle of the command processing

51973

The basic AS-i slave of the AC6001 has the CTT1 profile S-7.4. It supports the AS-i command interface. The user can use the following AS-i commands to access the IO-Link master using acyclic IO-Link commands:

• Write Parameter String (S-7.4): Send IO-Link command request
• Read Parameter String (S-7.4): Reading IO-Link command request
• Read Diagnosis (S-7.4): Read status information about the command processing

The IO-Link command request is sent encapsulated in the data range of the AS-i command "Write Parameter String (S-7.4)" to the basic AS-i slave of the AC6001.

The basic AS-i slave verifies the received data and indicates their validity in the status bit [CMD Req]. After that, the basic AS-i slave gives the IO-Link command request to the IO-Link master.

The IO-Link master executes the IO-Link command. After that, it provides the IO-Link command response. The availability of the IO-Link command response is indicated in the status bit [CMD Resp].

[CMD Req] and [CMD Resp] are part of the status information of the basic AS-i slave (→ **Mapping: Status information** (→ p. 59)). The status information can be read using the AS-i command "Read Diagnosis (S-7.4)" or via the cyclic input data of the basic AS-i slave.

The provided IO-Link command response will be read back using the AS-i command "Read Parameter String (S-7.4)". The IO-Link command response is stored in the data range of the AS-i command.

> Documentation of the acyclic AS-i commands: → User manual of the AS-i master

Procedure: Sending acyclic command to the IO-Link master

The following figure shows the chronological sequence of an acyclic IO-Link command by means of the AS-i commands:

```
Write Parameter □
   String S-7.4

                1
CMD Req Valid
                0

                1
CMD Resp
                0

Read Parameter □
   String S-7.4
```
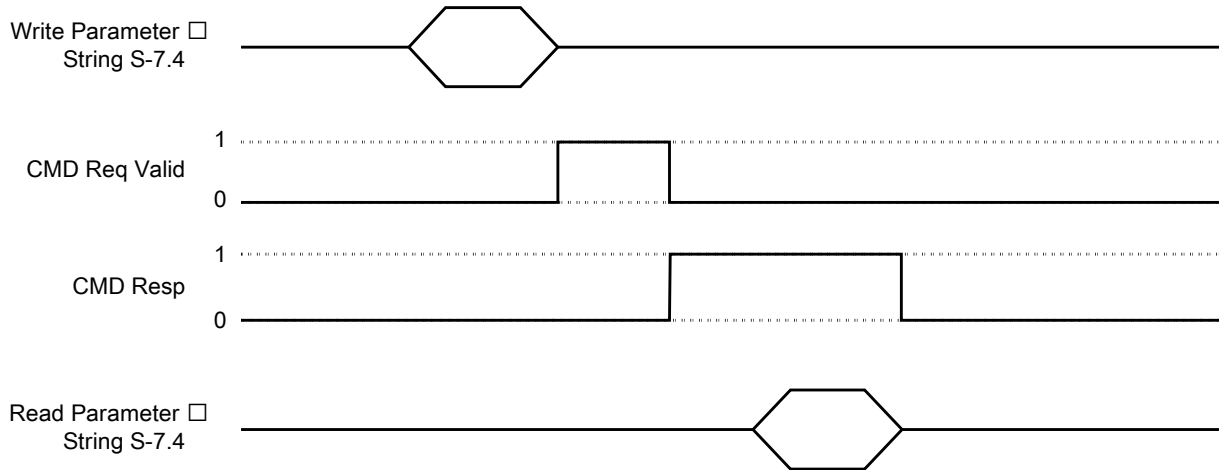
General process:

1   Send command request

► Send the IO-Link command request to the basic AS-i slave using the command "Write Parameter String (S-7.4)".

> The basic AS-i slave passes the IO-Link command request to the IO-Link master.

> IO-Link master executes command.

> The IO-Link master provides the IO-Link command response.

2   Verify the validity of the command request

► Read the cyclic input data of the basic AS-i slave
or
Read the status information of the basic AS-i slave using the AS-i command "Read Diagnosis (S-7.4)"

► Verify the bit [CMD Req Valid] (→ **Mapping: Status information** (→ p. 59)).

> If [CMD Req Valid] == 0:
Command request invalid; verify and repeat step 1

> If [CMD Req Valid] == 1:
Command request valid; continue with step 3

3   Verify the availability of the command response

► Read the cyclic input data of the basic AS-i slave
or
Read the status information of the basic AS-i slave using the AS-i command "Read Diagnosis (S-7.4)"

► Verify the bit [CMD Resp] (→ **Mapping: Status information** (→ p. 59)).

> If [CMD Resp] == 0:
Command response not available; Repeat step 3

> If [CMD Resp] == 1:
Command response available; continue with step 4

4   Read command response

► Request the IO-Link command response of the basic AS-i slave using the AS-i command "Read Parameter String (S-7.4)".

> The AS-i slave sends the command response to the AS-i master.

> After the AS-i command "Read Parameter String (S-7.4)" has been executed, the bit [CMD Resp] = 0 is set

► Verify the status of the command.

► Optional: Read requested data.

8.2 Addressing the AS-i slave of the AC6001

The user can use the following options when addressing the basic AS-i slave:

- AS-i master: → **Addressing via AS-i master** (→ p. 23)
- AS-interface addressing unit AC1154: → **Addressing with addressing unit** (→ p. 24)

Depending on the set ID1 code, the AC6001 takes up a space of up to 5 connected AS-i addresses in the AS-i network. (→ **Adjusting the gateway profile** (→ p. 25)).

The following restrictions apply for the addressing:

ID1 code basic AS-i slave	additional AS-i slaves	valid address range of the basic AS-i slaves
0xF	0	1...31
0xB, 0xD	1	1...30
0x1, 0x2, 0x3, 0xA, 0xC	2	1...29
0x8, 0x9	3	1...28
0x4, 0x5, 0x6, 0x7	4	1...27

► Take the valid address range into consideration when addressing the basic AS-i slave!

8.2.1 Addressing via AS-i master

Functions for addressing: → User documentation of the AS-i master

► Connect AC6001 with the AS-i network.
> AS-i master shows configuration error.
► Assign an free address to the AC6001 with functions of the AS-i master.
► Re-configure the AS-i network.
> AC6001 has a valid AS-i address.
> AS-i master switches to operating mode "Protected mode".
> Cyclic process data is transferred between the AS-i master and AC6001.

8.2.2 Addressing with addressing unit

59309

Detailed information about AS-Interface addressing unit AC1154: → www.ifm.com

If the AC1154 is used for the addressing, the AC6001 must be supplied with the AUX supply voltage.   For this purpose, ifm offers the Y cable EVC844 as an accessory (→ **Accessories** (→ p. 37)).

► Connect the AC1154 with the ASi OUT (X22) port using the Y cable EVC844.

► Connect the Y cable EVC844 to 24 V DC (20...30 V SELV/PELV)

► Make sure the Y cable is properly connected!

► Connect AC6001 with the addressing unit.

► Assign a free AS-i address to the AC6001.

► Connect the addressed AC6001 with the AS-i network.

> AS-i master shows configuration error.

► Re-configure the AS-i network.

> AC6001 has a valid AS-i address.

> AS-i master switches to operating mode "Protected mode".

> Cyclic process data is transferred between the AS-i master and AC6001.

8.3 Adjusting the gateway profile

59310

The gateway profile determines which process data of the IO-Link ports is transmitted cyclically between the IO-Link master and the AS-i network. The user can adjust various gateway profiles using the ID1 code of the basic AS-i slave. The process data is transmitted in the analogue channels of the additional AS-i slaves (→ **Mapping: inputs and outputs of the IO-Link ports** (→ p. 44)).

In the factory settings, the AC6001 is a single AS-i slave. It has the CTT1 profile S-7.4.E (ID1 = 0xF) with 4 analogue input channels. In each channel, 2 bytes of input data of an IO-Link port are transmitted (mapping: → **ID1 = 0xF** (→ p. 58)).

> Setting the ID1 code of the basic AS-i slave is done using the functions of the AS-i master (→ user documentation of the AS-i master).
>
> Independent of the set gateway profile, the user can access all process data of the connected IO-Link devices with acyclic commands.

► Set the ID1 code of the basic AS-i slave.

> AS-i master shows configuration error.

► Re-configure the AS-i network.

> AC6001 is a participant of the AS-i network.

> AS-i master works in the "Protected mode".

8.3.1   Example: Setting the gateway profile

51981

Task:

Each of the first two words of the input and output data of the IO-Link at the ports X01...X03 are to be transmitted.

Solution:

- Required ID1 code: 0x7
- Mapping of the process data (details: → **ID1 = 0x7** (→ p. 51)):

	Add. Slave (n+4)				Add. Slave (n+3)				Add. Slave (n+2)				Add. Slave (n+1)				Basic Slave (n)
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	S-7.4.E
Port X01							1	0							1	0	
Port X02					1	0							1	0			→ Status-Informationen
Port X03			1	0							1	0					
Port X04	1	0							1	0							

green = input data
rot = output data

- The following process data will be cyclically transmitted between IO-Link master and AS-i master:
  - Word 0 and 1 of the input and output data at port X01
  - Word 0 and 1 of the input and output data at port X02
  - Word 0 and 1 of the input and output data at Port X03
  - Word 0 and 1 of the input and output data at port X04 (remain unused)
- Number of Additional AS-i slaves: 4
- Valid address range for Basic AS-i slave: 1...27 (1 Basic AS-i slave + 4 Additional AS-i slaves = 5 consecutive AS-i addresses)

8.4 Configuring IO-Link ports

59311

The configuration of an IO-Link port consists of the following parameters:

- Operating mode (IO-Link, digital input, digital output, disabled)
- Cycle time of the data transmission between the IO-Link master and the IO-Link device
- Data storage of the IO-Link device configuration for automatic recovery
- Device validation for connected IO-Link devices (validation ID)
- Vendor and device ID for active device validation (Vendor ID / Device ID)
- Fail-safe values in case the AS-i connection is interrupted

Available commands:

Name	Description	Reference
0x03: Reading IO-Link port configuration	Read current configuration of all IO-Link ports	**0x03: Read IO-Link Port Configuration** (→ p. 70)
0x02: Write IO-Link Port Configuration	Write the configuration of all IO-Link ports	**0x02: Write IO-Link Port Configuration** (→ p. 66)
0x09: Set IO-Link Failsafe Data	Set fail-safe values	**0x09: Set IO-Link Failsafe Data** (→ p. 82)
0x01: Reading IO-Link Port Configuration Errors	Read configuration errors of the IO-Link ports	**0x01: Read IO-Link Port Configuration Errors** (→ p. 65)

8.4.1 Note: Device validation and data storage

59312

The user can choose how the IO-Link ports are to behave with regard to the device validation and the storage / recovery of parameter data of the connected IO-Link device.

The following options are available:

Option	Validation of the IO-Link device	Storage of the parameter values	Recovery of the parameter values
[No check and clear]	no	no	no
[Type compatible V1.0 device]	yes, test the compatibility with IO-Link standard V1.0	no	no
[Type compatible V1.1 device]	yes, test the compatibility with IO-Link standard V1.1	no	no
[Type compatible V1.1 device with Backup + Restore]	yes, test the compatibility with IO-Link standard V1.1 and identity of design (vendor ID and device ID)	yes, automatic storage of the parameter values; changes of the current parameter values will be stored	yes, recovery of the parameter values when connecting an identical IO-Link device with factory settings
[Type compatible V1.1 device with Restore]	yes, test the compatibility with IO-Link standard V1.1 and identity of design (vendor ID and device ID)	no, there is no automatic storage changes of the current parameter values will not be stored	yes, recovery of the parameter values when connecting an identical IO-Link device with factory settings

> [!] The options only apply if the IO-Link port is in the operating mode "IO-Link".
>
> For options [Type compatible V1.1 device with Backup + Restore] and [Type compatible V1.1 device with Restore]: If the vendor ID and device ID are changed in the online mode, the data memory will be deleted and a new backup of the parameter values of the connected IO-Link device will be created in the IO-Link master.

8.5   Reading / writing parameters of the IO-Link devices

The parameters of an IO-Link device can be accessed by means of ISDU (Indexed Service Data Unit).

> The "IO-Link Device Description" (IODD) contains all available parameters of an IO-Link device as well as their indexes and sub-indexes: → Operating instructions of the IO-Link device

Requirements:

- IO-Link port is in the operating mode "IO-Link".
- IO-Link device is connected to the IO-Link port of the AC6001.

Available commands:

Name	Description	Reference
0x0B: Read Parameter	Read the parameters of an IO-Link device	**0x0B: Read Parameter** (→ p. 87)
0x0A: Write Parameter	Write the parameters of an IO-Link device	**0x0A: Write Parameter** (→ p. 84)

8.5.1 Example: Reading parameter

Task:

The parameter of the IO-Link device at IO-Link port X02 is to be read (AS-i master: 1, AS-i slave address: 2, Index: 15000, sub-index: 0; parameter length: 172 bytes)

Solution:

Send read command with "Write Parameter String (S-7.4) to AC6001; read the parameter value that has been read with 2x "Read Parameter String (S-7.4).

Course:
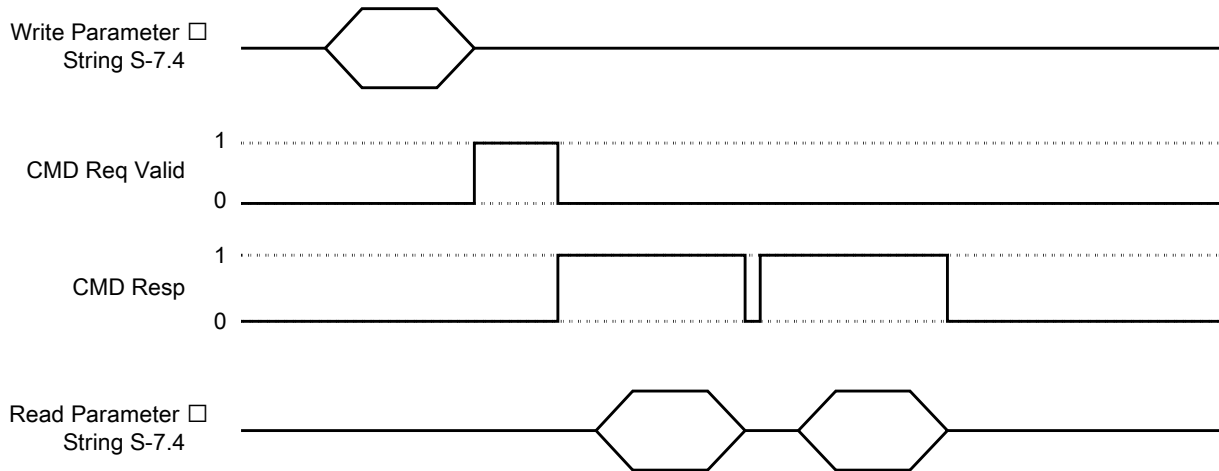
1   Request parameter value

► Send AS-i command "Write Parameter String (S-7.4)" to basic AS-i slave.

► Save the request of the IO-Link command "Read Parameter" in the data range:

Parameter	Value	Note
Block ID	0x00	single command
Command ID	0x0B	"Read Parameter" command
Target ID	0x02	IO-Link port X02
Data Length	0x03	Index (2 bytes) + sub-index (1 byte)
Index (MSB)	0x3A	
Index (LSB)	0x98	
Sub-index	0x00	

> Basic AS-i slave passes "Read Parameter" command request to IO-Link master.

> IO-Link master executes command.

> IO-Link master saves 1. Segment of the parameter value in "Read Parameter" command response.

2   Verify the availability of the IO-Link command response

► Read the status information of the basic AS-i slave.

► If [CMD Resp] == 0: IO-Link command response not available; Repeat step 2.

► If [CMD Resp] == 1: IO-Link command response available; continue with step 3

3   Read parameter value (first segment)

► Send AS-i command "Read Parameter String (S-7.4)" to basic AS-i slave.

► Data range of the command request: → step 1 (bytes 0...6)

> Data range of the command response contains "Read Parameter" command response (first segment):

Parameter	Value	Note
Block Counter	0x00...0xFF	cons. number
Block-ID	0x01	first segment; follow further segments
Response Data Length	0x96	150 bytes to return data
Command Status	0x01	Execution OK (→ error codes)
Response Data[0...149]	per byte: 0x00...0xFF	Parameter value (bytes 0...149)

> After the read command is finished, the IO-Link master sets the bit [CMD Resp] = 0.

> IO-Link master saves the second segment of the parameter value in "Read Parameter" command response.

4   Verify the availability of the IO-Link command response

► Read status information of the basic AS-i slave (→ step 2)

► If bit [CMD Resp] == 0: IO-Link command response not available; Repeat step 4.

► If bit [CMD Resp] == 1: IO-Link command response available; continue with step 5

5   Read parameter value (first Segment)

► Send AS-i command "Read Parameter String (S-7.4)" to basic AS-i slave.

► Data range of the command request: → Step 1 (bytes 0...6)

> Data range of the command response contains "Read Parameter" command response (second segment):

Parameter	value	Note
Block Counter	0x00...0xFF	cons. number
Block-ID	0xFF	last segment
Response Data Length	0x16	172 bytes to return data
Command Status	0x01	Execution OK (→ error codes)
Response Data[150...172]	per byte: 0x00...0xFF	Parameter value (bytes 150...172)

> After the read command is finished, the IO-Link master sets the bit [CMD Resp] = 0.

8.5.2   Example: Writing parameter

Task:

Parameter of the IO-Link devices on IO-Link port X02 is to be written (AS-i master: 1, AS-i slave address: 2, Index: 15000, sub-index: 0; parameter length: 192 bytes)

Solution:

Send parameter value with 2x "Write Parameter String (S-7.4)" to AC6001; verify the success of each write operation with "Read Parameter String (S-7.4)"

Course:
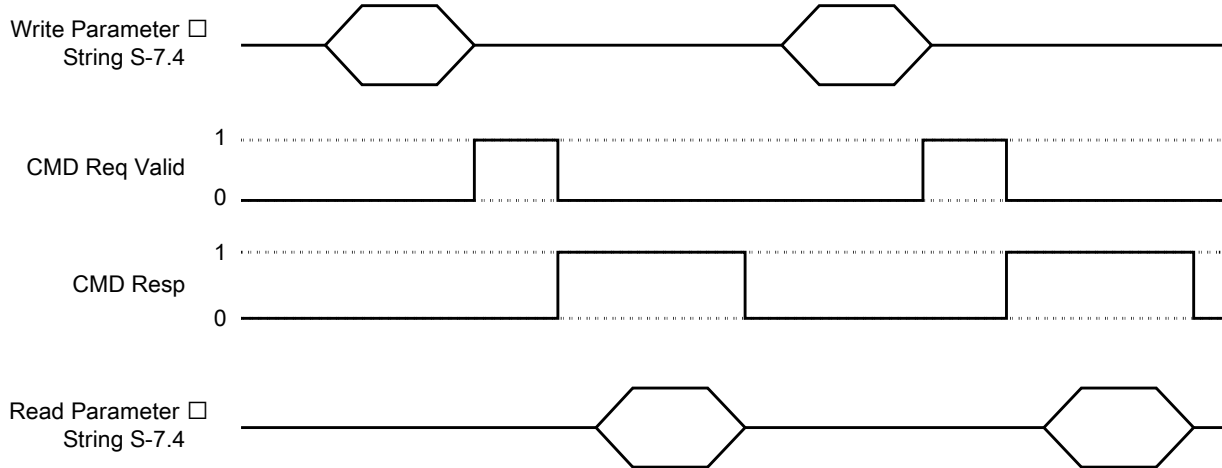
1   Send first segment of the parameter value

► Send AS-i command "Write Parameter String (S-7.4)" to basic AS-i slave.

► Save the request of the IO-Link command "Write Parameter" in the data range:

Parameter	Value	Note
Block ID	0x01	first segment; follow further segments
Command ID	0x0A	"Write Parameter" command
Target ID	0x02	IO-Link port X02
Data Length	0x9A	150 bytes of parameter data + 4 bytes (index, sub-index, parameter data length)
Index (MSB)	0x3A	
Index (LSB)	0x98	
Sub-index	0x00	
Parameter length	0xC0	192 bytes (length of the parameter)
Parameter Data[0...149]	per byte: 0x00...0xFF	Parameter value (bytes 0...149)

> IO-Link master executes command.

> IO-Link master saves the command status in IO-Link command response.

2   Verify the availability of the IO-Link command response

► Read the status information of the basic AS-i slave.

► If [CMD Resp] == 0: IO-Link command response not available; Repeat step 2.

► If [CMD Resp] == 1: IO-Link command response available; continue with step 3

3   Read command status

► Send AS-i command "Read Parameter String (S-7.4)" to basic AS-i slave.

► Data range of the command request: → step 1 (bytes 0...6)

> Data range of the command response contains "Read Parameter" command response

Parameter	Value	Note
Block Counter	0x00...0xFF	cons. number
Block-ID	0xFF	last segment
Command Status	0x01	Execution OK (→ error codes)
Data Length	0x00	no error

► Verify command status.

► If an error has occurred, repeat steps 1 to 3.

4   Send second segment of the parameter

► Send AS-i command "Write Parameter String (S-7.4)" to basic AS-i slave.

► Save the request of the IO-Link command "Write Parameter" in the data range:

Parameter	Value	Note
Block ID	0xFF	last segment
Command ID	0x0A	"Write Parameter" command
Target ID	0x02	IO-Link port X02
Data Length	0x2A	42 bytes of parameter data (43 = 192-150); Index, sub-index and parameter length not required
Parameter Data[150...191]	per byte: 0x00...0xFF	Parameter value (bytes 150...191)

> IO-Link master executes command.

> IO-Link master saves the command status in IO-Link command response.

5   Verify the availability of the IO-Link command response

► Read the status information of the basic AS-i slave.

► If [CMD Resp] == 0: IO-Link command response not available; Repeat step 5.

► If [CMD Resp] == 1: IO-Link command response available; continue with step 6

6   Read command status

► Send AS-i command "Read Parameter String (S-7.4)" to basic AS-i slave.

► Data range of the command request: → step 1 (bytes 0...6)

> Data range of the command response contains "Read Parameter" command response

Parameter	Value	Note
Block Counter	0x00...0xFF	cons. Article no.
Block-ID	0xFF	last segment
Command Status	0x01	Execution OK (→ error codes)
Data Length	0x00	No error

► Verify command status.

► If an error has occurred, repeat steps 4 to 6.

8.6 Reading / writing process data

59314

In the "Protected mode", the AC6001 provides the cyclic process data of the IO-Link ports via the gateway function in the AS-i network.

Additionally, the user can access the process data of the inputs and outputs acyclically.

Available commands:

Name	Description	Reference
0x04: Read Input Process Data	Read process data of the inputs	**0x04: Read Input Process Data** (→ p. 73)
0x05: Read Output Process Data	Read back process data of the outputs	**0x05: Read Output Process Data** (→ p. 75)
0x06: Write Output Process Data	Write process data of the outputs	**0x06: Write Output Process Data** (→ p. 77)

8.7 Reading identification and diagnostic information

59315

Available commands:

Name	Description	Reference
0x0C: Read Device Name, Serial Number, HW and SW Revisions	Read device information of the IO-Link master	**0x0C: Read Device Name, Serial Number, HW and SW Revisions** (→ p. 89)
Read Diagnosis (S-7.4)	Read the status information of the basic AS-i slave	**Mapping: Status information** (→ p. 59)

8.8 Reading IO-Link events

59316

The AC6001 receives event messages of the IO-Link devices. The messages signal the occurrence of specific events (errors, warnings, information).

Available commands:

Name	Description	Reference
0x07: Read Diagnosis Data	Reading IO-Link events of the ports	**0x07: Read Diagnosis Data** (→ p. 79)

8.9 Resetting IO-Link master

59317

The user can reset the AC6001 to the factory settings (→ **Factory settings** (→ p. 36)).

Available commands:

Name	Description	Reference
0x08: Factory Defaults	Resetting IO-Link master to factory settings	**0x08: Factory Defaults** (→ p. 81)

8.10 Updating the firmware

59318

When updating the firmware of the IO-Link master, the set parameter values will be kept.

During the firmware update, no process data of the IO-Link will be transferred.

► After the firmware update: Restart AC6001.

Available commands:

Name	Description	Reference
0x0D: Update Firmware	Update the firmware of the IO-Link master	**0x0D: Update Firmware** (→ p. 91)

ifm recommends using the function block "_FWUpdate" of the library ifm_AC600x_Lib for CODESYS for the firmware update.

9 Maintenance, repair and disposal

51990

The operation of the unit is maintenance-free.

► Dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations when it is no longer used.

9.1 Cleaning process

51991

► Clean the surface of the unit when necessary.

► Do not use any caustic cleaning agents for this!

9.2 Replacing IO-Link device

34182

To replace an IO-Link device:

Requirement:

> New IO-Link device is with factory settings.

> New IO-Link device supports IO-Link standard 1.1 or higher.

1 Set data storage

► Set the following parameters of the IO-Link port

▪ Set Validation and Data Storage to [Type compatible V1.1 device with Restore] or [Type compatible V1.1. device with Backup + Restore]

▪ Set correct values to [Vendor ID] and [Device ID] according to properties of the IO-Link device.

► Save changes.

2 Replace IO-Link device

► Disconnect old IO-Link device from IO-Link master.

► Connect new IO-Link device with the same IO-Link port of the AC6001.

> IO-Link master copies parameter values from the data memory to the new IO-Link device.

10 Factory settings

51993

In the factory settings, the device has the following parameter settings:

Parameter	Value
Data memory (Data Storage)	empty
AS-i slave address	0
CTT1 profile	S-7.4.E (ID1 = 0xF)

11 Accessories

33870

List of accessories of AC6001: → www.ifm.com > Product page > Accessories

12 Appendix

Content

33879

12.1   Technical data

34188

12.1.1   Application

33878

Application	
Application	Hygienic systems; I/O modules for field applications
Daisy-chain function	Voltage supply; Fieldbus interface

12.1.2   Electrical data

51995

Electrical data	
Operating voltage [V]	18...31.6 DC; (AS-i)
Current consumption [mA]	300...1500; (AUX)
Max. current consumption from AS-i [mA]	100
Protection class	III
Total current rating [A]	1.1; (Port 1+2: 0.55 (AUX); Port 3+4: 0.55 (AUX))
Additional voltage supply[V]	20...30 DC; (AUX)

12.1.3   Inputs / outputs

34068

Inputs / outputs	
Total number of inputs and outputs	8; (configurable)
Number of Inputs and Outputs	Number of digital inputs: 8; Number of digital outputs: 4

12.1.4   Inputs

51996

Inputs	
Number of digital inputs	8; (IO-Link Port Class A: 4 x 2)
Sensor supply	AUX
Switching level high [V]	11...30
Switching level low [V]	0...5
Short-circuit protection	yes

12.1.5   Outputs

51997

Outputs	
Number of digital outputs	4; (IO-Link Port Class A: 4 x 1)
Max. current load per output [mA]	300
Short-circuit protection	yes
Actuator supply of the switching outputs	AUX

12.1.6   Interfaces

51998

Interfaces	
Communication interface	IO-Link; AS-i
IO-Link master	
Type of transmission	COM 1 / COM 2 / COM 3
IO-Link revision	V1.1
Number of ports Class A	4

12.1.7   Operating conditions

52488

Operating conditions	
Ambient temperature [°C]	-25...60
Storage temperature [°C]	-25...85
Max. perm. relative air humidity [%]	90
Protection rating	IP 65; IP 66; IP 67; IP 69K; (operation with stainless steel protective caps: IP 69K)
Pollution Degree	2

12.1.8   Approvals / Tests

52813

Approvals / Tests	
EMC	▪ EN 61000-6-2 ▪ EN 61000-6-4
Shock resistance	DIN EN 60068-2-27
Vibration resistance	▪ DIN EN 60068-2-64 2009-04 ▪ DIN EN 60068-2-6 2008-10

12.1.9   AS-i classification

51999
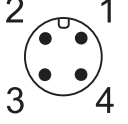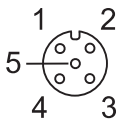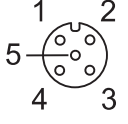
AS-i classification	
AS-i version	2.11; 3.0
Extended addressing mode possible	no
AS-i profile	S-7.4.E; (CTT1 input)
Number of AS-i devices	1...5
Other AS-i profiles	S-7.3.E: CTT1 input S-7.3.2: CTT1 output

12.1.10   Mechanical data

34050

Mechanical data	
Weight [g]	255
Materials	Housing: PA grey; socket: 1.4404 (stainless steel / 316L)

12.1.11 Electrical connection

52000

AS-i IN X21	
Connector	M12
Wiring	1: AS-i + 2: AUX - 3: AS-i - 4: AUX +

AS-i OUT X22	
Connector	M12
Wiring	1: AS-i + 2: AUX - 3: AS-i - 4: AUX + 5: -

Process connection IO-Link ports Class A X01...X04	
Connector	M12
Wiring	1: + 24 V DC (AUX) 2: DI 3: GND (AUX) 4: C/Q IO-Link 5: -

12.2   AS-Interface   43

Content

52002

12.2.1   Mapping: inputs and outputs of the IO-Link ports

52003

ID1 = 0x1

52527

	Add. Slave (n+2) S-7.3.E, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01							2	0	→ **Mapping: Status information** (→ p. 59)			
Port X02					2	0						
Port X03			2	0								
Port X04	2	0										

Legend:

n   = 1...29 (valid address range of the Basic AS-i slave)

x   = Word x of the process data at the input of the IO-Link port

45

ID1 = 0x2

52528

	Add. Slave (n+2) S-7.3.2, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01								0	→ **Mapping: Status information** (→ p. 59)			
Port X02							0					
Port X03						0						
Port X04	3	2	1	0	0							

Legend:

n = 1...29 (valid address range of the Basic AS-i slave)

x = Word x of the process data at the input of the IO-Link port

y = Word y of the process data at the output of the IO-Link port

46

ID1 = 0x3

52529

	Add. Slave (n+2) S-7.3.E, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01								0	→ **Mapping: Status information** (→ p. 59)			
Port X02							0					
Port X03						0						
Port X04	3	2	1	0								

Legend:

n   = 1...29 (valid address range of the Basic AS-i slave)

x   = Word x of the process data at the input of the IO-Link port

47

ID1 = 0x4

52530

	Add. Slave (n+4) S-7.3.E, ID1=4				Add. Slave (n+3) S-7.3.E, ID1=3				Add. Slave (n+2) S-7.3.E, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0				
Port X02																	→ **Mapping: Status information** (→ p. 59)			
Port X03																				
Port X04																				

Legend:

n = 1...27 (valid address range of the Basic AS-i slave)

x = Word x of the process data at the input of the IO-Link port

ID1 = 0x5

52531

	Add. Slave (n+4) S-7.3.E, ID1=4				Add. Slave (n+3) S-7.3.E, ID1=3				Add. Slave (n+2) S-7.3.E, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01									7	6	5	4	3	2	1	0	→ **Mapping: Status information** (→ p. 59)			
Port X02	7	6	5	4	3	2	1	0												
Port X03																				
Port X04																				

Legend:

n   = 1...27 (valid address range of the Basic AS-i slave)

x   = Word x of the process data at the input of the IO-Link port

ID1 = 0x6

52532

	Add. Slave (n+4) S-7.3.E, ID1=4				Add. Slave (n+3) S-7.3.E, ID1=3				Add. Slave (n+2) S-7.3.E, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01													3	2	1	0				
Port X02									3	2	1	0					→ **Mapping: Status information** (→ p. 59)			
Port X03					3	2	1	0												
Port X04	3	2	1	0																

Legend:

n   = 1...27 (valid address range of the Basic AS-i slave)

x   = Word x of the process data at the input of the IO-Link port

ID1 = 0x7

52533

	Add. Slave (n+4) S-7.3.2, ID1=4				Add. Slave (n+3) S-7.3.2, ID1=3				Add. Slave (n+2) S-7.3.E, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01							1	0							1	0	→ **Mapping: Status information** (→ p. 59)			
Port X02					1	0							1	0						
Port X03			1	0							1	0								
Port X04	1	0							1	0										

Legend:

n   = 1...27 (valid address range of the Basic AS-i slave)

x   = Word x of the process data at the input of the IO-Link port

y   = Word y of the process data at the output of the IO-Link port

ID1 = 0x8

52534

	Add. Slave (n+3) S-7.3.2, ID1=3				Add. Slave (n+2) S-7.3.2, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01							1	0				0	→ **Mapping: Status information** (→ p. 59)			
Port X02					1	0					0					
Port X03			1	0						0						
Port X04	1	0							0							

Legend:

n = 1...28 (valid address range of the Basic AS-i slave)

x = Word x of the process data at the input of the IO-Link port

y = Word y of the process data at the output of the IO-Link port

ID1 = 0x9

52535

	Add. Slave (n+3) S-7.3.2, ID1=3				Add. Slave (n+2) S-7.3.E, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01				0							1	0				
Port X02			0						1	0			→ **Mapping: Status information** (→ p. 59)			
Port X03		0					1	0								
Port X04	0				1	0										

Legend:

n = 1...28 (valid address range of the Basic AS-i slave)

x = Word x of the process data at the input of the IO-Link port

y = Word y of the process data at the output of the IO-Link port

ID1 = 0xA

52536

	Add. Slave (n+2) S-7.3.2, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01				0				0	→ **Mapping: Status information** (→ p. 59)			
Port X02			0				0					
Port X03		0				0						
Port X04	0				0							

Legend:

n = 1...29 (valid address range of the Basic AS-i slave)

x = Word x of the process data at the input of the IO-Link port

y = Word y of the process data at the output of the IO-Link port

54

ID1 = 0xB

52537

	Add. Slave (n+1) S-7.3.2, ID1=1				Basic Slave (n) S.-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 2	Channel 0
Port X01				0	→ **Mapping: Status information** (→ p. 59)			
Port X02			0					
Port X03		0						
Port X04	0							

Legend:

n = 1...30 (valid address range of the Basic AS-i slave)

y = Word y of the process data at the output of the IO-Link port

ID1 = 0xC

52538

	Add. Slave (n+2) S-7.3.E, ID1=2				Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01							1	0	→ **Mapping: Status information** (→ p. 59)			
Port X02					1	0						
Port X03			1	0								
Port X04	1	0										

Legend:

n = 1...29 (valid address range of the Basic AS-i slave)

x = Word x of the process data at the input of the IO-Link port

56

ID1 = 0xD

52539

	Add. Slave (n+1) S-7.3.E, ID1=1				Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0	Channel 3	Channel 2	Channel 1	Channel 0
Port X01				0	→ **Mapping: Status information** (→ p. 59)			
Port X02			0					
Port X03		0						
Port X04	0							

Legend:

n   = 1...30 (valid address range of the Basic AS-i slave)

x   = Word x of the process data at the input of the IO-Link port

57

ID1 = 0xF

52540

	Basic Slave (n) S-7.4.E			
	Channel 3	Channel 2	Channel 1	Channel 0
Port X01				0
Port X02			0	
Port X03		0		
Port X04	0			

Legend:

n   = 1...31 (valid address range of the Basic AS-i slave)

x   = Word x of the process data at the input of the IO-Link port

Mapping: Status information

52018

Bit															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
reserved														SC: X03 or X04	SC: X01 or X02
Port X01: PQI								reserved				PCE	res.	CMD Req	CMD Resp
Port X03: PQI								Port X02: PQI							
Number of Events in Buffer								Port X04: PQI							

Legend:

- SC — Short Circuit: indicates whether there is a short circuit on at least one of the pair of IO-Link ports — 1 bit — 0x0 — no short circuit
  0x1 — short circuit

- CMD Resp — Command Response: indicates whether the acyclic command channel (response) contains valid data and whether it can be read — 1 bit — 0x0 — not ready
  0x1 — ready

- CMD Req — Command Request: indicates whether the acyclic request channel (request) is valid — 1 bit — 0x0 — not valid
  0x1 — Valid

- PCE — Port Configuration Error: indicates whether projected values for "Vendor ID" and "Device ID" correspond with the values of the IO-Link devices on the IO-Link port — 1 bit — 0x0 — no error
  0x1 — error

- PQI — Port Qualifier Information: — 1 byte — → **Mapping: PQI** (→ p. 60)

- Number of Events in Buffer — Number of events in the buffer memory — 1 byte — 0x00...0x0C

Mapping: PQI

52019

Bit							
7	6	5	4	3	2	1	0
PQ	DE	DA	DACT	res.	res.	DI (Pin 2)	DI (Pin 4)

Legend:

- DI (Pin 4)   Signal level of the digital input on pin 4 (if in use)   1 bit   0x0   LOW
  - 0x1   HIGH

- DI (Pin 2)   Signal level of the digital input on pin 2 (DI)   1 bit   0x0   LOW
  - 0x1   HIGH

- DACT   Device Deactivated: indicates whether IO-Link device has been deactivated via the port function   1 bit   0x0   IO-Link device activated
  - 0x1   IO-Link device deactivated

- DA   Device Available: indicates whether an IO-Link device is available at the IO-Link port   1 bit   0x0   no IO-Link device available
  - 0x1   IO-Link device recognised and in the operating mode "Peroperate" or "Operate"

- DE   Device Error: indicates occurring errors in the connected IO-Link device   1 bit   0x0   no error
  - 0x1   error or warning

- PQ   Port Qualifier: indicates whether the input data / output data of the IO-Link device are valid   1 bit   0x0   Data is invalid
  - 0x1   Data is valid

12.3　Command interface

Content

52117

12.3.1　Structure of the command interface

52118

Via the command interface, the user can send acyclic commands from the AS-i master to the IO-Link master. An acyclic command consists of the following components:

- **Command request (AS-i master >>> IO-Link master)** (→ p. 62)

- **Command response (IO-Link master >>> AS-i master)** (→ p. 63)

Command request (AS-i master >>> IO-Link master)

52119

Byte	Contents
0	Block ID
1	Command ID
2	Target ID
3	Request Data Length
4...160	Request Data

Legend:

- [Block ID] | Fragmentation information for data transfer via several data blocks | 8 bits | 0x00 | No fragmentation
| | | | 0x01 | New command transmission started; this is the first segment
| | | | 0xFF | Last segment; after this data block, the command execution starts on IO-Link master

- [Command ID] | Command ID | 8 bits | → **Overview: Acyclic commands** (→ p. 64)

- [Target ID] | ID of the target of the required operation | 8 bits | 0x01 | IO-Link port 1
| | | | 0x02 | IO-Link port 2
| | | | 0x03 | IO-Link port 3
| | | | 0x04 | IO-Link port 4
| | | | 0x0A | all IO-Link ports

- [Request Data Length] | Length of the request data in this fragment (number of bytes) | 8 bits | 0x00 | 0
| | | | ... |
| | | | 0x9C | 156

- [Request Data] | Request data (n bytes) | n*8 bits | per byte: 0x00...0xFF |

Command response (IO-Link master >>> AS-i master)

52120

Byte	Contents
0	Block ID
1	Block Counter
2	Command Status
3	Response Data Length
4...160	Response Data

Legend:

- [Block ID] Fragmentation information for data transfer via several data blocks 8 bits 0x00 No fragmentation

  0x01 New command transmission started; this is the first Segment

  0xFF Last segment; after this data block, the command execution starts on IO-Link master

- [Block Counter] Counter for processed blocks; if the maximum value is reached, the counter is reset to 0x00 8 bits 0x00...0xFF

- [Command Status] Processing / diagnostic status (command-specific) 8 bits 0x00...0x0B

- [Response Data Length] Length of the return data in this fragment (number of the bytes n) 0x00 0

  ... ...

  0x9C 156

- [Response Data] Return data (n bytes) n*8 bits per byte: 0x00...0xFF

63

12.3.2   Overview: Acyclic commands

Command ID	Reference
0x01	→ **0x01: Read IO-Link Port Configuration Errors** (→ p. 65)
0x02	→ **0x02: Write IO-Link Port Configuration** (→ p. 66)
0x03	→ **0x03: Read IO-Link Port Configuration** (→ p. 70)
0x04	→ **0x04: Read Input Process Data** (→ p. 73)
0x05	→ **0x05: Read Output Process Data** (→ p. 75)
0x06	→ **0x06: Write Output Process Data** (→ p. 77)
0x07	→ **0x07: Read Diagnosis Data** (→ p. 79)
0x08	→ **0x08: Factory Defaults** (→ p. 81)
0x09	→ **0x09: Set IO-Link Failsafe Data** (→ p. 82)
0x0A	→ **0x0A: Write Parameter** (→ p. 84)
0x0B	→ **0x0B: Read Parameter** (→ p. 87)
0x0C	→ **0x0C: Read Device Name, Serial Number, HW and SW Revisions** (→ p. 89)
0x0D	→ **0x0D: Update Firmware** (→ p. 91)

12.3.3   0x01: Read IO-Link Port Configuration Errors

52123

The command verifies whether the projected parameters "Vendor ID" and "Device ID" correspond with the parameter values of the connected IO-Link devices at the IO-Link ports X01...X04.

Command request

52124

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	0x01							
2	0x0A							
3	0x00							
4...160	ignored							

Command response

52126

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	0x01							
4	reserved				Port X04: PCE	Port X03: PCE	Port X02: PCE	Port X01: PCE
5...160	ignored							

Legend:

- [Port X0n: PCE]   Port Configuration Error (PCE) - indicates whether projected values for "Vendor ID" and "Device ID" correspond with the values of the IO-Link devices at the IO-Link port   1 bit   0x0   OK
0x1   Error

Diagnostic codes:

- 0x01   OK
- 0x04   Blocked Port - another acyclic access is still active
- 0x07   Wrong Target ID (wrong Port number)
- 0x08   Invalid length (wrong input parameter length)
- 0x0A   Wrong Block ID

12.3.4   0x02: Write IO-Link Port Configuration

52127

The command writes the configuration of the IO-Link ports X01...X04 of the IO-Link master. The configuration consists of the following parameters:

- Port Mode
- Validation ID / Data Storage
- Vendor ID
- Device ID
- Failsafe Mode
- Failsafe Value Pin 4 (DO)

.

Command request

52128

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0x00							
1	0x02							
2	0x0A							
3	0x28							
4	Port X01: Port Mode							
5	Port X01: Master Cycle Time							
6	Port X01: Validation ID							
7	Port X01: Vendor ID (MSB)							
8	Port X01: Vendor ID (LSB)							
9	Port X01: Device ID (MSB)							
10	Port X01: Device ID							
11	Port X01: Device ID (LSB)							
12	Port X01: Failsafe Mode - IO-Link							
13	Port X01: Failsafe Value - Pin 4 (DO)							
14...23	Port X02: Port configuration (→ row 4...13)							
24...33	Port X03: Port configuration (→ row 4...13)							
34...43	Port X04: Port configuration (→ row 4...13)							
44...160	ignored							

Legend:

- [Port Mode]   Operating mode of the IO-Link port   1 byte

0x00	deactivated
0x01	digital input (DI)
0x02	digital output (DO)
0x03	IO-Link

- [Master Cycle Time]   Cycle time of the data transmission between the IO-Link master and the IO-Link device   1 byte

0x00	As fast as possible
0x01	2 milliseconds
0x02	4 milliseconds
0x03	8 milliseconds
0x04	16 milliseconds
0x05	32 milliseconds
0x06	64 milliseconds
0x07	128 milliseconds

- [Validation ID]   Supported IO-Link standard and behaviour of the IO-Link master when connecting new IO-Link devices to the IO-Link port   1 byte

0x00	no validation
0x01	V1.0 device
0x02	V1.1 device
0x03	V1.1 device with Backup + Restore
0x04	V1.1 device with Restore

▪	[Vendor ID]	Vendor ID of the manufacturer of the device on the IO-Link port
		Vendor ID = 0x1234
		  ▪ Vendor ID (MSB) = 0x12
		  ▪ Vendor ID (LSB) = 0x34
			2 bytes	per byte: 0x00...0xFF	

▪	[Device ID]	Device ID of the device on the IO-Link port
		Device ID = 0x123456
		  ▪ Device ID (MSB) = 0x12
		  ▪ Device ID = 0x34
		  ▪ Device ID (LSB) = 0x56
			3 bytes	per byte: 0x00...0xFF	

▪	[Failsafe Mode -- IO-Link]	Fail-safe mode for output data when the AS-Interface connection is interrupted	1 byte	0x00 0x01 0x02 0x03	No Failsafe Failsafe Reset Value Failsafe Old Value Failsafe with Pattern
▪	[Failsafe Mode -- Pin 4 (DO)]	Fail-safe value for the operating mode "digital output (DO)	1 byte	0x00 0x01 0x02	Failsafe Reset Value Failsafe Old Value Failsafe Set Value

Command response

52129

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	0x00							
4...160	ignored							

Diagnostic codes:

- 0x01   OK
- 0x04   Blocked Port - another acyclic access is still active
- 0x07   Wrong Target ID (wrong Port number)
- 0x08   Invalid length (wrong input parameter length)
- 0x09   Wrong parameter (value of a parameter not in proper range)
- 0x0A   Wrong Block ID

12.3.5   0x03: Read IO-Link Port Configuration

52130

The command reads the current configuration of the IO-Link ports X01...X04 of the IO-Link master.
The configuration consists of the following parameters:

- Port Mode
- Validation ID / Data Storage
- Vendor ID
- Device ID
- Failsafe Mode
- Failsafe Value Pin 4 (DO)

Command request

52131

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	0x03							
2	0x0A							
3	0x00							
4...160	ignored							

Command response

52132

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	0x28							
4	Port X01: Port Mode							
5	Port X01: Master Cycle Time							
6	Port X01: Validation ID							
7	Port X01: Vendor ID (MSB)							
8	Port X01: Vendor ID (LSB)							
9	Port X01: Device ID (MSB)							
10	Port X01: Device ID							
11	Port X01: Device ID (LSB)							
12	Port X01: Failsafe Mode - IO-Link							
13	Port X01: Failsafe Value - Pin 4 (DO)							
14...23	Port X02: Port configuration (→ row 4...13)							
24...33	Port X03: Port configuration (→ row 4...13)							
34...43	Port X04: Port configuration (→ row 4...13)							
44...160	ignored							

Legend:

- [Port Mode]   Operating mode of the IO-Link port   1 byte   0x00   deactivated

         0x01   digital input (DI)

         0x02   digital output (DO)

         0x03   IO-Link

- [Master Cycle Time]   Cycle time of the data transmission between the IO-Link master and the IO-Link device   1 byte   0x00   As fast as possible

         0x01   2 milliseconds

         0x02   4 milliseconds

         0x03   8 milliseconds

         0x04   16 milliseconds

         0x05   32 milliseconds

         0x06   64 milliseconds

         0x07   128 milliseconds

- [Validation ID]   Supported IO-Link standard and behaviour of the IO-Link master when connecting new IO-Link devices to the IO-Link port   1 byte   0x00   no validation

         0x01   V1.0 device

         0x02   V1.1 device

         0x03   V1.1 device with Backup + Restore

         0x04   V1.1 device with Restore

▪ [Vendor ID]	Vendor ID of the manufacturer of the device on the IO-Link port Vendor ID = 0x1234 ▪ Vendor ID (MSB) = 0x12 ▪ Vendor ID (LSB) = 0x34	2 bytes	per byte: 0x00...0xFF		
▪ [Device ID]	Device ID of the device on the IO-Link port Device ID = 0x123456 ▪ Device ID (MSB) = 0x12 ▪ Device ID = 0x34 ▪ Device ID (LSB) = 0x56	3 bytes	per byte: 0x00...0xFF		
▪ [Failsafe Mode -- IO-Link]	Fail-safe mode for output data when the AS-Interface connection is interrupted	1 byte	0x00 0x01 0x02 0x03	No Failsafe Failsafe Reset Value Failsafe Old Value Failsafe with Pattern	
▪ [Failsafe Mode -- Pin 4 (DO)]	Fail-safe value for the operating mode "digital output (DO)"	1 byte	0x00 0x01 0x02	Failsafe Reset Value Failsafe Old Value Failsafe Set Value	

Diagnostic codes:

- 0x01   OK
- 0x04   Blocked Port - another acyclic access is still active
- 0x07   Wrong Target ID (wrong Port number)
- 0x08   Invalid length (wrong input parameter length)
- 0x0A   Wrong Block ID

12.3.6   0x04: Read Input Process Data

52133

The command reads the process data of the inputs of an IO-Link port of the IO-Link master and the corresponding status information (PQI).

Command request

52134

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0x00							
1	0x04							
2	Target ID							
3	0x00							
4...160	ignored							

Legend:

- [Target ID]   Target of the required operation   8 bits   0x01   IO-Link port 1

                                                                                      0x02   IO-Link port 2

                                                                                      0x03   IO-Link port 3

                                                                                      0x04   IO-Link port 4

73

Command response

52135

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	Response Data Length							
4	PQ	DE	DA	DACT	res.	res.	DI (Pin2)	DI (Pin 4)
5	Input data (byte 1)							
...	...							
5+(n-1)	Input data (byte n)							
(5+n)...160	ignored							

Legend:

- [Response Data Length] — Length of the return data (number of bytes n) — 8 bits
  - 0x03 — 3 bytes (n=2)
  - 0x05 — 5 bytes (n=4)
  - 0x09 — 9 bytes (n=8)
  - 0x11 — 17 bytes (n=16)
  - 0x21 — 33 bytes (n=32)

- [PQ] — Port Qualifier: indicates the validity of the input/output data of the IO-Link device — 1 bit
  - 0x0 — data invalid
  - 0x1 — data valid

- [DE] — Device Error: shows if an error or a warning has occurred; Note: The user needs to determine the cause of the fault separately via acyclic services. — 1 bit
  - 0x0 — no error
  - 0x1 — error

- [DA] — Device Available: shows if the IO-Link device has been recognised and if the device is in the "preoperate" or in the "operate" state — 1 bit
  - 0x0 — no device
  - 0x1 — device detected

- [DACT] — Device Deactivated: shows if the IO-Link port is configured and can be used — 1 bit
  - 0x0 — device activated
  - 0x1 — device deactivated

- [DI (Pin 2)] — Signal level of the input data at pin 2 (if in use) — 1 bit
  - 0x0 — LOW
  - 0x1 — HIGH

- [DI (Pin 4)] — Signal level of the input data at pin 4 (DI) — 1 bit
  - 0x0 — LOW
  - 0x1 — HIGH

- [Input Data (Byte m)] — IO-Link input data (m = 1...n) — n*8 bits — per byte: 0x00...0xFF

Diagnostic codes:

- 0x01 — OK
- 0x04 — Blocked Port - another acyclic access is still active
- 0x07 — Wrong Target ID (wrong Port number)
- 0x08 — Invalid length (wrong input parameter length)
- 0x0A — Wrong Block ID

12.3.7   0x05: Read Output Process Data

52136

The command reads the process data of the outputs of an IO-Link port of the IO-Link master.

Command request

52137

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	0x05							
2	Target ID							
3	0x00							
4...160	ignored							

Legend:

- [Target ID]   Target of the required operation   8 bits   0x01   IO-Link port 1
                                                                                                      0x02   IO-Link port 2
                                                                                                      0x03   IO-Link port 3
                                                                                                      0x04   IO-Link port 4

Command response

52138

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	Response data length (number of bytes m)							
4	Output acyclic process data switch (OPDS)							
5	Output Data (Byte 1)							
...	...							
5+(n-1)	Output Data (Byte n)							
(5+n)...160	ignored							

Legend:

- [Response Data Length] — Length of the return data incl. OPDS byte (number of bytes n) — 8 bits — 0x03 — 3 bytes (n=2)

  0x05 — 5 bytes (n=4)

  0x09 — 9 bytes (n=8)

  0x11 — 17 bytes (n=16)

  0x21 — 33 bytes (n=32)

- [OPDS] — Output acyclic data Switch: signals whether cyclic or acyclic process data is transmitted — 8 bits — 0x00 — cyclic process data

  0x01 — acyclic process data

- [Output Data (Byte m)] — IO-Link output data (m = 1...n) — n*8 bits — per byte: 0x00...0xFF

Diagnostic codes:

- 0x01   OK
- 0x04   Blocked Port - another acyclic access is still active
- 0x07   Wrong Target ID (wrong Port number)
- 0x08   Invalid length (wrong input parameter length)
- 0x0A   Wrong Block ID

12.3.8   0x06: Write Output Process Data

52139

The command writes the process data of the outputs of an IO-Link port of the IO-Link master.

> [!] If the flag [OPDS] is set to 0x01, then the cyclic output of process data is blocked. The output remains blocked until [OPDS] is set to 0x00.

Command request

52140

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	0x06							
2	Target ID							
3	Output Data Length							
4	Output acyclic process data switch (OPDS)							
5	Output Data (Byte 1)							
...	...							
5+(n-1)	Output Data (Byte n)							
(5+n)...160	ignored							

Legend:

- [Target ID] — ID of the target of the required operation — 8 bits — 0x01 — IO-Link port 1
  - 0x02 — IO-Link port 2
  - 0x03 — IO-Link port 3
  - 0x04 — IO-Link port 4
- [Output Data Length] — Length of the output data incl. OPDS byte (number of bytes) — 8 bits — 0x03 — 3 bytes (n=2)
  - 0x05 — 5 bytes (n=4)
  - 0x09 — 9 bytes (n=8)
  - 0x11 — 17 bytes (n=16)
  - 0x21 — 33 bytes (n=32)
- [OPDS] — Output acyclic data switch: signals whether cyclic or acyclic process data is transmitted — 8 bits — 0x00 — cyclic process data
  - 0x01 — acyclic process data
- [Output Data (Byte m)] — IO-Link output data (m = 1...n) — n*8 bits — per byte: 0x00...0xFF

77

Command response

52141

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	0x00							
4...160	ignored							

Diagnostic codes:

- 0x01   OK
- 0x04   Blocked Port - another acyclic access is still active
- 0x07   Wrong Target ID (wrong Port number)
- 0x08   Invalid length (wrong input parameter length)
- 0x09   Wrong parameter (value of a parameter not in proper range)
- 0x0A   Wrong Block ID

12.3.9   0x07: Read Diagnosis Data

52142

The command reads the diagnostic information / events) of the IO-Link devices. The diagnostic information is stored in a ring buffer in the IO-Link master. The ring buffer stores a maximum of 12 events. If all memory locations of the ring buffer are occupied, the IO-Link master overwrites the oldest event with new incoming diagnostic information.

The ring buffer has a protection against the case that an IO-Link device reports the same error several times in a row. Only one message is stored for the same error.

Command request

52143

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	0x07							
2	0x0A							
3	0x00							
4...160	ignored							

Command response

52144

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	0x05							
4	IO-Link port							
5	Mode							
6	Type							
7	Event Code (MSB)							
8	Event Code (LSB)							
9...160	ignored							

Legend:

- [IO-Link port]   IO-Link port   8 bits   0x01   IO-Link port 1
  - 0x02   IO-Link port 2
  - 0x03   IO-Link port 3
  - 0x04   IO-Link port 4

- [Mode]   Occurrence of the error that has triggered the event   8 bits   0x40   Individual message or warning
  - 0x80   Error or warning has appeared
  - 0xC0   Error or warning has disappeared

- [Type]   Type of error that has triggered the event   8 bits   0x10   Message
  - 0x20   Warning
  - 0x30   Error

- [Event Code]   Error cause
  Event Code = 0x1234
  - Event Code (MSB) = 0x12
  - Event Code (LSB) = 0x34

  16 bits   per byte: 0x00...0xFF
  depends on the IO-Link device (→ IODD of the IO-Link devices)

Diagnostic codes:

- 0x01   OK
- 0x04   Blocked Port - another acyclic access is still active
- 0x05   Command Error, no response data available
- 0x07   Wrong Target ID (wrong Port number)
- 0x08   Invalid length (wrong input parameter length)
- 0x0A   Wrong Block ID

12.3.10 0x08: Factory Defaults

52145

The command resets the configuration of the IO-Link ports of the IO-Link master to the factory settings. The bytes 4...8 contain the "reset" string in hexadecimal representation.

Command request

52146

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	0x08							
2	0x0A							
3	0x05							
4	0x72							
5	0x65							
6	0x73							
7	0x65							
8	0x74							
9...160	ignored							

Command response

52147

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	0x00							
4...160	ignored							

Diagnostic codes:

- 0x04   Blocked Port - another acyclic access is still active

- 0x07   Wrong Target ID (wrong Port number)

- 0x08   Invalid length (wrong input parameter length)

- 0x09   Wrong parameter (value of a parameter not in proper range)

- 0x0A   Wrong Block ID

12.3.11   0x09: Set IO-Link Failsafe Data

52148

The command writes the fail-safe value of the output of an IO-Link port of the IO-Link master ("IO-Link" operating mode).

Command request

52149

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0x00							
1	0x09							
2	Target ID							
3	Failsafe Data Length							
4	Failsafe Data (Byte 1)							
...	...							
4+(n-1)	Failsafe Data (Byte n)							
(4+n)...160	ignored							

Legend:

- [Target ID] Target of the required operation 8 bits 0x01 IO-Link port 1
  0x02 IO-Link port 2
  0x03 IO-Link port 3
  0x04 IO-Link port 4
- [Failsafe Data Length] Length of the fail-safe value date (number of bytes) 1 Byte 0x01 1 byte
  ... ...
  0x20 32 bytes
- [Failsafe Data (Byte m)] IO-Link fail-safe values (m = 1...n) n*8 bits per byte: 0x00...0xFF

Command response

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	0x00							
4...160	ignored							

Diagnostic codes:

- 0x01   OK

- 0x04   Blocked Port - another acyclic access is still active

- 0x07   Wrong Target ID (wrong Port number)

- 0x08   Invalid length (wrong input parameter length)

- 0x0A   Wrong Block ID

12.3.12   0x0A: Write Parameter

52151

The command writes the parameter on an IO-Link device connected to the IO-Link master.

Parameters with a length <= 150 bytes are transferred with an acyclic write command (block ID = 0x00).

Parameters with a length > 150 bytes are transferred with 2 acyclic write commands.

1.   Command: Write first segment of the parameter
   - Block ID: 0x01
   - Data Length: 154 bytes
   - Parameter Data Length: Length n of the parameter (150 bytes < n < 233 bytes)
   - Parameter Data: Bytes 0...149
1.   Command: Write second segment of the parameter
   - Block ID: 0xFF
   - Data Length: Number m of the remaining bytes of the parameter data (m = n -150)
   - The fields Index, Subindex, Parameter Data Length contain the parameter data: Bytes 150...n

> ⚠ The total of the values in the fields Data Length of the first and second command is the length of the parameter.

Command request

52152

Byte	Bit							
	7	6	5	4	3	2	1	0
0	Block ID							
1	0x0A							
2	Target ID							
3	Data Length							
4	Index (LSB)							
5	Index (MSB)							
6	Subindex							
7	Parameter Data Length (n Bytes)							
8	Parameter Data (Byte 1)							
...	...							
8+(n-1)	Parameter Data (Byte n)							
(8+n)...160	ignored							

Legend:

- [Target ID] Target of the required operation 8 bits 0x01 IO-Link port 1
  0x02 IO-Link port 2
  0x03 IO-Link port 3
  0x04 IO-Link port 4
- [Data Length] Length of the request data in this segment (number of bytes) 8 bits 0x00 0
  ...
  0x9C 156
- [Index] Index of the IO-Link object 16 bits per byte: 0x00...0xFF
  Index = 0x1234
  - Index (MSB) = 0x12
  - Index (LSB) = 0x34
- [Subindex] Sub-index of the IO-Link object 8 bits 0x00...0xFF
- [Parameter Data Length] Length of the parameter data (number of bytes n) 8 bits 0x00 0 bytes
  ... ...
  0xE8 232 bytes
- [Parameter Data (Byte m)] Parameter data (m = 1...n) m*8 bits per byte: 0x00...0xFF

Command response

52153

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	Data Length							
4	ignored / Error Code							
5	ignored / Additional Error Code							
6...160	ignored							

Legend:

- [Data Length]   Length of the return data (number of bytes n)   8 bits   0x00   no error codes

                                                 0x02   Error code and additional error code

- [Error Code]   Error code   8 bits   0x80   Error in IO-Link device

- [Additional Error Code]   additional error code   8 bits   → IODD of the IO-Link device

Diagnostic codes:

- 0x01   OK

- 0x04   Blocked Port - another acyclic access is still active

- 0x07   Wrong Target ID (wrong Port number)

- 0x08   Invalid length (wrong input parameter length)

- 0x0A   Wrong Block ID

- 0x0B   Error - for additional information see data field

12.3.13   0x0B: Read Parameter

52154

The command reads the parameter of an IO-Link device connected to the IO-Link master. The parameter can be accessed via index and sub-index of the corresponding IO-Link object.

Parameters that are longer than 150 bytes are read with 2 acyclic commands.

1. Command: Read first segment of the parameter value

    ▪ Block ID: 0x01
    ▪ Parameter Data Length: 150 bytes
    ▪ Parameter Data: Bytes 0...149

1. Command: Read second segment of the parameter value

    ▪ Block ID: 0xFF
    ▪ Parameter Data Length: Number m of the remaining bytes (m = n - 150)
    ▪ Parameter Data: Bytes 150...n (n = length of the parameter)

Command request

52155

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	0x0B							
2	Target ID							
3	0x03							
4	Index (LSB)							
5	Index (MSB)							
6	Subindex							
7...160	ignored							

Legend:

▪ [Target ID]	Target of the required operation	8 bits	0x01	IO-Link port 1
			0x02	IO-Link port 2
			0x03	IO-Link port 3
			0x04	IO-Link port 4
▪ [Index]	Index des IO-Link Objekts	16 bits	per byte: 0x00...0xFF	
	Index = 0x1234			
	▪ Index (MSB) = 0x12			
	▪ Index (LSB) = 0x34			
▪ [Subindex]	Sub-index of the IO-Link object	8 bits	0x00...0xFF	

Command response

52156

Byte	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Block-ID							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	Parameter Data Length (n Bytes)							
4	Parameter Data (Byte 1)							
...	...							
4+(n-1)	Parameter Data (Byte n)							
(4+n)...160	ignored							

Legend:

- [Parameter Data Length]   Length of the return data (number of bytes n)   8 bits   0x00   0 bytes

     ...   ...

     0x9C   156 bytes

- [Parameter Data (Byte m)]   Parameter-Daten (m = 1...n)   n*8 bits   per byte: 0x00...0xFF

Diagnostic codes:

- 0x01   OK
- 0x04   Blocked Port - another acyclic access is still active
- 0x07   Wrong Target ID (wrong Port number)
- 0x08   Invalid length (wrong input parameter length)
- 0x0A   Wrong Block ID
- 0x0B   Error - for additional information see data field

12.3.14   0x0C: Read Device Name, Serial Number, HW and SW Revisions

52157

The command reads the following parameters of the IO-Link master:

- Device Name
- Serial number
- Hardware revision
- AS-i CPU - software revision
- IOL CPU - software revision

Command request

52158

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	0x0C							
2	0x0A							
3	0x00							
4...160	ignored							

Command response

52159

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	0x32							
0...5	Device Name							
6	0x20							
7...18	Serial Number							
19	0x20							
20...21	Hardware revision							
22	0x20							
23...35	AS-i CPU - software revision							
36	0x20							
37...49	IOL CPU - software revision							
50...160	ignored							

Legend:

- [Device Name]   Device name (ASCII coded)   48 bits   per byte: 0x00...0xFF
- [Serial Number]   Serial number (ASCII coded)   96 bits   per byte: 0x00...0xFF
- [Hardware revision]   Hardware revision (ASCII coded)   16 bits   per byte: 0x00...0xFF
- [AS-i CPU - software revision]   AS-i CPU software revision (ASCII coded)   104 bits   per byte: 0x00...0xFF
- [IOL CPU software revision]   IOL CPU - software revision (ASCII coded)   104 bits   per byte: 0x00...0xFF

Diagnostic codes:

- 0x01   OK
- 0x04   Blocked Port - another acyclic access is still active
- 0x07   Wrong Target ID (wrong Port number)
- 0x08   Invalid length (wrong input parameter length)
- 0x0A   Wrong Block ID

12.3.15   0x0D: Update Firmware

52160

The command updates the firmware of the IO-Link masters via the AS-i network. The bytes 4...9 contain the "update" string in hexadecimal representation.

Carry out the following steps in the correct sequence:

> ► During the firmware update, disconnect all IO-Link devices from the IO-Link master to avoid unexpected behaviour (deactivate ports).
>
> The command uses 1 AS-i input slave and 4 AS-i output slaves for the data transmission. The valid address range for the basic AS-i slave of the AC6001 is restricted to 1...27.
> ► Ensure that 5 connected AS-i addresses are available for the update process.
> ► Select and set the valid address for the basic AS-i slave of the AC6001.
> ► Ensure that the PLC application does not write any data to the AS-i outputs during the update process.

> ifm recommends using the function block "_FWUpdate" of the library ifm_AC600x_Lib for CODESYS for the firmware update.

1.   Deactivate all IO-Link ports of the AC6001 (→ **0x02: Write IO-Link Port Configuration** (→ p. 66)
2.   For AS-i master, activate the Projection Mode.
3.   Allow PLC access to the AS-i outputs (Output Access)
4.   Execute the command "0x0D: Updating Firmware".
5.   After the update, disconnect the device from power and reconnect it.
>   The boot loader verifies the CRC sum and container version of the firmware file.
>   If the update has been successful, each channel of the AS-i input slaves indicates the value 0x01.

Command request

52161

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	0x0D							
2	0x0A							
3	0x08							
4	0x75							
5	0x70							
6	0x64							
7	0x61							
8	0x74							
9	0x65							
10	File Size (LSB)							
11	File Size (MSB)							
12...160	ignored							

Legend:

- [File Size]   Size of the ifm firmware file in bytes divided by 4 (rounded up value)   16 bits   per byte: 0x00...0xFF

    The IO-Link master calculates the start address in the flash memory from this valuer

    Size = 0x1234

    - Size (MSB) = 0x12
    - Size (LSB) = 0x34

Command response

52162

Byte	Bit							
	7	6	5	4	3	2	1	0
0	0x00							
1	Block Counter							
2	Command status (→ list "Diagnostic codes")							
3	0x00							
4...160	ignored							

Diagnostic codes:

- 0x04   Blocked Port - another acyclic access is still active

- 0x07   Wrong Target ID (wrong Port number)

- 0x08   Invalid length (wrong input parameter length)

- 0x09   Wrong parameter (value of a parameter not in proper range)

- 0x0A   Wrong Block ID

13   Index

O

P

R

S

T

U

V

W