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ET 200S distributed I/O Electronic module 4SI IO-Link (6ES7138-4GA50-0AB0)

Manual

Preface

Electronic module 4SI IO-Link (6ES7138-4GA50-0AB0) 1

Configuring 2

Parameter 3

Functions 4

Diagnostics 5

Address space 6

Order numbers A

01/2011

A5E01646741-03

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A5E01646741-03
℗ 01/2011

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Preface

Purpose of the manual

This manual supplements the *ET 200S Distributed I/O System* Operating Instructions. General functions for the ET 200S are described in the ET 200S Distributed I/O System Operating Instructions (http://support.automation.siemens.com/WW/view/en/1144348).

The information in this document along with the operating instructions enables you to commission the ET 200S.

Basic knowledge requirements

To understand these operating instructions you should have general knowledge of automation engineering.

Scope of the manual

This manual applies to this ET 200S module. It describes the components that are valid at the time of publication.

Recycling and disposal

Thanks to the fact that it is low in contaminants, this ET 200S module is recyclable. For environmentally compliant recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste.

Additional support

If you have any questions relating to the products described in this manual and do not find the answers in this document, please contact your local Siemens representative (http://www.siemens.com/automation/partners).

A guide to the technical documentation for the various SIMATIC products and systems is available on the Internet. (http://www.siemens.com/simatic-docu).

The online catalog and ordering systems are available on the Internet (http://www.siemens.com/automation/mall).

Training center

We offer courses to help you get started with the ET 200S and the SIMATIC S7 automation system. Please contact your regional training center or the central training center in D - 90327, Nuremberg, Germany (http://www.siemens.com/sitrain).

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- The bulletin board, a worldwide knowledge exchange for users and experts.
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Table of contents

Preface **3**

1 Electronic module 4SI IO-Link (6ES7138-4GA50-0AB0) **7**

1.1 Properties 7

1.2 Technical specifications 9

2 Configuring **15**

2.1 Configuration with STEP 7 15
2.1.1 Configuration with STEP 7 and S7-PCT 16
2.1.2 Configuration with STEP 7 and S7-PCT (GSD version) 16

2.2 Configuration without STEP 7 17

3 Parameter **19**

3.1 Parameters 19

3.2 Parameter description 19

4 Functions **21**

4.1 Operating modes 21

4.2 Replacing the 4SI IO-Link electronic module without programming device 22

4.3 Resetting to factory settings 22

4.4 Acyclic data exchange with the FB IOL_CALL 23

5 Diagnostics **25**

5.1 Diagnostics using LED display 25

5.2 Error types 27

6 Address space **29**

A Order numbers **31**

A.1 Order numbers for connection cables for 4SI IO-Link electronic module 31

Electronic module 4SI IO-Link (6ES7138-4GA50-0AB0)

1

1.1 Properties

Properties

The 4SI IO-Link electronic module is a serial interface module with four channels. Its main features are as follows:

- Connection of up to 4 IO-Link devices (3-wire connection).
- Connection of up to 4 standard actuators/encoders.
- The 4SI IO-Link is a single-width (15 mm) electronic module that can be used with the following terminal modules:
  - TM-E15S26-A1, TM-E15C26-A1 and TM-E15N26-A1
- Replacing the 4SI IO-Link electornic module without programming device (via user program)
- Supports I&M data
- Supports firmware update
- Extended temperature range from 0 to 55°C with vertical installation.

What is IO-Link?

IO-Link is a point-to-point connection to conventional and intelligent sensors/actuators via unshielded standard cable in proven 3-conductor technology. IO-Link is backwards compatible with all DI/DO sensors/actuators. Circuit state and data channel designed in proven 24 VDC technology.

Supports mixed operation of encoders/actuators in the IO-Link and DI/ DO operating modes on all four channels of the 4SI IO-Link module.

Configuring

Configuration of the 4SI IO-Link electronic module takes place in two steps with STEP 7 as of V5.4 SP5:

- In HW Config, you configure the 4SI IO-Link electronic module using the HSP0180 or the GSD file. You can download the GSD files from the Internet (http://www.siemens.com/automation/csi_en_WW/support).

With *STEP 7* as of V5.4 SP5		
ET 200S PROFIBUS interface modules	IM151-1 STANDARD	6ES7151-1AA05-0AB0
	IM151-1 FO STANDARD	6ES7151-1AB05-0AB0
	IM151-1 HIGH FEATURE *	6ES7151-1BA02-0AB0
ET 200S PROFINET interface modules	IM151-3 PN	6ES7151-3AA23-0AB0, as of V6.1
	IM151-3 PN HF **	6ES7151-3BA23-0AB0, as of V6.1
	IM151-3 PN FO **	6ES7151-3BB23-0AB0, as of V6.1
	IM151-3 PN HS **	6ES7151-3BA60-0AB0, as of V2.1
Configuration with Hardware Support Package HSP0180:		
ET 200S PROFIBUS-CPU	IM151-7 CPU	6ES7151-7AA20-0AB0, as of V2.6
	IM151-7 F-CPU	6ES7151-7FA20-0AB0, as of V2.6
ET 200S PROFINET-CPU	IM 151-8 PN/DP CPU	6ES7151-8AB00-0AB0, as of V2.7
	IM151-8 F-CPU	6ES7151-8FB00-0AB0, as of V2.7

* Not possible in conjunction with fail-safe modules or isochronous mode when configuring using GSD.

** Configuring using GSD not possible in conjunction with fail-safe modules (with HF and FO) and isochronous mode (with HS)

Note

Using an IO-Link master behind a CPU IM151-7 or CPU IM151-8 in DO or IO-Link (actor) operating mode

If the IO-Link master is located behind an ET200S-CPU, the last valid output value may be output in the following cases:

- Switching on the load voltage on the power module PM-E
- Installing the IO-Link master
- CPU startup

Workaround: Write a valid output value in the I/O address area of the IO-Link master in the respective execution level (e. g. OB 100, ...).

- Configure the connected IO-Link devices, encoders, and actuators with the Port Configurator tool *(S7-PCT)* .

Note

Configuration of the encoders and actuators takes place in *S7-PCT* via the data channel in IO-Link operating mode. In addition, diagnostic messages from the encoder/actuator will be forwarded to the CPU in IO-Link operating mode.

See also

Configuration with STEP 7 and S7-PCT (Page 16)
Configuration with STEP 7 and S7-PCT (GSD version) (Page 16)

1.2 Technical specifications

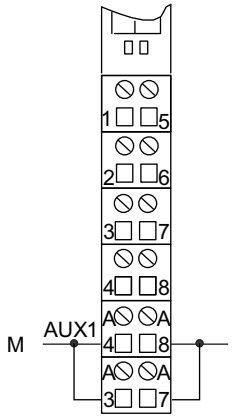
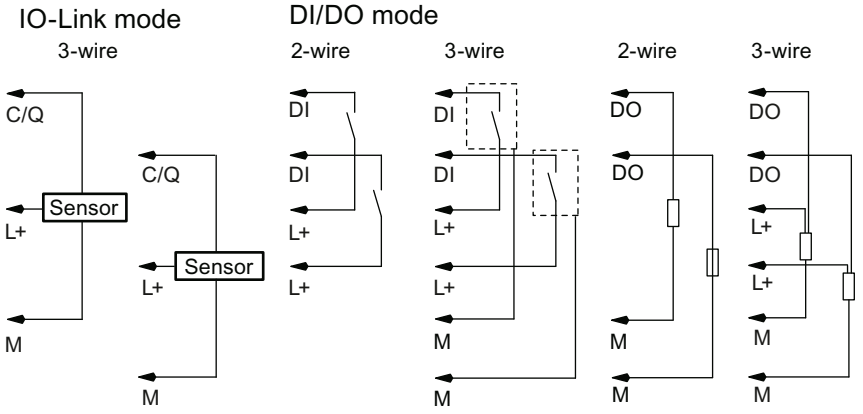
General terminal assignment

Note

Terminals A4, A8, A3 and A7 are only available at specified terminal modules.

Terminal assignment for the 4SI IO-Link electronic module (6ES7138-4GA50-0AB0)				
Terminal	**Assignment**	**Terminal**	**Assignment**	**Notes**
1	C/Q Port 1	**5**	C/Q Port 2	• C/Q: Communication signal / DI/DO • L+: Supply voltage • M: Ground
2	C/Q Port 3	**6**	C/Q Port 4	
3	L+ Port 1	**7**	L+ Port 2	
4	L+ Port 3	**8**	L+ Port 4	
A4	M Port 1 (AUX)	**A8**	M Port 2 (AUX)	
A3	M Port 3 (AUX)	**A7**	M Port 4 (AUX)	

Usable terminal modules

TM-E15C26-A1 (6ES7193-4CA50-0AA0)	← Spring terminal
TM-E15S26-A1 (6ES7193-4CA40-0AA0)	← Screw-type terminal
TM-E15N26-A1 (6ES7193-4CA80-0AA0)	← Fast Connect
	Connection examples 

Note

Connect the terminals AUX1 and M of the associated power module.

Note

The terminals for the IO-Link devices are protected against polarity reversal.

The minimum wire cross-section for the IO-Link devices is 0.25 mm².

For matching connection cables see the appendix "Order numbers (Page 31)".

Block diagram

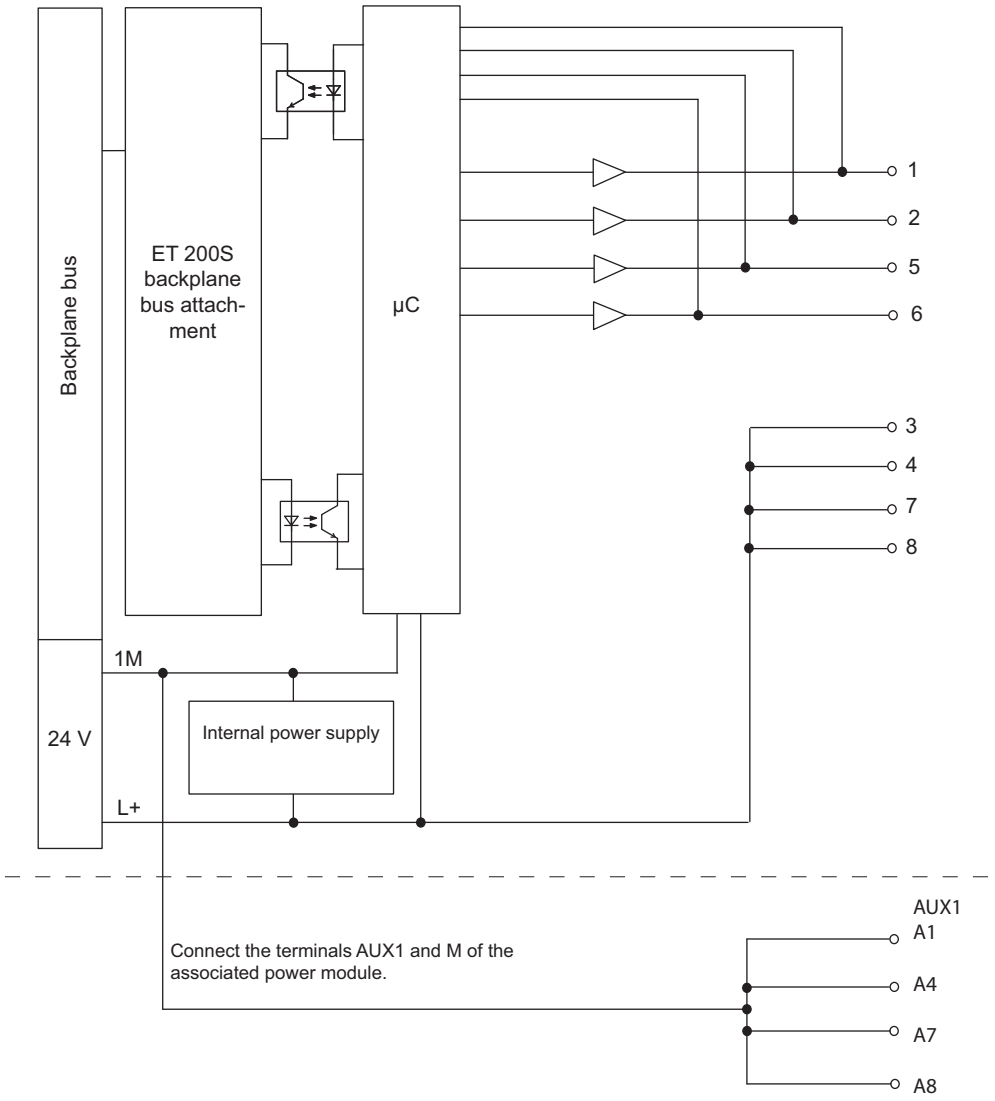


Figure 1-1 Block diagram of the 4SI IO-Link electronic module

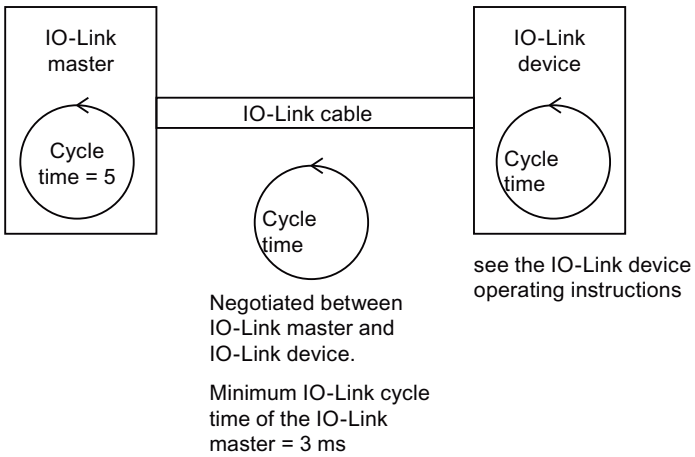
Technical data of the electronic module 4SI IO-Link (6ES7138-4GA50-0AB0)

Dimensions and weight	
Width (mm)	15
Weight	Approximately 50 g
Module-specific data	
Supports isochronous operation	No
Number of inputs / outputs	4
Parameter length	7 bytes in parameter message or in DS1
Address space per port	can be set via PCT [1]
Address space for the 4SI IO-Link module total	32 bytes input and 32 bytes output (Consistency: 8 bytes)
Cable length	
• Unshielded	Max. 20 m
Voltages, currents, potentials	
Rated supply voltage (from the power module)	24 VDC
• Reverse polarity protection	Yes
• Short-circuit resistance	C/Q yes, response threshold 0.4 A per channel (function deactivation, no effect on neighboring ports)
Electrical isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC / 60 VAC
Insulation test voltage	500 VDC
Current consumption	
• From supply voltage	Max. 0.3 A
Power dissipation of the module	Typically 1 W
Status, interrupts, diagnostics	
Status display	1 green LED per channel for IO-Link operating mode
	1 green LED per channel for DI /DO operating mode
Diagnostics function	
• Group error	Red "SF" LED
• Diagnostic information can be displayed	Yes

Data for selecting a sensor	
Connectable IO-Link devices	all IO-Link capable
Connection type	
• IO link	3-wire connection
• DI/DO	2-wire connection 3-wire connection
Transfer rate	4.8 kBd and 38.4 kBd (COM1, COM2) for IO-Link operation; automatically negotiated per port
Operating modes	• IO link • SIO – DI (Type 1) – DO (100 mA per channel, output voltage for Signal "1": typ. 1L+ (-4V)) • Disabled
Response times	
Cycle time	
• of the master to the backplane bus	5 ms
• from the master to the IO-Link device	min. 3 ms

[1] max. 8 bytes input / 8 bytes output

Overview of the response time



Configuring

2

2.1 Configuration with STEP 7

Procedure when configuring IO-Link master and IO-Link devices

Configuration takes place in two steps with STEP 7, V5.4 SP5 or higher:

1. In *HW Config* , you configure the 4SI IO-Link electronic module (IO-Link master) (possibly with GSD).
2. Configure the connected IO-Link devices, encoders, and actuators with the Port Configurator tool *S7-PCT (as of V2.0)* .

Requirements

- STEP 7 V5.4 SP5 or higher
- The Port Configurator tool *S7-PCT (V2.0 or higher)* is installed on the PG/PC.

  You can either install *S7-PCT* together with STEP 7 V5.4 SP5 or higher, or you can download it from the Internet (http://support.automation.siemens.com/WW/view/en/33102519/133100).
- The associated IO-Link IODD file (IO Device Description) is installed in *S7-PCT*. IODD files for the IO-Link devices are available from the manufacturer.
- Optional: The GSD files are installed in HW Config. You can download the GSD files for the ET 200S from the Internet (http://www.siemens.de/automation/csi_en_WW).
- Optional: Install the function block FB "IOL_CALL" for backing up/restoring IO-Link master parameters and IO-Link device parameters.
  You can download the function block from the Internet (http://support.automation.siemens.com/WW/view/en/32011237) .

Behavior in non-configured status and after "Reset to factory settings"

- All ports of the 4SI IO-Link module are disabled.
- All user data are equal to 0.
- The "port qualifier" is set to "invalid" for all ports.
- I&M data 1 to 3 are deleted.

2.1.1 Configuration with STEP 7 and S7-PCT

Configuration of the 4SI IO-Link electronic module with *HW Config*

1. Start the SIMATIC Manager and configure the project as described in the *STEP 7* online help.
2. Select the 4SI IO-Link electronic module in the hardware catalog of *HW Konfig*.
   - PROFIBUS DP > ET 200S > *Interface modules* > IO-Link master modules
   - PROFINET IO > I/O > ET 200S > *Interface Modules* > IO-Link Master Modules
3. Drag and drop the 4SI IO-Link electronic module from the hardware catalog to the configuration table.
4. Configure the 4SI IO-Link electronic module.

Configure the IO-Link devices with the Port Configurator tool

1. Select the 4SI IO-Link electronic module in the configuration table.
2. Right-click and select "**Configure IO-Link**" in the shortcut menu.

   Result: *S7-PCT* will be started.
3. Start by setting the parameters of the IO-Link devices.
   Additional information is available in the *S7-PCT* online help.

2.1.2 Configuration with STEP 7 and S7-PCT (GSD version)

Configuration of the 4SI IO-Link electronic module in *HW Config* with GSD

1. Start the SIMATIC Manager and configure the project as described in the *STEP 7* online help.
2. Select the 4SI IO-Link electronic module in the hardware catalog of *HW Konfig*.
   - PROFIBUS DP > Other FIELD DEVICES > I/O > ET 200S
   - PROFINET IO > I/O > ET 200S > GSD
3. Drag and drop the 4SI IO-Link electronic module from the hardware catalog to the configuration table.
4. Configure the 4SI IO-Link electronic module.

Configure the IO-Link devices with the Port Configurator tool

1. Select the 4SI IO-Link electronic module in the configuration table.
2. Right-click and select "**Start Device Tool**" in the shortcut menu. Click on "S7-PCT" in the submenu.

   Result: *S7-PCT* will be started.
3. Start by setting the parameters of the IO-Link devices.
   Additional information is available in the *S7-PCT* online help.

2.2 Configuration without STEP 7

Basic procedure when configuring IO-Link master and IO-Link devices with S7-PCT standalone

You configure the connected IO-Link devices with the Port Configurator tool S7-PCT (as of V2.0).

Requirements

- The Port Configurator tool *S7-PCT (V2.0 or higher)* is installed on the PG/PC.

  You can either install *S7-PCT* together with STEP 7 V5.4 SP5 or higher, or you can download it from the Internet (http://support.automation.siemens.com/WW/view/en/33102519/133100).
- The associated IO-Link IODD file (IO Device Description) is installed in *S7-PCT*. IODD files for the IO-Link devices are available from the manufacturer.

Configuring the IO devices with the Port Configurator tool

1. Start the S7-PCT port configuration tool from the Windows Start menu
2. Create a new project or open an existing project as described in the online help.
3. Select an IO-Link master.
4. Select the IO-Link device in the hardware catalog of S7-PCT

Parameter

3

3.1 Parameters

Table 3- 1 Parameters of the 4SI IO-Link electronic module

Parameters	Range of values	Default setting	Applicability
Group diagnostics	• Disable • Enable	Disabled	Module
Diagnostics enable for ports 1 to 4	• Disable • Enable	Disabled	Channel

3.2 Parameter description

Group diagnostics parameter

You can generally enable / disable the diagnostics function of the module by setting this parameter.

Parameter for diagnostics enable for ports 1 to 4

This parameter is used to enable diagnostics of the 4 IO-Link ports channel-by-channel. The following assignment applies:

- Port 1 → Channel 1
- Port 2 → Channel 2
- Port 3 → Channel 3
- Port 4 → Channel 4

See also

ET 200S Operating Instructions
(http://support.automation.siemens.com/WW/view/en/1144348)

Functions

4

4.1 Operating modes

Introduction

You can select one of the following operating modes for each of the four ports of the 4SI IO-Link electronic module:

- IO link
- DI
- DO
- Disabled

You make the selection in the Port Configurator tool during configuration. The ports will be disabled without configuration.

Note

The value status (PortQualifier) is relevant in IO-Link mode only.

IO link

In IO-Link operating mode, the port is located in IO-Link communication. There are two data transmission rates in this operating mode. COM1 with 4.8 kBaud; COM2 with 38.4 kBaud. The data transmission rate depends on the used IO-Link device. The 4SI IO-Link electronic module and the used IO-Link device automatically negotiate the maximum data transmission rate at startup.

DI/DO

In the DI/ DO operating mode a port of the 4SI IO-Link electronic module will behave like a standard DI or DO without diagnostics.

Disabled

The respective port of the 4SI IO-Link electronic module is disabled in the Disabled operating mode. The ports are disabled if the 4SI IO-Link electronic module has not been configured with *S7-PCT* yet (default setting).

4.2 Replacing the 4SI IO-Link electronic module without programming device

You can replace the 4SI IO-Link electronic module during operation.

You will have to create a *STEP 7* user program that saves the IO-Link parameters of the 4SI IO-Link electronic module and rewrites them after module replacement.
The function block IOL_CALL supports you when backing up/restoring the IO-Link master parameters.

Acyclic data exchange with the FB IOL_CALL (Page 23)

4.3 Resetting to factory settings

Introduction

Use the function "Resetting to factory defaults" to reset the configurations of your 4 SI IO-Link module made with *S7-PCT* to the factory defaults.

The parameter settings of the 4SI IO-Link module after "Resetting to factory defaults" are as follows:

- All ports of the 4SI IO-Link module are deactivated.
- All user data are equal to 0.
- All bits of the value status (PortQualifier) are set to "invalid."
- The maintenance data 1 to 3 are deleted.

NOTICE
Reset the removed 4SI IO-Link module to factory defaults before putting it into storage.

Procedure

For "Resetting to factory defaults" proceed as described in the *S7-PCT* online help.

4.4 Acyclic data exchange with the FB IOL_CALL

"IOL-CALL" function block

For acyclic data exchange, the function block "IOL-CALL" is available as a download for controllers of the S7-400 and S7-300 families.

The function block supports you in the following tasks:

- Parameterization of an IO-Link device during operation
- Executing IO-Link port functions
- Backing up/restoring IO-Link device parameters
- Backing up/restoring IO-Link master parameters

Procedure for configuring 4SI IO-Link with S7-PCT

1. Copy the IO-Link CALL function block FB1 (including data block DB10) to a STEP 7 project.
2. Use the IO-Link CALL function block FB1 as described in the demo project.

Reference

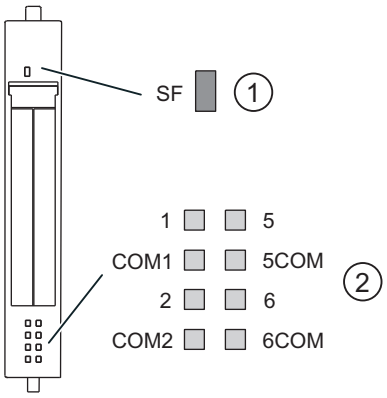
You can download the "IOL-CALL" function block and the description from the Internet (http://support.automation.siemens.com/WW/view/en/32011237).

Diagnostics

5

5.1 Diagnostics using LED display

LED display on the 4SI IO-Link electronic module:



① Group error (red)
② Status display for port status (green)

Status and error displays

Event (LEDs)					Cause	Remedy
SF	1	5	2	6		
on					No parameter assignment.	Check the parameter assignment.
					A diagnostic message is pending.	Evaluate the diagnostics. See chapter "Error types (Page 27)."
	on				Input (DI) or output (DO) at port 1 (terminal 1) enabled.[1]	—
		on			Input (DI) or output (DO) at port 2 (terminal 5) enabled.[1]	—
			on		Input (DI) or output (DO) at port 3 (terminal 2) enabled.[1]	—
				on	Input (DI) or output (DO) at port 4 (terminal 6) enabled.[1]	—
[1] off in IO-Link operating mode						

Event (LEDs)				Cause	Remedy
Com 1	Com 5	Com 2	Com 6		
on				Communication on port 1	—
	on			Communication on port 2	—
		on		Communication on port 3	—
			on	Communication on port 4	—
2 Hz				Start port 1	—
				Steady flashing if functional IO-Link device was not found.	Check the IO-Link devices or the configuration in *S7-PCT*.
	2 Hz			Start port 2	—
				Steady flashing if functional IO-Link device was not found.	Check the IO-Link devices or the configuration in *S7-PCT*.
		2 Hz		Start port 3	—
				Steady flashing if functional IO-Link device was not found.	Check the IO-Link devices or the configuration in *S7-PCT*.
			2 Hz	Start port 4	—
				Steady flashing if functional IO-Link device was not found.	Check the IO-Link devices or the configuration in *S7-PCT*.

5.2 Error types

Introduction

The 4 IO-Link electronic module has 5 channels for which you will receive diagnostics information:

- Channel 0 will report the diagnostics affecting the entire module.
- Channels 1 to 4 will report the diagnostics for ports 1 to 4.

  The diagnostics can be triggered either by the connected IO-Link device or the 4SI IO-Link electronic module if there is a problem with the port.

Error types of the 4 IO-Link electronic module

IO-Link errors are mapped as PROFIBUS DP errors. Mapping takes place as described in *IO-Link Integration Part 1*:

PROFIBUS DP error type		Description (IO-Link error code)	IO-Link master	IO-Link device
1_D	00001: Short circuit	Short circuit at the process cables of the IO-Link device (0x5151)		X
2_D	00010: Undervoltage	Supply voltage too low (0x5110 to 0x5119)		X
4_D	00100: Overload	Overload of the output stage of the IO-Link devices (0x5410)		X
5_D	00101: Overtemperature	• The ambient temperature is too high (0x4110). • IO-Link device too hot (0x4210) • IO temperature exceeded (0x4310)		X
6_D	00110: Open circuit	• No IO-Link device connected • Incorrect IO-Link device connected • Signal cable to IO-Link device interrupted • Signal cable to IO-Link device short-circuited • Short circuit of supply voltage at encoder • IO-Link device addressed with communication cycle time that is too short • IO-Link device cannot communicate due to another error (0xFF10)	X	
7_D	00111: Overflow	• Process tag range exceeded (0x8C10) • Measuring range exceeded (0x8C20)		X
8_D	01000: Underflow	Process tag range too small (0x8C30)		X
9_D	01001: Error	Not all listed IO-Link error codes will be mapped to this PROFIBUS DP error.		X
		Hardware error at IO-Link master detected (0x5011)	X	

PROFIBUS DP error type		Description (IO-Link error code)	IO-Link master	IO-Link device
16_D	10000: Parameter assignment error	IO-Link master could not be configured: • Parameter error on DS1, DS250, DS226, factory reset (0x6320) • Parameter error on the other data sets or they are incompatible with DS1 (0x6321)	X	
		(0x6230 to 0x6340)		X
18_D	10010: Blown fuse	(0x5450 to 0x5459)		X
25_D	11001: Safety shutdown	Serious error (0x1000)	X	
26_D	11010: External fault	• IO-Link device cannot be set to desired mode (0x6100) • IO-Link device has more than 6 errors pending (0xFF31)	X	

Note

For IO-Link devices supplied by Siemens, the manufacturer-specific range 0x8CA0 to 0x8CBF will be mapped to the PROFIBUS DP error types 0 to 31.

Additional information on your IO-Link device is available in the operating instructions.

Address space

6

Properties

The address range of the process image inputs and outputs (PIQ / PII) that is assigned depends on the configuration, i.e. the selection of the relevant entry in *HW Config*.

Configuring by means of GSD file

You can select the following configurations in *HW Config*:

Configuration	PIQ (bytes)	PII (bytes)
32 bytes I / 32 bytes O	32	32
16 bytes I / 16 bytes O	16	16
8 bytes I / 8 bytes O	8	8
4 bytes I / 4 bytes O	4	4
4 bytes I	4	—
4 bytes O	—	4
1 bytes I / 1 bytes O	1	1
1 bytes I	1	—
1 bytes O	—	1

Configurations with the HSP

You can select the following input/output addresses in *HW Config*:

- from 0 to 15 bytes in steps of 1 byte
- from 16 to 32 bytes in steps of 2 bytes

Order numbers

A

A.1 Order numbers for connection cables for 4SI IO-Link electronic module

The following table contains the connecting cables for the sensors on the 4SI IO-Link electronic module. These connecting cables are also listed in the FS 10 catalog (chapter approximation switches, accessories).

Table A- 1 Connecting cables for the 4SI IO-Link electronic module

Name	Order No.:
M 12 cable box for screw-type attachment with 5 m PUR connecting cable 3 x 0.34 mm ^{2}	3RX8 000-0CB32-1AF0
M 12 cable box for screw-type attachment with 5 m PUR connecting cable 4 x 0.34 mm ^{2}	3RX8 000-0CB42-1AF0

A.1 Order numbers for connection cables for 4SI IO-Link electronic module