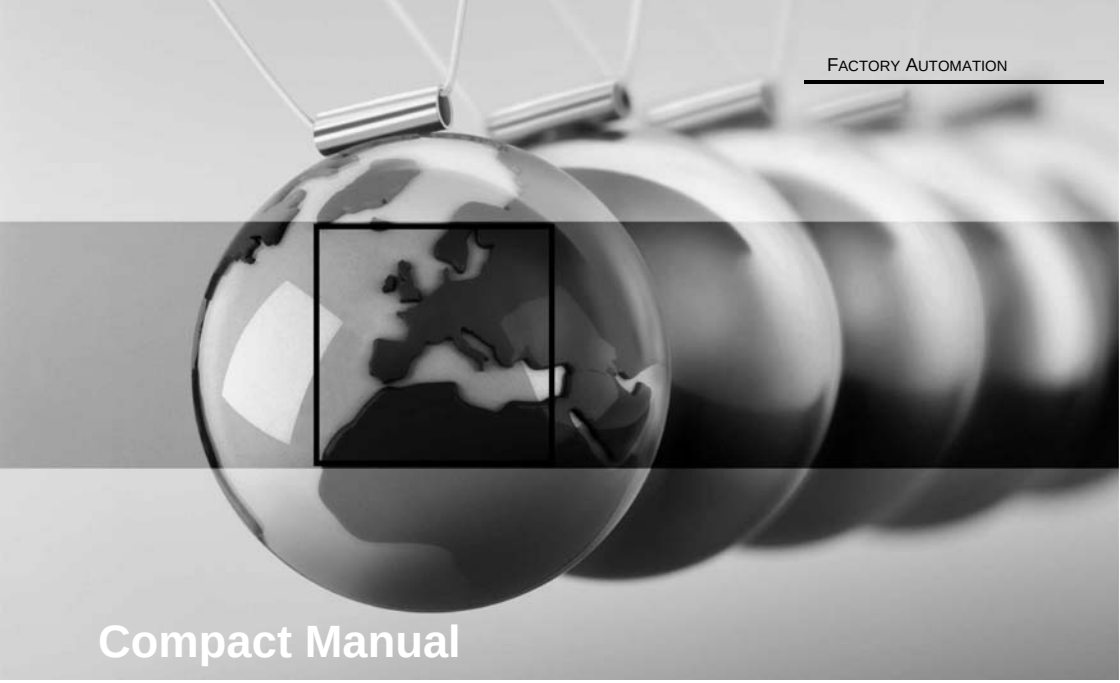

Compact Manual

ETHERCAT GATEWAYS

PEPPERL+FUCHS
SENSING YOUR NEEDS

With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship".

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EtherCAT Gateways

26.02.2016

1. Introduction

Congratulations

You have chosen a device manufactured by Pepperl+Fuchs. Pepperl+Fuchs develops, produces and distributes electronic sensors and interface modules for the market of automation technology on a worldwide scale.

Before installing this equipment and put into operation, read this manual carefully. This manual containes instructions and notes to help you through the installation and commissioning step by step. This makes sure bring such a trouble-free use of this product. This is for your benefit, since this:

- ensures the safe operation of the device
- helps you to exploit the full functionality of the device
- avoids errors and related malfunctions
- avoids costs by disruptions and any repairs
- increases the effectiveness and efficiency of your plant

Keep this manual at hand for subsequent operations on the device.

After opening the packaging please check the integrity of the device and the number of pieces of supplied.

Symbols used

The following symbols are used in this manual:

Information!

This symbol indicates important information.

Attention!

This symbol warns of a potential failure. Non-compliance may lead to interruptions of the device, the connected peripheral systems, or plant, potentially leading to total malfunctioning.

Warning!

This symbol warns of an imminent danger. Non-compliance may lead to personal injuries that could be fatal or result in material damages and destruction.

Contact

If you have any questions about the device, its functions, or accessories, please contact us at:

Pepperl+Fuchs GmbH

Lilienthalstraße 200

68307 Mannheim

Telephone: +49 621 776-4411

Fax: +49 621 776-274411

E-Mail: fa-info@pepperl-fuchs.com

26.02.2016

2. Declaration of conformity

2.1 Declaration of conformity

This product was developed and manufactured under observance of the applicable European standards and guidelines.

Information!

A Declaration of Conformity can be requested from the manufacturer.

The product manufacturer, Pepperl+Fuchs GmbH, D-68307 Mannheim, has a certified quality assurance system that conforms to ISO 9001.

3. Safety

3.1 Symbols relevant to safety

Information!

This symbol indicates important information.

Attention!

This symbol warns of a potential failure. Non-compliance may lead to interruptions of the device, the connected peripheral systems, or plant, potentially leading to total malfunctioning.

Warning!

This symbol warns of an imminent danger. Non-compliance may lead to personal injuries that could be fatal or result in material damages and destruction.

3.2 General notes on safety

Only instructed specialist staff may operate the device in accordance with the operating manual.

User modification and or repair are dangerous and will void the warranty and exclude the manufacturer from any liability. If serious faults occur, stop using the device. Secure the device against inadvertent operation. In the event of repairs, return the device to your local Pepperl+Fuchs representative or sales office.

The connection of the device and maintenance work when live may only be carried out by a qualified electrical specialist.

The operating company bears responsibility for observing locally applicable safety regulations.

Store the not used device in the original packaging. This offers the device optimal protection against impact and moisture.

Ensure that the ambient conditions comply with regulations.

3.3 Disposal

Information!

Electronic waste is hazardous waste. Please comply with all local ordinances when disposing this product!

The device does not contain batteries that need to be removed before disposing it.

4. Setting up the AS-i bus

1. Connect the unit to power.
2. Connect the AS-i cable to the unit.
3. One after the other connect the AS-i slaves to the AS-i cable and set the slave addresses.
   You may set the addresses directly on the slave using a portable addresser or by using the option **[SLAVE ADR TOOL]** in the display menu of your gateway.
4. In the display menu select **[QUICK SETUP]** to use the configuration of all AS-i circuits connected to the unit.
   Confirm with **[STORE+RUN]**.
5. Set the EtherCAT address and connect the gateway to the host fieldbus controller.
   You can set the addresses directly using the option **[ETHERCAT]** in the display menu of your gateway or through the PC using the ASIMON software with integrated AS-i Control Tools.

   The address can also be set by the host controller.

For more detailed information please refer to the installation guide for your gateway which is included with the unit.

5. Configuration and Start-up of the Safety Monitor

Configuration and start-up of the AS-i Safety Monitor is accomplished using a PC/ notebook running the ASIMON configuration software.

Note!

For more detailed information please refer to the separate manual for the ASIMON configuration software.

Configuration should be performed only by a safety specialist. All safety-related commands are password protected.

The correct safety functioning of the unit must absolutely be verified in the system!

Note!

Quick Start Guides for commissioning and service are provided on the website available for download.

6. EtherCAT

6.1 Overview of communication via EtherCAT

The communication via EtherCAT can be basically divided into two communication objects. The process data are transmitted via Process Data Objects (PDOs), while the Service Data Objects (SDOs) are available for the service data.

The objects have the following properties:

- Process Data Objects (PDO):
  - cyclical transmission
  - differentiation between sending- and receiving-PDOs
  - PDOs occupy its own identifier in the EtherCAT network.
- Service Data Objects (SDOs):
  - differentiation between sending- and receiving-PDOs

The main features of „Process Data Objects“ (PDOs) and "Service Data Objects" (SDOs) are shown in the table below.

Process Data Objects (PDOs)	Service Data Objects (SDOs)
used for real time data exchange	provide access to a device object dictionary
typically high priority messages	low priority messages
cyclic transmission	typically acyclic transmission
pre-formatted data field	access to device object directory entry by index and sub-index

6.2 Gateways and Gateways with integrated Safety Monitor with 4 release circuits

6.2.1 Object directory

Rx Prozess Data Objects:	RxPDO are received from the EtherCAT slave. They transmit Prozess Output Data (from the Master to the EtherCAT slave).
Tx Prozess Data Objects:	TxPDO are sent from the EtherCAT slave back to the Ether-CAT-Master. They transmit Process Input Data.

Single Master

Object	Description
0x1000	device type
0x1008	device name
0x1009	hardware version
0x100A	software version
0x1018	identity
0x1600	RxPDO 1. mapping
…	…
0x1603	RxPDO 4. mapping
0x1A00	TxPDO 1. mapping
…	…
0x1A03	TxPDO 4. mapping
0x1C00	Sync manager type
0x1C02	Cycle diagnose
0x1C12	RxPDO assign
0x1C13	TxPDO assign
0x1C32	SM output parameter
0x1C33	SM input parameter
…	…

Tab. 6-1.

Object	Subindex	Description
0x2010	0x01	hi flags, inputs single/A slaves 1 … 15
0x2010	0x02	inputs single/A slaves 16 … 31
0x2010	0x03	inputs B slaves 1 … 15
0x2010	0x04	inputs B slaves 16 … 31
0x2020	0x01	inputs analog slave 1
…	…	…
0x2020	0x1F	inputs analog slave 31
0x2040	0x01	EC flags, outputs single/A slaves 1 … 15
0x2040	0x02	outputs single/A slaves 16 … 31
0x2040	0x03	outputs B slaves 1 … 15
0x2040	0x04	outputs B slaves 16 … 31
0x2050	0x01	outputs analog slave 1
…	…	…
0x2050	0x1F	outputs analog slave 31

Tab. 6-2.

Double Master

Object	Description
0x1000	device type
0x1008	device name
0x1009	hardware version
0x100A	software version
0x1018	identity
0x1600	RxPDO 1. mapping
…	…
0x1607	RxPDO 8. mapping
0x1A00	TxPDO 1. mapping
…	…
0x1A07	TxPDO 8. mapping
0x1C00	Sync manager type
0x1C02	Cycle diagnose
0x1C12	RxPDO assign
0x1C13	TxPDO assign
0x1C32	SM output parameter
0x1C33	SM input parameter
…	…

Tab. 6-3.

Object	Subindex	Description
0x2010	0x01	hi flags, inputs single/A slaves 1 … 15, circuit 1
0x2010	0x02	inputs single/A slaves 16 … 31, circuit 1
0x2010	0x03	inputs B slaves 1 … 15, circuit 1
0x2010	0x04	inputs B slaves 16 … 31, circuit 1
0x2011	0x01	hi flags, inputs single/A slaves 1 … 15, circuit 2
0x2011	0x02	inputs single/A slaves 16 … 31, circuit 2
0x2011	0x03	inputs B slaves 1 … 15, circuit 2
0x2011	0x04	inputs B slaves 16 … 31, circuit 2
0x2020	0x01	inputs analog slave 1, circuit 1
…	…	…
0x2020	0x1F	inputs 16 bit slave 31, circuit 1
0x2021	0x01	inputs 16 bit slave 1, circuit 2
…	…	…
0x2021	0x1F	inputs 16 bit slave 31, circuit 2
0x2040	0x01	EC flags, outputs single/A slaves 1 … 15, circuit 1
0x2040	0x02	outputs single/A slaves 16 … 31, circuit 1
0x2040	0x03	outputs B slaves 1 … 15, circuit 1
0x2040	0x04	outputs B slaves 16 … 31, circuit 1
0x2041	0x01	EC flags, outputs single/A slaves 1 … 15, circuit 2
0x2041	0x02	outputs single/A slaves 16 … 31, circuit 2
0x2041	0x03	outputs B slaves 1 … 15, circuit 2
0x2041	0x04	outputs B slaves 16 … 31, circuit 2
0x2050	0x01	outputs 16 bit slave 1, circuit 1
…	…	…
0x2050	0x1F	outputs 16 bit slave 31, circuit 1
0x2051	0x01	outputs 16 bit slave 1, circuit 2
…	…	…
0x2051	0x1F	outputs 16 bit slave 31, circuit 2

Tab. 6-4.

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Single Master with integrated Safety Monitor

Object	Description
1000	device type
1008	device name
1009	hardware version
100A	software version
1018	Identity
1600	RxPDO 1. mapping
…	…
1604	RxPDO 5.mapping
1A00	TxPDO 1.mapping
…	…
1A05	TxPDO 6.mapping
1C00	sync manager type
1C02	cycle diagnose
1C12	RxPDO assign
1C13	TxPDO assign
1C32	SM output parameter
1C33	SM input parameter
…	…

Tab. 6-5.

Object	Subindex	Description
2010	1	hi flags, inputs single/A slaves 1 … 15
2010	2	inputs single/A slaves 16 … 31
2010	3	inputs B slaves 1 … 15
2010	4	inputs B slaves 16 … 31
2020	1	inputs analog slave 1
…	…	…
2020	31	inputs analog slave 31
2040	1	EC flags, outputs single/A slaves 1 … 15
2040	2	outputs single/A slaves 16 … 31
2040	3	outputs B slaves 1 … 15
2040	4	outputs B slaves 16 … 31
2050	1	outputs analog slave 1
…	…	…
2050	31	outputs analog slave 31
2100	1	safety status internal monitor OSSD 1 … 8
2100	2	safety status internal monitor OSSD 9 … 16

Tab. 6-6.

Double Master with integrated Safety Monitor

Object	Description
1000	device type
1008	device name
1009	hardware version
100A	software version
1018	identity
1600	RxPDO 1. mapping
…	…
1608	RxPDO 9.mapping
1A00	TxPDO 1.mapping
…	…
1A09	TxPDO 10.mapping
1C00	sync manager type
1C02	cycle diagnose
1C12	RxPDO assign
1C13	TxPDO assign
1C32	SM output parameter
1C33	SM input parameter
…	…

Tab. 6-7.

Object	Subindex	Description
2010	1	hi flags, inputs single/A slaves 1 … 15, circuit 1
2010	2	inputs single/A slaves 16 … 31, circuit 1
2010	3	inputs B slaves 1 … 15, circuit 1
2010	4	inputs B slaves 16 … 31, circuit 1
2011	1	hi flags, inputs single/A slaves 1 … 15, circuit 2
2011	2	inputs single/A slaves 16 … 31, circuit 2
2011	3	inputs B slaves 1 … 15, circuit 2
2011	4	inputs B slaves 16 … 31, circuit 2
2020	1	inputs analog slave 1, circuit 1
…	…	…
2020	31	inputs analog slave 31, circuit 1
2021	1	inputs analog slave 1, circuit 2
…	…	…
2021	31	inputs analog slave 31, circuit 2
2040	1	EC flags, outputs single/A slaves 1 … 15, circuit 1
2040	2	outputs single/A slaves 16 … 31, circuit 1
2040	3	outputs B slaves 1 … 15, circuit 1
2040	4	outputs B slaves 16 … 31, circuit 1
2041	1	EC flags, outputs single/A slaves 1 … 15, circuit 2
2041	2	outputs single/A slaves 16 … 31, circuit 2
2041	3	outputs B slaves 1 … 15, circuit 2
2041	4	outputs B slaves 16 … 31, circuit 2
2050	1	outputs analog slave 1, circuit 1
…	…	…
2050	31	outputs analog slave 31, circuit 1
2051	1	outputs analog slave 1, circuit 2
…	…	…
2051	31	outputs analog slave 31, circuit 2
2100	1	safety status internal monitor OSSD 1…8
2100	2	safety status internal monitor OSSD 9…16

Tab. 6-8.

6.2.2 Process data objects

6.2.2.1 AS-i data

This section describes the mapping of AS-i data to EtherCAT-PDOs.

Information!

The process data are assigned fix and can not be configured.

Input and output data image:

PDO	Byte	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
X+1	0	flags				slave 1/1A			
		F3	F2	F1	F0	D3	D2	D1	D0
	1	slave 2/2A				slave 3/3A			
	2	slave 4/4A				slave 5/5A			
	3	slave 6/6A				slave 7/7A			
	4	slave 8/8A				slave 9/9A			
	5	slave 10/10A				slave 11/11A			
	6	slave 12/12A				slave 13/13A			
	7	slave 14/14A				slave 15/15A			
X+2	0	slave 16/16A				slave 17/17A			
	1	slave 18/18A				slave 19/19A			
	2	slave 20/20A				slave 21/21A			
	3	slave 22/22A				slave 23/23A			
	4	slave 24/24A				slave 25/25A			
	5	slave 26/26A				slave 27/27A			
	6	slave 28/28A				slave 29/29A			
	7	slave 30/30A				slave 31/31A			

Tab. 6-9.

X = 0:	Input and output data image circuit 1
X = 35:	Input and output data image circuit 2

Flags

	Input data	Output data
F0	ConfigError	Off-line
F1	APF	LOS-master-bit
F2	PeripheryFault	→ ConfigurationMode
F3	ConfigurationActive	→ ProtectedMode

Tab. 6-10.

ConfigError:	0=ConfigOK, 1=ConfigError
APF:	0=AS-i Power OK, 1=AS-i Power Fail
PeripheryFault:	0=PeripheryOK, 1=PeripheryFault
ConfigurationActive:	0=ProtectedOperationMode, 1=ProjectMode
Off-Line:	0=On-Line, 1=Off-Line
LOS-master-bit:	0=Off-Line by ConfigError deactivated
	1=Off-Line by ConfigError activated

6.2.2.2 Safety Control/Status

Safety Control

Byte	Description	
1	byte from fieldbus	
	bit 0:	1.Y1
	bit 1:	1.Y2
	bit 2:	2.Y1
	bit 3:	2.Y2
	bit 4 ... 7:	reserved
2	bit 0 ... 7:	reserved

Tab. 6-11.

The table shows the color coding as represented in the ASIMON software.

Safety Status per OSSD (release circuit)

Bit value [0 ... 2]	Status or color	Description
0	continuous green	output on
1	flashing green	Wait time for **Stop cat. 1** running
2	continuous yellow	Start-up / Restart block active
3	flashing yellow	External test required / Acknowledgment / Turn-on delay active
4	continuous red	output off
5	flashing red	error
6	grey or off	output not projected
7	reserved	
Bit value [3 ... 5]	**status or color**	
	reserved	
Bit value [6]	**status or color**	
0	no device flashing yellow	
1	at least one device flashing yellow	
Bit value [7]	**status or color**	
0	no device flashing red	
1	at least one device flashing red	

Tab. 6-12. Coding of status bytes

6.2.2.3 Receive PDOs

Single Master

Number	Content
RxPDO 1	hi flags, outputs single/A slaves 1 … 15
RxPDO 2	outputs single/A slaves 16 … 31
RxPDO 3	outputs B slaves 1 … 15
RxPDO 4	outputs B slaves 16 … 31

Tab. 6-13.

Double Master

Number	Content
RxPDO 1	hi flags, outputs single/A slaves 1 … 15, circuit 1
RxPDO 2	outputs single/A slaves 16 … 31, circuit 1
RxPDO 3	outputs B slaves 1 … 15, circuit 1
RxPDO 4	outputs B slaves 16 … 31, circuit 1
RxPDO 5	hi flags, hi flags, outputs single/A slaves 1 … 15, circuit 2
RxPDO 6	outputs single/A slaves 16 … 31, circuit 2
RxPDO 7	outputs B slaves 1 … 15, circuit 2
RxPDO 8	outputs B slaves 16 … 31, circuit 2

Tab. 6-14.

Single Master with integrated Safety Monitor

Number	Content
RxPDO 1	hi flags, outputs single/A slaves 1 … 15
RxPDO 2	outputs single/A slaves 16 … 31
RxPDO 3	outputs B slaves 1 … 15
RxPDO 4	outputs B slaves 16 … 31
RxPDO 5	control internal monitor

Tab. 6-15.

Double Master with integrated Safety Monitor

Number	Content
RxPDO 1	hi flags, outputs single/A slaves 1 … 15, circuit 1
RxPDO 2	outputs single/A slaves 16 … 31, circuit 1
RxPDO 3	outputs B slaves 1 … 15, circuit 1
RxPDO 4	outputs B slaves 16 … 31, circuit 1
RxPDO 5	hi flags, hi flags, outputs single/A slaves 1 … 15, circuit 2
RxPDO 6	outputs single/A slaves 16 … 31, circuit 2
RxPDO 7	outputs B slaves 1 … 15, circuit 2
RxPDO 8	outputs B slaves 16 … 31, circuit 2
RxPDO 9	control internal monitor

Tab. 6-16.

6.2.2.4 Send PDOs

Single Master

Number	Content
TxPDO 1	EC flags, inputs single/A slaves 1 … 15
TxPDO 2	inputs single/A slaves 16 … 31
TxPDO 3	inputs B slaves 1 … 15
TxPDO 4	inputs B slaves 16 … 31

Tab. 6-17.

Double Master

Number	Content
TxPDO 1	EC flags, inputs single/A slaves 1 … 15, circuit 1
TxPDO 2	inputs single/A slaves 16 … 31, circuit 1
TxPDO 3	inputs B slaves 1 … 15, circuit 1
TxPDO 4	inputs B slaves 16 … 31, circuit 1
TxPDO 5	EC flags, inputs single/A slaves 1 … 15, circuit 2
TxPDO 6	inputs single/A slaves 16 … 31, circuit 2
TxPDO 7	inputs B slaves 1 … 315, circuit 2
TxPDO 8	inputs B slaves 16 … 31, circuit 2

Tab. 6-18.

Single Master with integrated Safety Monitor

Number	Content
TxPDO 1	EC flags, inputs single/A slaves 1 … 15
TxPDO 2	inputs single/A slaves 16 … 31
TxPDO 3	inputs B slaves 1 … 15
TxPDO 4	inputs B slaves 16 … 31
TxPDO 5	status internal monitor OSSD 1 … 8
TxPDO 6	status internal monitor OSSD 9 … 16

Tab. 6-19.

Double Master with integrated Safety Monitor

Number	Content
TxPDO 1	EC flags, inputs single/A slaves 1 … 15, circuit 1
TxPDO 2	Inputs single/A slaves 16 … 31, circuit 1
TxPDO 3	Inputs B slaves 1 … 15, circuit 1
TxPDO 4	Inputs B slaves 16 … 31, circuit 1
TxPDO 5	EC flags, inputs single/A slaves 1 … 15, circuit 2
TxPDO 6	Inputs single/A slaves 16 … 31, circuit 2
TxPDO 7	Inputs B slaves 1 … 315, circuit 2
TxPDO 8	Inputs B slaves 16 … 31, circuit 2
TxPDO 9	status internal monitor OSSD 1 … 8
TxPDO 10	status internal monitor OSSD 9 … 16

Tab. 6-20.

6.2.3 Service data objects

6.2.3.1 AS-i data

This section describes the mapping of AS-i data to EtherCAT-SDOs.

The SDOs for the digital inputs and outputs have the same structure as the PDOs.

Analog in/out data image

Subindex	Byte	Content
0x01	0	analog slave 1, channel 0 low
	1	analog slave 1, channel 0 high
	...	…
	6	analog slave 1, channel 3 low
	7	analog slave 1, channel 3 high
…	…	…
0x1F	0	analog slave 31, channel 0 low
	1	analog slave 31, channel 0 high
	...	…
	6	analog slave 31, channel 3 low
	7	analog slave 31, channel 3 high

Tab. 6-21.

6.2.3.2 Receive SDOs

Single Master

Object	Subindex	Description
0x2040	0x01	EC flags, outputs single/A slaves 1 … 15
0x2040	0x02	outputs single/A slaves 16 … 31
0x2040	0x03	outputs B slaves 1 … 15
0x2040	0x04	outputs B slaves 16 … 31
0x2050	0x01	outputs analog slave 1
…	…	…
0x2050	0x1F	outputs analog slave 31

Tab. 6-22.

Double Master

Object	Subindex	Description
0x2040	0x01	EC flags, outputs single/A slaves 1 … 15, circuit 1
0x2040	0x02	outputs single/A slaves 16 … 31, circuit 1
0x2040	0x03	outputs B slaves 1 … 15, circuit 1
0x2040	0x04	outputs B slaves 16 … 31, circuit 1
0x2041	0x01	EC flags, outputs single/A slaves 1 … 15, circuit 2
0x2041	0x02	outputs single/A slaves 16 … 31, circuit 2
0x2041	0x03	outputs B slaves 1 … 15, circuit 2
0x2041	0x04	outputs B slaves 16 … 31, circuit 2
0x2050	0x01	outputs analog slave 1, circuit 1
…	…	…
0x2050	0x1F	outputs analog slave 31, circuit 1
0x2051	0x01	outputs analog slave 1, circuit 2
…	…	…
0x2051	0x1F	outputs analog slave 31, circuit 2

Tab. 6-23.

Single Master with integrated Safety Monitor

Object	Subindex	Description
2040	1	EC flags, outputs single/A slaves 1 … 15
2040	2	outputs single/A slaves 16 … 31
2040	3	outputs B slaves 1 … 15
2040	4	outputs B slaves 16 … 31
2050	1	outputs analog slave 1
		…
2050	31	outputs analog slave 31
2130	1	safety control internal monitor

Tab. 6-24.

Double Master with integrated Safety Monitor

Object	Subindex	Description
2040	1	EC flags, outputs single/A slaves 1 … 15, circuit 1
2040	2	outputs single/A slaves 16 … 31, circuit 1
2040	3	outputs B slaves 1 … 15, circuit 1
2040	4	outputs B slaves 16 … 31, circuit 1
2041	1	EC flags, outputs single/A slaves 1 … 15, circuit 2
2041	2	outputs single/A slaves 16 … 31, circuit 2
2041	3	outputs B slaves 1 … 15, circuit 2
2041	4	outputs B slaves 16 … 31, circuit 2
2050	1	outputs analog slave 1, circuit 1
		…
2050	31	outputs analog slave 31, circuit 1
2051	1	outputs analog slave 1, circuit 2
		…
2051	31	outputs analog slave 31, circuit 2
2130	1	safety control internal monitor

Tab. 6-25.

6.2.3.3 Send SDOs

Single Master

Object	Subindex	Description
0x2010	0x01	Hi flags, inputs single/A slaves 1 … 15
0x2010	0x02	inputs single/A slaves 16 … 31
0x2010	0x03	inputs B slaves 1 … 15
0x2010	0x04	inputs B slaves 16 … 31
0x2020	0x01	inputs analog slave 1
…	…	…
0x2020	0x1F	inputs analog slave 31

Tab. 6-26.

Double Master

Object	Subindex	Description
0x2010	0x01	Hi flags, inputs single/A slaves 1 … 15, circuit 1
0x2010	0x02	inputs single/A slaves 16 … 31, circuit 1
0x2010	0x03	inputs B slaves 1 … 15, circuit 1
0x2010	0x04	inputs B slaves 16 … 31, circuit 1
0x2011	0x01	Hi flags, inputs single/A slaves 1 … 15, circuit 2
0x2011	0x02	inputs single/A slaves 16 … 31, circuit 2

Tab. 6-27.

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Double Master

Object	Subindex	Description
0x2011	0x03	inputs B slaves 1 … 15, circuit 2
0x2011	0x04	inputs B slaves 16 … 31, circuit 2
0x2020	0x01	inputs analog slave 1, circuit 1
…	…	…
0x2020	0x1F	inputs analog slave 31, circuit 1
0x2021	0x01	inputs analog slave 1, circuit 2
…	…	…
0x2021	0x1F	inputs analog slave 31, circuit 2

Tab. 6-27.

Single Master with integrated Safety Monitor

Object	Subindex	Description
2010	1	Hi flags, inputs single/A slaves 1 … 15
2010	2	inputs single/A slaves 16 … 31
2010	3	inputs B slaves 1 … 15
2010	4	inputs B slaves 16 … 31
2020	1	inputs analog slave 1
…	…	…
2020	31	inputs analog slave 31
2100	1	safety status internal monitor OSSD 1 … 8
2100	2	safety status internal monitor OSSD 9 … 16

Tab. 6-28.

Double Master with integrated Safety Monitor

Object	Subindex	Description
2010	1	Hi flags, inputs single/A slaves 1 … 15, circuit 1
2010	2	inputs single/A slaves 16 … 31, circuit 1
2010	3	inputs B slaves 1 … 15, circuit 1
2010	4	inputs B slaves 16 … 31, circuit 1
2011	1	Hi flags, inputs single/A slaves 1 … 15, circuit 2
2011	2	inputs single/A slaves 16 … 31, circuit 2
2011	3	inputs B slaves 1 … 15, circuit 2
2011	4	inputs B slaves 16 … 31, circuit 2
2020	1	inputs analog slave 1, circuit 1
…	…	…
2020	31	inputs analog slave 31, circuit 1
2021	1	inputs analog slave 1, circuit 2
…	…	…
2021	31	inputs analog slave 31, circuit 2
2100	1	safety status internal monitor OSSD 1 … 8
2100	2	safety status internal monitor OSSD 9 … 16

Tab. 6-29.

6.3 Gateways with integrated Safety Monitor with 6 release circuits

6.3.1 Object directory

Rx Prozess Data Objects:	RxPDO are received from the EtherCAT slave. They transmit Prozess Output Data (from the Master to the EtherCAT slave).
Tx Prozess Data Objects:	TxPDO are sent from the EtherCAT slave back to the Ether-CAT-Master. They transport Process Input Data.
receiving data:	*read* only.
send data:	*read* and *write*.
„Circ 1“:	AS-i circuit 1 (with double master)
„Circ 2“:	AS-i circuit 2 (with double master)

Objects Single/Double Master with integrated Safety Monitor

Object	Subindex	Description	Data direction	Process data objects
0x1000	0	Device type	received data	
0x1008	0	Device name	received data	
0x1009	0	Hardware version	received data	
0x100A	0	Software version	received data	
0x1018		Identity		
0x1018	1	Vendor ID	received data	
0x1018	2	Product code	received data	
0x1018	3	Revision	received data	
0x1018	4	Serial number	received data	
0x16XX		RxPDO mapping	received data	
0x1AXX		TxPDO mapping	received data	
0x1C00		Sync manager type		
0x1C12		RxPDO assign	send data	
0x1C13		TxPDO assign	send data	
0x1C32		SM output parameter		
0x1C33		SM input parameter		

Tab. 6-30.

Objects Single Master with integrated Safety Monitor

Object	Subindex	Description	Data Direction	Process Data Objects
		Digital inputs		
0x2010	1	EC flags, inputs single/A slave s 1..15	received data	TxPDO
0x2010	2	inputs single/A slave s 16..31	received data	TxPDO
0x2010	3	EC flags, inputs B slave s 1..15	received data	TxPDO
0x2010	4	inputs B slave s 16..31	received data	TxPDO
		Analog inputs		
0x2020	1	analog inputs, slave 1	received data	TxPDO
...	...	...	...	...
0x2020	31	analog inputs, slave 31	received data	TxPDO
		Digital outputs		
0x2040	1	hi flags, outputs single/A slave s 1..15	send data	RxPDO
0x2040	2	outputs single/A slave s 16..31	send data	RxPDO
0x2040	3	outputs B slave s 1..15	send data	RxPDO
0x2040	4	outputs B slave s 16..31	send data	RxPDO
		Analog outputs		
0x2050	1	analog outputs, slave 1	send data	RxPDO
...	...	...	...	...
0x2050	31	analog outputs, slave 31	send data	RxPDO
		Flags + Fault Detector		
0x2210	1	flags + fault detector	received data	TxPDO

Tab. 6-31.

Objects Double master with integrated Safety Monitor

Object	Subindex	Description	Data Direction	Process Data Objects
		Digital Inputs, Circuit 1		
0x2010	1	EC flags, inputs single/A slave 1 … 15, circuit 1	received data	TxPDO
0x2010	2	inputs single/A slave 16 … 31, circuit 1	received data	TxPDO
0x2010	3	EC flags, inputs B slave 1 … 15, circuit 1	received data	TxPDO
0x2010	4	inputs B slave 16 … 31, circuit 1	received data	TxPDO
		Digital Inputs, Circuit 2		
0x2011	1	EC flags, inputs single/A slave 1 … 15, circuit 2	received data	TxPDO
0x2011	2	inputs single/A slave 16 … 31, circuit 2	received data	TxPDO
0x2011	3	EC flags, inputs B slave 1 … 15, circuit 2	received data	TxPDO
0x2011	4	inputs B slave 16 … 31, circuit 2	received data	TxPDO
		Analog Inputs, Circuit 1		
0x2020	1	analog inputs, slave 1, circuit 1	received data	TxPDO
…	…	…	…	…
0x2020	31	analog inputs, slave 31, circuit 1	received data	TxPDO
		Analog Inputs, Circuit 2		
0x2021	1	analog inputs, slave 1, circuit 2	received data	TxPDO
…	…	…	…	…
0x2021	31	analog inputs, slave 31, circuit 2	received data	TxPDO
		Digital Outputs, Circuit 1		
0x2040	1	Hi flags, outputs single/A slave 1 … 15, circuit 1	send data	RxPDO
0x2040	2	outputs single/A slave 16 … 31, circuit 1	send data	RxPDO
0x2040	3	outputs B slave 1 … 15, circuit 1	send data	RxPDO
0x2040	4	outputs B slave 16 … 31, circuit 1	send data	RxPDO
		Digital Outputs, Circuit 2		
0x2041	1	Hi-flags, outputs single/A slave 1 … 15, circuit 2	send data	RxPDO
0x2041	2	outputs single/A slave 16 … 31, circuit 2	send data	RxPDO
0x2041	3	outputs B slave 1 … 15, circuit 2	send data	RxPDO
0x2041	4	outputs B slave 16 … 31, circuit 2	send data	RxPDO
		Analog Outputs, Circuit 1		
0x2050	1	analog outputs, slave 1, circuit 1	send data	RxPDO
…	…	…	…	…
0x2050	31	analog outputs, slave 31, circuit 1	send data	RxPDO
0x2051		analog outputs, circuit 2		
0x2051	1	analog outputs, slave 1, circuit 2	send data	RxPDO
…	…	…	…	…
0x2051	31	analog outputs, slave 31, circuit 2	send data	RxPDO
		Flags + Fault Detector, Circuit 1		
0x2210	1	flags + fault detector, circuit 1	received data	TxPDO
		Flags + Fault Detector, Circuit 2		
0x2211	1	flags + fault detector, circuit 2	received data	TxPDO

Tab. 6-32.

Objects Internal Monitor

Object	Subindex	Description	Data Direction	Process Data Objects
		Safety Status (Internal Monitor)		
0x2100	1	safety status internal monitor, channels 1 ... 8	received data	TxPDO
0x2100	2	safety status internal monitor, channels 9 ... 16	received data	TxPDO
0x2100	3	safety status internal monitor, channels 17 ... 24	received data	TxPDO
0x2100	4	safety status internal monitor, channels 25 ... 32	received data	TxPDO
		Fieldbus Bits (Internal Monitor)		
0x2101	1	safety fieldbus bits internal monitor	received data	TxPDO
		Monitor and local I/O Info		
0x2103	1	bytes monitor and local I/O info (byte 0 … 6)	received data	TxPDO
		Safety Control (Internal Monitor)		
0x2130	1	Safety Control internal monitor	send data	RxPDO
		Power on offline		
0x2301	1	Power on offline	send data	

Tab. 6-33. Safety status, fieldbus bits, monitor and local I/O info, safety control, power on offline (internal monitor)

6.3.2 Digital Data

6.3.2.1 Input Data Image IDI

Object	Sub-index	Description	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
				F3/D3	F2/D2	F1/D1	F0/D0	D3	D2	D1	D0
0x2010; 0x2011.	1	EC flags, inputs single/A slaves 1 ...15, circ 1; EC flags, inputs single/A slaves 1..15, circ 2.	0	flags				slave 1/1A			
			1	slave 2/2A				slave 3/3A			
			2	slave 4/4A				slave 5/5A			
			3	slave 6/6A				slave 7/7A			
			4	slave 8/8A				slave 9/9A			
			5	slave 10/10A				slave 11/11A			
			6	slave 12/12A				slave 13/13A			
			7	slave 14/14A				slave 15/15A			
	2	inputs single/A slaves 16..31, circ 1; inputs single/A slaves 16..31, circ 2.	0	slave 16/16A				slave 17/17A			
			1	slave 18/18A				slave 19/19A			
			2	slave 20/20A				slave 21/21A			
			3	slave 22/22A				slave 23/23A			
			4	slave 24/24A				slave 25/25A			
			5	slave 26/26A				slave 27/27A			
			6	slave 28/28A				slave 29/29A			
			7	slave 30/30A				slave 31/31A			
	3	EC flags, inputs B slaves 1..15, circ 1; EC flags, inputs B slaves 1..15, circ 2.	0	flags				slave 1B			
			1	slave 2B				slave 3B			
			2	slave 4B				slave 5B			
			3	slave 6B				slave 7B			
			4	slave 8B				slave 9B			
			5	slave 10B				slave 11B			
			6	slave 12B				slave 13B			
			7	slave 14B				slave 15B			
	4	inputs B slaves 16..31, circ 1; inputs B slaves 16..31, circ 2.	0	slave 16B				slave 17B			
			1	slave 18B				slave 19B			
			2	slave 20B				slave 21B			
			3	slave 22B				slave 23B			
			4	slave 24B				slave 25B			
			5	slave 26B				slave 27B			
			6	slave 28B				slave 29B			
			7	slave 30B				slave 31B			

Tab. 6-34. EC flags inputs (single/double master)

6.3.2.2 Output Data Image ODI

Object	Sub-index	Description	Byte	Bit 7 F3/D3	Bit 6 F2/D2	Bit 5 F1/D1	Bit 4 F0/D0	Bit 3 D3	Bit 2 D2	Bit 1 D1	Bit 0 D0
0x2040; 0x2041	1	Hi flags, outputs single/A slaves 1 … 15, circ 1; Hi flags, outputs single/A slaves 1 … 15, circ 2.	0	flags				slave 1/1A			
			1	slave 2/2A				slave 3/3A			
			2	slave 4/4A				slave 5/5A			
			3	slave 6/6A				slave 7/7A			
			4	slave 8/8A				slave 9/9A			
			5	slave 10/10A				slave 11/11A			
			6	slave 12/12A				slave 13/13A			
			7	slave 14/14A				slave 15/15A			
	2	outputs single/A slaves 16 … 31, circ 1; outputs single/A slaves 16 … 31, circ 2.	0	slave 16/16A				slave 17/17A			
			1	slave 18/18A				slave 19/19A			
			2	slave 20/20A				slave 21/21A			
			3	slave 22/22A				slave 23/23A			
			4	slave 24/24A				slave 25/25A			
			5	slave 26/26A				slave 27/27A			
			6	slave 28/28A				slave 29/29A			
			7	slave 30/30A				slave 31/31A			
	3	outputs B slaves 1 … 15, circ 1; outputs B slaves 1 … 15, circ 2.	0	flags				slave 1B			
			1	slave 2B				slave 3B			
			2	slave 4B				slave 5B			
			3	slave 6B				slave 7B			
			4	slave 8B				slave 9B			
			5	slave 10B				slave 11B			
			6	slave 12B				slave 13B			
			7	slave 14B				slave 15B			
	4	outputs B slaves 16 … 31, circ 1; outputs B slaves 16 … 31, circ 2.	0	slave 16B				slave 17B			
			1	slave 18B				slave 19B			
			2	slave 20B				slave 21B			
			3	slave 22B				slave 23B			
			4	slave 24B				slave 25B			
			5	slave 26B				slave 27B			
			6	slave 28B				slave 29B			
			7	slave 30B				slave 31B			

Tab. 6-35. EC flags outputs (single/Double master)

Flags

Bits	Input data	Output data
F0	ConfigError	Off-line
F1	APF	LOS-master-bit
F2	PeripheryFault	-> ConfigurationMode
F3	ConfigurationActive	-> ProtectedMode

Tab. 6-36.

ConfigError	0=ConfigOK	1=ConfigError
APF	0=AS-i Power OK	1=AS-i Power Fail
PeripheryFault	0=AS-i Power OK	1=PeripheryFault
ConfigurationActive	0=ProtectedOperationMode	1=ProjectMode
Off-Line:	0=On-Line	1=Off-Line
LOS-master-bit:	0=Off-Line by ConfigError deactivated	1=Off-Line by ConfigError activated

6.3.3 Analog data

This section describes the analog process data (16-bit I/O data). If you have analog slaves in your AS-i network, incorporate them as described in the following.

Object	Subindex	Description	Byte	Content
0x2020; 0x2021; 0x2050; 0x2051.	1	analog inputs, slave 1, circ 1; analog inputs, slave 1, circ 2; analog outputs, slave 1, circ 1; analog outputs, slave 1, circ 2.	0	analog slave 1, channel 0, low byte
			1	analog slave 1, channel 0, high byte
			2	analog slave 1, channel 1, low byte
			3	analog slave 1, channel 1, high byte
			4	analog slave 1, channel 2, low byte
			5	analog slave 1, channel 2, high byte
			6	analog slave 1, channel 3, low byte
			7	analog slave 1, channel 3, high byte
	...			
	31	analog inputs, slave 31, circ 1; analog inputs, slave 31, circ 2; analog outputs, slave 31, circ 1; analog outputs, slave 31, circ 2.	0	analog slave 31, channel 0, low byte
			1	analog slave 31, channel 0, high byte
			2	analog slave 31, channel 1, low byte
			3	analog slave 31, channel 1, high byte
			4	analog slave 31, channel 2, low byte
			5	analog slave 31, channel 2, high byte
			6	analog slave 31, channel 3, low byte
			7	analog slave 31, channel 3, high byte

Tab. 6-37. Analog data (option single/double master")

Information!

A slaves map the data on channels 1 and 2.

B slaves map the data on channels 3 and 4.

6.3.4 Flags + Fault Detector

These flags indicate in the individual bits the operating status of the AS-i EtherCAT Gateway and should be evaluated in the application program.

Object	Subindex	Description	Byte	Content
0x2210	1	Flags + Fault Detector, circuit 1	0	bit 0: configuration error
				bit 1: slave with address '0' detected
				bit 2: auto_address_assignment *not* available
				bit 3: auto_address_assignment available
				bit 4: configuration mode active
				bit 5: *not* in normal operation
				bit 6: AS-i power fail
				bit 7: AS-i master offline
			1	bit 0: periphery fault
				bit 1: reserved
				bit 2: failure $24V_{AUX}$ (option safety monitor)
				bit 3: failure redundant $24V_{AUX}$ (option single master)
				bit 4: earth fault
				bit 5: over voltage
				bit 6: noise
				bit 7: duplicate address
0x2211	1	Flags + Fault Detector, circuit 2	0	bit 0: configuration error
				bit 1: slave with address '0' detected
				bit 2: auto_address_assignment *not* available
				bit 3: auto_address_assignment available
				bit 4: configuration mode active
				bit 5: *not* in normal operation
				bit 6: AS-i power fail
				bit 7: AS-i master offline
			1	bit 0: periphery fault
				bit 1: reserved
				bit 2: failure $24V_{AUX}$ (option safety monitor)
				bit 3: failure redundant $24V_{AUX}$ (option single master)
				bit 4: earth fault
				bit 5: over voltage
				bit 6: noise
				bit 7: duplicate address

Tab. 6-38. Flags + fault detector (single/double master)

6.3.5 Safety/Control Status

Safety Status internal monitor (data for read access)

Object	Subindex	Description	Byte	Content[1]
0x2100	1	safety status internal monitor, channels 1…8	0	status OSSD 1
			1	status OSSD 2
			2	status OSSD 3
			3	status OSSD 4
			4	status OSSD 5
			5	status OSSD 6
			6	status OSSD 7
			7	status OSSD 8
	...			
	8	safety status internal monitor, channels 57…64	0	status OSSD 57
			1	status OSSD 58
			2	status OSSD 59
			3	status OSSD 60
			4	status OSSD 61
			5	status OSSD 62
			6	status OSSD 63
			7	status OSSD 64

Tab. 6-39. Safety Status (option single/double master)

1. See Tab. <Coding of status bytes> for color-coding of the OSSD states.

The table shows the color coding as represented in the ASIMON software.

Safety Status per OSSD (release circuit)

Bit value [0 ... 2]	**Status or color**	**Description**
0	continuous green	output on
1	flashing green	Wait time for **Stop cat. 1** running
2	continuous yellow	Start-up / Restart block active
3	flashing yellow	External test required / Acknowledgment / Turn-on delay active
4	continuous red	output off
5	flashing red	error
6	grey or off	output not projected
7	reserved	
Bit value [3 ... 5]	**status or color**	
	reserved	
Bit value [6]	**status or color**	
0	no device flashing yellow	
1	at least one device flashing yellow	
Bit value [7]	**status or color**	
0	no device flashing red	
1	at least one device flashing red	

Tab. 6-40. Coding of status bytes

Safety Control internal monitor (data for write access)

Object	Subindex	Description	Byte	Content
0x2130	1	Safety Control internal monitor	0	Byte from the fieldbus
				Bit 0: SI1
				Bit 1: SI2
				Bit 2: SI3
				Bit 3: SI4
				Bit 4 … 7: reserved In the safety version „SV 4.3“ Bit 4 … 7: FB_{04} … FB_{07}
			1	reserved In the safety-version „SV 4.3“ Bit 0…7: FB_{08} … FB_{15}

Tab. 6-41. Safety control (single/double master)

FB: Fieldbus Bit
FB_{04} ... FB_{15}: Outputs

6.3.6 Fieldbus Bits

Information!

This functionality is only available in devices in the safety version 'SV 4.3' (see lateral label)!

The fieldbus bits enable communication between the controller and the safety program. The fieldbus bits can be used to pass any acknowledgment signals or similar to the safety program and provide status information to the controller.

The states of the AS-i Safety in- and outputs are sent to the controller via the input data image (see par. <Safety diagnostics in the Input Data Image (IDI)>).

Object	Subindex	Description	Data Direction	Process data objects	Annotation
Fieldbus Bits internal monitor					
0x2101	1	safety fieldbus bits internal monitor	received data	TxPDO	Safety-Version "SV4.3"

Tab. 6-42. Safety Fieldbus Bits (internal Monitor)

Fieldbus Bits (internal monitor)

Object	Subindex	Description	Byte	Content
0x2101	1	**Fieldbus Bits internal monitor**	0	bit 0: SI1
				bit 1: SI2
				bit 2: SI3
				bit 3: SI4
				bit 4: FB_{04}
				bit 5: FB_{05}
				bit 6: FB_{06}
				bit 7: FB_{07}
			1	bit 0: FB_{08}
				bit 1: FB_{09}
				bit 2: FB_{10}
				bit 3: FB_{11}
				bit 4: FB_{12}
				bit 5: FB_{13}
				bit 6: FB_{14}
				bit 7: FB_{15}

Tab. 6-43.

FB: fieldbus-bit
SI1 ... SI4: monitor-inputs

Information!

Additional information can be found in system manual "ASIMON configuration software", section "Monitoring devices -> Fieldbus bit" and "Output assignment".

6.3.7 Monitor and I/O Data

The object contains 6 bytes of information about the current switching states of the local in- and outputs as well as 1 byte of monitor information.

Object	Sub-index	Description	Byte		Content
0x2103	1	7 bytes monitor and local I/O info (byte 0..6)	0	Monitor Info	bit 0. 0: configuration mode 1: protection mode
					bit 1. 0: 24V missing 1: 24V OK
					bit 2..5: reserved
					bit 6: 1: at least one device yellow flashing
					bit 7: 1: at least one device red flashing
			1	Status SI1/SI2	bit 0. status SI1
					bit 1 status SI2
					bit 2 … 3. device-color
					bit 4. 0: no input 1: input
					bit 5 … 7. reserved
			2	Status SI3/SI4	bit 0. status SI3
					bit 1. status SI4
					bit 2 … 3. device-color
					bit 4. 0: no input 1: input
					bit 5 … 7. reserved
			3	Status SI5/SI6	bit 0. status SI5
					bit 1. status SI6
					bit 2 … 3. device-color
					bit 4. 0: no input 1: input
					bit 5 … 7. reserved
			4	Status SO1/ SO2	bit 0. status SO1
					bit 1. status SO2
					bit 2 … 3. device-color
					bit 4. 0: no input 1: input
					bit 5 …7. reserved
			5	Status SO3/ SO4	bit 0. status SO3
					bit 1. status SO4
					bit 2 … 3. device-color
					bit 4. 0: no input 1: input
					bit 5 … 7. reserved

Tab. 6-44.

Object	Sub-index	Description	Byte		Content
			6	Status SO5/ SO6	bit 0. status SO5
					bit 1. status SO6
					bit 2 … 3. Device-color
					bit 4. 0: no input 1: input
					bit 5 … 7. reserved
			7	reserved	

Tab. 6-44.

Status
0 switched off
1 switched on

Device colors (only if clamping terminals are used as a safety input)

Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	X	X	device color: red, green or gray
0	1	X	X	device color: yellow ("wait")
1	0	X	X	device color: yellow flashing ("test")
1	1	X	X	device color: red flashing ("error")

Tab. 6-45. Color of the associated safety-relevant component:

6.3.8 Failsafe Behavior

Settings of the master behavior in case of failure of AS-i slaves.

clear:	input data set to 0_{hex} (standard)
set:	input data set to F_{hex}.
hold:	input data are kept on the last valid value.

Object	Subindex	Description	Byte	Content
0x2302	1	Failsafe Behavior, circ 1	0	0: clear 1: set 2: hold
	2	Failsafe Behavior, circ 2	0	0: clear 1: set 2: hold

Tab. 6-46. Failsafe behavior (option single/double master)

6.3.9 IDI Substitution Mode

Setting the substitution of safety related AS-i slaves input data

no change:	no change
no substitution:	no substitution (code sequence)
substitution values:	substitution on the basis of status switch
diagnostic values:	substitution on the basis of status switch and the corresponding safety related device

Object	Subindex	Description	Byte	Content
0x2305	1	IDI Substitution Mode, circ 1	0	0: no change 1: no substitution 2: substitution values 3: diagnostic values
	2	IDI Substitution Mode, circ 2	0	0: no change 1: no substitution 2: substitution values 3: diagnostic values

Tab. 6-47. IDI Substitution Mode (option single/double master)

7. Diagnostics

7.1 System diagnostics on the PC

7.1.1 Software for diagnostics, service and release measurements

The intuitively constructed software for diagnostics, service and release measurements enables PC-assisted measurement using the high-level measuring technology built into the masters.

This specially developed software assists both machine and systems builders in release measurements and preventive troubleshooting as well as end users in preventive maintenance and fast, self-performed error elimination. As an option the analysis data can also be sent to our technical support group and used as the basis for fast, reliable help with problem handling.

7.1.2 AS-i Control Tools

The Software AS-i Control Tools provide you with all the key testing and configuration possibilities of your AS-i circuit in organized fashion on your PC.

A graphic representation of your AS-i network provides you with a quick overview of the system status, showing for example any missing or unprojected slaves. In addition, peripheral errors and the status of the "AS-i Monitors" integrated into the Masters. The **diagnostic buffer** (not available with all devices!) stores with a time stamp in a ring buffer up to 1024 events. The AS-i Control Tools software also provides a simple and convenient way to configure new AS-i circuits or modify already existing configurations. This software is also a component of the ASIMON software.

7.1.3 ASIMON

The ASIMON software is used to configure the safety unit. Already configured systems can be diagnosed live using the software. The status of all in- and outputs is graphically represented as are the results of the preparatory processing.

When projecting the user has the ability to assign unique identifiers to the individual devices. These also appear in the device displays in connection with error messages. To prevent errors in the projecting stage the ASIMON software provides advance warning at the relevant points.

The AS-i Control Tools software is also part of the ASIMON.

7.1.4 Web server

Units having an Ethernet port provide all the diagnostics data through a web server. If necessary this also allws the system information to be viewed from any PC connected to the network without any additional software, simply using a standard internet browser and Java.

To be able to take advantage of the full scope of diagnostics functions and configuration possibilities of the AS-i Masters, you will however need the ASIMON software with integrated AS-i Control Tools and ideally also the software for diagnostics, service and release measurement.

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7.2 Diagnostics on the host controller

All the diagnostics information is also provided on the host controller.

7.2.1 On the fly diagnostics

EtherCAT gateways transfer the most diagnostic information via the standard diagnostic.

7.2.2 Diagnostics through process data

Diagnostics through the process data provides a very simple means of incorporating diagnostics information into the controller program and displaying it on a control panel.

For useful diagnostics we recommend use of the following modules:

7.2.2.1 Diagnosing the AS-i circuits

Gateways and gateways with integr. Safety Monitor with 4 OSSDs

- Flags (see tab. <Flags> in chap. 6.2.2.1)

Gateways with integr. Safety Monitor with 6 OSSDs

- Flags + Fault Detector (see chap. 6.3.4)

When a configuration error is reported, e.g. because an AS-i slave has failed, the AS-i master continues to communicate with the remaining slaves. In many cases however a good and simple solution is to terminate running of the PLC program in case of a configuration error.

7.2.2.2 Diagnosing the Safety Monitor

Gateways and gateways with integr. Safety Monitor with 4 OSSDs

- Safety Control/Status (see chap. 6.2.2.2)

Gateways with integr. Safety Monitor with 6 OSSDs

- Safety diagnostics in the Input Data Image
  Diagnostics for the states of the safety AS-i in- and outputs. To obtain diagnostics information for a safety AS-i output the associated diagnostics slave address must be incorporated (see subsection <A>).
- Feldbus Bits and Safety Status
  User-specific diagnosing and diagnosing the states of the release circuits (see chap. 6.3.6, chap. 6.3.5, chap. 6.3.8 and chap. 6.3.9).

Subsection A: Safety diagnostics in the Input Data Image (IDI)

□ Safety diagnostics of safe AS-i inputs

Diagnostics in the IDI is a way of sending the key diagnostics functions to the controller without a command interface (Mailbox) or any additional effort. The diagnostics information is sent in the input data image, coded for the input bits of the address of the safety input slave.

The switching state of Channels 1 and 2 of the safety input is shown with negligible time lag in bits 0 and 1 and can be directly read:

Bit3	Bit2	Bit1	Bit0	Description
X	X	0	0	Both channels open
X	X	0	1	2nd channel open, 1st channel closed
X	X	1	0	2nd channel closed, 1st channel open
X	X	1	1	Both channel closed

Tab. 7-48.

Bits 2 and 3 are used to send the status of the safety input (the device color of the ASIMON):

Bit3	Bit2	Bit1	Bit0	Description
0	0	X	X	Device color: red, green or gray
0	1	X	X	Device color: yellow ("waiting")
1	0	X	X	Device color: yellow flashing ("testing")
1	1	X	X	Device color: red flashing ("Error")

Tab. 7-49. Stae of safety input

☐ Safety diagnostics of safe AS-i outputs

The diagnostic informations are transfered via the Input Data Image, coded to the input bits of the diagnostic address (diagnostic slave) of an AS-i safety slave. The diagnostics information for the safety output is encoded to the input data of the diagnostics slave of the respective safety output.

Bit value of the input bits of the diagnostic slaves

Bit	AS-i input
E0	diagnostics (see table device colors)
E1	
E2	
E3	reserved for EDM input

Tab. 7-50. Bit value of input bits of the diagnostic slaves

Device colors

The colors refer to the diagnostics in the ASIMON.

Value	Color	Description	state change	LED "OUT"[1]
0	green	output on	–	on
1	green flashing	–	–	–
2	yellow	restart inhibit	auxiliary signal 2	1 Hz
3	yellow flashing	–	–	–
4	red	output off	–	off
5	red flashing	waiting for reset of error condition	auxiliary signal 1	8 Hz
6	gray	connection or internal error	only via **Power On** on device	all LEDs flashing
7	green/yellow	output released, but not switched on	switched on by setting the output bit[1]	off

Tab. 7-51. Device colors

1. See documentation of the AS-i slave.

Important!

The following points must be noted for processing:

- The information for switching state and error status are not processed time-synchronous.
- When there is a configuration error all bits having value 0 are sent; this must be noted when processing the data.
- When the Monitor is stopped the device color is "gray".
- When regularly switching, the status "yellow flashing" can be recognized as a transition status. This depends on the component model set. This status cannot be understood as a testing request until it is stably reported (see Monitor Info and Safety Control/Status Byte). This is not the case until bit ’6’ is set in the Monitor Info and Safety Control/Status Byte ("At least one module in Test status"). This means the diagnostics information in the input data image does not serve as a trigger for the testing request, but rather only as detailed information after the Monitor Info and Safety Control/Status byte have indicated that at least one component has reported a testing request.

Changing the base setting

Setting and changing the diagnostics type is done using the device display (**`[SAFETY]->[AS-I SAFETY]->[SAFE SUBST VAL]`**)

7.2.3 Diagnosing the safety unit using the command interface

All the diagnostics data can also be queried individually and acyclic using the command interface commands. This method does however involve greater programming effort.

7.3 Error indication directly on the device

7.3.1 LEDs

The LEDs located on the device allow you to quickly see the status of the main function parameters, such as power, communication with the host controller, communication on the AS-i circuit and state of the safety in- and outputs.

7.3.2 LC-Display

In the display of the gateways plain text messages are shown spontaneously for any detected errors (e.g. missing slaves, earth fault, duplicate address…).

7.3.3 AS-i Monitor

Comprehensive, standard measuring technology built into the AS-i Masters make it possible to simply localize even sporadically occurring configuration errors and interference sources affecting AS-i communication.

7.3.3.1 Duplicate address detection

The Master detects when two slaves having the same address are present in the AS-i circuit.

7.3.3.2 Earth fault monitor

The earth fault monitor checks the symmetry of the AS-i voltage. If the voltage is no longer sufficiently symmetrical, the noise immunity of data transmission is compromised.

7.3.3.3 Noise voltage detection

Noise voltages on the AS-i cable can cause telegram errors. The noise voltage detector monitors the AS-i circuit for AC voltages which have been generated by neither the AS-i Master nor the slaves.

7.3.3.4 Overvoltage detection

Normally UASi+ and UASi- are in symmetry with system ground. If this potential rises significantly, the overvoltage detector reports this anomaly.

8. Appendix

Quick Start Guides for commissioning and service are provided on the website available for download.

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FACTORY AUTOMATION – SENSING YOUR NEEDS

Worldwide Headquarters
Pepperl+Fuchs GmbH
68307 Mannheim · Germany
Tel. +49 621 776-0
E-mail: info@de.pepperl-fuchs.com

USA Headquarters
Pepperl+Fuchs Inc.
Twinsburg, Ohio 44087 · USA
Tel. +1330 4253555
E-mail: sales@us.pepperl-fuchs.com

Asia Pacific Headquarters
Pepperl+Fuchs Pte Ltd.
Company Registration No. 199003130E
Singapore 139942
Tel. +65 67799091
E-mail: sales@sg.pepperl-fuchs.com

www.pepperl-fuchs.com

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