

SIEMENS

SIMATIC

ET 200S distributed I/O
4 IQ-SENSE module
(6ES7138-4GA00-0AB0)

Manual

Preface

4 IQ-SENSE module
(6ES7138-4GA00-0AB0)

1

Parameters

2

Diagnostics

3

Control interface (PIO) and
feedback interface (PII)

4

Order numbers

A

Safety Guidelines

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

⚠ DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
⚠ WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
⚠ CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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

Qualified Personnel

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

Prescribed Usage

Note the following:

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

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

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

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.

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 these operating instructions, and do not find the answers in this document, please contact your local Siemens representative.

<http://www.siemens.com/automation/partner>

The portal to our technical documentation for the various SIMATIC products and systems is available at:

<http://www.siemens.com/automation/simatic/portal>

The online catalog and ordering system are available at:

<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.

Phone: +49 (911) 895-3200.

<http://www.siemens.com/sitrain>

Technical Support

You can reach technical support for all A&D projects

- using the support request web form:
<http://www.siemens.com/automation/support-request>
- Phone: + 49 180 5050 222
- Fax: + 49 180 5050 223

For more information about our technical support, refer to our Web site at

<http://www.siemens.de/automation/service>

Service & Support on the Internet

In addition to our documentation services, you can also make use of our comprehensive online knowledge base on the Internet.

<http://www.siemens.com/automation/service&support>

There you will find:

- Our Newsletter, which constantly provides you with the latest information about your products.
- The right documentation for you using our Service & Support search engine.
- The bulletin board, a worldwide knowledge exchange for users and experts.
- Your local contact for Automation & Drives in our contact database.
- Information about on-site services, repairs, spare parts. Lots more can be found on our "Services" pages.

Table of contents

	Preface	3
1	4 IQ-SENSE module (6ES7138-4GA00-0AB0)	7
1.1	Properties of 4 IQ-SENSE	7
1.2	Technical specifications	8
2	Parameters	13
2.1	Parameters.....	13
2.2	Group diagnostics parameter.....	14
2.3	Synchronization group parameter.....	15
2.4	Sensor type parameter	16
2.5	Switching hysteresis parameter.....	17
2.6	Time functions, time values parameters	18
2.7	Teach-in disable parameter	18
3	Diagnostics	19
3.1	Diagnostics using LED display.....	19
3.2	Error types.....	20
4	Control interface (PIO) and feedback interface (PII)	21
4.1	Fundamentals of the control and feedback interface ((PIQ / PII)	21
4.2	Standard.....	22
4.3	Enhanced	23
A	Order numbers	27
3.1	Order numbers for connecting cables for 4 IQ-SENSE electronic module.....	27
	Index	29

4 IQ-SENSE module (6ES7138-4GA00-0AB0)

1.1 Properties of 4 IQ-SENSE

Properties

The 4 IQ-SENSE has the following properties.:

- Connection of sensors with IQ-SENSE®, photoelectric proximity switches: for example, reflex sensors, diffuse sensors, and laser sensors.
- You can connect up to 4 sensors to every module. Each sensor requires a two-wire cable.
- Function reserve and monitoring
- Time functions, switching hysteresis, synchronization groups that can be assigned parameters
- Sensitivity and distance values can be specified (*IntelliTeach* using the "IQ-SENSE Opto" FB)
- Teach-in
- Module can be removed and inserted during operation (restart the *Teach-in* using the "IQ-SENSE Opto" function block or the button on the sensor)
- Sensors can be removed and inserted during operation (automatic reassignment of parameters)
- Supports sensors with alignment tool
- The 4 IQ-SENSE is a single-width (15 mm) electronic module that can be used with the following terminal modules:
 - TM-E15S24-01, TM-E15C24-01 and TM-E15N24-01
 - TM-E15S26-A1, TM-E15C26-A1 and TM-E15N26-A1

Parameter assignment

You set the parameters for the 4 IQ-SENSE using the *STEP 7* parameter assignment software.

Configuration rules	
STEP 7 as of V5.1 SP3	With STEP 7 as of V5.0, Service Pack 3 or other configuration software
Contained in the hardware catalog of HW Config. A GSD file is not required.	IM151-1 BASIC: GSD file SIEM80F3.GSx as of 09/02 (as of V1.0)
	IM151-1 STANDARD: GSD file SIEM806A.GSx as of 10/01 (as of V1.10)
	IM151-1 FO STANDARD: GSD file SIEM806B.GSx as of 10/01 (as of V1.5)
	IM151-1 HIGH FEATURE: GSD file SIR380E0.GSx as of 12/01 (as of V1.0)
	IM151-3 PN (as of 6ES7151-3AA10-0AB0), IM151-3 PN HIGH FEATURE:

1.2 Technical specifications

General terminal assignment

Note

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

Terminal assignment for 4 IQ-SENSE (6ES7138-4GA00-0AB0)				
Terminal	Assignment	Terminal	Assignment	Notes
1	M ₀₊	5	M ₁₊	<ul style="list-style-type: none"> M_{n+}: Input signal "+", Channel n M_{n-}: Input signal "-", Channel n AUX1: Protective-conductor terminal or potential bus (freely usable up to 230 VAC)
2	M ₂₊	6	M ₃₊	
3	M ₀₋	7	M ₁₋	
4	M ₂₋	8	M ₃₋	
A4	AUX1	A8	AUX1	
A3	AUX1	A7	AUX1	

Usable terminal modules

Usable terminal modules for 4 IQ-SENSE (6ES7138-4GA00-0AB0)		
TM-E15C26-A1 (6ES7193-4CA50-0AA0)	TM-E15C24-01 (6ES7193-4CB30-0AA0)	← Spring terminal
TM-E15S26-A1 (6ES7193-4CA40-0AA0)	TM-E15S24-01 (6ES7193-4CB20-0AA0)	← Screw-type terminal
TM-E15N26-A1 (6ES7193-4CA80-0AA0)	TM-E15N24-01 (6ES7193-4CB70-0AA0)	← Fast Connect

Note

The terminals to the sensors are protected against polarity reversal.
 The maximum wire cross-section for the sensors is 0.25 mm².
 The connecting cable for the sensors can be found in the *order numbers* appendix.

Block diagram

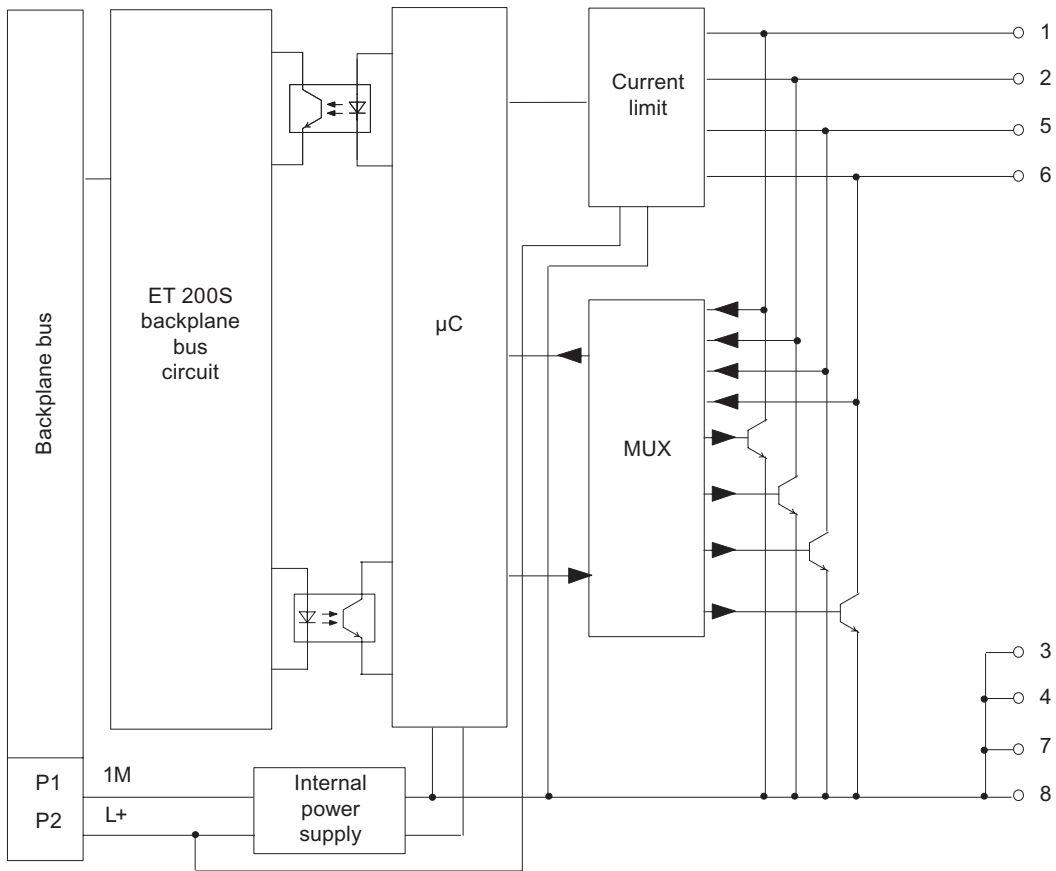


Figure 1-1 Block diagram of the 4 IQ-SENSE

4 IQ-SENSE technical data (6ES7138-4GA00-0AB0)

Dimensions and weight	
Width (mm)	15
Weight	Approx. 35 g
Module-specific data	
Supports isochronous operation	No
Number of inputs	4
Cable length	
• Unshielded	Max. 50 m
• Shielded	Max. 50 m
Parameter length	16 bytes
Address space (Standard)	1-byte inputs
Address space (Enhanced)	4-byte inputs, 4-byte outputs
Voltages, currents, potentials	
Rated supply voltage (from the power module)	24 VDC
• Reverse polarity protection	Yes
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 0.85 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostics function	
• Group error	Red "SF" LED
• Diagnostic information can be displayed	Yes
Data for selecting a sensor	
Connectable sensors	Photoelectric proximity switches with IQ-Sense
Response times	
Cycle time	Max. 3.24 ms

Parameters

2.1 Parameters

Table 2-1 Parameters for the 4 IQ-SENSE

Parameters	Range of values	Default setting	Applicability
Group diagnostics	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Module
Synchronization group	<ul style="list-style-type: none"> • 1 • 2 • 3 • 4 	1	Module
Sensor type	<ul style="list-style-type: none"> • Reflex sensor • Diffuse sensor • De-activated 	Reflex sensor	Channel
Switching hysteresis	<ul style="list-style-type: none"> • 5 % • 10 % • 20 % • 50 % 	20 %	Channel
Time functions	<ul style="list-style-type: none"> • None • Return delay • Pickup delay • Pickup and return delay • Momentary impulse 	None	Channel
Time value	<ul style="list-style-type: none"> • 5 ms • 10 ms • 20 ms • 50 ms • 100 ms • 200 ms • 500 ms • 1 s • 2 s • 5 s • 10 s 	5 ms	Channel
Teach-in disable	<ul style="list-style-type: none"> • <i>Teach-in</i> with button possible • <i>Teach-in</i> with button not possible 	<i>Teach-in</i> with button possible	Channel

2.2 Group diagnostics parameter

Note

Unused channels of the module must be deactivated otherwise the wire break diagnosis will be reported.

Measurement type parameter: **De-activated**

- All the diagnostics are suppressed.
 - Sensitivity/distance values and circuit states are set to "0".
 - The sensor is switched off.
-

2.2 Group diagnostics parameter

If group diagnostics is enabled, a pending diagnostics message is entered.

Reference

Information on channel-related diagnostics can be found in the *ET 200S Operating Instructions*.

2.3 Synchronization group parameter

- Sensors between different modules of the 4 IQ-SENSE may influence one another (for example scattered light).
- To prevent interference from neighboring sensors on different modules, this parameter can be used to allocate a separate synchronization group to every module. Modules in different synchronization groups do not interfere with one another.
- Sensors on the same module cannot interfere with one another.

Operating principle

The diagram below explains the functioning of the synchronization group parameter:

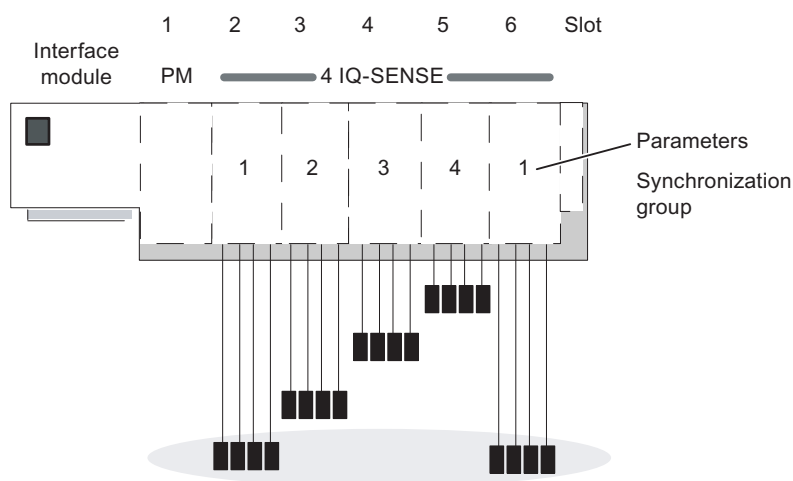


Figure 2-1 Synchronization group

Mutual interference is only possible between the sensors of the modules in slot 2 and 6, because they are in the same synchronization group 1.

Note

Sensors in the same synchronization group must be installed to maintain the minimum clearance (see sensor package insert) and to prevent mutual interference.

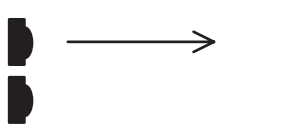
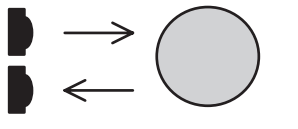
2.4 Sensor type parameter

This parameter is used to set the sensor type per channel:

- Reflex sensor or
- Diffuse sensor or
- De-activated

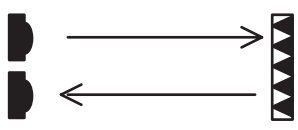
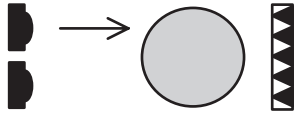
Diffuse sensor

Table 2-2 Diffuse sensor

Diffuse sensor	Object	
Transmitter Receiver		Circuit state 0: no object detected, i.e. the object is not in the beam. The receiver does not see any light.
Transmitter Receiver		Circuit state 1: object detected, i.e. the object is in the beam. The receiver does not see any light.

Reflex sensor

Table 2-3 Reflex sensor

Reflex sensor	Object	
Transmitter Receiver		Circuit state 0: no object detected, i.e. the object is not in the beam. The receiver sees light.
Transmitter Receiver		Circuit state 1: object detected, i.e. the object is in the beam. The receiver does not see any light.

2.5 Switching hysteresis parameter

Faults with the diffuse sensor or in the production process can result in signal wobbles. The measured value then changes the switching threshold by 100 % (object detected - object not detected). You can prevent this switching threshold wobble using the switching hysteresis parameter. This will ensure a stable output signal on the sensor.

You can assigned parameters to 5 %/10 %/20 %/50 % for switching hysteresis.

Prerequisites

You can only set the switching hysteresis parameter for diffuse sensors with background fadeout.

Operating principle

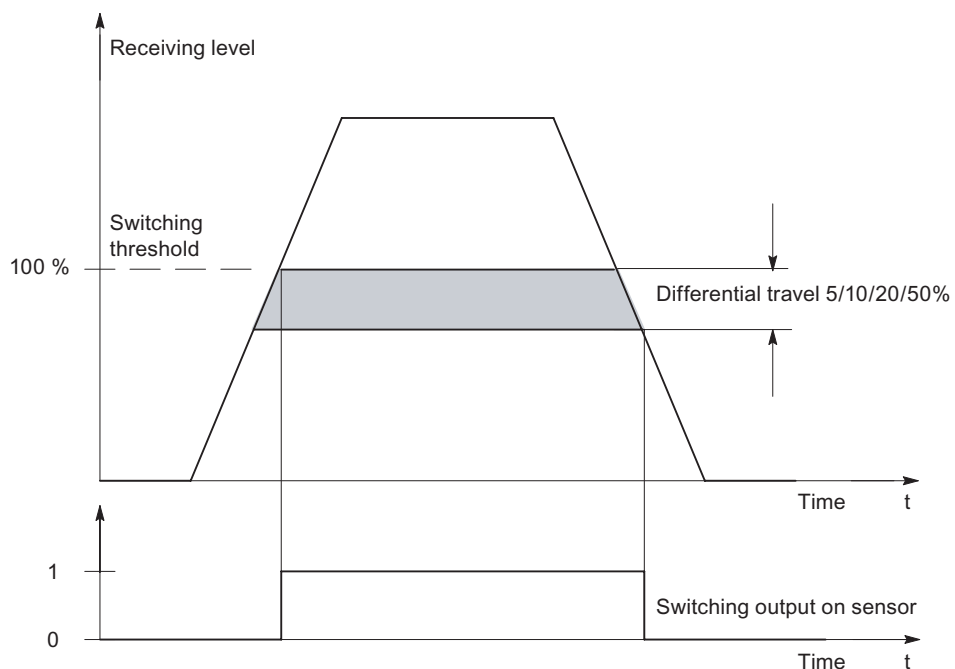


Figure 2-2 Switching hysteresis parameter

2.6 Time functions, time values parameters

These parameters can be used to set the electronic module for its specific application.

Operating principle

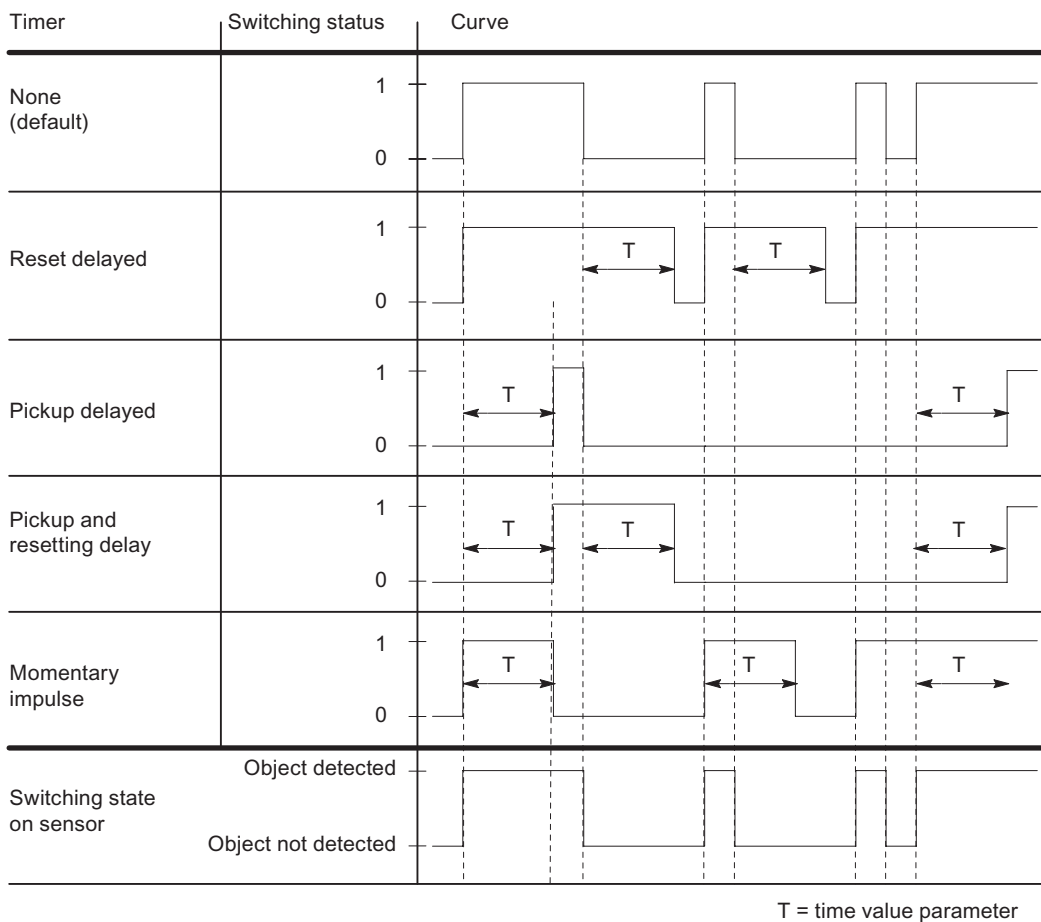


Figure 2-3 Time functions, time values parameters

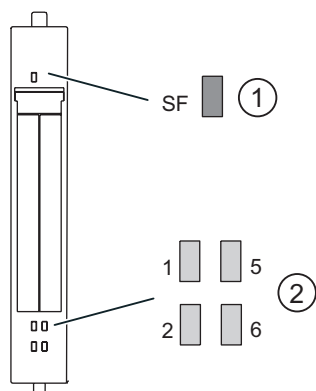
2.7 Teach-in disable parameter

This parameter can be used to disable the *Teach in* button on the sensor.

Diagnostics

3.1 Diagnostics using LED display

LED displays on the 4 IQ-SENSE electronic module:



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

Status and error displays

SF	Event (LEDs)				Cause	Remedy
	1	5	2	6		
On					No parameter assignment.	Check the parameter assignment.
					A diagnostic message is pending.	Evaluate the diagnostics.
					Underrange of function reserve.	Adjust the retroflexive sensor. Clean the optical system. Replace the sensor.
					Teach-in operation is running.	Terminate the teach-in operation.
	On				Input on channel 0 activated.	
		On			Input on channel 1 activated.	
			On		Input on channel 2 activated.	
				On	Input on channel 3 activated.	

3.2 Error types

4 IQ-SENSE error types

Table 3-1 4 IQ-SENSE error types

Error type		Meaning	Remedy
1 _D	00001: Short circuit	Short circuit on the wiring between the electronic module and sensor	Check the wiring to the sensor. Correct the process wiring.
6 _D	00110: Open circuit	Wiring to the sensor interrupted. No sensor connected. Sensor does not respond.	Correct the process wiring. Connect the sensor. Replace the sensor.
8 _D	01000: Lower limit value undershot	Maintenance requirement (signal quality < 130%, excess gain), sensor-dependent	Adjust the retroreflective sensor. Clean the optical system.
9 _D	01001: Error	Communication error between the electronic module and sensor	Replace the electronic module or the sensor. Check the wiring.
16 _D	10000: Parameter assignment error	Faulty parameter assignment Inserted module does not match the one configured. Teach-in error (a new value could not be determined/obtained) Inserted sensor does not match configured sensor.	Correct the parameter assignment. Correct the configuration (align actual and set configuration). Repeat <i>Teach-in</i> . Correct the configuration, or insert a different sensor type.
26 _D	11010: External error	Excess gain lower limit violated (signal quality < 110%) or sensor error, sensor-dependent	Adjust the retroreflective sensor. Clean the optical system. Replace the sensor.
27 _D	11011: Unclear error	<i>Teach-in</i> operation is running. Alignment aid is active.	Terminate the <i>Teach-in</i> operation. Close the alignment aid.

Control interface (PIO) and feedback interface (PII)

4.1 Fundamentals of the control and feedback interface ((PIQ / PII)

Introduction

You can configure the address space of the control and feedback interfaces of the 4 IQ-SENSE. You can choose between **Standard** and **Enhanced**.

Standard properties

- The 4 IQ-SENSE occupies 4 bits in the feedback interface.
- You can use the feedback interface to evaluate the circuit state for each channel.

Enhanced properties

- The 4 IQ-SENSE occupies one byte in the control interface and one in the feedback interface.
- You can use the control interface to specify the sensitivity and distance values for each channel (*IntelliTeach* via "IQ-SENSE Opto" FB) and execute *Teach-in*.
- You can use the feedback interface to evaluate the taught sensitivity and distance value (switching threshold) and the circuit state for each channel.

Requirements:

- You can use the "IQ-SENSE Opto" function block. The FB facilitates easy access to the control and feedback interface.
- Please note that in this case PII equals PIQ.
- You can download the function block and the relevant product information on the Internet at http://www.ad.siemens.de/csi_e/gsd.

4.2 Standard

Configuring the address space

Address area	With STEP 7 as of V5.1, Service Pack 3	With STEP 7 as of V4.02 or COM PROFIBUS or other configuration software
Standard	In the hardware catalog of HW Config, choose 4 IQ-SENSE Opto S	From the GSD file, choose S 6ES7138-4GA00-0AB0 IQ-SENSE Opto
Enhanced	In the hardware catalog of HW Config, choose 4 IQ-SENSE Opto E	From the GSD file, choose E 6ES7138-4GA00-0AB0 IQ-SENSE Opto

4.2 Standard

Feedback interface (PII)

Table 4-1 Standard feedback interface

Address	Assignment
Byte 0	Bit 7: 0 (not assigned)
	Bit 6: 0 (not assigned)
	Bit 5: 0 (not assigned)
	Bit 4: 0 (not assigned)
	Bit 3: Circuit state sensor on Channel 3 1: Object detected 0: Object not detected
	Bit 2: Circuit state sensor on Channel 2 1: Object detected 0: Object not detected
	Bit 1: Circuit state sensor on Channel 1 1: Object detected 0: Object not detected
	Bit 0: Circuit state sensor on Channel 0 1: Object detected 0: Object not detected

4.3 Enhanced

Feedback interface (PII)

Table 4-2 Enhanced feedback interface

Address	Assignment		Designation on "IQ-SENSE Opto" FB
Byte 0	Bit 0:	Circuit state sensor on Channel 0 1: Object detected 0: Object not detected	Q_CH0
	Bit 1 to Bit 7: Acquired sensitivity/distance value at Channel 0 by Teach in ¹		TEACH_VAL_OUT
Byte 1	Bit 0:	Circuit state sensor on Channel 1 1: Object detected 0: Object not detected	Q_CH1
	Bit 1 to Bit 7: Acquired sensitivity/distance value at Channel 1 by Teach in ¹		TEACH_VAL_OUT
Byte 2	Bit 0:	Circuit state sensor on Channel 2 1: Object detected 0: Object not detected	Q_CH2
	Bit 1 to Bit 7: Acquired sensitivity/distance value at Channel 2 by Teach in ¹		TEACH_VAL_OUT
Byte 3	Bit 0:	Circuit state sensor on Channel 3 1: Object detected 0: Object not detected	Q_CH3
	Bit 1 to Bit 7: Acquired sensitivity/distance value at Channel 3 by Teach in ¹		TEACH_VAL_OUT
¹ The current sensitivity/distance value is entered: <ul style="list-style-type: none"> - After teach-in is completed on the sensor - After teach-in is completed via the "IQ-SENSE Opto" 			

Control interface (PIQ)

Table 4-3 Enhanced control interface

Address	Assignment	Designation on "IQ-SENSE Opto" FB
Byte 0	Specify sensitivity/distance value at Channel 0 <ul style="list-style-type: none"> • Bit 0: 1: Transfer sensitivity/distance value to the sensor on Channel 0 (using rising edge) 0: De-activated • Bit 1 to Bit 7: Specify sensitivity/distance value at Channel 0 1 to 126, (sensor-dependent) 	WR_TEACH_VAL TEACH_VAL_IN
	Teach-in on the sensor on Channel 0 <ul style="list-style-type: none"> • Bit 0: 1: Start teach-in on the sensor on Channel 0 (at the rising edge) 0: De-activated • Bit 1 to 7: 0 	START_TEACH
Byte 1	Specify sensitivity/distance value on Channel 1 <ul style="list-style-type: none"> • Bit 0: 1: Transfer sensitivity/distance value to the sensor on Channel 1 (using rising edge) 0: De-activated • Bit 1 to Bit 7: Specify sensitivity/distance value at Channel 1 1 to 126, (sensor-dependent) 	WR_TEACH_VAL TEACH_VAL_IN
	Teach-in on the sensor on Channel 1 <ul style="list-style-type: none"> • Bit 0: 1: Start teach-in on the sensor on Channel 1 (at the rising edge) 0: De-activated • Bit 1 to 7: 0 	START_TEACH
Byte 2	Specify sensitivity/distance value on Channel 2 <ul style="list-style-type: none"> • Bit 0: 1: Transfer sensitivity/distance value to the sensor on Channel 2 (using rising edge) 0: De-activated • Bit 1 to Bit 7: Specify sensitivity/distance value at Channel 2 1 to 126, (sensor-dependent) 	WR_TEACH_VAL TEACH_VAL_IN
	Teach-in on Channel 2 <ul style="list-style-type: none"> • Bit 0: 1: Start teach-in on the sensor on Channel 2 (at the rising edge) 0: De-activated • Bit 1 to 7: 0 	START_TEACH

Address	Assignment	Designation on "IQ-SENSE Opto" FB
Byte 3	Specify sensitivity/distance value on Channel 3 <ul style="list-style-type: none"> • Bit 0: 1: Transfer sensitivity/distance value to the sensor on Channel 3 (using rising edge) 0: De-activated • Bit 1 to Bit 7: Specify sensitivity/distance value on Channel 3: 1 to 126, (sensor-dependent) 	WR_TEACH_VAL TEACH_VAL_IN
	Teach-in on the sensor on Channel 3 <ul style="list-style-type: none"> • Bit 0: 1: Start teach-in on the sensor on Channel 3 (at the rising edge) 0: De-activated • Bit 1 to 7: 0 	START_TEACH

Principle of operation: Specifying a sensitivity/distance value (IntelliTeach)

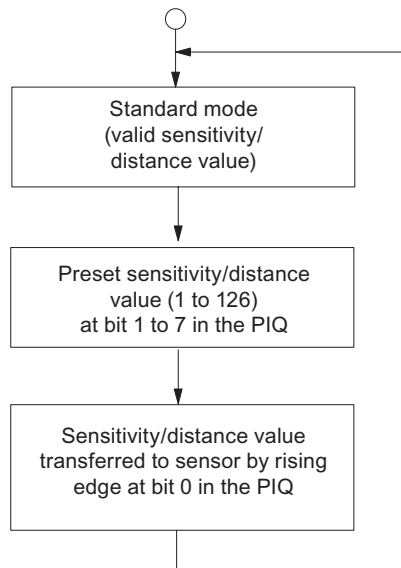


Figure 4-1 Principle of operation: Specifying a sensitivity/distance value (IntelliTeach)

Principle of operation: Teach-in

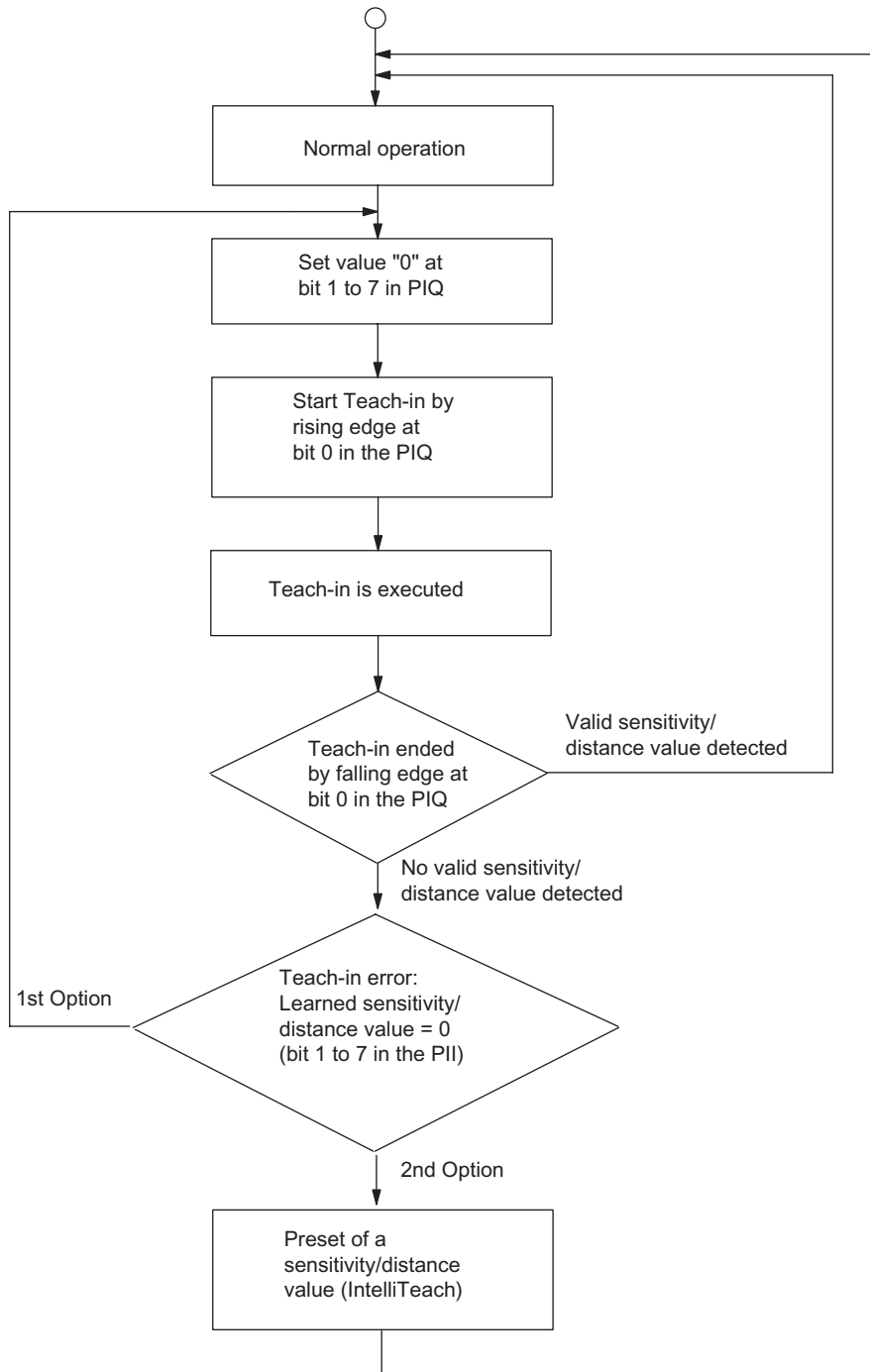


Figure 4-2 Principle of operation: Teach-in

Order numbers

A.1 Order numbers for connecting cables for 4 IQ-SENSE electronic module

The following table contains the connecting cables for the sensors on the 4 IQ-SENSE electronic module. These connecting cables are also to be found in the FS 10 catalog (chapter on BERO approximation switches, accessories).

Table A-1 Connecting cables for 4 IQ-SENSE 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	3RX1533
M 12 cable box for screw-type attachment with 5 m PUR connecting cable 4 x 0.34 mm ²	3RX1536

Index

B

Basic knowledge requirements, 3

D

Disposal, 3

E

Error types, 20

I

Internet
Service & Support, 4

R

Recycling, 3

S

Scope
Manual, 3
Service & Support, 4

T

Technical Support, 4
Training center, 4

