SIEMENS

SIMATIC

Automation systems S7-300, ET 200M
8xIQ Sense module

Manual

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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 to property damage only have no safety alert symbol. The 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.

Attention

indicates that an unintended result or situation can occur if the corresponding notice 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 notices 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 and its components 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.

Disclaim 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 this manual

This manual provides you with information on the operation, functional definitions and technical data of modules with IQ Sense interface.

It also shows you how to integrate devices (sensors, actuators) with IQ Sense interface into an S7-300 or ET 200M.

How to use these modules to set up an S7-300 or ET 200M system, that is, the installation and wiring of the modules, is described in the relevant system installation manuals.

Basic knowledge requirements

It is presumed that users of this manual have a general knowledge of automation systems engineering. Experience in the handling of optoelectronic sensors, pressure sensors and ultrasonic sensors is helpful.

You should have a sufficient knowledge of standard *STEP 7* software.

Area to which this manual applies

This manual applies to the 8xIQ Sense module (order no. 6ES7 338-7XF00-0AB0) with IQ Sense interfaces which are used to integrate IQ Sense devices with different IQ profile IDs into an (S7) automation system.

This release of the manual describes the current module version. We reserve the right of providing revisions of module data in a product info on the Internet or for new modules or later module versions.

Approvals

The IQ Sense modules described in this manual are approved by:

- Underwriters Laboratories, Inc.: UL 508 registered
  (Industrial Control Equipment)

- Canadian Standards Association: CSA C22.2 Number 142,
  (Process Control Equipment)

- Factory Mutual Research: Approval Standard Class Number 3611.

CE label

The IQ Sense modules described in this manual meet the requirements and protective aims of the following EC directives.

- EC directive 73/23/EEC "Low-voltage guideline"
- EC directive 89/336/EC "EMC guideline"

C-Tick-Mark

The IQ Sense modules described in this manual meet the requirements of the AS/NZS 2064 standard (Australia and New Zealand.)

Standards

The IQ Sense modules described in this manual meet the requirements and criteria of IEC 61131-2.

Position in the information environment

S7-300

Name of the manual	Description
Device manual • CPU 31xC and CPU 31x, Technical data	Description of the operation, functions and technical data of the CPU.
Reference manual • CPU Data: CPU 312 IFM – 318-2 DP	Description of the operation, functions and technical data of the CPU.
Operating instructions • S7-300, CPU 31xC and CPU 31x: Installation	Description of the design, installation, wiring, networking and commissioning of an S7-300.
Installation manual • S7-300 PLC, Installation: CPU 312 IFM – 318-2 DP	Description of the design, installation, wiring, networking and commissioning of an S7-300.
Manual • CPU 31xC: Technological functions • Example	Description of the various technological functions: Positioning, counting, PtP communication, controlling. The CD contains examples of the technological functions.
(Reference) Manual • S7-300 PLC: Module data You are reading this manual → • Automation systems S7-300, ET 200M: 8xIQ Sense module	Functional definition and technical data of signal modules, power supply modules and interface modules.
Instruction list • CPU 312 IFM – 318-2 DP • CPU 31xC and CPU 31x	List of instruction resources of the CPUs and their execution times. List of runtime modules (OBs / SFCs / SFBs) and their execution times.

Name of the manual	Description
Getting Started • CPU 31x: Commissioning • CPU 31xC: Commissioning • CPU 31xC: Positioning with analog output • CPU 314C: Positioning with digital output • CPU 31xC: Counting • CPU 31xC: Control • CPU 31xC: PtP communication • CPU 317-2 PN/DP: Design of the PROFInet interface X2	Based on a practical example, the Getting Started documentation guides you through the various steps in commissioning, up to a fully functional application.

ET 200M

Name of the manual	Description
Manual • Distributed I/O device ET 200M	Description of the design, installation and wiring.
(Reference) Manual • Signal module for process automation	Description of their use in a process automation system, of parameter assignment with SIMATIC PDM and of digital input and output modules.
• S7-300 PLC: Module data You are reading this manual → • Automation systems S7-300, ET 200M: 8xIQ Sense module	Functional definition and technical data of signal modules, power supply modules and interface modules.

Guide

Features of the manual providing quick and easy access to specific information:

- At the beginning of this manual, you will find a comprehensive table of contents and a list of images and tables.

- Thumbnails on the left margin of each page provide information on the content of the relevant chapter.

- To the appendix, we have appended a glossary of important engineering terminology used in this manual.

- Use the index to find the most important sections in our documents.

Structure

The structure of this manual is based on the following topics.

- Chapter 1 provides an overview of the product and describes its system integration.

- Chapters 2 to 4 contain a comprehensive description of module configuration in *STEP 7.*

- Chapters 5 to 7 provide information on diagnostics, identification data and firmware updates.

- Chapter 8 contains the technical data of the IQ Sense modules.

- Appendices A to C describe module configuration based on a GSD file.

- The list of abbreviations contains their full text, and the glossary describes important terms.

- The index helps you to quickly find text passages relating to important keywords.

Conventions

This manual refers to modules with IQ Sense interface as "IQ Sense module".

Encoders (sensors, actuators, ...) with IQ Sense interface which can be connected to the described IQ Sense modules are referred to as "IQ Sense devices".

The hardware catalog of *HW Config* distinguishes between the "8xIQ Sense" and the "8xIQ Sense IDENT" modules. However, this is physically one and the same module. The specifications in this manual dealing with the 8xIQ Sense module also apply to the 8xIQ Sense IDENT "module". Any deviations are dealt with in the corresponding section.

Recycling and disposal

The IQ Sense modules described in this manual can be recycled due to their low-pollutant equipment. For environment-friendly recycling and disposal of your old device, please contact a company certified for the disposal of electronic waste.

Further support

If you have any technical questions, please get in touch with your Siemens representative or agent responsible.

You will find your contact person at:

`http://www.siemens.com/automation/partner`

You will find a guide to the technical documentation offered for the individual SIMATIC Products and Systems here at:

`http://www.siemens.com/simatic-tech-doku-portal`

The online catalog and order system is found under:

`http://mall.automation.siemens.com`

Training Center

Siemens offers corresponding courses to get newcomers started with IQ Sense and the SIMATIC S7 automation system. Please contact your regional Training Center or our central Training Center in
D 90327 Nuremberg.

Phone: +49 (911) 895-3200

Internet: `http://www.sitrain.com`

Technical Support

You can reach the Technical Suport for all A&D products

- Via the Web formula for the Support Request
  `http://www.siemens.com/automation/support-request`

- Phone: + 49 180 5050 222

- Fax:+ 49 180 5050 223

Additional information about our Technical Support can be found on the Internet pages:
`http://www.siemens.com/automation/service.`

Service & Support on the Internet

In addition to our documentation, we offer our Know-how online on the internet at:

`http://www.siemens.com/automation/service&support`

where you will find the following:

- The newsletter, which constantly provides you with up-to-date information on your products.

- The right documents via our Search function in Service & Support.

- A forum, where users and experts from all over the world exchange their experiences.

- Your local representative for Automation & Drives.

- Information on field service, repairs, spare parts and more under "Services".

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Product overview and system integration   **1**

Chapter overview

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1.1 8xIQ Sense module

Order number

6ES7 338-7XF00-0AB0

Functionality

Functionality of the 8xIQ Sense module:

- The 8xIQ Sense module is used to integrate devices (sensors, actuators) with IQ Sense interface into an (S7) automation system.

- The 8xIQ Sense module can be operated on a distributed system with IM153 (ET 200M), or locally on an S7-300 system (CPU 31x).

- The 8xIQ Sense module is designed for communication with up to 8 IQ Sense device which are equipped with an IQ Sense communication interface.

- The system supports hot-swapping of IQ Sense devices without the need to reconfigure system data. In this case the system automatically downloads the static and dynamic parameter last used to the new IQ Sense device.

- The relevant channel of the 8xIQ Sense module and the IQ Sense device are interconnected point-to point via a two-wire cable. This two-wire cable transfers power to the device (24 V) and also the IQ Sense communication data.

Advantages

The 8xIQ Sense module offers you the following benefits:

- The 8xIQ Sense is a multiple-profile module, i.e. it can be connected to different IQ Sense devices (IQ profile), for example

  – optoelectronic sensors with IQ profile ID 1 or

  – Ultrasonic sensors (IQ profile ID 128)

  – RFID read/write devices (SLG) (IQ profile ID 248).

- *STEP 7* V5.3 or higher supports the implementation of a different IQ Sense profile for each of the eight channels (exception: the identification system V5.3 SP1 or higher, where an RFID read/write device uses four channels.)

Requirements

The 8xIQ Sense module is used to connect IQ Sense sensors / actuators. The module does not support conventional sensors.

Warning

This manual describes the functionality of the 8xIQ Sense module. The functionality of interconnected IQ Sense devices may be different. Decisive is here the documentation for the relevant IQ Sense device.

A list of compatible SIEMENS IQ Sense sensors / actuators is available in the appendix.

Integration into S7-300 / ET 200M

- The basic function of an 8xIQ Sense module is to map the object world of an IQ Sense device (user data, static / dynamic parameters, diagnostics, job communication) to the object world of the automation systems (S7-CPU, ET 200M).

- Consistent data exchange functions allow easy configuration of sensor parameters at the controller, or to copy already learned values by means of IntelliTeach $^\circledR$ to other sensors, and diagnostic functions directly associated with a channel. This not only enhances system redundancy, but also serves for an error-free configuration and wiring.

- The 8xIQ Sense module represents a communication gateway. The 8xIQ Sense module provides all properties / functionality to the IQ Sense devices (sensors, actuators) at the programming interface (function block.) The system also provides an interface for presetting (parameter assignment) the properties of IQ Sense devices.

Configuration

You configure the 8xIQ Sense module or IQ Sense devices

- of the SIMATIC S7 system using *STEP 7* V5.3 or higher, or
- by means of a corresponding entry in the IM153-x GSD files.

Warning

The hardware catalog of *HW Config* distinguishes between the "8xIQ Sense" and the "8xIQ Sense IDENT" modules. Select the "8xIQ Sense IDENT" module if you are going to use the IQ profile ID 248 for identification systems with IQ Sense interface.

Configuration options for 8xIQ Sense modules

Integration in *STEP 7* V5.3 SP1 or higher

STEP 7 V5.3 SP1 or higher provides full support for the integration of all 8xIQ Sense configurations.

Integration into *STEP 7* V4.02 or higher or into external systems

The integration in *STEP 7* V4.02 or higher, or in external systems is supported by GSD module configurations. The GSD file contains an entry for each configuration:

- Opto-profile Enhanced: 6ES7_338-7XF00-0AB0_IQ-Opto

  - 8 channels with IQ profile ID 1 (= optoelectronic sensors only)

- Mixed configuration optical / ultrasonic: 6ES7_338-7XF00_IQ-ID1/128/129A

  - 6 channels with IQ profile ID 1 (= optical sensors) +
    2 channels with IQ profile ID 128 (= ultrasonic).

- ID profile: 6ES7_338-7XF00-0AB0_IQ-Ident

  - 2 channels with IQ profile ID 248 (= 2 x ID system: each RFID read/write device occupies four words in the I/O data area)

- Mixed configuration optical / ident: 6ES7_338-7XF00_IQ-ID1/248

  - 4 channels with IQ profile ID 1 (= optical sensors) +
    1 channel with IQ profile ID 248 (= 1 x ID system: each RFID read/write device occupies four words in the I/O data area.)

With an integration based on a GSD file, the supported 8xIQ Sense configurations are determined by the relevant IM version and communication profile (DPV0, DPV1) of the CPU. See table 1-1.

Table 1-1   Possible configurations of the 8xIQ Sense module

Configuration	CPU	IM 153...	FB/FC	IQ profile (IQ Sense devices)	Supported GSD configuration
STEP 7 V5.3 SP1 or higher, central	all available	–	IQ Sense Opto Channel IQ Sense Ultrasonic MOBY FC-IQ	IQ profile ID 1 (optoelectronic sensors) IQ profile ID 128 (ultrasonic sensors) IQ profile ID 248 (RFID-SLG)	–
STEP 7 V5.3 SP1 or higher, distributed	all available	-1AA03 (as of ES 9) -2BA00 (release 3.0.1 or higher) -2BB00 (release 3.0.1 or higher)	IQ Sense Opto Channel IQ Sense Ultrasonic MOBY FC-IQ	IQ profile ID 1 (optoelectronic sensors) IQ profile ID 128 (ultrasonic sensors) IQ profile ID 248 (RFID-SLG)	–

Table 1-1   Possible configurations of the 8xIQ Sense module, continued

Configuration	CPU	IM 153...	FB/FC	IQ profile (IQ Sense devices)	Supported GSD configuration
STEP 7 V4.02 or higher, distributed	DPV1	-2BA00 (release 3.0.1 or higher) -2BB00 (release 3.0.1 or higher)	IQ Sense Opto Channel IQ Sense Ultrasonic MOBY FC-IQ	IQ profile ID 1 (optoelectronic sensors) IQ profile ID 128 (ultrasonic sensors) IQ profile ID 248 (RFID-SLG)	6ES7_338-7XF00-0AB0_IQ-Opto 6ES7_338-7XF00_IQ-ID1/128/129A 6ES7_338-7XF00-0AB0_IQ-Ident 6ES7_338-7XF00_IQ-ID1/248
	DPV0	-2BA00 (release 3.0.1 or higher) -2BB00 (release 3.0.1 or higher)	IQ Sense Opto Channel MOBY FC-IQ	IQ profile ID 1 (optoelectronic sensors) IQ profile ID 248 (RFID-SLG)	6ES7_338-7XF00-0AB0_IQ-Opto 6ES7_338-7XF00-0AB0_IQ-Ident 6ES7_338-7XF00_IQ-ID1/248
External systems (DP)	DPV1	-2BA00 (release 3.0.1 or higher) -2BB00 (release 3.0.1 or higher)	–	IQ profile ID 1 (optoelectronic sensors) IQ profile ID 128 (ultrasonic sensors) IQ profile ID 248 (RFID-SLG)	6ES7_338-7XF00-0AB0_IQ-Opto 6ES7_338-7XF00_IQ-ID1/128/129A 6ES7_338-7XF00-0AB0_IQ-Ident 6ES7_338-7XF00_IQ-ID1/248
	DPV0	-2BA00 (release 3.0.1 or higher) -2BB00 (release 3.0.1 or higher)	–	IQ profile ID 1 (optoelectronic sensors) IQ profile ID 248 (RFID-SLG)	6ES7_338-7XF00-0AB0_IQ-Opto 6ES7_338-7XF00-0AB0_IQ-Ident 6ES7_338-7XF00_IQ-ID1/248

Warning

The functions and properties of the IM interface module differ based on the IM version used. For information, refer to the *Distributed I/O device ET 200M* manual.

Warning

The description of programming and configuring the module using a GSD file is available in the appendix.

Free of charge downloads

The function blocks, GSD file, user documentation and a sample ProTool project can be downloaded free of charge from the Intranet / Internet under:

`http://www.siemens.com/automation/service&support`

Article ID 17629087

Front view

Fig. 1-1 shows the front view of the 8xIQ Sense module.
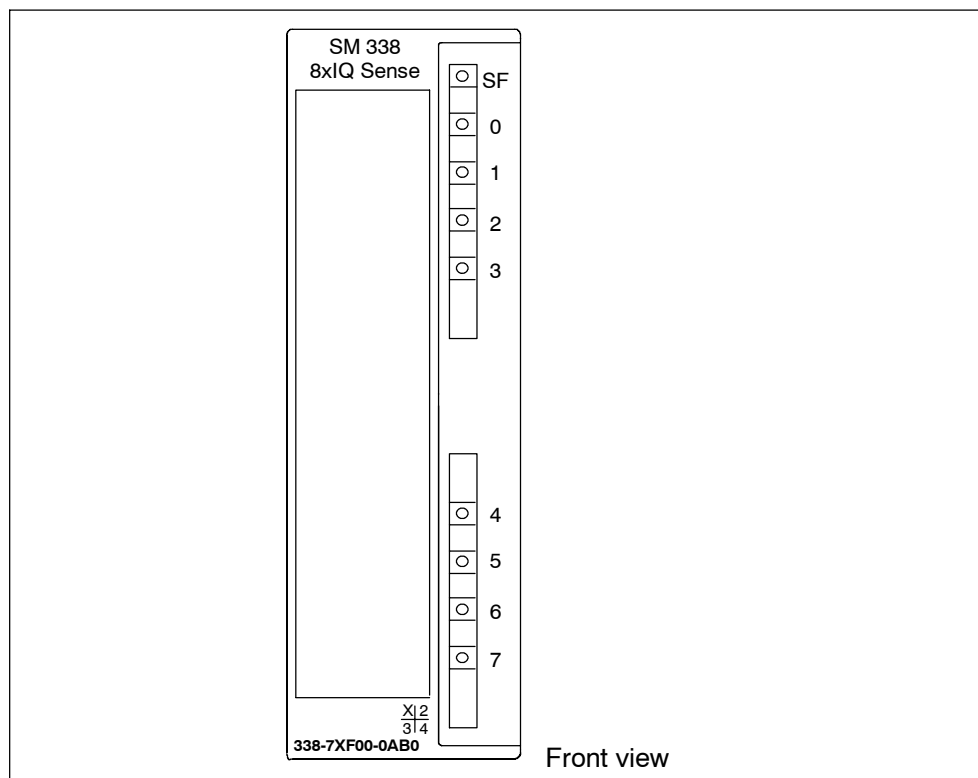
Figure 1-1   Front view of the 8xIQ Sense module

LED status indicators

The 8xIQ Sense module is equipped with one green status LED per channel. In addition, it is equipped with a red SF LED (group error LED) which indicates the diagnostic status of the module.

Table 1-2   LED displays of the 8xIQ Sense module

LED	Labeling	LED status	Meaning
Green LED per channel	0...7	Lit	Object detected
		Not lit	Object not detected, channel disabled
Red	SF	Lit	Module error, sensor error, active teach-in process, external auxiliary voltage missing
		Not lit	No error or active teach-in process

Warning

The green LED is insignificant for IQ profile ID 248 (RFID-SLG.)

Diagnostic messages of the SF LED

The 8xIQ Sense module signals active teach-in operations, module and sensor errors and missing external load voltage by means of its SF LED. The SF LED is lit when the module or IQ Sense device triggers a diagnostic event. The SF LED flashes after a faulty firmware update. It is switched off again after all errors have been rectified or all teach-in processes have been terminated.

The lit SF LED also signals external faults (short-circuit in the sensor power supply), regardless of the operating state of the CPU (upon POWER ON).

Diagnostic messages and alarm processing of the module

For information on diagnostics messages, their likely causes, remedies and available alarms, refer to chapter 5.

Replacement scenarios

- The system supports **the replacement of IQ Sense devices** (sensor, actuator) in RUN, without the need to reconfigure the device. In this case the system automatically downloads the static and dynamic parameter last used to the new IQ Sense device.

- After the **replacement of an 8xIQ Sense module**, the static parameter set used last is automatically downloaded to the new module and to the IQ Sense devices. The dynamic parameters of the IQ Sense devices must be reconfigured.

Warning

After you replace an 8xIQ Sense module, its dynamic parameters are cleared from memory. Because of the fact that dynamic parameter are usually not stored on the IQ Sense devices, you need to reconfigure these.

Standards and approvals

The specifications in the *S7-300PLC, Module data* apply to the 8xIQ Sense module.

Configuring the module in *STEP 7* **2**

Chapter overview

2.1 Basic steps

The 8xIQ Sense module is basically configured in two ways.

- Within an S7 system, you configure the module as usual in *STEP 7* V5.3 SP1 or higher.

- 8xIQ Sense modules can also be operated in combination with an ET 200M slave system on PROFIBUS DP. For this scenario, a corresponding GSD file containing IQ Sense configuration data is provided for each IM 153-x (for details, refer to the appendix.)

Warning

IQ Sense functionality can be fully utilized in the S7 system.

For information on restrictions, functionality and dependencies when integrating the 8xIQ Sense module by means of GSD file, refer to chapter 1.1.

2.2 Function overview for programming

Definitions

Programming

Programming in this context refers to the configuration of inserted modules and the and assignment of parameters using a PG/PC.

Configuring

Configure the installed modules in *STEP 7*. In this configuration, define only the basic properties of the DP slaves or modules (for example, network parameters, I/O address space.)

Parameter assignment

This refers to the assignment of parameters to inserted modules or IQ Sense devices.

Warning

A comprehensive glossary of terms used is found in the *Configuring Hardware and Connections in STEP 7* manual.

Function principle of the configuration

Fig. 2-1 illustrates the function principle of the configuration.
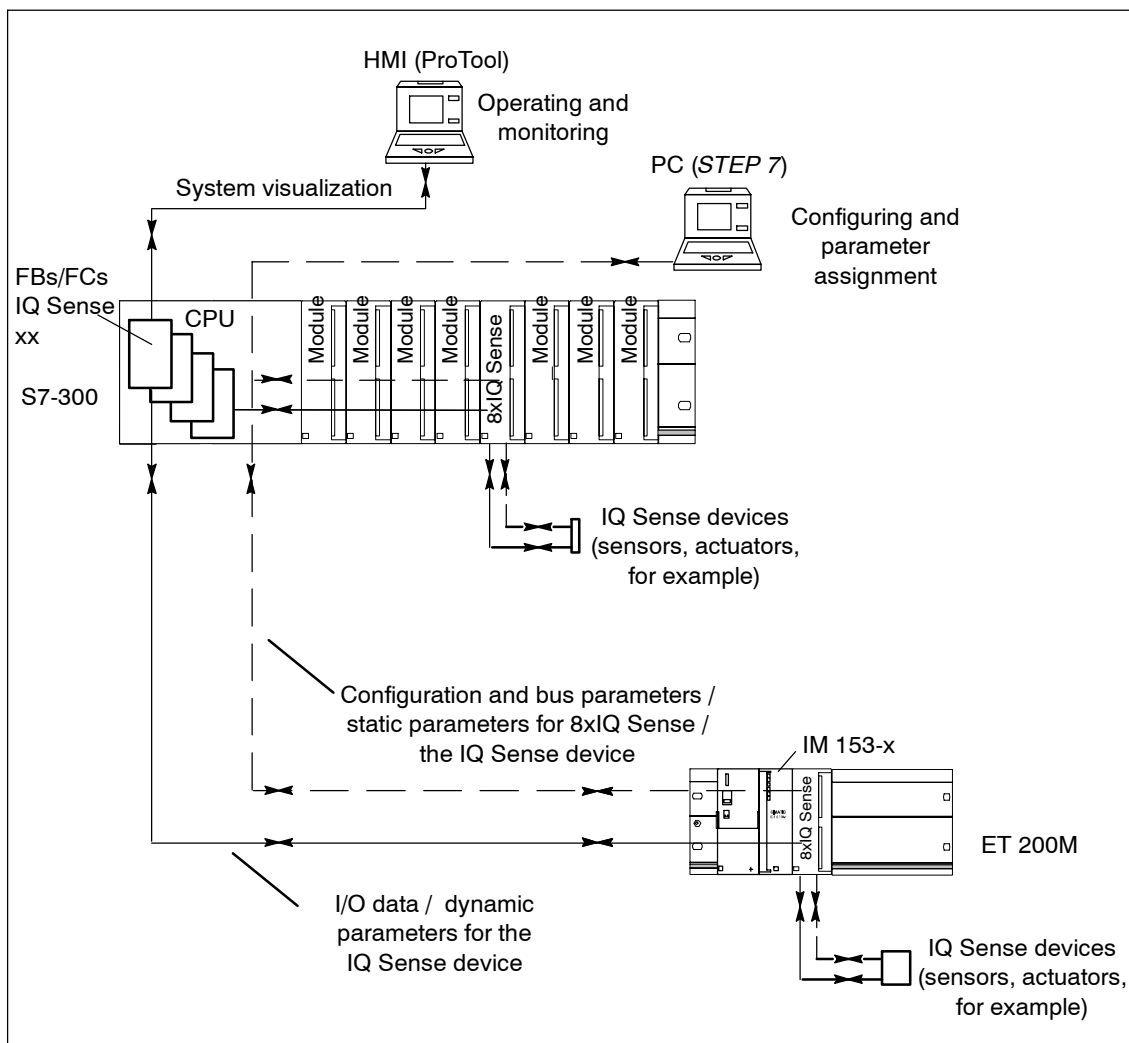
Figure 2-1   Function principle of the configuration

2.3   IQ Sense parameter assignment model

Editing static and dynamic parameters

In the context of IQ Sense, we basically distinguish two type of parameters. This static and dynamic parameters are organized in corresponding IQ profiles. The functions for mapping the IQ parameters to S7 parameter objects make allowances for this fact.

Static parameters

You set up the static parameters of IQ Sense devices and modules in *STEP 7 HW Config*. Static parameters are backed up to retentive memory in the PLC and transferred to the module during (module) startup. The module then passes the relevant parameters to the IQ Sense device.

Any change of static parameters (startup parameters) triggers a restart sequence on the module and its connected IQ Sense devices (process init). Static and dynamic parameter are automatically downloaded to replaced IQ Sense devices.

Dynamic parameters

Dynamic parameters can be edited by the user while the user program is in RUN. Dynamic parameters are usually set or modified in the program (function blocks).

Dynamic parameters are backed up to retentive memory in the module and are passed to the relevant IQ Sense device during device startup or upon initialization commands.

Table 2-1   Assignment of static and dynamic parameters

Parameter	adjustable with	CPU status
static	*STEP 7 HW Config*	STOP
dynamic	FBs (IntelliTeach)/FCs in the user program	RUN
	Teach-in	RUN

2.4 I/O data

I/O data of the IQ Sense channels (devices) are stored in the I/O data areas of the 8xIQ Sense module.

- The output data area contains the data which are transferred from the CPU to the IQ Sense device.

- The input data area contains the data which are transferred from the IQ Sense device to the CPU.

The I/O data of all IQ Sense channels are stored according to their channel number and in ascending order (see Fig. 2-2).

Address range

8xIQ Sense modules have an address range of 16 bytes of I/O data:

- One word is reserved in the input and output data areas of the module for each channel.

This always applies, regardless of the channel profile you selected for your connected device (i.e. the IQ profile IDs in *HW Config*, see chapter 3.4).

Warning

Each RFID read/write device occupies four words in the I/O address space of the module.

Access to memory areas

There is a direct correlation between the channel number an IQ Sense device is connected to (terminal) and the I/O data area of the module.

Based on the address range, we can derive the following addresses for access to memory areas:

- Address = Module start address + (channel number x 2)

    - Example: Module start address 8xIQ Sense = 280
      I/O address channel 3: 286

    - Example of 2 connected ID systems:
      Module start address 8xIQ Sense IDENT = 280
      I/O address channel 0: 280
      I/O address channel 4: 288

See the figure below.

	Channel addresses
	Module start address (I/O data)
	Example: 280
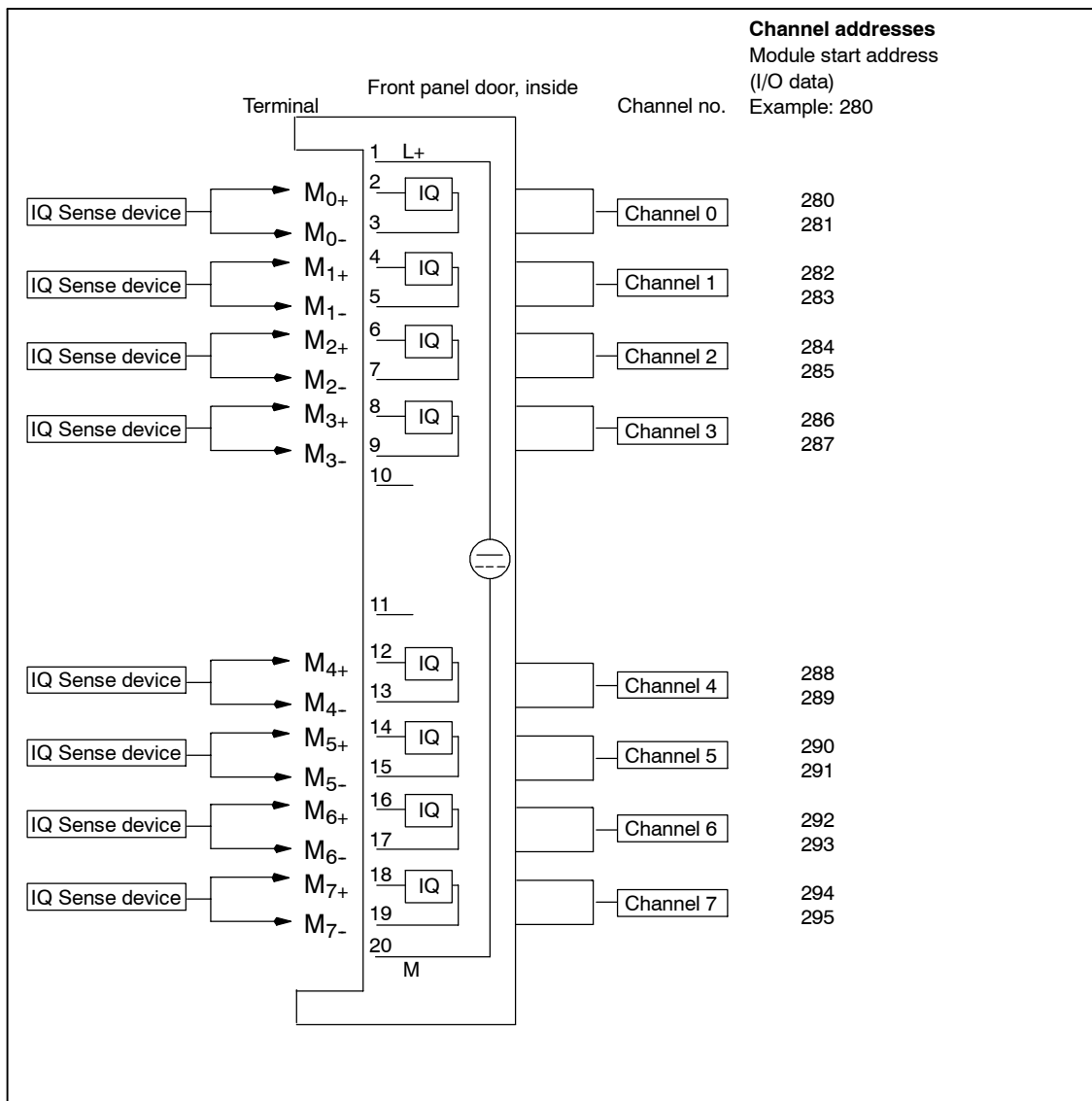
Figure 2-2 8xIQ Sense module: assignment of the terminal pair to the memory area

2.5 Overview: Steps in configuring and parameter assignment

Table 2-2   Overview: Steps in configuring and parameter assignment

The step	you can find	in chapter
1	Configuring the module in *STEP 7*	3.1
2	Enter the module start address	3.2
3	Set module-specific parameters	3.3
4	Select the channel profile	3.4
5	Set profile-specific parameters	3.5
6	Configure the parameters in FB "IQ Sense Opto Channel"	4.2
7	Configure the parameters in FB "IQ Sense Ultrasonic"	4.4
8	Configuration of FC "MOBY FC-IQ" parameters	4.6

Programming static parameters in *STEP 7* 3

Chapter overview

3.1 Configuring the module in *STEP 7*

You customize the 8xIQ Sense module parameters using the programming tool *STEP 7*.

Programming rules	
in *STEP 7* V5.3 SP1 or higher	**for *STEP 7* V4.02 or higher or external programming tools**
Provided in the hardware catalog of *HW Config*. A GSD file is not required.	IM153-x: The current version of the GSD file is available for download from the Internet, under **http://www.ad.siemens.de/csi_e/gsd**.

You configure the module in three basic steps:

- Enter the start address of the module (see chapter 3.2)
- Customize the module-specific parameters (see chapter 3.3)
- Select the channel profile and assign the parameters (see chapter 3.4).

Warning

Select the "8xIQ Sense IDENT" module from the hardware catalog if you are going to use IQ profile ID 248 for identification systems with IQ Sense interface.

3.2 Enter the module start address

To enter the module start address:

1. Select the module in *HW Config*, then select the **Edit > Object properties** command.

2. Enter the start address of the module on the "Address" tab.

Warning

Make sure you assign identical values to the start addresses of the I/O data areas.

3.3 Set module-specific parameters

To customize the module-specific parameters:

1. Select the module in *HW Config*, then select the **Edit > Object properties** command.

2. Set the following module-specific parameters on the "Base parameters" tab.

Table 3-1   Module-specific parameters

Parameter	Range of values	Default	Effective range
Diagnostic alarm enable	• Disable • Enable	Disable	Module
Interference suppression group	• None • 3 • 4	None	Module
Diagnostics channel 0 ... channel 7	• Disable • Enable	Disable	Channel

3.3.1 Enable diagnostics alarm parameter

When you enable diagnostics alarms, all diagnostics events are logged in the diagnostics data record (see chapter 5).

Requirements

The diagnostics parameter must be enabled for each channel (see chapter 3.3.3).

If you disable diagnostics alarms, but enable diagnostics for a channel x, the diagnostic event

- is not logged in the diagnostic data record,

- but is indicated on the SF LED of the module.

3.3.2 Interference suppression group parameters

Properties

- This parameter is only relevant to **optoelectronic** IQ Sense devices!

- In order to prevent interference (e.g. as a result of stray light) of neighboring optoelectronic sensors, you can use the interference suppression group parameter to assign a separate interference suppression group to the **module.** That means:

  - **Interference suppression group: None** (= default)
    An unfavorable arrangement of optoelectronic sensors operated on different modules or on the same module may cause interference.

  - **Interference suppression group: 3** or **4**
    Optoelectronic sensors with interference suppression group 3 or 4 operated on the same module can not influence each other (no interference within the module.)
    Interference between optoelectronic sensors on different modules with different interference suppression groups is also excluded (no interference between optoelectronic sensors on different modules.)
    You do not need to maintain a minimum clearance between optoelectronic IQ Sense devices, i.e. you can align two reflecting light barriers on a common reflector, for example.

- This parameter setting applies to the entire module, but takes effect only on the optoelectronic IQ Sense devices (IQ profile ID 1.)
  For IQ Sense devices with IQ profile ID 128 (ultrasonic), refer to the channel-specific parameter "Multiplex / Sync mode" (chapter 3.7.4).

Function principle

The figure below demonstrates the function principle of the interference suppression group parameter:

Interference between optoelectronic sensors of the modules in slots 5, 6, 7 and 9 may be possible, because either these are all assigned to interference suppression group 3, or "None" is set.
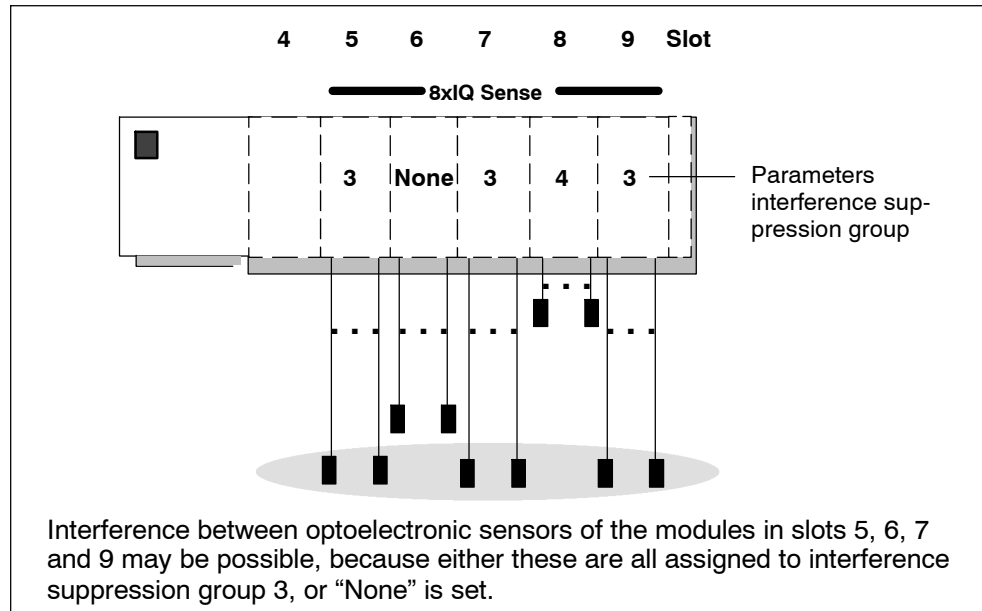
Figure 3-1   Interference suppression group

Warning

Optoelectronic sensors connected to modules with the same or undefined interference suppression group should be mounted in a way that excludes optical interference between these.

For information on the effects of the interference suppression group parameter on the scan cycle time of the 8xIQ Sense module, refer to table 3-2.

Table 3-2   Interference suppression group parameter: Scan cycle times of the IQ Sense
            devices (channels)

IQ profile ID	Parameter	Scan cycle time (per channel)
IQ profile ID1	Interference suppression group: None	approx. 3 ms
	Interference suppression group 3, 4	Only IQ profile ID 1: approx. 3 ms Other: approx. 6 ms

For further details on cycle times, refer to chapter 8.4.

3.3.3   Diagnostics channel x parameters

This parameter allows you to enable or disable diagnostics for the selected
channel x.

3.4   Select the channel profile

To select the channel profiles:

1. Select the module in *HW Config*, then select the **Edit > Object properties**
   command.

2. On the "Channel x...x+1" tab, select the "IQ Profile" for each channel of the
   connected IQ Sense device.

Warning

The IQ profile IDENT (IQ profile ID 248) of the 8xIQ Sense IDENT can only be
configured for channel 0 or channel 4:

- By setting the "IDENT" profile at channel 0, you automatically disable channels 1 to 3 for
  use in other profiles.
- By setting the "IDENT" profile at channel 4, you automatically disable channels 5 to 7 for
  use in other profiles.

Warning

You should not disable unused channels of the module if you have enabled
channel diagnostics (chapter 3.3.3), because otherwise the diagnostics function
will report a cable break (for information on diagnostics, refer to chapter 5).

You are offered the corresponding IQ profile parameters for each channel you
selected based on the selected IQ profile ID (see chapter 3.5).

3.5 Setting profile-specific parameters

Below you will find a list of parameters for the various profiles and their description. These parameters affect the IQ Sense device which is interconnected with the relevant channel.

3.6 Parameters of IQ profile ID 1 (Opto)

Table 3-3   Parameters of IQ profile ID 1

Parameter	Range of values	Default	Effective range
Sensor type	• Reflecting light barrier • Reflecting light sensor (with / without background noise suppression)	Reflecting light barrier	Channel
Switching hysteresis	• Low • Normal • High • Maximum	Low	Channel
Teach-in with button	• Possible • Not possible	Possible	Channel
Timer function	• None • On delay • Off delay • On and off delay • One-shot pulse	None	Channel
Time value	• 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

3.6.1 Sensor type parameter

Properties

You set the sensor type for each channel at this parameter:

• Reflecting light barrier or

• Reflecting light sensor (with / without BNS)

Reflecting light barrier
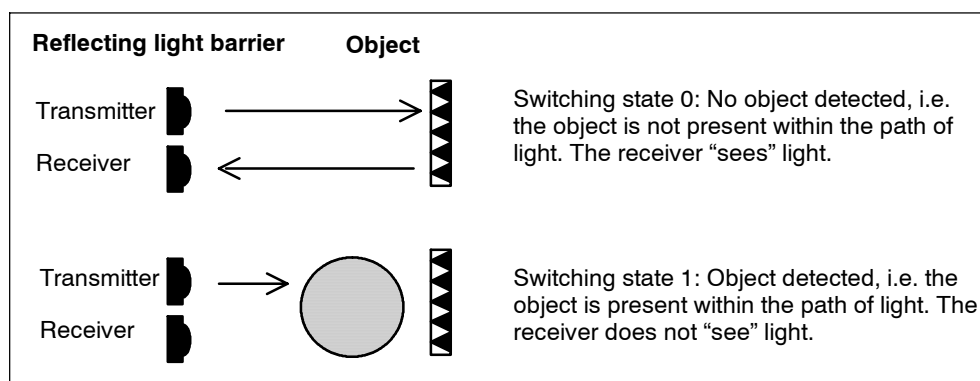
Figure 3-2   Reflecting light barrier

Reflecting light sensor with or **without background noise suppression**
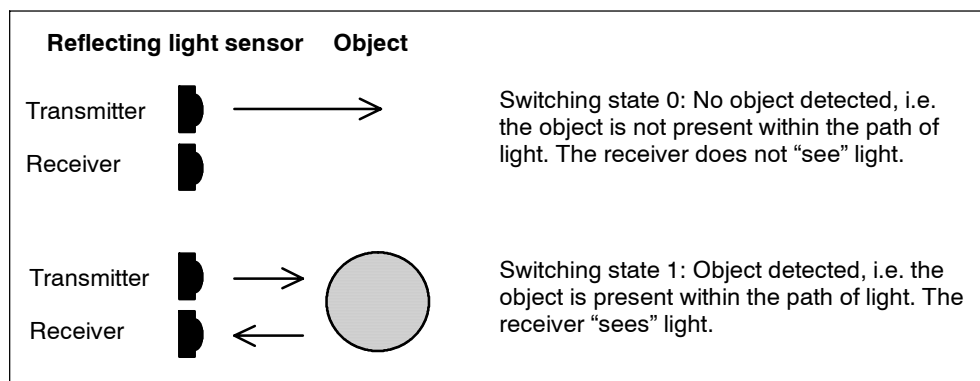
Figure 3-3   Reflecting light sensor

3.6.2   Parameters Switching hysteresis

Properties

Interference at the reflecting light sensor, or the manufacturing process, may cause "signal flutter" in this case, the measured value fluctuates around the 100 % switching threshold (object detected – object not detected.) This flutter of the switching threshold can be prevented by means of the switching hysteresis parameter. The result is a constant output signal at the sensor.

You can set a low / normal / high / maximum switching hysteresis at this parameter.

Requirements

The switching hysteresis parameter can only be set for reflecting light sensors with background noise suppression.

Function principle
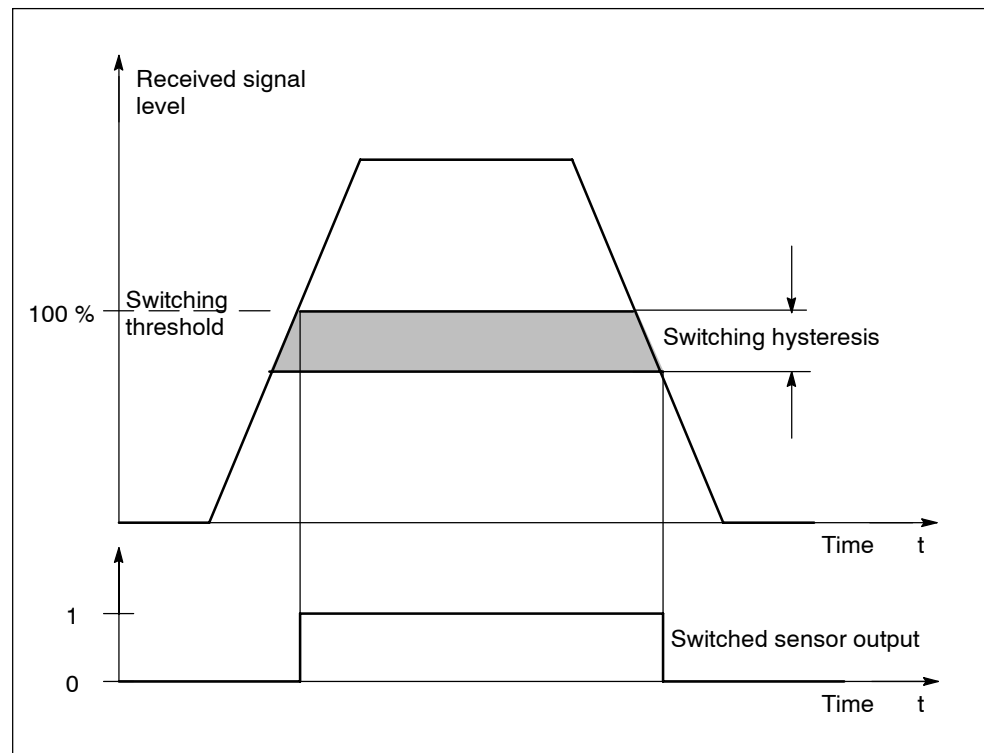
Figure 3-4   Switching hysteresis parameter

3.6.3 Teach-in with button parameter

Properties

At this parameter, you can disable the Teach-in button on the sensor.

3.6.4 Time function parameter, Time value

Properties

You can customize the module for your specific application at these parameters.

Function principle
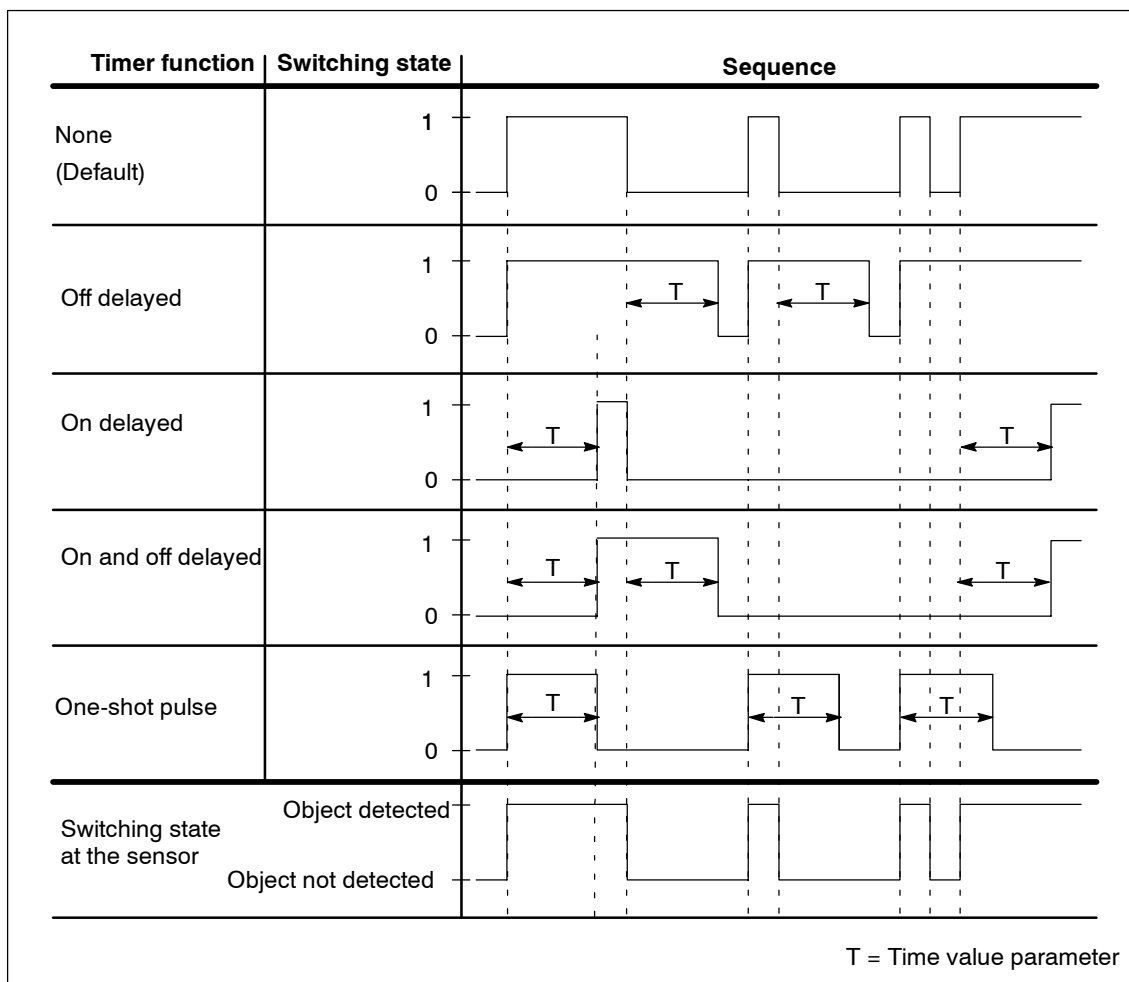
Figure 3-5   Time value parameter, time functions

3.7 Parameters of IQ profile ID 128 (ultrasonic)

Table 3-4 Parameters of IQ profile ID 128

Parameter	Range of values	Default	Effective range
Operating mode Q_CH0	• 0: Analog mode • 1: BNS button • 2: Reserved • 3: Filling level • 4: Window • 5: Reflecting light barrier • 6: Reserved • 7: Reserved	1: BNS button (background noise suppression)	Channel
Operating mode Q_CH1	• 0: Analog mode • 1: BNS button • 2: Reserved • 3: Filling level • 4: Window • 5: Reflecting light barrier • 6: Reserved • 7: Reserved	1: BNS button	Channel
Switching hysteresis	• 0.5 % • 1 % • 2 % • 5 %	0.5 %	Channel
Time function Q_CH0	• None • On delay • Off delay • On and off delay • One-shot pulse	None	Channel
Time value Q_CH0	• 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

Table 3-4   Parameters of IQ profile ID 128, continued

Parameter	Range of values	Default	Effective range
Time function Q_CH1	• None • On delay • Off delay • On and off delay • One-shot pulse	None	Channel
Time value Q_CH1	• 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
Functional reserve	• None • 0.2 % • 0.5 % • 1 % • 2 % • 5 % • 10 % • 20 % • 30 % • 40 % • 50 % • 60 % • 70 % • 80 % • 90 % • Sensor default value	None	Channel
Formation of mean value	• None • 2 • 8 • 32 • 64 • 128 • 256 • Sensor default value	None	Channel
Teach-in with button	• Possible • Not possible	Possible	Channel

Table 3-4   Parameters of IQ profile ID 128, continued

Parameter	Range of values	Default	Effective range
Multiplex / Sync mode	• Disabled • Multiplex • Synchronization	Disabled	Channel
Synchronous cycle time	• 3 ms • 6 ms • 12 ms • 24 ms • 48 ms • 96 ms	3 ms	Channel
Manufacturer-specific parameter 1	• 0...7	0	Channel
Manufacturer-specific parameter 2	• 0...15	0	Channel
Manufacturer-specific parameter 3	• 0...15	0	Channel

Warning

Below we only list and describe the parameters not already described in the section dealing with optoelectronic parameters (cf. chapter 3.6.1).

For detailed information on operating modes and other parameters, refer to the documentation provided for the Sonar-BERO.

3.7.1   Operating mode parameter

Properties

At this parameter, you set the operating mode for each switching output of a channel (Q_CH0, Q_CH1):

- Analog mode or
- BNS button, or
- filling level, or
- window, or
- reflecting light barrier.

Analog mode

In this operating mode, the relevant switching output is disabled; the measured distance is transferred cyclically as analog value to the IQ Sense module. This value is normalized to the scale of the connected sensors and entered in FB "IQ Sense Ultrasonic" (parameter Scale, see chapter 4.4 and 4.5). For information on the scaling range, please refer to the relevant sensor documentation.

The analog mode can also be used as "Test mode", because other and less useful settings are then ignored, without error messages being generated.

BNS button

In this operating mode, the IQ Sense ultrasonic device responds in the same way as an optoelectronic device with sensor type parameter = Reflecting light sensor with background noise suppression (see chapter 3.6.1).

Filling level

In this operating mode, the IQ Sense ultrasonic device responds in the same way as an optoelectronic device with switching hysteresis parameter = large (see chapter 3.6.2). This operating mode is used for filling level measurements, for example.

Window

In this operating mode, the IQ Sense ultrasonic device responds in the same way as a reflecting light sensor with foreground and background noise suppression (cf. chapter 3.6.1).

Reflecting light barrier

In this operating mode, the IQ Sense ultrasonic device responds in the same way as an optoelectronic device with sensor type parameter = Reflecting light barrier (see chapter 3.6.1).

3.7.2 Function reserve parameter

Properties

The properties of the function reserve parameter are determined by the relevant interconnected IQ Sense device (see the corresponding device documentation.)

- 15 adjustable steps plus a user-defined default value in the IQ Sense device are available.

3.7.3 Mean value parameter

Properties

Unfavorable reflection conditions or moving objects (e.g. moving liquids or parts on conveyors) may lead to continuous fluctuation of measured values and, thus, to fluttering switching reactions.

In order to counteract this effect, you can use the mean average function. When this mean average function is active, the system ignores signal losses (no objects within the detection range.) After each measurement, the system immediately calculates a new mean value, based on the new measured value and on the set number if old values.

- 7 adjustable steps plus a user-defined default value in the sensor are available.

3.7.4 Multiplex / Sync mode parameters

Properties

This parameter concerns only IQ Sense ultrasonic devices!

In order to exclude interference between neighboring IQ Sense devices with IQ profile ID 128, use this parameter to set multiplex or synchronous mode for each interconnected IQ Sense ultrasonic sensor.

Disabled

Interference between neighboring IQ Sense ultrasonic sensors is possible (default).
The cycle time is determined by the IQ Sense ultrasonic sensor (see the documentation of the relevant IQ Sense device.)

Multiplex

The IQ Sense ultrasonic sensors determine the process value (distance) in sequential order, in order to exclude interference.
The cycle time is here formed by the accumulated configured synchronous cycle times of all multiplexed IQ Sense ultrasonic sensors.

Synchronization

All IQ Sense ultrasonic sensors determine the process value (distance) precisely at the same time, in order to exclude interference.
In this case, the cycle time is proportional to the highest configured synchronous cycle time of the IQ Sense ultrasonic sensors to be synchronized.
In synchronous mode, for example, you could use a screening function so that multiple IQ Sense ultrasonic sensors share one extended detection area in parallel mode. All ultrasonic pulses output by the sensors are synchronized. When an object enters the detection range, the sensor which is closest to the object first receives the ultrasonic echo. This allows you not only to detect the object, but also to determine its position.

For information on the effects of the Multiplex / Sync mode parameter on the scan cycle time of the 8xIQ Sense module, refer to table 3-5.

Table 3-5   Multiplex / Sync mode parameter: Scan cycle times of the IQ Sense devices (channels)

IQ profile ID	Parameter	Scan cycle time (per channel)
IQ profile ID 128	Multiplex / Sync mode: Disabled	Determined by the IQ Sense devices, but > 3 ms (see the documentation of the relevant IQ Sense device)
	Multiplex / Sync mode: Multiplex	Accumulated value of the set synchronous cycle times for the channels to be multiplexed; at least approx. 6 ms
	Multiplex / Sync mode: Synchronization	The highest synchronous cycle time of one of the channels to be synchronized; at least approx. 3 ms

For further details on cycle times, refer to chapter 8.4.

3.7.5   Parameter Synchronous cycle time

Properties

Here you program the cycle time to be used at the Multiplex / Sync mode parameter for each channel of the IQ Sense ultrasonic sensor.

Warning

The value returned by the IQ Sense device is initially decisive for the synchronous cycle time, i.e. the minimum cycle time returned by the sensor (for example.) The physical cycle time, however, is never lower than the time returned by the IQ Sense device. For further information, refer to the documentation of the relevant IQ Sense device.

For further details on cycle times, refer to chapter 8.4.

3.7.6   Manufacturer-specific parameters

Properties

Use those three parameters to configure the manufacturer-specific properties of the connected IQ Sense devices (for example, by tilting the display unit). For further information, refer to the documentation of the relevant IQ Sense device.

3.8 Parameters of IQ profile ID 248 (IDENT)

Warning

Select the "8xIQ Sense IDENT" module from the hardware catalog if you are going to use IQ profile "IDENT" (IQ profile ID 248) for identification systems with IQ Sense interface.

For a detailed description of the parameters, refer to the RF 300 documentation.

Table 3-6   Parameters of IQ profile ID 248

Parameter	Range of values	Default	Effective range
AFI value	• 0...255	0	Channel
Transponder type	• 0: manufacturer-specific • 1: ISO transponder	0	Channel

3.8.1 AFI valueparameter

Properties

The AFI value (Application Family Identifier, defined in the International Standard ISO 15693-3) can be used as a criterion for the selection of transponders for different applications. The system only processes transponders whose AFI value matches the value set at the sensor. A transponder assigned AFI value "0" can be identified and processed independently of the AFI value of the sensor.

This parameter is only of significance if it is supported by the ID system, and may otherwise contain any other value (usually "0".)

3.8.2 Transponder type Parameter

Properties

Based on the transponder type, you either configure an ISO transponder, or a manufacturer-specific type.

Select the value "1" for all transponders which are compliant with International Standard ISO 15693, and set "0" for all other types. Based on this setting, you select one of two possible air interface drivers in the sensor.

This parameter is only of significance if it is supported by the ID system, and may otherwise contain any other value (usually "0".)

Programming dynamic parameters in *STEP 7*

4

Chapter overview

4.1 Functions of the FBs/FCs "IQ Sense xx"

The function blocks and functions offered provide you with a user interface to your IQ Sense devices. Basically, the various S7 blocks offer the following functionality.

Basic functionality of the "IQ Sense" FBs/FCs

- These blocks return the current process value (range value, data ...).

- The blocks return the signal status for two control points (not applicable for ID systems).

- The blocks return the error and channel status.

- The block can be used to write dynamic parameters (IntelliTeach, for example) (not applicable for ID systems).

- The block can also be used for job handling tasks.

The function blocks can be used irrespective of the module configuration data (channel profile) (see chapter 3.4).

4.2 Assigning parameters to FB "IQ Sense Opto Channel"

The FB "IQ Sense Opto Channel" supports you in operating the 8xIQ Sense modules with optolelectronic IQ Sense devices (IQ profile ID 1).

Warning

This block operates only one IQ Sense channel.

4.2.1 Interface description

Properties

- Available functions:

  - Object status logging

  - IntelliTeach (defining sensitivity and range values)

  - Teach-in (remote triggering)

- The FB does not generate diagnostic messages (for information on this diagnostics function, refer to chapter 5)

- The FB is write-protected ("closed FB")

- Capable of multiple instances.

Parameters

Table 4-1   Parameters of FB "IQ Sense Opto Channel"

Parameter	Declaration	Data type	Memory area	Description
REQ	INPUT	BOOL	I, O, M, D, L, Const.	1: Job initiation
CH_ADDR	INPUT	INTEGER	I, O, M, D, L, Const.	I/O address of channel x of the 8xIQ Sense module, for example, 286
WR_TEACH_VAL	INPUT	BOOL	I, O, M, D, L, Const.	IntelliTeach 1: Download sensitivity / range value to the sensor (triggered at the positive edge) 0: disabled
START_TEACH	INPUT	BOOL	I, O, M, D, L, Const.	1: Start teach-in (triggered at the positive edge) 0: disabled
TEACH_VAL_IN	INPUT	BYTE	I, O, M, D, L, Const.	Sensitivity / range value for IntelliTeach: 1 to 126 (01 to FE) (depends on the sensor)
ERROR_ STATE	OUTPUT	BYTE	I, O, M, D, L	Error information: If an error occurs while this function is being executed, the return value contains an error code. See the section *Error information*
CH_STATE	OUTPUT	BOOL	I, O, M, D, L	Status information of the IQ Sense device: 0: Valid process value 1: Invalid process value
BUSY	OUTPUT	BOOL	I, O, M, D, L	TRUE: Task not completed yet FALSE: Task completed
Q_CH	OUTPUT	BOOL	I, O, M, D, L	1: Object detected on x of 8xIQ Sense 0: Object not detected
TEACH_VAL_OUT	OUTPUT	BYTE	I, O, M, D, L	Sensitivity / range value at channel x: 1 to 126 (01 to FE) (depends on the sensor) Error: 0: Sensor does not have a valid sensitivity / range value

Error information at output parameter ERROR_STATE

Table 4-2   Error information of FB "IQ Sense Opto Channel"

Error code (B#16#...)	Description
00	No error
04*	Sensitivity / range value = 0 entered at input parameter TEACH_VAL_IN.
08*	Sensitivity / range value > 126 entered at input parameter TEACH_VAL_IN.
09	Input parameter WR_TEACH_VAL and START_TEACH were simultaneously set to "1" (positive edge trigger.)
FD (253)	No sensor or sensitivity / range value detected.
FF (255)	Job (teach-in) is busy

*   The input sensitivity value was not transferred to the sensor.

4.3 Example of parameter assignments with FB "IQ Sense Opto Channel"

4.3.1 Object status logging with FB "IQ Sense Opto Channel"

Properties

- You log the current object status of a selected sensor on the 8xIQ Sense module.

- You log the sensitivity / range value of a selected sensor on the 8xIQ Sense module.

Functional diagram of object status logging with FB "IQ Sense Opto Channel"
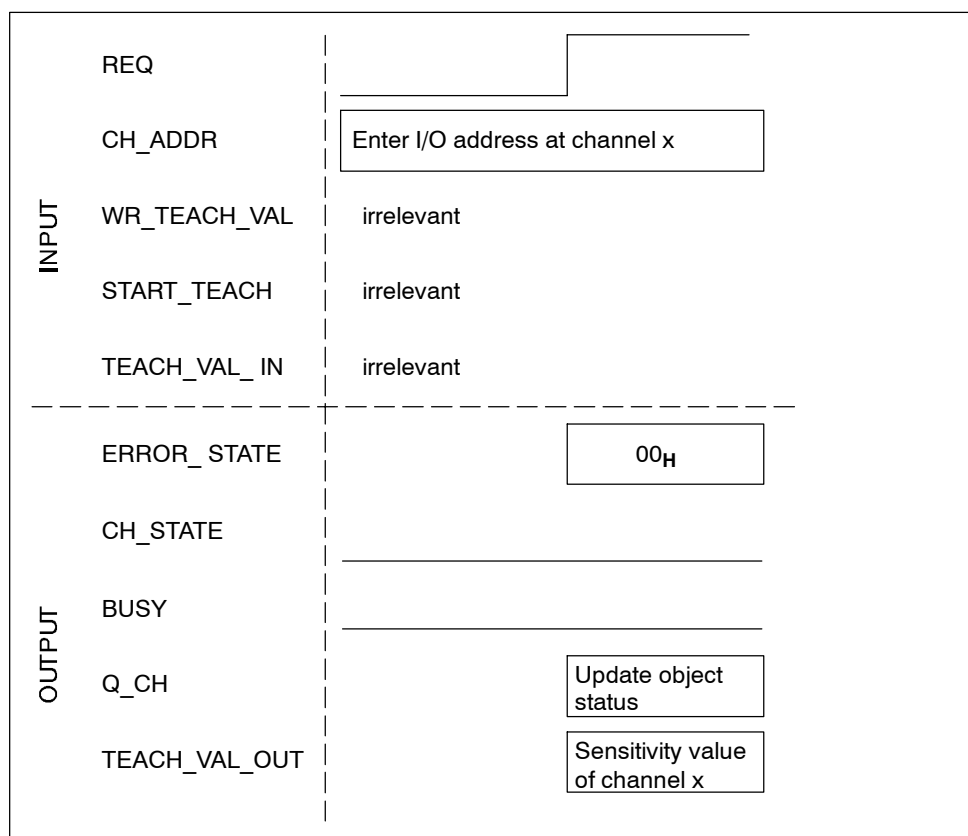
Figure 4-1   Functional diagram of object status logging with FB "IQ Sense Opto Channel"

Procedure

1. Configure FB "IQ Sense Opto Channel": INPUT/OUTPUT parameter (see chapter 4.2).

2. At the CH_ADDR parameter, enter the I/O address of the required 8xIQ Sense channel x.

3. Start this procedure by setting parameter REQ = 1.

4. The sensitivity / range value is written to output parameter TEACH_VAL_OUT. The current object status is saved to output parameter Q_CH.

5. Evaluate the ERROR_STATE (error information) and CH_STATE (status information) output parameters.

Example of object status logging with FB "IQ Sense Opto Channel"

The next example shows the call of FB "IQ Sense Opto Channel":

– Logging the channel x object status

– Logging the sensitivity / range value of channel x

– Start address of the 8xIQ Sense module: 280.

Table 4-3   Example of object status logging with FB "IQ Sense Opto Channel"

STL		Explanation
`CALL FB20,DB120`		Call of FB "IQ Sense Opto Channel" with instance DB 120 (e.g.)
`REQ`	`:=TRUE`	TRUE: Initiate execution
`CH_ADDR`	`:=286`	I/O address of channel 3 (I/O data) = 286
`WR_TEACH_VAL`	`:=`	irrelevant
`START_TEACH`	`:=`	irrelevant
`TEACH_VAL_IN`	`:=`	irrelevant
`ERROR_STATE`	`:=AB2`	AB2 contains the error information
`CH_STATE`	`:=A5.2`	A5.2 contains the status information
`BUSY`	`:=A5.1`	A5.1:=TRUE Task still busy
`Q_CH`	`:=A5.0`	A5.0 contains the new object status at channel 3
`TEACH_VAL_OUT`	`:=AB4`	AB4 contains the sensitivity / range value of the sensor on channel 3

4.3.2   Teach-in with FB "IQ Sense Opto Channel"

Properties

The "IQ Sense Opto Channel" FB can be used for remote triggering of a sensor "teach-in" job.

Functional diagram of the Teach-in function with FB "IQ Sense Opto Channel"
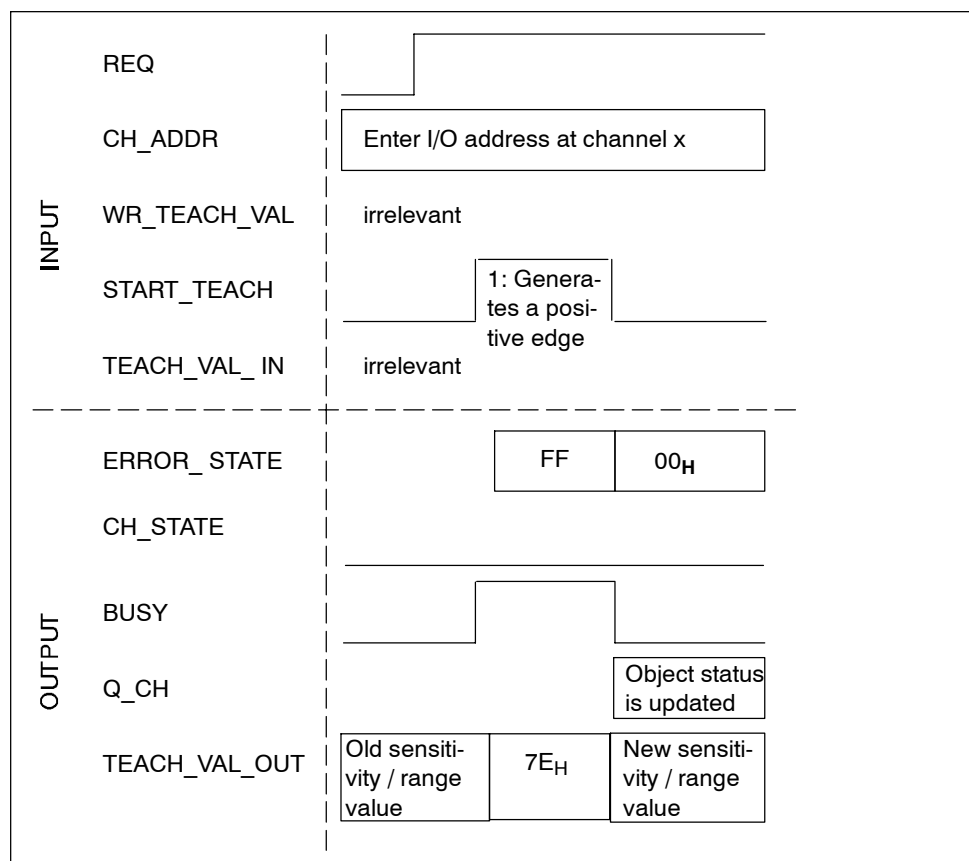
Figure 4-2   Functional diagram of the Teach-in function with FB "IQ Sense Opto Channel"

Procedure

1. Configure FB "IQ Sense Opto Channel": INPUT/OUTPUT parameter (see chapter 4.2).

2. Enable the FB with REQ = 1.

3. At the CH_ADDR parameter, enter the I/O address of the required 8xIQ Sense channel x.

4. Start the Teach-in job with a positive edge at the START_TEACH parameter.

5. After Teach-in is completed (several bright / dark value processes), terminate the function with a negative edge at the START_TEACH parameter.

6. The sensitivity / range value is written to output parameter TEACH_VAL_OUT. The current object status is saved to output parameter Q_CH.

7. Evaluate the ERROR_STATE (error information) and CH_STATE (status information) output parameters.

Example of Teach-in with FB "IQ Sense Opto Channel"

The example below shows you the call of FB "IQ Sense Opto Channel" when teaching a sensor on channel 3. The module start address of the 8xIQ Sense is here 280.

Table 4-4   Example of Teach-in with FB "IQ Sense Opto Channel"

STL		Explanation
CALL FB20,DB120		Call of FB "IQ Sense Opto Channel" with instance DB 120 (e.g.)
REQ	:=TRUE	TRUE: Initiate execution
CH_ADDR	:=286	I/O address of channel 3 (I/O data) = 286
WR_TEACH_VAL	:=	irrelevant
START_TEACH	:=E5.7	E5.7:=TRUE Start Teach-in =FALSE Terminate Teach-in
TEACH_VAL_IN	:=	irrelevant
ERROR_STATE	:=AB2	AB2 contains the error information
CH_STATE	:=A5.2	A5.2 contains the status information
BUSY	:=A5.1	A5.1:=TRUE Task still busy
Q_CH	:=A5.0	A5.0 contains the new object status at channel 3
TEACH_VAL_OUT	:=AB4	AB4 contains the logged sensitivity / range value of the sensor on channel 3

4.3.3   IntelliTeach (preset of sensitivity / range values) with FB "IQ Sense Opto Channel"

Properties

The "IQ Sense Opto Channel" FB can be used to transfer a sensitivity / range value

- to a selected sensor of a module, and
- to copy it to other sensors.

Functional diagram IntelliTeach with FB "IQ Sense Opto Channel"
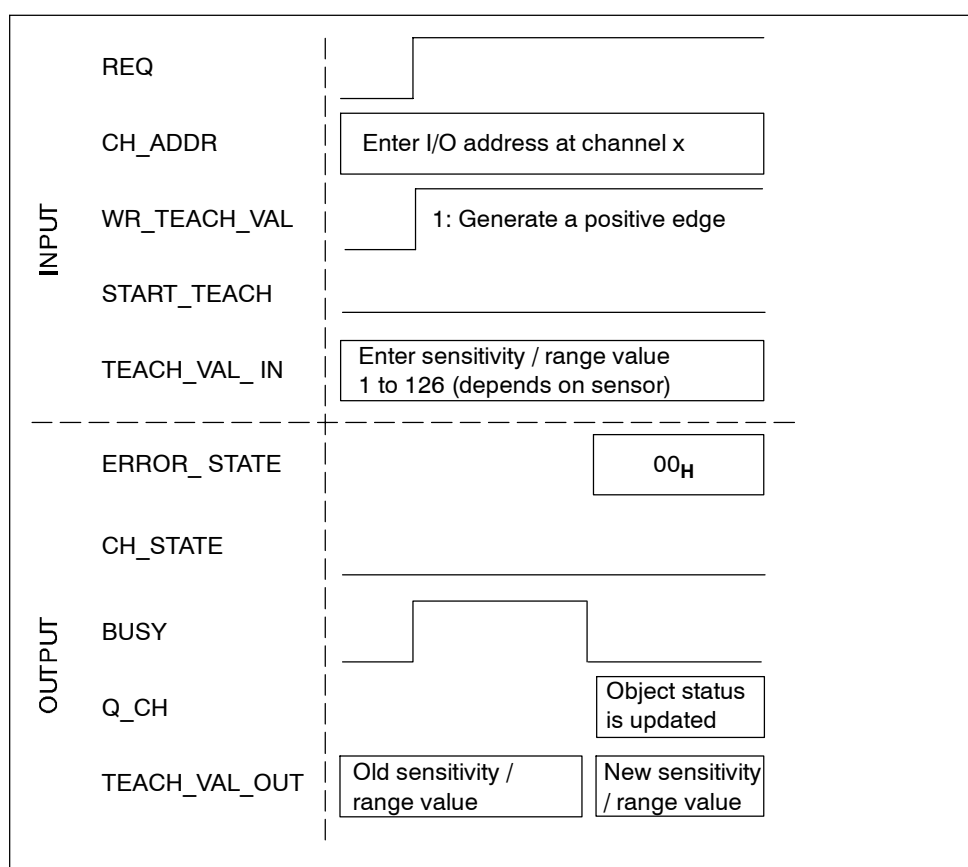
Figure 4-3   Functional diagram IntelliTeach with FB "IQ Sense Opto Channel"

Procedure

1. Configure FB "IQ Sense Opto Channel": INPUT/OUTPUT parameter (see chapter 4.2).

2. Enable the FB with REQ = 1.

3. At the CH_ADDR parameter, enter the I/O address of the required 8xIQ Sense channel x.

4. At the TEACH_VAL_IN parameter, enter a sensitivity / range value from 1 to 126 (depends on sensor.)

5. The sensitivity / range value is transferred to the sensor by generating a positive edge at the WR_TEACH_VAL input parameter.

6. The new sensitivity / range value is written to output parameter TEACH_VAL_OUT. The current object status is saved to output parameter Q_CH.

7. Evaluate the ERROR_STATE (error information) and CH_STATE (status information) output parameters.

Example of IntelliTeach with FB "IQ Sense Opto Channel"

The example below shows the call of FB "IQ Sense Opto Channel", at a preset sensitivity / range value 70 (46_H) for the sensor on channel 3. The start address of the 8xIQ Sense module is 280.

Table 4-5   Example of IntelliTeach with FB "IQ Sense Opto Channel"

STL		Explanation
CALL FB20,DB120		Call of FB "IQ Sense Opto Channel" with instance DB 120 (e.g.)
REQ	:=TRUE	TRUE: Initiate execution
CH_ADDR	:=286	I/O address of channel 3 (I/O data) = 286
WR_TEACH_VAL	:=E5.7	E5.7:=TRUE Transfers the sensitivity / range value to the sensor
START_TEACH	:=FALSE	FALSE: No Teach-in
TEACH_VAL_IN	:=EB4	EB4:=46_H sensitivity / range value 70
ERROR_STATE	:=AB2	AB2 contains the error information
CH_STATE	:=A5.2	A5.2 contains the status information
BUSY	:=A5.1	A5.1:=TRUE Task still busy
Q_CH	:=A5.0	A5.0 contains the new object status at channel 3
TEACH_VAL_OUT	:=AB4	AB4 contains the new sensitivity / range value of the sensor on channel 3

4.4 Configuring FB "IQ Sense Ultrasonic"

FB "IQ Sense Ultrasonic" supports you in operating the 8xIQ Sense module with IQ Sense ultrasonic devices (IQ profile ID 128).

Warning

This block operates only one IQ Sense channel.

4.4.1 Interface description

Properties

- Available functions:
  - Object status logging
  - IntelliTeach (defining the switching points)
  - Teach-in (remote triggering)
  - Call of sensor-relevant functions (requests to the sensor / actuator, e.g. read / write sensor data)
- The FB does not generate diagnostic messages (for information on this diagnostics function, refer to chapter 5)
- The FB is write-protected ("closed FB")
- Capable of multiple instances.

Parameters

Table 4-6   Parameters of FB "IQ Sense Ultrasonic"

Parameter	Declaration	Data type	Memory area	Description
REQ	INPUT	BOOL	I, O, M, D, L, Const.	1: Job initiation
LADDR	INPUT	INTEGER	I, O, M, D, L, Const.	Start address of the 8xIQ Sense module, e.g.280
CH_ADDR	INPUT	INTEGER	I, O, M, D, L, Const.	I/O address of channel x of the 8xIQ Sense module, for example, 286

Table 4-6   Parameters of FB "IQ Sense Ultrasonic", continued

Parameter	Declaration	Data type	Memory area	Description
FUNC_SELECT	INPUT	INTEGER	I, O, M, D, L, Const.	Selection of the task: 0: IntelliTeach all (see chapter 4.5.2) 2: IntelliTeach SP0.0 3: IntelliTeach SP0.1 4: IntelliTeach SP0.0 5: IntelliTeach SP0.1 6: Reserved 7: Reserved 8: Teach-in TP0.0 9: Teach-in TP0.1 (see chapter 4.5.3) 10: Teach-in TP0.0 11: Teach-in TP0.1 12: Read switching positions (see chapter 4.5.4) 13 ... 15: Reserved 16:Read sensor diagnostics data (see chapter 4.5.5) 17 ... 34: Reserved 35 ... 255: Reserved for sensor-specific functions (see chapter 4.5.6) 10000: Delete all dynamic parameters of the module – **Caution**: This deletes the dynamic parameters **of all module channels!**
SP00	INPUT	REAL	I, O, M, D, L, Const.	Switching position SP0.0 in mm
SP01	INPUT	REAL	I, O, M, D, L, Const.	Switching position SP0.1 in mm
SP10	INPUT	REAL	I, O, M, D, L, Const.	Switching position SP1.0 in mm (if available)
SP11	INPUT	REAL	I, O, M, D, L, Const.	Switching position SP1.1 in mm (if available)
START_FUNC	INPUT	BOOL	I, O, M, D, L, Const.	1: Start function / job (triggered at the positive edge) 0: disabled
SCALE	INPUT	INTEGER	I, O, M, D, L, Const.	Sensor scaling range: 0 ... 32767
DATA_IN	INPUT	ANY	I, O, M, D, L	Data area for parameters / job (16 bytes)
TIM_WD	INPUT	TIMER	TIMER	Select the watchdog timer
TIM_POLL	INPUT	TIMER	TIMER	Select the polling timer
ERROR_STATE	OUTPUT	BYTE	I, O, M, D, L	Error information: If an error occurs while this function is being executed, the return value contains an error code. See the section *Error information*

Table 4-6   Parameters of FB "IQ Sense Ultrasonic", continued

Parameter	Declaration	Data type	Memory area	Description
BUSY	OUTPUT	BOOL	I, O, M, D, L	1: Task still busy 0: Task completed
Q_CH0	OUTPUT	BOOL	I, O, M, D, L	Switching output 0 (according to operating mode): 1: Object detected 0: No object detected
Q_CH1	OUTPUT	BOOL	I, O, M, D, L	Switching output 1 (according to operating mode): 1: Object detected 0: No object detected
DISTANCE	OUTPUT	REAL	I, O, M, D, L	Process value (distance...) in mm
CH_STATE	OUTPUT	BOOL	I, O, M, D, L	Status information of the IQ Sense device: 0: Valid process value 1: Invalid process value
DATA_OUT	OUTPUT	ARRAY (1 ... 22)	D, L	Data area for job response

Error information at output parameter ERROR_STATE

Table 4-7   Error information of FB "IQ Sense Ultrasonic"

Error code (B#16#...)	Description
00	No error
FA (250)	Communication error
FB (251)	Temporary error (another job is still busy)
FC (252)	Faulty parameters
FD (253)	No sensor available *
FE (254)	Timeout (no feedback)
FF (255)	Job is busy
01 - F0 (1 - 240)	Error code (RES_CODE) of the IQ Sense device

*   Hence, DISTANCE = "0" and CH_STATE = "1".

4.5 Example of parameter assignments with FB "IQ Sense Ultrasonic"

4.5.1 Object status logging with FB "IQ Sense Opto Ultrasonic"

Properties

- You log the current object status / distance of a selected ultrasonic sensor connected to the 8xIQ Sense module.

Functional diagram of object status logging with FB "IQ Sense Ultrasonic"

INPUT		
REQ		
LADDR	Enter module start address	
CH_ADDR	Enter I/O address at channel x	
FUNC_SELECT	irrelevant	
SP00	irrelevant	
SP01	irrelevant	
SP10	irrelevant	
SP11	irrelevant	
START_FUNC	irrelevant	
SCALE	Enter the sensor scaling range in [mm] (sensor-specific)	
DATA_IN	irrelevant	
TIM_WD	Select the watchdog timer	
TIM_POLL	Select the polling timer	

OUTPUT		
ERROR_STATE	00_H	
BUSY		
Q_CH0	Update object status	
Q_CH1	Update object status	
DISTANCE	Range value at channel x	
CH_STATE		
DATA_OUT	irrelevant	

Figure 4-4   Functional diagram of object status logging with FB "IQ Sense Ultrasonic"

Procedure

1. Configure FB "IQ Sense Ultrasonic": INPUT/OUTPUT parameters (see chapter 4.4).

2. At the LADDR parameter, enter the start address of the 8xIQ Sense module, and at the CH_ADDR parameter, the I/O address of the selected channel x of the 8xIQ Sense.

3. Start this procedure by setting parameter REQ = 1.

4. The object distance in [mm] is written to output parameter DISTANCE. The current object status is saved to the output parameters Q_CH0 and Q_CH1.

5. Evaluate the ERROR_STATE (error information) and CH_STATE (status information) output parameters.

Example of object status logging with FB "IQ Sense Ultrasonic"

The next example shows the call of FB "IQ Sense Ultrasonic":

– Logging the channel x object status

– Logging the object distance value at channel x

– Start address of the 8xIQ Sense module: 288.

Table 4-8 Example of object status logging with FB "IQ Sense Ultrasonic"

STL		Explanation
`CALL FB21,DB125`		`Call of FB "IQ Sense Ultrasonic" with instance DB 125 (e.g.)`
`REQ`	`:=TRUE`	`TRUE: Initiate execution`
`LADDR`	`:=288`	`Module start address = 288`
`CH_ADDR`	`:=296`	`I/O address of channel 4 (I/O data) = 296`
`FUNC_SELECT`	`:=`	`irrelevant`
`SP00`	`:=`	`irrelevant`
`SP01`	`:=`	`irrelevant`
`SP10`	`:=`	`irrelevant`
`SP11`	`:=`	`irrelevant`
`START_FUNC`	`:=`	`irrelevant`
`SCALE`	`:=500`	`Enter the sensor scaling range in [mm] (see the sensor documentation)`
`DATA_IN`	`:=`	`irrelevant`
`TIM_WD`	`:=T4`	`T4 is used as watchdog Timer 1`
`TIM_POLL`	`:=T5`	`T5 is used as watchdog Timer 2`
`ERROR_STATE`	`:=AB2`	`AB2 contains the error information`
`BUSY`	`:=A5.2`	`A5.2:=TRUE Task still busy`
`Q_CH0`	`:=A5.0`	`A5.0 contains the new object status at Q_CH0`
`Q_CH1`	`:=A5.1`	`A5.1 contains the new object status at Q_CH1`
`DISTANCE`	`:=MD40`	`MD40 contains the new object distance in [mm]`
`CH_STATE`	`:=A5.2`	`A5.2 contains the status information`
`DATA_OUT`	`:=`	`irrelevant`

4.5.2 IntelliTeach (preset of switching positions) with FB "IQ Sense Ultrasonic"

Properties

FB "IQ Sense Ultrasonic" can be used to transfer a switching position to

- to a selected sensor of a module, and
- to copy it to other sensors.

Functional diagram IntelliTeach with FB "IQ Sense Ultrasonic"

INPUT	REQ	
	LADDR	Enter module start address
	CH_ADDR	Enter I/O address at channel x
	FUNC_SELECT	Select "IntelliTeach all"
	SP00	Enter the switching position in [mm] (sensor-specific)
	SP01	Enter the switching position in [mm] (sensor-specific)
	SP10 (if available)	Enter the switching position in [mm] (sensor-specific)
	SP11 (if available)	Enter the switching position in [mm] (sensor-specific)
	START_FUNC	1: Generates a positive edge
	SCALE	Enter the sensor scaling range in [mm] (sensor-specific)
	DATA_IN	irrelevant
	TIM_WD	Select the watchdog timer
	TIM_POLL	Select the polling timer
OUTPUT	ERROR_STATE	IntelliTeach is busy 00$_H$
	BUSY	
	Q_CH0	Object status is updated
	Q_CH1	Object status is updated
	DISTANCE	Range value at channel x
	CH_STATE	
	DATA_OUT	irrelevant

Figure 4-5   Functional diagram IntelliTeach with FB "IQ Sense Ultrasonic"

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A5E00247642-02

Procedure

1. Configure FB "IQ Sense Ultrasonic": INPUT/OUTPUT parameters (see chapter 4.4).

2. Enable the FB with REQ = 1.

3. At the LADDR parameter, enter the start address of the 8xIQ Sense module, and at the CH_ADDR parameter, the I/O address of the selected channel x of the 8xIQ Sense.

4. At the FUNC_SELECT parameter, set function 0 for "IntelliTeach all" (= transfer all switching positions to the sensor).

5. At the SP00 and SP01 (and at SP10 and SP11, if available) parameters, enter the required switching position values.

6. Start IntelliTeach with a positive edge at the START_TEACH parameter.

7. The object distance in [mm] is written to output parameter DISTANCE. The current object status is saved to the output parameters Q_CH0 and Q_CH1.

8. Evaluate the ERROR_STATE (error information) and CH_STATE (status information) output parameters.

Example of IntelliTeach with FB "IQ Sense Ultrasonic"

The example below shows the call of FB "IQ Sense Ultrasonic" when presetting the switching threshold values of the ultrasonic sensor on channel 4. The module start address of 8xIQ Sense is 288.

Table 4-9   Example of IntelliTeach with FB "IQ Sense Ultrasonic"

STL		Explanation
`CALL FB21,DB125`		Call of FB "IQ Sense Ultrasonic" with instance DB 125 (e.g.)
`REQ`	`:=TRUE`	TRUE: Initiate execution
`LADDR`	`:=288`	Module start address = 288
`CH_ADDR`	`:=296`	I/O address of channel 4 (I/O data) = 296
`FUNC_SELECT`	`:=0`	Task selection: 0 = IntelliTeach all
`SP00`	`:=60.0`	Switching position value SP00: 60 mm
`SP01`	`:=200.0`	Switching position value SP01: 200 mm
`SP10`	`:=90.0`	If SP10 is available: Switching position value SP10: 90 mm
`SP11`	`:=400.0`	If SP11 is available: Switching position value SP11: 400 mm
`START_FUNC`	`:=E1.0`	A positive edge at I1.0 initiates the transfer of the new switching positions to the sensor
`SCALE`	`:=500`	Enter the sensor scaling range in [mm] (see the sensor documentation)
`DATA_IN`	`:=`	irrelevant
`TIM_WD`	`:=T4`	T4 is used as watchdog Timer 1
`TIM_POLL`	`:=T5`	T5 is used as watchdog Timer 2
`ERROR_STATE`	`:=AB2`	AB2 contains the error information
`BUSY`	`:=A5.2`	A5.2:=TRUE Task still busy
`Q_CH0`	`:=A5.0`	A5.0 contains the object status at Q_CH0
`Q_CH1`	`:=A5.1`	A5.1 contains the object status at Q_CH1
`DISTANCE`	`:=MD40`	MD40 contains the new object distance in [mm]
`CH_STATE`	`:=A5.2`	A5.2 contains the status information
`DATA_OUT`	`:=`	irrelevant

4.5.3 Teach-in with FB "IQ Sense Ultrasonic"

Properties

FB "IQ Sense Ultrasonic" can be used for remote triggering of a sensor "teach-in" job.

Functional diagram of the Teach-in function with FB "IQ Sense Ultrasonic"

INPUT		
REQ		
LADDR	Enter module start address	
CH_ADDR	Enter I/O address at channel x	
FUNC_SELECT	Select "Teach-in TPx.x"	
SP00	irrelevant	
SP01	irrelevant	
SP10	irrelevant	
SP11	irrelevant	
START_FUNC		1: Generates a positive edge
SCALE	Enter the sensor scaling range in [mm] (sensor-specific)	
DATA_IN	irrelevant	
TIM_WD	Select the watchdog timer	
TIM_POLL	Select the polling timer	

OUTPUT		
ERROR_ STATE	Teach-in is busy	00$_H$
BUSY		
Q_CH0		Object status is updated
Q_CH1		Object status is updated
DISTANCE		Range value at channel x
CH_STATE		
DATA_OUT	irrelevant	

Figure 4-6   Functional diagram of the Teach-in function with FB "IQ Sense Ultrasonic"

Procedure

1. Configure FB "IQ Sense Ultrasonic": INPUT/OUTPUT parameters (see chapter 4.4).

2. Enable the FB with REQ = 1.

3. At the LADDR parameter, enter the start address of the 8xIQ Sense module, and at the CH_ADDR parameter, the I/O address of the selected channel x of the 8xIQ Sense.

4. At the FUNC_SELECT parameter, set the required function (e.g. "9" for "Teach-in TP0.1").

5. Start the Teach-in job with a positive edge at the START_FUNC parameter.

6. The IQ Sense sensor detects the range value and automatically terminates the Teach-in process.

7. The object distance in [mm] is written to output parameter DISTANCE. The current object status is saved to the output parameters Q_CH0 and Q_CH1.

8. Evaluate the ERROR_STATE (error information) and CH_STATE (status information) output parameters.

Example of the Teach-in function with FB "IQ Sense Ultrasonic"

The example below shows you the call of FB "IQ Sense Ultrasonic" for executing a Teach-in of the switching position SP0.1 of the ultrasonic sensor at channel 4. The module start address of 8xIQ Sense is 288.

Table 4-10 Example of the Teach-in function with FB "IQ Sense Ultrasonic"

STL		Explanation
CALL FB21,DB125		Call of FB "IQ Sense Ultrasonic" with instance DB 125 (e.g.)
REQ	:=TRUE	TRUE: Initiate execution
LADDR	:=288	Module start address = 288
CH_ADDR	:=296	I/O address of channel 4 (I/O data) = 296
FUNC_SELECT	:=9	Task selection: 9 = Teach-in TP0.1
SP00	:=	irrelevant
SP01	:=	irrelevant
SP10	:=	irrelevant
SP11	:=	irrelevant
START_FUNC	:=E1.0	A positive edge at I1.0 initiates the Teach-in of TP0.1
SCALE	:=500	Enter the sensor scaling range in [mm] (see the sensor documentation)
DATA_IN	:=	irrelevant
TIM_WD	:=T4	T4 is used as watchdog Timer 1
TIM_POLL	:=T5	T5 is used as watchdog Timer 2
ERROR_STATE	:=AB2	AB2 contains the error information
BUSY	:=A5.2	A5.2:=TRUE Task still busy
Q_CH0	:=A5.0	A5.0 contains the object status at Q_CH0
Q_CH1	:=A5.1	A5.1 contains the object status at Q_CH1
DISTANCE	:=MD40	MD40 contains the new object distance in [mm]
CH_STATE	:=A5.2	A5.2 contains the status information
DATA_OUT	:=	irrelevant

4.5.4 Reading the switching positions of the ultrasonic sensor

Properties

FB "IQ Sense Ultrasonic" can be used to read the switching positions of the ultrasonic sensor.

Functional diagram of the function for reading the switching positions of the sensor with FB "IQ Sense Ultrasonic"

INPUT		
REQ		
LADDR	Enter module start address	
CH_ADDR	Enter I/O address at channel x	
FUNC_SELECT	Select the "Read switching positions" task	
SP00	irrelevant	
SP01	irrelevant	
SP10	irrelevant	
SP11	irrelevant	
START_FUNC	1: Generates a positive edge	
SCALE	Enter the sensor scaling range in [mm] (sensor-specific)	
DATA_IN	irrelevant	
TIM_WD	Select the watchdog timer	
TIM_POLL	Select the polling timer	

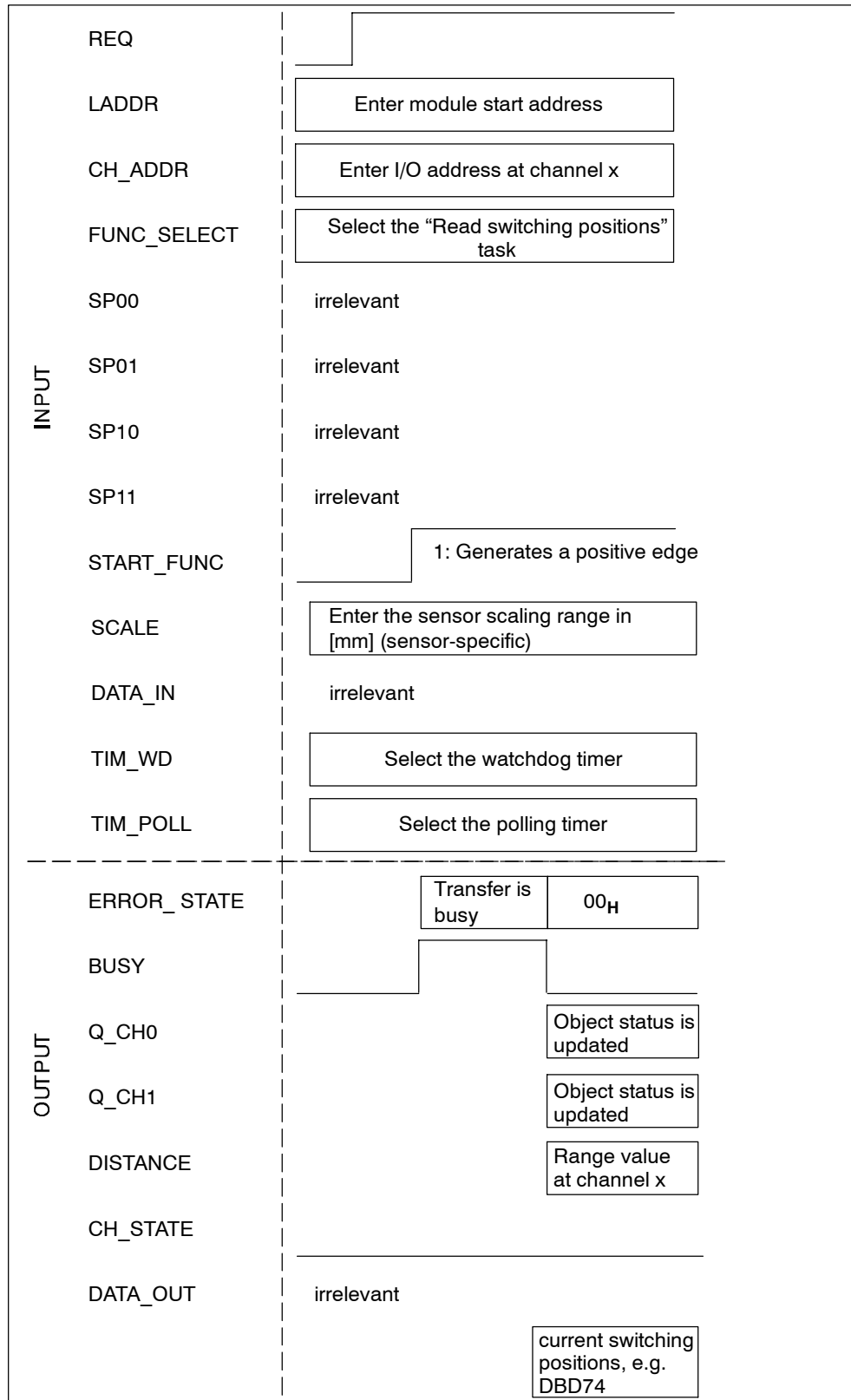| OUTPUT		
ERROR_ STATE	Transfer is busy	00$_H$
BUSY		
Q_CH0		Object status is updated
Q_CH1		Object status is updated
DISTANCE		Range value at channel x
CH_STATE		
DATA_OUT	irrelevant	
		current switching positions, e.g. DBD74

Figure 4-7   Functional diagram of the function for reading the switching positions of the sensor with FB "IQ Sense Ultrasonic"

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Procedure

1. Configure FB "IQ Sense Ultrasonic": INPUT/OUTPUT parameters (see chapter 4.4).

2. Enable the FB with REQ = 1.

3. At the LADDR parameter, enter the start address of the 8xIQ Sense module, and at the CH_ADDR parameter, the I/O address of the selected channel x of the 8xIQ Sense.

4. At the FUNC_SELECT parameter, set function 12 for "Read switching positions (= read all switching positions from the sensor).

5. Start the read operation with a positive edge at the START_FUNC parameter.

6. The switching positions [in mm] are written to the static variables (STAT) of the instance DB (see the call example below.)
   The object distance in [mm] is written to output parameter DISTANCE. The current object status is saved to the output parameters Q_CH0 and Q_CH1.

7. Evaluate the ERROR_STATE (error information) and CH_STATE (status information) output parameters.

Example of the function for reading the switching positions of the sensor with FB "IQ Sense Ultrasonic"

The example below shows you the call of FB "IQ Sense Ultrasonic" for reading the switching positions of the ultrasonic sensor at channel 4. The module start address of 8xIQ Sense is 288.

Table 4-11   Example of the function for reading the switching positions of the ultrasonic sensor with FB "IQ Sense Ultrasonic"

STL		Explanation
CALL FB21,DB125		Call of FB "IQ Sense Ultrasonic" with instance DB 125 (e.g.)
REQ	:=TRUE	TRUE: Initiate execution
LADDR	:=288	Module start address = 288
CH_ADDR	:=296	I/O address of channel 4 (I/O data) = 296
FUNC_SELECT	:=12	Task selection: 12 = Read switching positions
SP00	:=	irrelevant
SP01	:=	irrelevant
SP10	:=	irrelevant
SP11	:=	irrelevant
START_FUNC	:=E1.0	A positive edge at I1.0 initiates reading of the sensor switching positions
SCALE	:=500	Enter the sensor scaling range in [mm] (see the sensor documentation)
DATA_IN	:=	irrelevant
TIM_WD	:=T4	T4 is used as watchdog Timer 1
TIM_POLL	:=T5	T5 is used as watchdog Timer 2
ERROR_STATE	:=AB2	AB2 contains the error information
BUSY	:=A5.2	A5.2:=TRUE Task still busy
Q_CH0	:=A5.0	A5.0 contains the object status at Q_CH0
Q_CH1	:=A5.1	A5.1 contains the object status at Q_CH1
DISTANCE	:=MD40	MD40 contains the new object distance in [mm]
CH_STATE	:=A5.2	A5.2 contains the status information
DATA_OUT	:=	irrelevant

To read the various switching positions:

STL		Explanation
L DB125.DBD 74		Read switching position SP00
T MD44	:=60.0	Switching position SP00 in mm (example)
L DB125.DBD 78		Read switching position SP01
T MD44	:=200.0	Switching position SP01 in mm (example)
L DB125.DBD 82		Read switching position SP10 (if available)
T MD44	:=90.0	Switching position SP10 in mm (example)
L DB125.DBD 86		Read switching position SP11 (if available)
T MD44	:=400.0	Switching position SP11 in mm (example)

4.5.5 Reading diagnostic data of the sensor with FB "IQ Sense Ultrasonic"

Properties

FB "IQ Sense Ultrasonic" can be used to read diagnostic data of the ultrasonic sensor.

Functional diagram of the read diagnostic data function with FB "IQ Sense Ultrasonic"

INPUT		
REQ		
LADDR	Enter module start address	
CH_ADDR	Enter I/O address at channel x	
FUNC_SELECT	Select the "Read sensor diagnostics" task	
SP00	irrelevant	
SP01	irrelevant	
SP10	irrelevant	
SP11	irrelevant	
START_FUNC	1: Generates a positive edge	
SCALE	Enter the sensor scaling range in [mm] (sensor-specific)	
DATA_IN	irrelevant	
TIM_WD	Select the watchdog timer	
TIM_POLL	Select the polling timer	

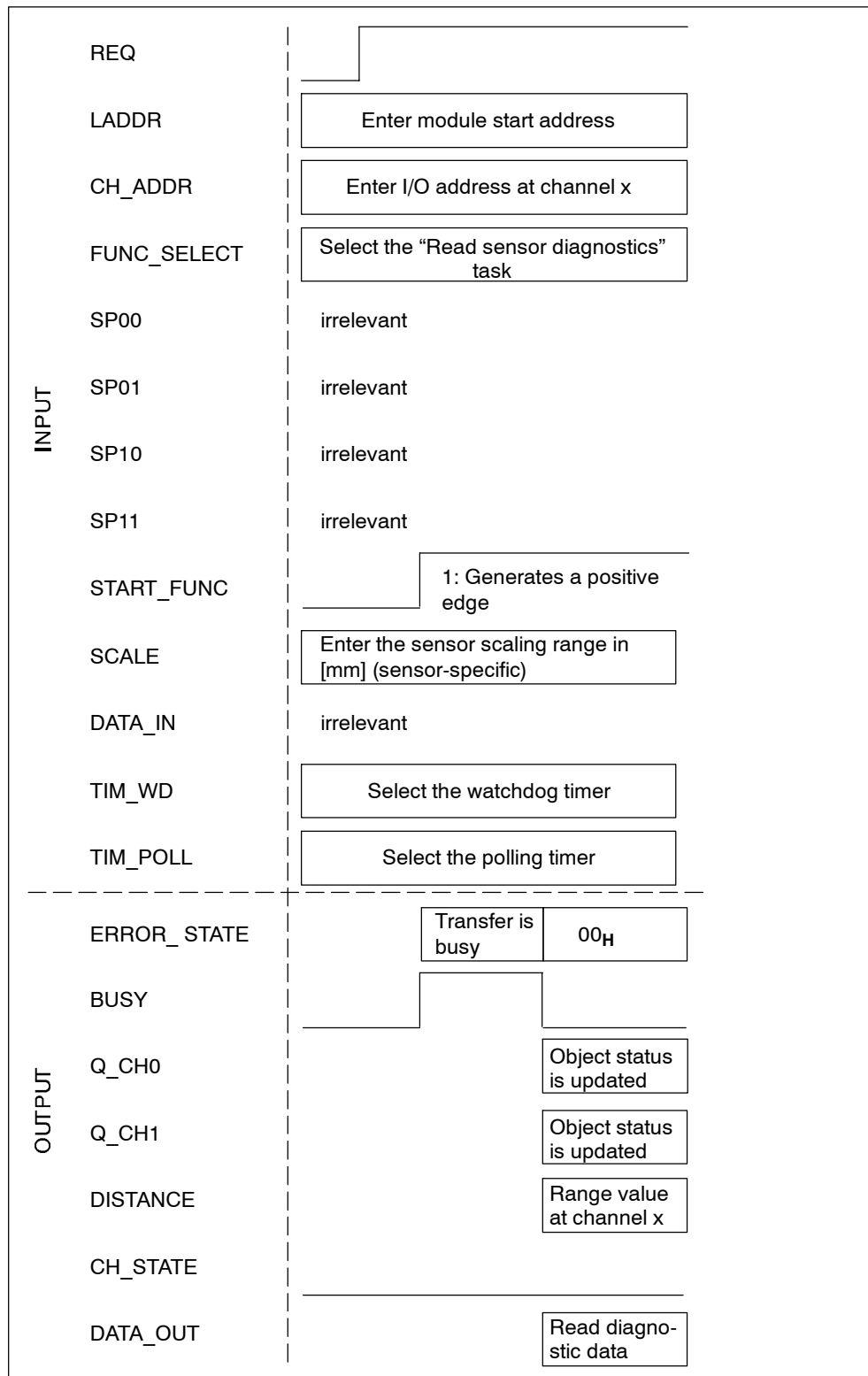| OUTPUT		
ERROR_ STATE	Transfer is busy	00_H
BUSY		
Q_CH0	Object status is updated	
Q_CH1	Object status is updated	
DISTANCE	Range value at channel x	
CH_STATE		
DATA_OUT	Read diagnostic data	

Figure 4-8   Functional diagram of the read diagnostic data function with FB "IQ Sense Ultrasonic"

Procedure

1. Add DB 999 (example) to your user program. Create a "Data_out" variable of the data format ARRAY. See the figure below.

■ DB999 -- IQ_STEP7281003\SIMATIC 300(1)\CPU 315-2 DP				_ □ x
Adresse	**Name**	**Typ**	**Anfangswert**	**Kommentar**
0.0		STRUCT		
+0.0	Data_out	ARRAY[1..22]		vorläufige Platzhaltervariable
*1.0		BYTE		
=22.0		END_STRUCT		

Figure 4-9   Creating a "Data_out" variable of the data format ARRAY

2. Configure FB "IQ Sense Ultrasonic": INPUT/OUTPUT parameters (see chapter 4.4).

3. Enable the FB with REQ = 1.

4. At the LADDR parameter, enter the start address of the 8xIQ Sense module, and at the CH_ADDR parameter, the I/O address of the selected channel x of the 8xIQ Sense.

5. At the FUNC_SELECT parameter, set function 16 for "Read sensor diagnostics".

6. Start the operation with a positive edge at the START_FUNC parameter.

7. The diagnostic data of the sensor are written to output parameter DATA_OUT.

8. The object distance in [mm] is written to output parameter DISTANCE. The current object status is saved to the output parameters Q_CH0 and Q_CH1.

9. Evaluate the ERROR_STATE (error information) and CH_STATE (status information) output parameters.

Example of the read diagnostic data function with FB "IQ Sense Ultrasonic"

The example below shows you the call of FB "IQ Sense Ultrasonic" for reading the diagnostic data of the ultrasonic sensor at channel 4. The module start address of 8xIQ Sense is 288.

Table 4-12 Example of the read diagnostic data function with FB "IQ Sense Ultrasonic"

STL		Explanation
CALL FB21,DB125		Call of FB "IQ Sense Ultrasonic" with instance DB 125 (e.g.)
REQ	:=TRUE	TRUE: Initiate execution
LADDR	:=288	Module start address = 288
CH_ADDR	:=296	I/O address of channel 4 (I/O data) = 296
FUNC_SELECT	:=16	Task selection: 16 = Read sensor diagnostics
SP00	:=	irrelevant
SP01	:=	irrelevant
SP10	:=	irrelevant
SP11	:=	irrelevant
START_FUNC	:=E1.0	The selected task is initiated with a positive edge at I1.0
SCALE	:=500	Enter the sensor scaling range in [mm] (see the sensor documentation)
DATA_IN	:=	irrelevant
TIM_WD	:=T4	T4 is used as watchdog Timer 1
TIM_POLL	:=T5	T5 is used as watchdog Timer 2
ERROR_STATE	:=AB2	AB2 contains the error information
BUSY	:=A5.2	A5.2:=TRUE Task still busy
Q_CH0	:=A5.0	A5.0 contains the object status at Q_CH0
Q_CH1	:=A5.1	A5.1 contains the object status at Q_CH1
DISTANCE	:=MD40	MD40 contains the new object distance in [mm]
CH_STATE	:=A5.2	A5.2 contains the status information
DATA_OUT	:=DB999.Data_out	The diagnostics data of the sensor are written to the Data_out array in DB999
L DB999.DBB0		// DBB0 = Diagnostics byte 0
L DB999.DBB1		// DBB1 = Diagnostics byte 1
L DB999.DBB2		// DBB2 = Diagnostics byte 2
L DB999.DBB3		// DBB2 = Diagnostics byte 3

Arrangement of the diagnostic data in the Data_out array of DB999:

- DB999.**DBB0**: IQ Sense system diagnostics

  – Bit 0: Parameter assignment error

  – Bit 1: Error

  – Bit 2: External error

  – Bit 3: Maintenance request

  – Bit 4: Specific operating state

  – Bit 5: Simulation mode

  – Bit 6: Reserved

  – Bit 7: Reserved

- DB999.**DBB1**: Manufacturer-specific diagnostics
  See the documentation of the relevant sensor.

  Example: Ultrasonic sensor Sonar-BERO M18 IQ

  – Bit 0: Wrong sensor

  – Bit 1: Invalid switching position SP0.x

  – Bit 2: Mode not supported

  – Bit 3: Invalid static parameter

  – Bit 4 ... Bit 7: Reserved

- DB999.**DBB2**: Manufacturer-specific diagnostics
  See the documentation of the relevant sensor.

  – Bit 0 ... Bit 7

- DB999.**DBB3**: Manufacturer-specific diagnostics
  See the documentation of the relevant sensor.

  – Bit 0 ... Bit 7

4.5.6 Calling sensor-specific functions with FB "IQ Sense Ultrasonic"

Properties

FB "IQ Sense Ultrasonic" may be used to call sensor-specific functions of the ultrasonic sensor and to read the answer frames output by the sensor. For information on actually available functions of the interconnected IQ Sense ultrasonic sensor, please refer to the relevant sensor documentation.

Functional diagram showing the call of sensor-specific functions with FB "IQ Sense Ultrasonic"
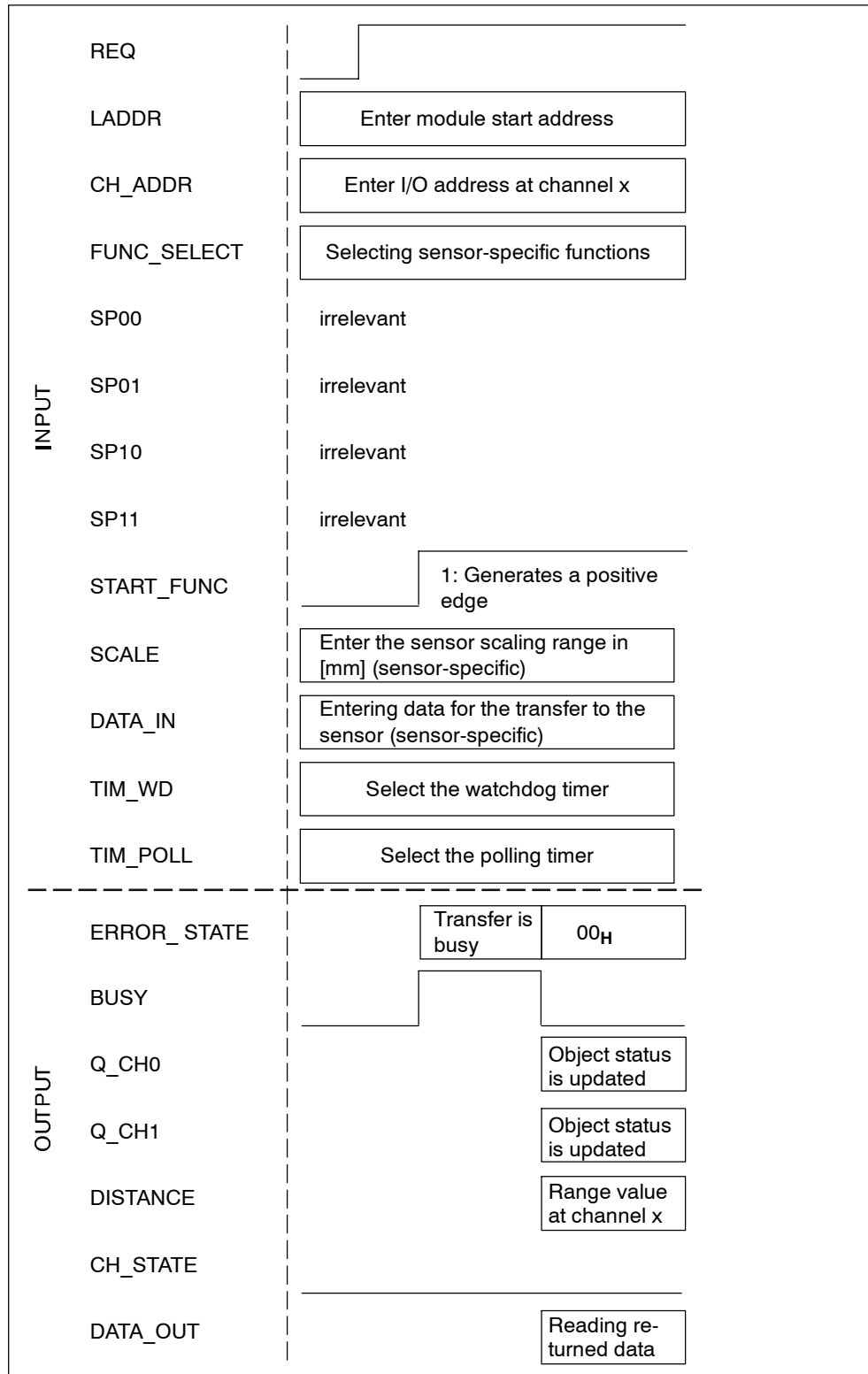
INPUT		
REQ		
LADDR	Enter module start address	
CH_ADDR	Enter I/O address at channel x	
FUNC_SELECT	Selecting sensor-specific functions	
SP00	irrelevant	
SP01	irrelevant	
SP10	irrelevant	
SP11	irrelevant	
START_FUNC	1: Generates a positive edge	
SCALE	Enter the sensor scaling range in [mm] (sensor-specific)	
DATA_IN	Entering data for the transfer to the sensor (sensor-specific)	
TIM_WD	Select the watchdog timer	
TIM_POLL	Select the polling timer	

OUTPUT		
ERROR_STATE	Transfer is busy	00_H
BUSY		
Q_CH0	Object status is updated	
Q_CH1	Object status is updated	
DISTANCE	Range value at channel x	
CH_STATE		
DATA_OUT	Reading returned data	

Figure 4-10   Functional diagram showing the call of sensor-specific functions with FB "IQ Sense Ultrasonic"

Procedure

1. Add DB 999 (example) to your user program. Create a "Data_out" variable of the data format ARRAY (see Fig. 4-9).

2. Configure FB "IQ Sense Ultrasonic": INPUT/OUTPUT parameters (see chapter 4.4).

3. Enable the FB with REQ = 1.

4. At the LADDR parameter, enter the start address of the 8xIQ Sense module, and at the CH_ADDR parameter, the I/O address of the selected channel x of the 8xIQ Sense.

5. At the FUNC_SELECT parameter, declare the required sensor-specific function (66 for "read/write sensor data".)

6. Enter the data to be transferred at the DATA_IN parameter (e.g. in a DB).

7. Start the operation with a positive edge at the START_FUNC parameter.

8. The data returned by the sensor are written to output parameter DATA_OUT.

9. The object distance in [mm] is written to output parameter DISTANCE. The current object status is saved to the output parameters Q_CH0 and Q_CH1.

10. Evaluate the ERROR_STATE (error information) and CH_STATE (status information) output parameters.

Example showing the call of sensor-specific functions with FB "IQ Sense Ultrasonic"

The next example shows you the call of FB "IQ Sense Ultrasonic" for executing the sensor-specific "Read / write sensor data" function, with respect to data of the ultrasonic sensor connected to channel 4. The module start address of the 8xIQ Sense is 288.

Table 4-13 Example of calling the sensor-specific "Read / write sensor data" function with FB "IQ Sense Ultrasonic"

STL		Explanation
`CALL FB21,DB125`		Call of FB "IQ Sense Ultrasonic" with instance DB 125 (e.g.)
`REQ`	`:=TRUE`	TRUE: Initiate execution
`LADDR`	`:=288`	Module start address = 288
`CH_ADDR`	`:=296`	I/O address of channel 4 (I/O data) = 296
`FUNC_SELECT`	`:=66`	Job selection (sensor-specific), for example, 66 = read/write sensor data
`SP00`	`:=`	irrelevant
`SP01`	`:=`	irrelevant
`SP10`	`:=`	irrelevant
`SP11`	`:=`	irrelevant
`START_FUNC`	`:=E1.0`	The selected task is initiated with a positive edge at I1.0
`SCALE`	`:=500`	Enter the sensor scaling range in [mm] (see the sensor documentation)

Table 4-13 Example of calling the sensor-specific "Read / write sensor data" function with FB "IQ Sense Ultrasonic", continued

`DATA_IN`	`:=DB10.DBX20.0`	`The data starting at byte 20 in DB10 are transferred to the sensor`
`TIM_WD`	`:=T4`	`T4 is used as watchdog Timer 1`
`TIM_POLL`	`:=T5`	`T5 is used as watchdog Timer 2`
`ERROR_STATE`	`:=AB2`	`AB2 contains the error information`
`BUSY`	`:=A5.2`	`A5.2:=TRUE Task still busy`
`Q_CH0`	`:=A5.0`	`A5.0 contains the object status at Q_CH0`
`Q_CH1`	`:=A5.1`	`A5.1 contains the object status at Q_CH1`
`DISTANCE`	`:=MD40`	`MD40 contains the new object distance in [mm]`
`CH_STATE`	`:=A5.2`	`A5.2 contains the status information`
`DATA_OUT`	`:=DB999.Data_out`	`Data returned by the sensor are written to the Data_out array in DB999`

4.6 Assigning parameters to FC "MOBY FC-IQ"

FC "MOBY FC-IQ" (= FC 35) controls the data transfer between a *STEP 7* program (user application) and the 8xIQ Sense module with IQ Sense ID systems (IQ profile ID 248).

4.6.1 Interface description

Properties

- Available functions:
    - Write data to MDS (Mobile data storage)
    - Read data from MDS
    - Initialize MDS
- The FC does not generate diagnostic messages (for information on this diagnostics function, refer to chapter 5)
- Preconfigured user-defined data types (UDTs) are available for the definition of data structures.

Parameter assignment scheme of FC "MOBY FC-IQ"

You can not open FC "MOBY FC-IQ". To assign the FC parameters:

1. In the call of FC "MOBY FC-IQ", use the "Params_DB, Params_ADDR" statements to point to a parameter DB you define using a preconfigured "UDT 1x" (UDT 10 = English, UDT 11 = German, UDT 14 = Spanish). See table 4-14.

2. The "command_DB_number" and "command_DB_address" tags are available in UDT 1x. Use those tags to point to a command data block and to its entry which contains the MOBY command to be executed with the MDS. See table 4-15.

3. Define the MOBY command in the command DB which you define in a "UDT 2x" (UDT 20 = English, UDT 21 = German, UDT 24 = Spanish). See table 4-16. You may define different commands and command sequences by calling UDT 2x several times.

4. The "DAT_DB_number" and "DAT_DB_address" tags are available in UDT 2x. Use those tags to point to the DB which is to receive the read MDS data in your user program.

Warning

Create a parameter data area and a command data area for each RFID read/write device ("MOBY channel").

For detailed information on parameters, the definition of the MOBY data structure, and descriptions based on examples of parameter assignments, refer to the RF 300 documentation.

Parameters

Table 4-14   Scheme of the assignment of parameters to the "MOBY FC-IQ" function

Block call	Parameter	Data type	Description
CALL MOBY FC-IQ – Params_DB	Params_DB	INTEGER	Number of the parameter DB for the RFID read/write device, for example, 35 2 to 32767
– Params_ ADDR	Params_ ADDR	INTEGER	Address pointer in the parameter DB, pointing to the start of a UDT 1x for example, 0, 300, 600, ... *
* Those values are derived, for example, in a sequential data structure of the type UDT 1x. The values change when UDT 1x is followed by the command DB (UDT 2x).			

Table 4-15   Parameter data block MOBY DB with assigned UDT 10 "MOBY Param_e"

Address	Name	Type	Start value	Comment
0.0		STRUCT		
+0.0	ASM_address	INTEGER	0	Start address of the 8xIQ Sense module, e.g.280
+2.0	ASM_channel	INTEGER	1	Number of the 8xIQ Sense channel, for example, 1 or 2
+4.0	command_ DB_number	INTEGER	37	Number of the command DB for a RFID read/ write device, for example, 37
+6.0	command_ DB_address	INTEGER	0	Address pointer in the command DB, pointing to the start of a UDT 20x,for example, 0, 10, 20, ...
+18.0	ANZ_MDS_ present	BOOL	FALSE	TRUE: MDS present in the transfer window of the RFID SLG TRUE: no MDS present in the transfer window of the RFID SLG
+18.6	error	BOOL	FALSE	TRUE: error in command execution (group error; for precise error information, refer to the error_MOBY, error_FC or error_BUS tags) FALSE: command successfully completed

Address	Name	Type	Start value	Comment
+18.7	ready	BOOL	FALSE	TRUE: command executed FALSE: no command busy
+19.1	command_start	BOOL	FALSE	TRUE: command start signal FALSE: no command start signal
+19.3	init_run	BOOL	TRUE	TRUE: restart of 8xIQ Sense/RFID-SLG FALSE: no restart of 8xIQ Sense/RFID-SLG
+19.4	ASM_failure	BOOL	FALSE	TRUE: module 8xIQ Sense/RFID-SLG has failed FALSE: no failure
+19.5	FC35_active	BOOL	FALSE	TRUE: FC "MOBY FC-IQ" is executing a command FALSE: FC does not execute a command
+19.7	ANZ_reset	BOOL	FALSE	TRUE: the most recently executed command was a reset initiated by the user with "init_run" FALSE: no reset
+20.0	ASM_busy	BOOL	FALSE	TRUE: module 8xIQ Sense/RFID-SLG is busy executing a command FALSE: no command execution
+22.0	error_MOBY	BYTE	B#16#0	Error information from 8xIQ Sense/ RFID-SLG module See the section *Error information*
+23.0	error_FC	BYTE	B#16#0	Error information from FC "MOBY FC-IQ" See the section *Error information*
+24.0	error_BUS	WORD	W#16#0	Bus error information from the bus segment between FC "MOBY FC-IQ" and the 8xIQ Sense/ RFID-SLG module See the section *Error information*
+26.0	version_MOBY	WORD	W#16#0	Indication of the firmware version of RFID-SLG (in ASCII code)
+28.0 to +57.7	FC_int	ARRAY (1...30) of BYTE	B#16#0	Internal FC tag. Do not modify!
+58.0	initRUN_timeout	INTEGER	15	Internally in FC.
+60.0 to +299.0	send_receive_buffer	ARRAY (1...60) of DWORD	DW#16#0	Internally in FC.
=300.0		END_STRUCT		

Warning

The "init_run" bit must be set in the restart OB (OB 100) for each RFID-SLG (MOBY channel). "init_run" is used to reconfigure and synchronize the RFID-SLG and "MOBY FC-IQ".

The system sets the "ASM_failure" bit when it detects the failure of an RFID-SLG. Prerequisite is a programmed module failure detection routine in OB 122 for each MOBY channel, see "MOBY FC 35 Technical description", chapter 5.5. This allows the output of a proper error message to the user (error_FC=09) after a MOBY PROFIBUS slave has failed. (In addition to OB 122, the automation system should also contain OB 86, in order to prevent a system STOP as a result of the failure of a PROFIBUS slave.)

Table 4-16 Command DB Command with assigned UDT 20 "MOBY CMD_e"

Address	Name	Type	Start value	Description
0.0		STRUCT		
+0.0	command	BYTE	B#16#2	MOBY command to be executed with the MDS: 01: write data to MDS 02: read data from MDS 03: initialize MDS
+1.0	sub_command	BYTE	B#16#0	For "command=03", define the hex value to be written to the MDS 00 to FF
+2.0	length	INTEGER	1	Length of the read/write MDS data in bytes, according to the address space in the MDS version used 1 to 32767
+4.0	address_MDS	WORD	W#16#0	This is the start address for • writing data to the MDS (with "command=01") • reading data from the MDS (with "command=02") At "command=03", define the memory capacity of the MDS to be initialized
+6.0	DAT_DB_ number	INTEGER	38	Pointer to the DB • providing the data to be written to the MDS (with "command=01") • which is to receive the MDS data (with "command=02")
+8.0	DAT_DB_ address	INTEGER	0	Pointer to the start word of your DB
=10.0		END_ STRUCT		

Error information

Warning

For details on the error information and remedies, refer to the RF 300 documentation.

Error information at output parameter error_MOBY

This error is reported by the RFID-SLG. The error_MOBY error is indicated at the SLG by an error LED.

Error information at output parameter error_FC

This error is reported by FC "MOBY FC-IQ" (= FC 35).

Error information at output parameter error_BUS

The bus segment between FC "MOBY FC-IQ" (= FC 35) and the module 8xIQ Sense/ RFID-SLG reports an error. This is usually a PROFIBUS error. The error is reported by the system functions SFC14 and SFC15.

General errors

Slave failure

When FC "MOBY FC-IQ" is used to address a faulty slave, the *SIMATIC* system generates an I/O access error.

Then,

- OB 122 will be called

- and the automation system goes into STOP, if you have not programmed an OB 122.

An integral mechanism of FC "MOBY FC-IQ" allows the system to properly report an error to the user (error_FC=09) when it detects the failure of a MOBY PROFIBUS slave. The user prepares this function by setting the bit "ASM_failure" = '1' at OB 122 for the failed MOBY channel.

In addition to OB122, the automation system should also contain OB86, in order to prevent a system STOP as a result of the failure of a PROFIBUS slave. You do not need to program any OB 86 code to ensure proper operation of FC "MOBY FC-IQ".

After you have cleared the error state at your 8xIQ Sense/RFID-SLG module, and the module is ready for operation, run an "init_run" at FC "MOBY FC-IQ". 8xIQ Sense/RFID-SLG is then ready for operation.

Invalid pointer

The error (automation system goes into STOP) only occurs when FC "MOBY FC-IQ" is called:

- The "Params_DB", "command_DB" or "DAT_DB" pointers either do not exist, or point to an address area which does not exist.

4.7 Examples of parameter assignment with FC "MOBY FC-IQ"

Warning

For detailed information on the parameters, and a description based on examples of parameter assignments, refer to the RF 300 documentation.

Diagnostics

5

Chapter overview

5.1 Diagnostics data

Introduction

This chapter describes the structure of system diagnostic data. You need to be familiar with this structure, in order to be able to evaluate diagnostic data of the 8xIQ Sense module in your *STEP 7* application program.

Requirements

Conditions to be met for generating diagnostic alarms:

- The module-specific parameter for enabling diagnostics alarms must be enabled. See chapter 3.3.1.

- The channel-specific diagnostics parameter must be enabled for the relevant channel. See chapter 3.3.3.

If these conditions are not met, the system does not generate diagnostics alarms and the group error LED on the 8xIQ Sense module is not lit.

Any changes in the diagnostic status of the module or IQ Sense device trigger a diagnostics alarm.

Diagnostics data are logged in data records

Diagnostics data of the 8xIQ Sense module have a length of 16 bytes and are logged in data records 0 and 1:

- Data record 0 contains 4 bytes of diagnostics data, which describe the current status of the automation system.

- Data record 1 contains 4 bytes of diagnostics data, which are also in data record 0, **and** up to 12 bytes of module- or channel-specific diagnostics data.

Warning

For detailed information on the principle of analyzing diagnostics data of signal modules in the application program and on the relevant SFCs which can be used for this analysis, refer to the *STEP 7* manuals.

Reading the diagnostics data record

You may also view the cause of error using the *STEP 7* module diagnostics tool (see the *STEP 7* Online Help).

You could use SFC 59 "RD_REC" (read data record), for example, to read a specific data record of the addressed module.

Actions after a diagnostics alarm in *STEP 7*

Each diagnostics alarm triggers the following actions:

- If you have set "Enable diagnostics alarm" and configured "Diagnostics parameters channel x", a diagnostics alarm will be triggered and OB 82 is called.

- The red group error LED on the 8xIQ Sense module is lit. It remains lit until all errors on the module and IQ Sense device have been eliminated (or after a Teach-in task has been terminated).

- You can read the current diagnostic status by means of data record 1.

5.2 System diagnostics data bytes 0 to 3

The structure and content of the various system diagnostics bytes are described below. What generally happens is: The corresponding bit is set to logical "1" after an error event.

Bytes 0 and 1
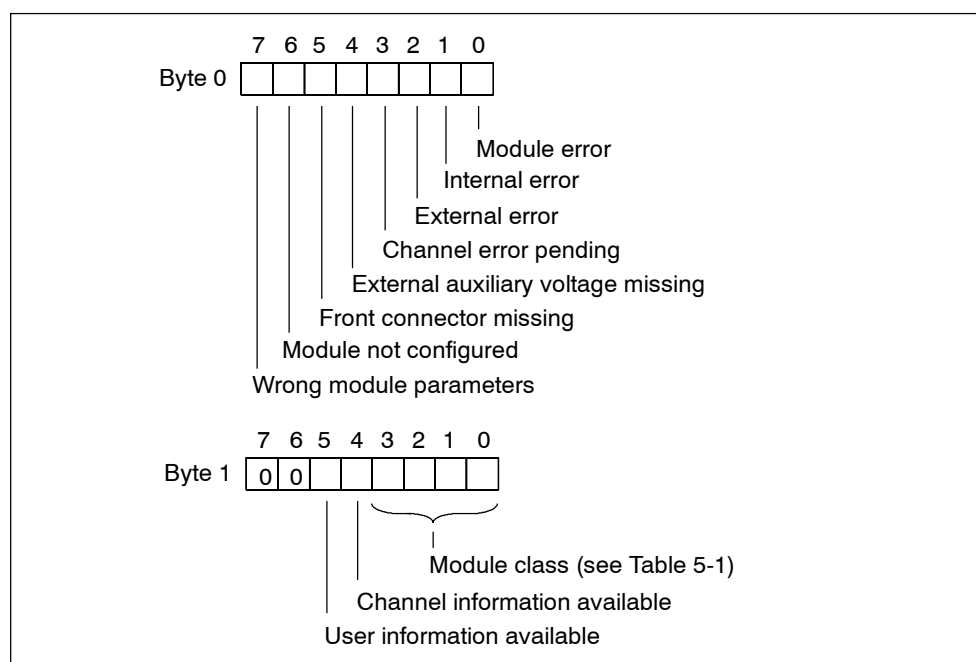
Figure 5-1   Bytes 0 and 1 of diagnostics data

Module classes

The table below contains the module class IDs (bits 0 to 3 in byte 1).

Table 5-1   Module class IDs

ID	Module class
0101	Analog module
0110	CPU
1000	Function module
1100	CP
1111	Digital module

Bytes 2 and 3
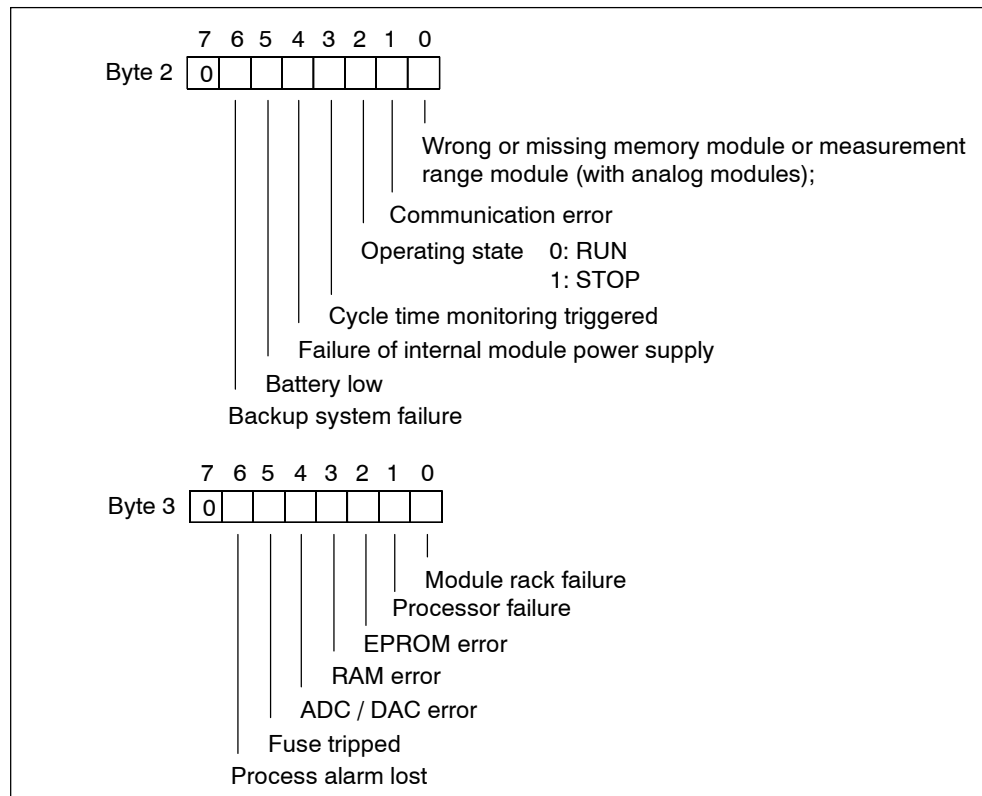
Figure 5-2   Bytes 2 and 3 of diagnostics data

5.3 Module-specific diagnostics data starting at byte 4

The figure below shows the module-specific diagnostics data for the 8xIQ Sense modules.

Bytes 4 to 7
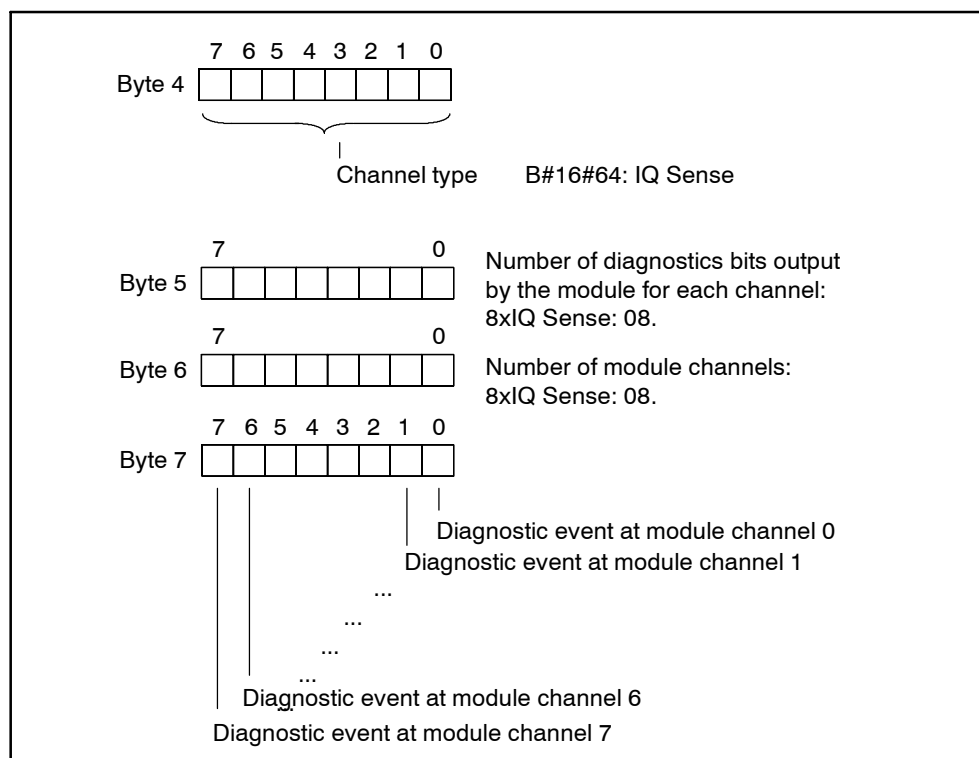
Figure 5-3   Bytes 4 to 7 of diagnostics data

5.4 Channel-specific diagnostics data starting at byte 8

Bytes 8 to byte 15 of data record 1 contain the channel-specific diagnostics data. The figure below shows the allocation of the diagnostics byte for one channel of the 8xIQ Sense module. What generally happens is: The corresponding bit is set to logical "1" as long as an error is present.

For information on possible causes of error and their appropriate remedy, refer to chapter 5.5.

Bytes 8 to 15

Byte 8:   Channel 0

Byte 9:   Channel 1

.

.

.

Byte 14:   Channel 6

Byte 15:   Channel 7
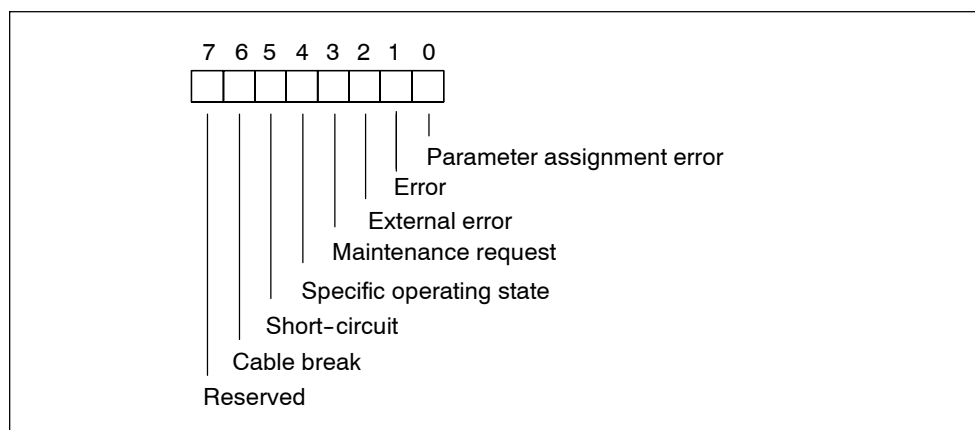
Figure 5-4   Diagnostics byte for one channel of the 8xIQ Sense module

5.5 Error causes and remedies

The table below lists the channel-specific diagnostics alarms, possible causes of error and remedies.

Table 5-2   Channel-specific diagnostics alarm, causes of error and remedies

Diagnostics alarm	Possible cause of error	Remedy
Faulty configuration / parameters	Faulty parameters, for example: • The IQ Sense device is unable to evaluate the parameters (unknown, illegal combination...) • The IQ Sense device is not configured • Invalid sensor ID	Adjustment of parameters
Error	Faulty IQ Sense device (sensor)	Replacement of the IQ Sense device:
External error	Error in the area of the IQ Sense device, e.g.: • Function reserve too low • Faulty calibration	Check of operational conditions
Maintenance request	No error, function is OK	Initiate maintenance of the IQ Sense device
Specific operating state	Functional events, e.g.: • Teach-in is busy	–
Short–circuit	Short-circuit in signal cable	Repair the wiring
Cable break	Break of the signal cable to the IQ Sense device	Repair the wiring

Identification data

<div style="text-align: right; font-size: 3em; font-weight: bold;">6</div>

Chapter overview

In chapter	you find	on page
6.1	Identification data of the 8xIQ Sense module	6-2

6.1 Identification data of the 8xIQ Sense module

Definition

Identification data represent information stored in the module, supporting you in

- Troubleshooting the system
- Verifying the system configuration
- Localizing system hardware changes.

The identification data allow you the unique identification of online modules.

In *HW Config*, you can call the **PLC > Load module identification data** / **Upload to PG** to calibrate editable identification data such as the system ID or the date of creation (alignment of configuration data and loaded identification data.)

You can configure the identification data in the "Identification" tab of the object properties dialog box of the module. To view the configuration data, select **PLC > Module status**.

Warning

The table below describes the specific identification data of 8xIQ Sense modules. For information on two-step access to identification data and their basic structure, refer to the *Distributed I/O device ET 200M* manual.

Identification data of the 8xIQ Sense module

Table 6-1   Identification data of the 8xIQ Sense module

Identification data	Access	Default	Description
Index 1			
Manufacturer	read (2 bytes)	2A hex (= 42 dec)	The manufacturer name is stored here. (42 dec = Siemens AG)
Device name	read (20 bytes)	6ES7 338-7XF00-0AB0	Order number of the module
Device serial number	read (16 bytes)	The serial number of the module is stored at this location. This allows unique identification of the module.	
Hardware revision	read (2 bytes)	Provides information about the revision status of the module.	
Software revision	read (4 bytes)	Provides information about the firmware version of the module.	
Statistical revisions no.	read (2 bytes)	–	Not supported
Profile_ID	read (2 bytes)	0 hex	Internal parameter (according to PROFIBUS DP)
Profile-specific type	read (2 bytes)	03 hex (= 3 dec)	Internal parameter (according to PROFIBUS DP)
I&M supported	read (2 bytes)	1F hex (= 31 dec)	Internal parameter (according to PROFIBUS DP)
Index 2			
TAG	read / write (max. 32 characters)	–	Local ID of the module. Here you specify a module identifier which is unique throughout the system.
Index 3			
Data of installation	read / write (max. 16 characters)	–	Contains the data of module installation. Enter the data at this location. Format YYYY-MM-DD
Index 4			
Description	read / write (max. 54 characters)	–	User–specific text that is stored in the module. This may contain additional information about the module properties.

Firmware update

7

Chapter overview

7.1 Update of the 8xIQ Sense module firmware

The firmware of the 8xIQ Sense module can be updated. To do so, you need *STEP 7* V5.3 or higher.

When should I update the firmware of 8xIQ Sense?

You should update the 8xIQ Sense module with the latest firmware version after you installed (compatible) functional expansions, eliminated errors, or added new IQ profiles or enhanced performance features.

Where do I obtain the latest firmware version?

The latest firmware versions are provided by your local Siemens partner, or you can download them from the Internet:

`http://www.siemens.com/automation/service&support`

Tip:

• Before you install the update, not down the number of the current firmware version.

• If any problems arise after you installed the new firmware, download your old version from the Internet and reinstall it on the 8xIQ Sense module.

Requirements

• The 8xIQ Sense must be accessible online with the PG / PC.

• The latest firmware files are available in the file system of your PG / PC.

• A firmware update is not possible for 8xIQ Sense module you integrated by means of a GSD file.

Procedure

To update the firmware:

1. Open *HW Config* and select the relevant 8xIQ Sense module.

2. Select the **PLC > Update firmware** command.

The further steps are described in the *STEP 7* Online Help.

Warning

To download the firmware file to the 8xIQ Sense module, you **must** set the CPU into STOP mode.

Completion of the update is confirmed with a message. The update is active immediately.

After you have completed the update of the 8xIQ Sense firmware, cover the old version label with a label identifying the current update version.

Update failed

The red SF LED on the module flashes if the update has failed. Repeat the update.

If the update still fails, please contact your local Siemens partner.

Example: Update via MPI to the CPU and / or PROFIBUS DP

Central configuration: The PG / PC containing the update files is connected to the MPI interface of the CPU.

Distributed configuration: The IM153x is connected to the CPU via PROFIBUS DP (see Fig. 7-1). The IM153-x must be integrated into the *STEP 7* project on the CPU.
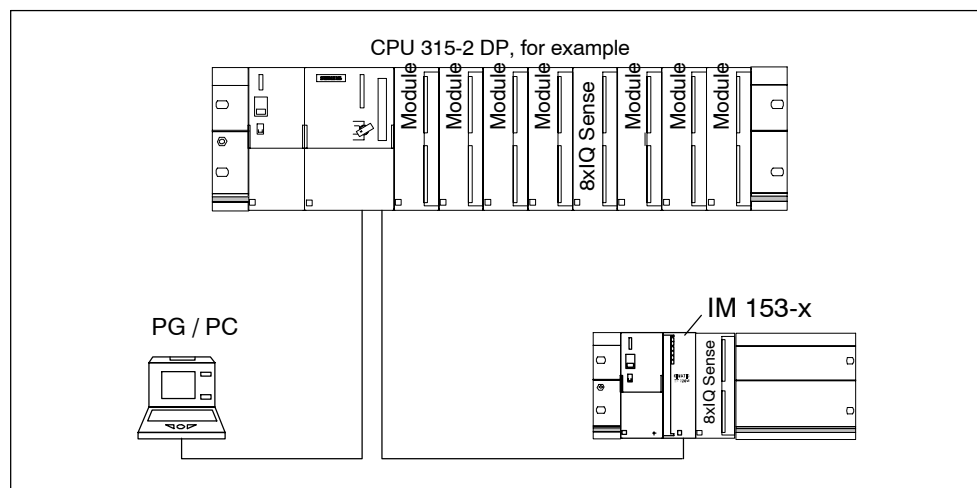
Figure 7-1   Example: Update via MPI to the CPU and / or PROFIBUS DP (PG / PC is connected to the CPU)

Technical data

<div style="text-align: right; font-size: 3em; font-weight: bold;">8</div>

Chapter overview

8.1　Pin-out

The table below shows the pin-out of the 8xIQ Sense module.

Table 8-1　Pin-out of the 8xIQ Sense module

LED	LED name	Pin no.	Assignment	
Red	SF	1	L+	Load voltage L+
green	0	2	M0+	Channel 0
		3	M0–	
green	1	4	M1+	Channel 1
		5	M1–	
green	2	6	M2+	Channel 2
		7	M2–	
green	3	8	M3+	Channel 3
		9	M3–	
		10		
		11		
green	4	12	M4+	Channel 4
		13	M4–	
green	5	14	M5+	Channel 5
		15	M5–	
green	6	16	M6+	Channel 6
		17	M6–	
green	7	18	M7+	Channel 7
		19	M7–	
		20	M	Load voltage M
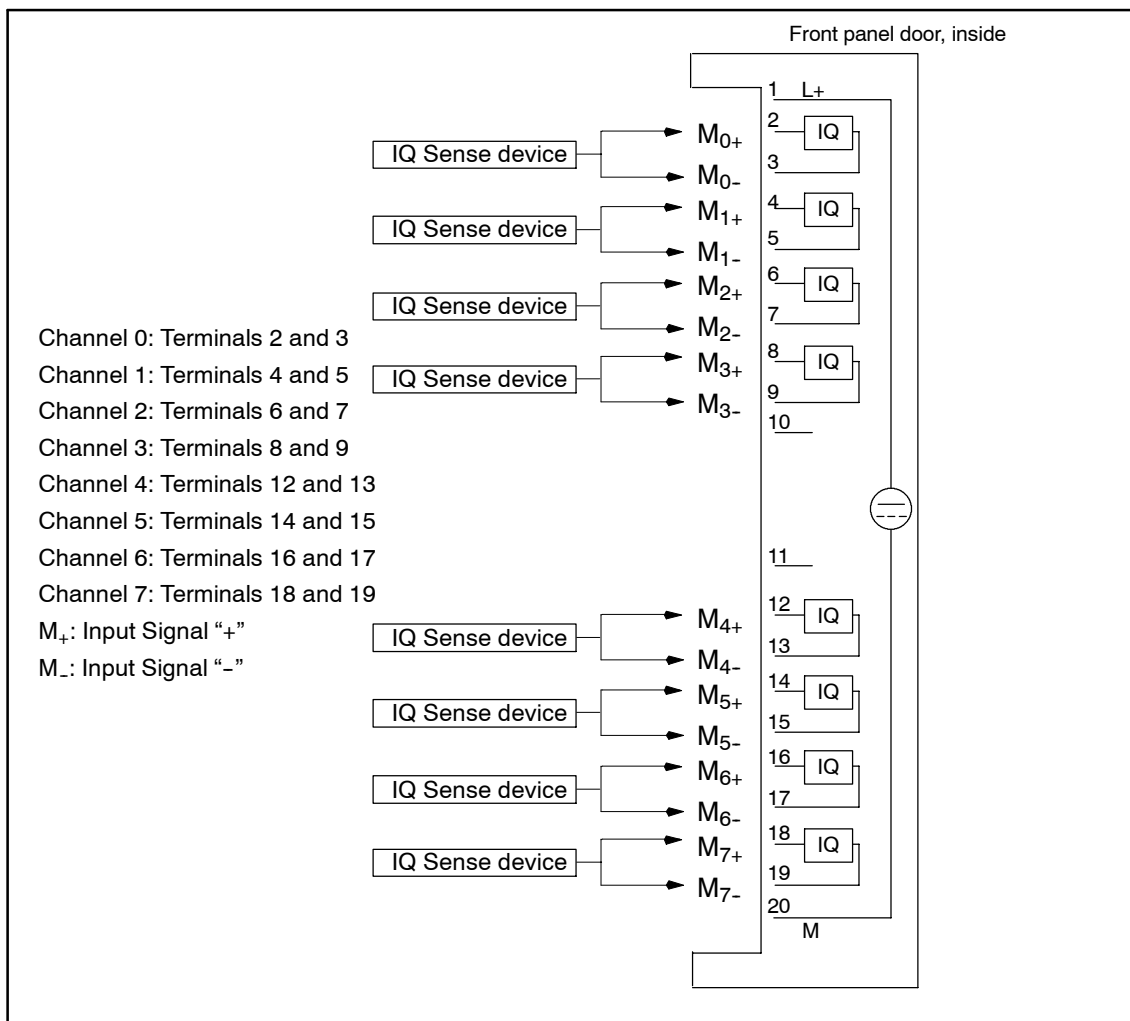
Figure 8-1 Pin-out of the 8xIQ Sense module

Warning

- The connections of the IQ Sense devices are protected against polarity reversal!
- Minimum conductor cross-section for IQ Sense devices: 0.25 mm^2.

8.2 Functional diagram
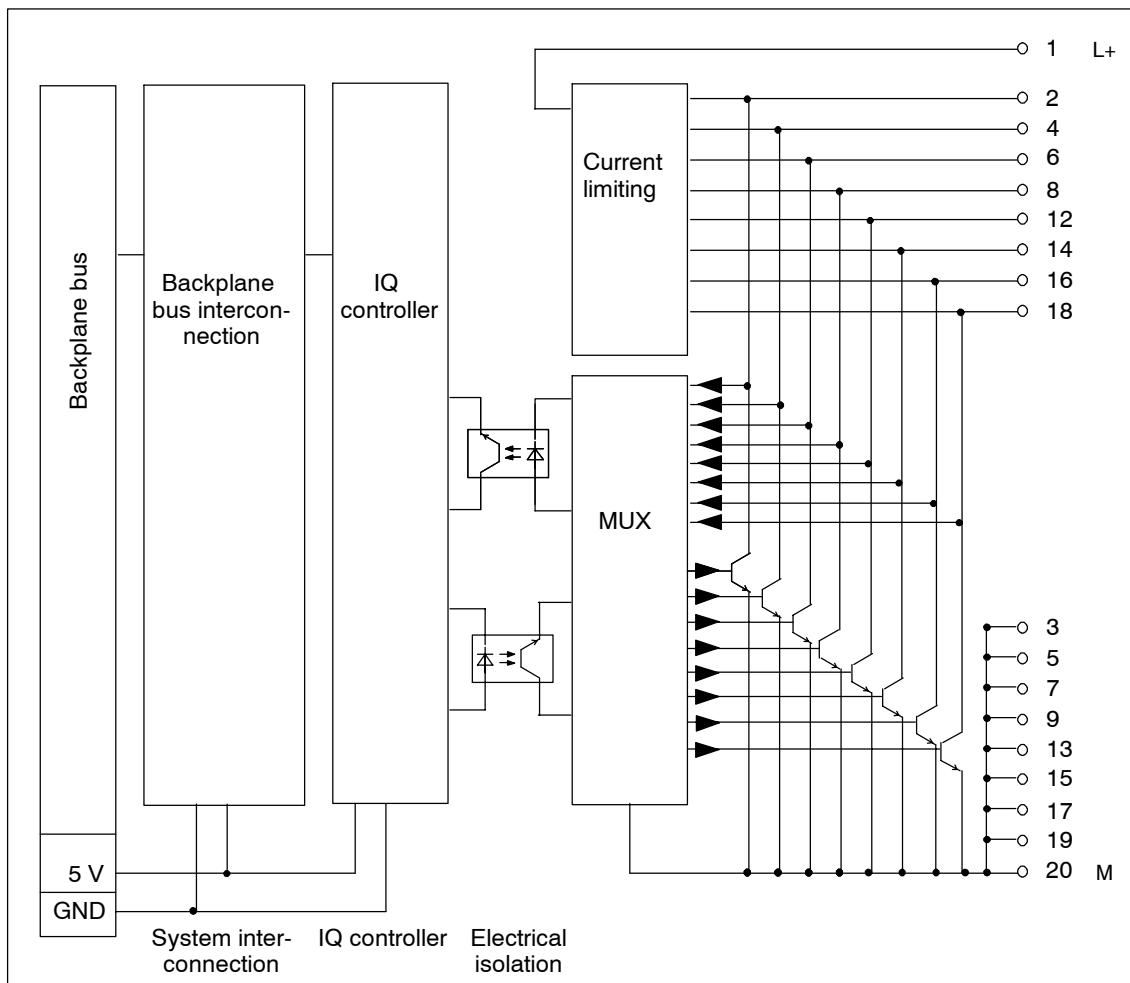
Figure 8-2   Functional diagram of the 8xIQ Sense module

8.3 Technical data

8xIQ Sense module

Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 120
Weight	approx. 250g
Module-specific data	
Number of channels	8
Cable length	
• unshielded	max. 50m
Voltages, currents, potentials	
Rated power supply	24 V DC
• Polarity reversal protection	yes
Potential isolation	
• between channels	no
• between the channels and the backplane bus	yes
Permitted potential difference	
• between different circuits	75 V DC, 60 V AC
Isolation tested at	500 V DC
Current consumption	
• from backplane bus	typically 120 mA
• from load voltage L+	max. 500 mA
Power loss of the module	typically 2.5 W

Status, alarms, diagnostics	
Status indication	green LED per channel
Alarms	
• Diagnostics alarm	configurable
Diagnostics functions	
• Group error	red LED "SF"
• Readable diagnostics information	yes
Data for encoder selection	
Connectable encoders	IQ Sense devices with IQ profile ID 1, 128, 248 (for example, optoelectronic and ultrasonic sensors and ID systems with IQ Sense interface)
Response times	
Cycle time	See chapter 8.4.

8.4 Cycle times

Introduction

The 8xIQ Sense module communicates with IQ Sense devices in a constant cycle time pattern. Communication with the interconnected IQ Sense device takes place at the start of a cycle. Communication with the IQ Sense devices takes place in the order of the ascending channel number 0...7.
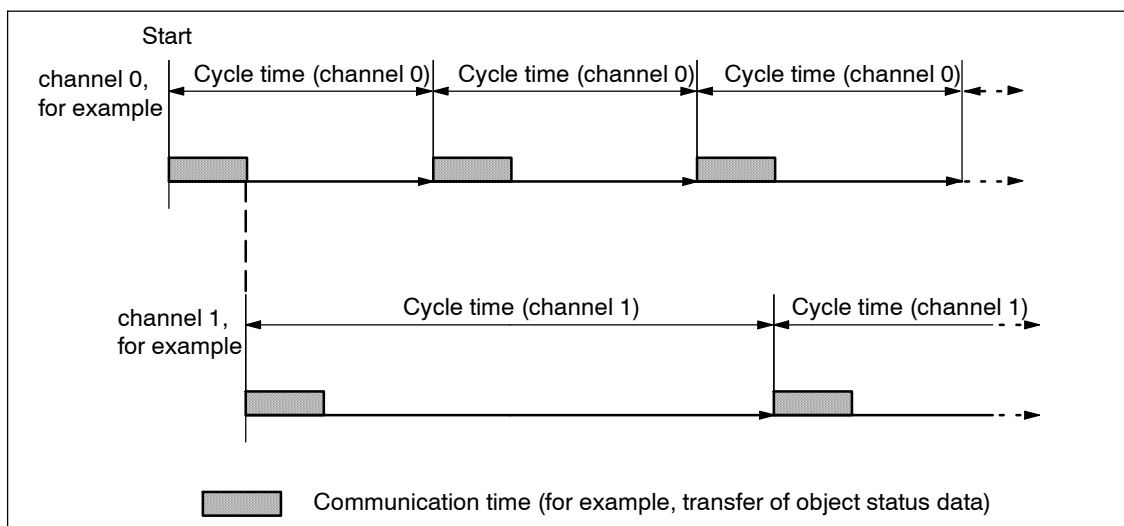
Figure 8-3   Cycle times of the IQ Sense devices (channels)

The event (detection of a status change or object status on the IQ Sense device) response time of the module is therefore determined primarily by the cycle times of the IQ Sense devices: Response time $\geqq$ cycle time.

In normal mode of operation of the IQ Sense device, the system usually reads the relevant input data (object status / distance) in each cycle.

Acyclic events (e.g. new output data, parameter assignment, diagnostics) cause a relevant delay in the transfer of input data.

The cycle times for processing IQ Sense devices are determined by various parameters.

Parameters influencing the cycle times

Parameters influencing the cycle times of IQ Sense devices (channels):

- IQ profile ID 1: Interference suppression group, see chapter 3.3.2

- IQ profile ID 128: Multiplex / Sync mode, see chapter 3.7.4

For information on the effects of the relevant parameters on the scan cycle time of the 8xIQ Sense module, refer to the tables 3-2 and 3-5.

Warning

Initially decisive for the synchronous cycle time is the value returned by the IQ Sense device, i.e. the minimum cycle time returned by the sensor, for example. The actual cycle time, however, is never lower than the time returned by the IQ Sense device. For further information, refer to the documentation of the relevant IQ Sense device.

Configuring the module with a GSD file **A**

Chapter overview

In chapter	you find	on page
A.1	Introduction	A-2
A.2	Overview: Steps in configuring and parameter assignment using a GSD file	A-3

A.1 Introduction

The configuration in a distributed structure as DP standard slave is based on a GSD file. The GSD file contains the various channel profiles for the 8xIQ Sense module and the appropriately adapted parameter descriptions.

GSD module configurations are provided. The GSD file contains one entry for each configuration:

- Opto-profile Enhanced: 6ES7_338-7XF00-0AB0_IQ-Opto

  - 8 channels with IQ profile ID 1 (= optical sensors only)

- Mixed configuration optical / ultrasonic: 6ES7_338-7XF00_IQ-ID1/128/129A

  - 6 channels with IQ profile ID 1 (= optical sensors) +
    2 channels with IQ profile ID 128 (= ultrasonic).

- ID profile: 6ES7_338-7XF00-0AB0_IQ-Ident

  - 2 channels with IQ profile ID 248 (= 2 x ID system: each RFID read/write device occupies four words in the I/O data area)

- Mixed configuration optical / ident: 6ES7_338-7XF00_IQ-ID1/248

  - 4 channels with IQ profile ID 1 (= optical sensors) +
    1 channel with IQ profile ID 248 (= 1 x ID system: each RFID read/write device occupies four words in the I/O data area.)

Warning

For further information re possible configurations of 8xIQ Sense modules, refer to chapter 1.1.

The GSD file imposes some restrictions on your system configuration and configuration of the 8xIQ Sense module. See the table below.

Integrating the 8xIQ Sense module by means of GSD file

Table A-1   Integrating the 8xIQ Sense module by means of GSD file

Functions / properties	Integration into *STEP 7* by means of GSD file	Integration into an external system by means of GSD file
Configuration of static parameters	x	x
Configuration of dynamic parameters	restricted	restricted
Using function blocks/functions FB/FC IQ Sense ...	Opto Channel: with DP-V0 and DP-V1 Ultrasonic: with DP-V1 MOBY FC-IQ: with DP-V0 and DP-V1	–
Job log	–	–
Access to I/O data	x	x
Configurability of channels ...	by selecting a GSD configuration (DPV0: only Opto and Ident profiles)	by selecting a GSD configuration (DPV0: only Opto and Ident profiles)
Diagnostics	DPV0/DPV1 channel diagnostics	DPV0/DPV1 channel diagnostics

A.2 Overview: Steps in configuring and parameter assignment by means of GSD file

Table A-2   Overview: Steps in configuring and parameter assignment

You find	you find	in chapter
1	Integrating IM153-x GSD files into your system. **Note**: The current versions of the GSD files are available on the Internet under http://www.ad.siemens.de/csi_e/gsd.	–
2	Selecting the required channel profile (Ident profile, Opto profile or mixed configuration) in the GSD file	B.1
3	Configuring static parameters of the 8xIQ Sense module	B.2 – B.4
4	Configuring I/O data for the 8xIQ Sense module and IQ Sense device	C.1cf.

Programming the static parameters by means of GSD

<div style="text-align: right; font-size: 2em; font-weight: bold;">B</div>

Chapter overview

B.1 GSD channel profiles

B.1.1 Selecting the channels profiles of the module

In the GSD file, select Opto-profile Enhanced (6ES7_338-7XF00-0AB0_IQ-Opto) in order to operate all 8 module channels with IQ profile ID 1 (= optoelectronic sensors only).

In the GSD file, select the mixed mode configuration Optoelectronic / Ultrasonic (6ES7_338-7XF00_IQ-ID1/128/129A), in order to operate 6 channels with IQ profile ID 1 (= optoelectronic sensors) and 2 channels with IQ profile ID 128 (= ultrasonic) on the system.

In the GSD file, select ID profile (6ES7_338-7XF00-0AB0_IQ-Ident) in order to operate two module channels with IQ profile ID 248 (= 2 x ID system: each RFID read/write device occupies four words in the I/O data area).

In the GSD file, select mixed configuration Opto/Ident (6ES7_338-7XF00_IQ-ID1/248) in order to operate four channels with IQ profile ID 1 (= optical sensors), plus one channel with IQ profile ID 248 (= 1 x ID system: each RFID read/write device occupies four words in the I/O data area).

Warning

For information on the parameter mentioned below, refer to the chapters 3.3 to 3.8.

For detailed information on operating modes and other parameters, refer to the documentation of the Sonar BEROs and RF 300.

B.2 Configuring IQ profile ID 1

You configure the following IQ profile ID 1 parameters:

- Enable diagnostics alarm
- Interference suppression group
- Diagnostics
- Switching hysteresis
- Sensor type
- Time functions, time value
- Disable Teach-in

B.3 Configuring IQ profile ID 128

You configure the following IQ profile ID 128 parameters:

- Enable diagnostics alarm
- Interference suppression group
- Diagnostics
- Operating mode for switching outputs Q_CH0 / Q_CH1
- Switching hysteresis
- Time functions, time value for switching outputs Q_CH0 / Q_CH1
- Function reserve
- Mean average
- Disable Teach-in
- Multiplex / Sync mode
- Synchronous cycle time
- Manufacturer-specific parameters 1 / 2 / 3

B.4 Configuring IQ profile ID 248

You configure the following IQ profile ID 248 parameters:

- Enable diagnostics alarm
- Diagnostics
- AFI value parameter
- Transponder type parameter

Programming dynamic parameters by means of GSD file

C

Chapter overview

C.1 Access to I/O data

I/O data of the IQ Sense channels (devices) are stored in the I/O data areas of the 8xIQ Sense module.

- The output data area contains the data which are transferred from the CPU to the IQ Sense device.

- The input data area contains the data which are transferred from the IQ Sense device to the CPU.

The I/O data of all IQ Sense channels are stored according to their channel number and in ascending order (see Fig. 2-2).

Defining the address range

When you select a GSD module configuration, you also determine the address range. In contrast to a configuration within *STEP 7*, you can choose the following module configuration variants.

- Opto-profile Enhanced: 6ES7_338-7XF00-0AB0_IQ-Opto

  – 8 channels with IQ profile ID 1 (= optical sensors only)

  – One word is reserved for each channel in the input and output data areas of the module.

- Mixed configuration optical / ultrasonic: 6ES7_338-7XF00_IQ-ID1/128/129A

  – 6 channels with IQ profile ID 1 (= optoelectronic sensors) +
    2 channels with IQ profile ID 128 (= ultrasonic)

  – One word is reserved for each channel in the input and output data areas of the module.

- ID profile: 6ES7_338-7XF00-0AB0_IQ-Ident

  – 2 channels with IQ profile ID 248 (= 2 x ID system: each RFID read/write device occupies four words in the I/O data area)

  – Four words are reserved for each channel in the input area, and in the output data area of the module.

- Mixed configuration optical / Ident: 6ES7_338-7XF00_IQ-ID1/248

  – 4 channels with IQ profile ID 1 (= optical sensors) +
    1 channel with IQ profile ID 248 (= 1 x ID system: each RFID read/write device occupies four words in the I/O data area.)

  – Optical sensors: one word is reserved for each channel in the input area, and in the output data area of the module.

  – ID system: four words are reserved for each channel in the input area, and in the output data area of the module.

Warning

Each RFID read/write device occupies four words in the I/O address space of the module.

Access to memory areas

There is a direct correlation between the channel number an IQ Sense device is connected to (terminal) and the I/O data area of the module.

Based on the address range, we can derive the following addresses for access to memory areas:

- Address = Module start address + (channel number x 2)

    - Example: Module start address 8xIQ Sense = 280
      I/O address channel 3: 286

    - Example of 2 connected ID systems:
      Module start address 8xIQ Sense IDENT = 280
      I/O address channel 0: 280
      I/O address channel 4: 288

C.2   Direct access to input data

Input data IQ profile ID 1

Table C-1   Input data IQ profile ID 1

Address	Assignment
Byte 0	**Bit 0:** Switching status of the sensor connected to channel x 1: Object detected 0: No object detected
	Bit 1 to bit 7: Sensitivity / range value at channel x learned by means of **Teach-in**. The current sensitivity / range value is entered: - when Teach-in at the sensor is completed - when Teach-in is completed, by means of FB "IQ Sense Opto Channel".

Input data IQ profile ID 128

Table C-2   Input data IQ profile ID 128

Address	Assignment
Word 0	**Bit 0:** Status of switching output 0 (Q_CH0) at channel x 1: Object detected 0: No object detected **Bit 1:** Status of switching output 1 (Q_CH1) at channel x 1: Object detected 0: No object detected
	Bit 0 to bit 15: Process value (input data) at channel x

The value recorded by the IQ Sense device is mapped internally to the IQ Sense variable "Process value".

Calculate the current process value based on the following formula:

$$Current process value(mm) = \frac{\{Process value(Input data) \cdot max.rage(mm)\}}{32676}$$

For information on the maximum range of the IQ Sense device (sensor), refer to the relevant documentation.

Valid process values are always indicated in the positive range (15 bit plus sign.) If the process value is negative (bit 15 = 1), the system reports an invalid process value and switching states ("No sensor connected").

Input data IQ profile ID 248

Table C-3   Input data IQ profile ID 248

Address	Assignment
Word 0	**Byte 0:** cyclic sequence no.

	Byte 1: Status byte
	• **Bit 0 to bit 2:** Executed MDS/SLG command
	    Value:
	    0: Reset
	    1: write one word
	    2: read one word
	    3: initialize MDS
	    4: write one byte
	    5: read one byte
	    6: Reserved
	    7: Reserved
	• **Bit 3:** Reserved
	• **Bit 4:** Startup bit
	    1: SLG has restarted, Reset required
	• **Bit 5:** Presence bit
	    1: MDS is present
	    0: MDS is not present
	• **Bit 6:** Error bit
	    1: error in command execution
	    0: no error in command execution
	• **Bit 7:** "ready" bit
	    1: SLG is ready for new command
	    0: SLG is not ready for new command

Word 1	**Byte 2:** MDS address (most significant bit)
	Byte 3: MDS address (least significant bit)
Word 2	**Byte 4:** first data byte (or error code)
	Byte 5: second data byte
Word 3	**Bytes 6 and 7:** not used

Six bytes of input data are read from the read/write device (SLG).

The data of the most recent access to the SLG will be fetched in this action. The data have a different meaning, based on the nature of the command.

The "Cyclic sequence no." byte is used to secure consistency for the function (FC) or application.

C.3 Direct access to output data

Output data IQ profile ID 1

Direct access to output data of the IQ profile ID 1 allows you to use the Teach-in and IntelliTeach functionality.

Table C-4   Output data IQ profile ID 1

Address	Assignment
Byte 0	**Specifying a sensitivity / range value at channel x (IntelliTeach):** • **Bit 0:** 1: Transfer the sensitivity / range value in bit 1 to bit 7 to the sensor at channel x (at the positive edge) 0: disabled • **Bit 1 to bit 7:** Sensitivity / range value at channel x: 1 to 126 (sensor-specific) **OR** **Teach-in at sensor channel x** • **Bit 0:** 1: Start Teach-in at sensor channel x (at the positive edge) 0: disabled • **Bit 1 to 7:** 0

Output data IQ profile ID 128

Although direct access to output data of the IQ profile ID 128 allows you to use Teach-in functionality, you can not read back the new threshold values learned by Teach-in.

You can not use the IntelliTeach functionality for this process.

Table C-5   Output data IQ profile ID 128

Address	Assignment

Word 0	**Specifying a sensitivity / range value at channel x (IntelliTeach)**
	• only by means of FB "IQ Sense Ultrasonic"
	  (see chapter 4.4 and table 1-1)
	
	Teach-in at sensor channel x
	• **Bit 0 :**
	  1: Start Teach-in at switching position SP0.0 of sensor channel x
	  (at the positive edge)
	  0: disabled
	• **Bit 1 :**
	  1: Start Teach-in at switching position SP0.1 of sensor channel x
	  (at the positive edge)
	  0: disabled
	• **Bit 2 :**
	  1: Start Teach-in at switching position SP0.0 of sensor channel x
	  (at the positive edge)
	  0: disabled
	• **Bit 3 :**
	  1: Start Teach-in at switching position SP0.1 of sensor channel x
	  (at the positive edge)
	  0: disabled
	• **Bit 4 to 15:** 0 (irrelevant)

Warning

The calculation of switching outputs will be disabled (Q_CH0 = 0, Q_CH1 = 0) as long as the IQ Sense device with IQ profile ID 128 has not been assigned valid parameters. Detection of the process value is continued and provided to the system via IQ Sense interface. This basic functionality of reporting the process value is therefore always available, even without "dynamic parameter assignment."

Output data IQ profile ID 248

Table C-6   Output data IQ profile ID 248

Address	Assignment
Word 0	**Byte 0:** cyclic sequence no.

	Byte 1: Control byte (MDS/SLG commands)
	• **Bit 0 to bit 2:** MDS/SLG command
	  Value:
	  0: Reset
	  1: write one word
	  2: read one word
	  3: initialize MDS
	  4: write one byte
	  5: read one byte
	  6: Reserved
	  7: Reserved
	• **Bit 3 to bit 7:** Reserved

Word 1	**Byte 2:** MDS address (most significant bit)
	Byte 3: MDS address (least significant bit)
Word 2	**Byte 4:** first data byte (or init value)
	Byte 5: second data byte
Word 3	**Bytes 6 and 7:** not used

Six bytes of output data are used. Those output data are necessary to allow the execute r/w or init commands at the MDS.

The system always reads/writes two user data bytes, starting at the defined MDS address. The initialization command is applied to the entire memory area of the MDS. In this case, or when you initiate a reset, the passed MDS address will be ignored.

The "Cyclic sequence no." byte is used to secure consistency for the function (FC) or application.

C.4 Function principle (IQ profile ID 1): Specifying a sensitivity / range value (IntelliTeach)
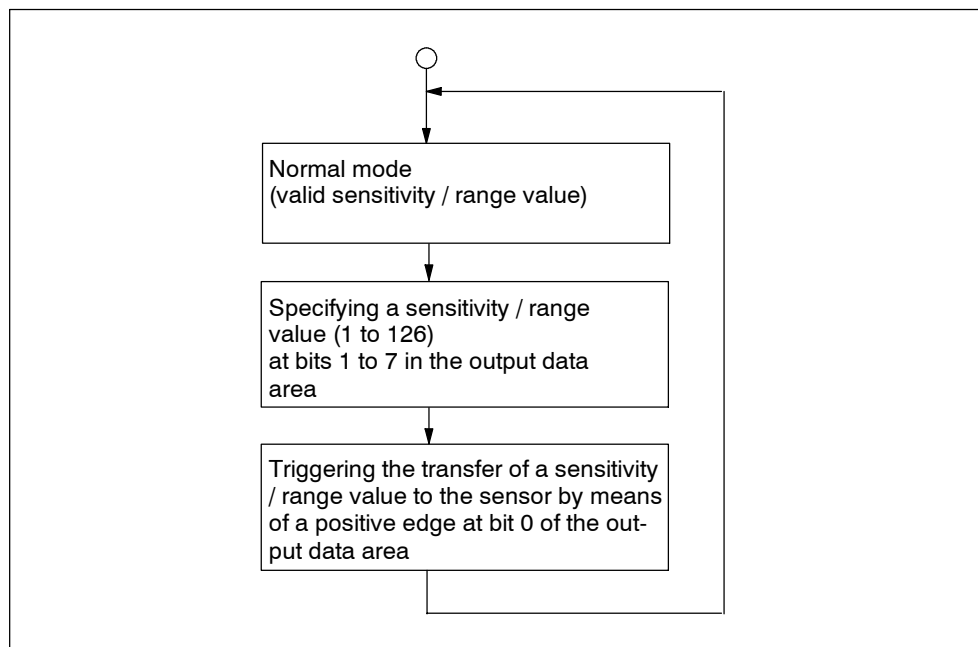
Figure C-1   Function principle (IQ profile ID 1): Preset of a sensitivity / range value (IntelliTeach)

C.5   Function principle (IQ profile ID 1): Teach-in

```
                    ○
                    │
                    ↓
        ┌─────────────────────┐ ◄──────────────┐
        │     Normal mode     │                │
        └─────────────────────┘                │
                    │                          │
   ┌───────────────→│                          │
   │    ┌─────────────────────┐                │
   │    │ Defining a "0" at    │                │
   │    │ bits 1 to 7 in       │                │
   │    │ the output data area │                │
   │    └─────────────────────┘                │
   │                │                          │
   │    ┌─────────────────────┐                │
   │    │ Starting Teach-in by │                │
   │    │ means of a positive  │                │
   │    │ edge at bit 0 of the │                │
   │    │ output data area     │                │
   │    └─────────────────────┘                │
   │                │                          │
   │    ┌─────────────────────┐                │
   │    │ Teach-in is executed │                │
   │    └─────────────────────┘                │
   │                │                          │
   │               ◇                           │
   │          Teach-in is      Valid sensitivity / range value
   │       terminated by means  detected       │
   │       of a negative edge at ──────────────┘
   │          0 of the output
   │             data area
   │                │
   │    No valid sensitivity / range value
   │    detected
   │                │
   │               ◇
   │    1st option  Teach-in error:
   └───── Learned sensitivity / range value = 0
               (bits 1 to 7 in the
                input data area)
                    │
               2nd option
                    │
        ┌─────────────────────┐
        │ Specifying a new     │
        │ sensitivity /        │
        │ range value          │
        │ (IntelliTeach)       │
        └─────────────────────┘
```

Figure C-2   Function principle (IQ profile ID 11): Teach-in

Slave diagnostics

<div style="text-align: right; font-size: 2em;">D</div>

Chapter overview

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D.2	Module-specific diagnostics data, starting at byte x + 4	D-3
D.3	Channel-specific diagnostics data, starting at byte x + 12	D-4
D.4	Error causes and troubleshooting	D-5

D.1 Introduction

In order to be able to use channel-specific diagnostics, you need to enable the diagnostics alarms in each I/O module configuration.

When you configure the IM 153-x, you can enable or disable diagnostics, process alarms and insertion / removal alarms, regardless whether "extended diagnostics" is enabled or not.

In the DPV1 parameters (GSD Rev. 3 or higher), you can enable or disable specific blocks of the extended diagnostics function. Disabled diagnostics are removed from the diagnostics frame.

Extended diagnostics is available by default on an IM 153-2Bx00 operating in DPV0 / DPV1 mode. In your configuration, you can disable this function for specific blocks.

Alarm with another DP master

If you operate the ET 200M with another DP master, the alarms are mapped as **device-specific diagnostics** of the ET 200M. The corresponding diagnostics events must be further processed in the user program of the DP master.

Insertion / removal alarm with another DP master

Note that when using the ET 200M in "Module hot-swap mode" on another DP master, you can not evaluate the insertion / removal alarms. Insertion / removal alarms can be evaluated by means of the ID and device-specific diagnostics function of the IM 153-x.

Warning

For details on the structure of diagnostics data for slave diagnostics, refer to the *Distributed I/O device ET 200M* manual. The section below describes only the module- and channel-specific diagnostics data for the 8xIQ Sense module.

D.2 Module-specific diagnostics data starting at byte x + 4

The figure below shows the module-specific diagnostics data for the 8xIQ Sense modules.
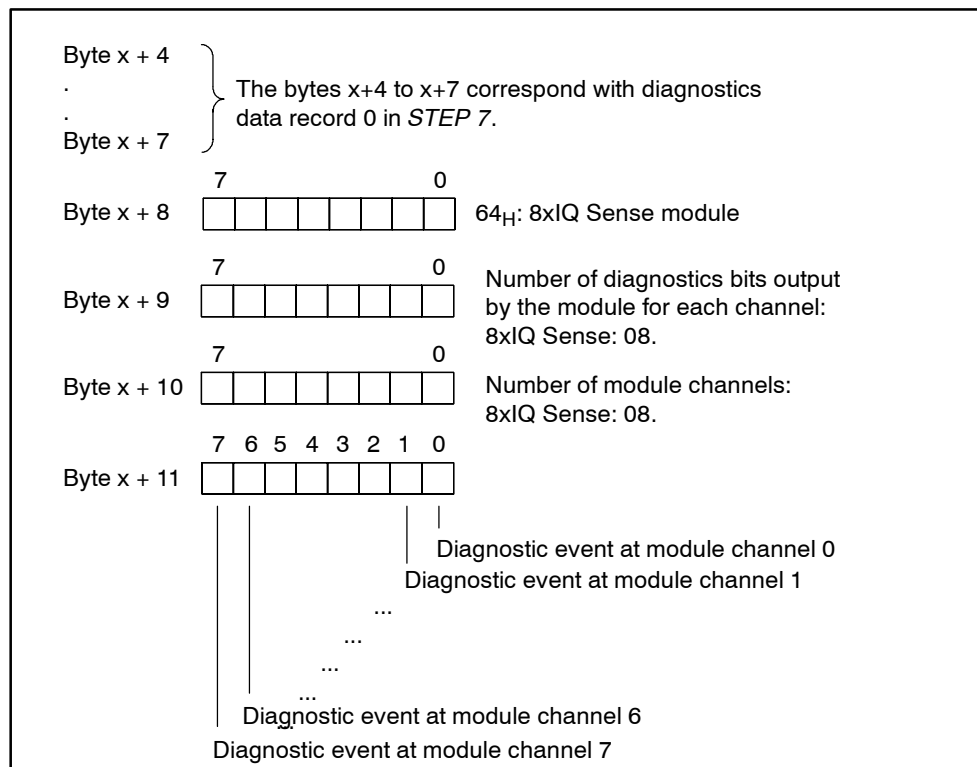
Figure D-1   Bytes x + 4 to x + 11 of diagnostics data for slave diagnostics

D.3 Channel-specific diagnostics data starting at byte x + 12

Bytes x + 12 to x + 19 contain the channel-specific diagnostics data (in accordance with diagnostics data record 1 in *STEP 7*). The figure below shows the allocation of the diagnostics byte for one channel of the 8xIQ Sense module. What generally happens is: The corresponding bit is set to logical "1" as long as an error is present.

For information on possible causes of error and appropriate remedies, refer to chapter D.4.

Bytes x + 12 to x + 19

Byte x + 12:   Channel 0

Byte x + 13:   Channel 1

.

.

.

Byte x + 18:   Channel 6

Byte x + 19:   Channel 7
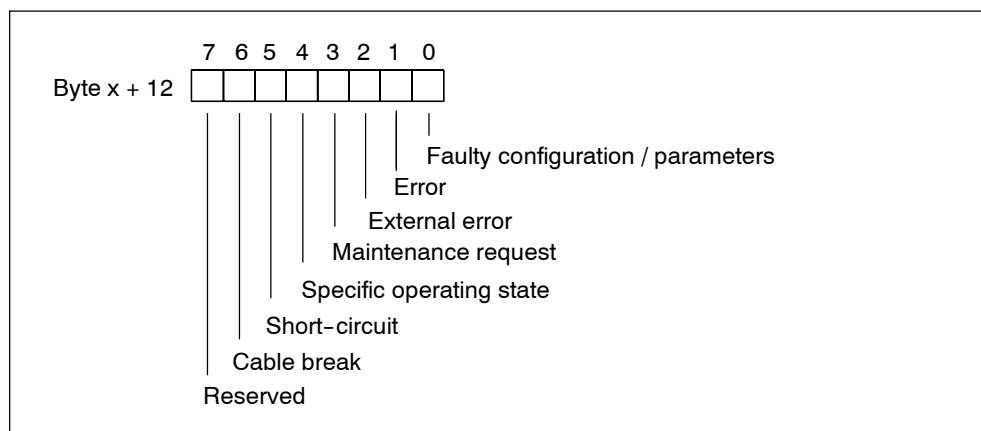
Figure D-2   Diagnostics byte for one channel of the 8xIQ Sense module with slave diagnostics

D.4 Error causes and remedies

The table below lists the channel-specific diagnostics alarms, possible causes of error and remedies.

Table D-1 Channel-specific diagnostics alarms, error causes and remedies for slave diagnostics

Error type		Error text	Possible cause of error	Remedy
10000_B	16_D	Parameter assignment error	Faulty parameters, for example: • The IQ Sense device is unable to evaluate the parameters (unknown, illegal combination...) • The IQ Sense device is not configured • Invalid sensor ID	Adjustment of parameters
01001_B	9_D	Error	Faulty IQ Sense device (sensor)	Replacement of the IQ Sense device:
11010_B	26_D	External error	Error in the area of the IQ Sense device, e.g.: • Function reserve too low • Faulty calibration	Check of operational conditions
01000_B	8_D	Maintenance request	No error, function is OK	Initiate maintenance of the IQ Sense device
11011_B	27_D	Undefined error	Functional events (specific operating state), e.g.: • Teach-in is busy	–
00001_B	1_D	Short–circuit	Short-circuit in signal cable	Repair the wiring
00110_B	6_D	Cable break	Break of the signal cable to the IQ Sense device	Repair the wiring

Order numbers and accessories

E

Table E-1   Order numbers and accessories

Module / sensor / accessories	Order number
8xIQ Sense module	6ES7 338-7XF00-0AB0
Sensors for connecting to the 8xIQ Sense module	
Reflecting light sensor, design C40 IQ Sense	3SF7 240-3JQ00
Reflecting light sensor, design K80 IQ Sense	3SF7 210-3JQ00
Reflecting light sensor with background noise suppression, design K80 IQ Sense	3SF7 214-3JQ00
Reflecting light barrier, design C40 IQ Sense	3SF7 241-3JQ00
Reflecting light barrier, design K80 IQ Sense	3SF7 211-3JQ00
Ultrasonic sensor Sonar-BERO M18 IQ; range 5-30 cm	3SF6 232-3JA00
Ultrasonic sensor Sonar-BERO M18 IQ; range 15-100 cm	3SF6 233-3JA00
RFID read/write device RF 310-R with integrated antenna	6GT2 801-0AA00
Mobile data memory MDS P 121 (20 bytes memory capacity)	6GT2 800-1CA00
Mobile data memory MDS P 412 (8K memory capacity)	6GT2 800-4BB00
Mobile data memory MDS P 514 (32K memory capacity)	6GT2 800-5BD00
Front connector	
20-pin, with screw terminals	6ES7 392-1AJ00-0AA0
20-pin, with spring terminals	6ES7 392-1BJ00-0AA0
20-pin, with crimp contacts	6ES7 392-1CJ00-0AA0
Connecting cable	
Cable socket M12 with screw terminals and 5 m PUR connecting cable 3 x 0.34 mm^2	3RX1 533
Cable socket M12 with screw terminals and 5 m PUR connecting cable 4 x 0.34 mm^2	3RX1 536

Warning

The table above contains the recommended cable for connecting IQ Sense devices to the 8xIQ Sense module. Further sensors, accessories and ordering information can be found in the *BERO - Sensor system for Automation* and *FS10* catalogs.

The latest information is available on the Internet under:
`https://mall.ad.siemens.com`

List of abbreviations

<div style="text-align: right; font-size: 2em; font-weight: bold;">F</div>

Abbrevia-tions	Definitions
AC	Alternating Current
AFI	Application Family Identifier
AS	Automation System
O+M	Operating and Monitoring
BERO	Siemens proximity switches
Module	Module
CP	Communication processor
CPU	Central Processing Unit of the PLC
DB	Data block
DC	Direct Current
DP	Distributed Peripherals
DPV0	Distributed Peripherals - Version 0 (PROFIBUS communication profile)
DPV1	Distributed Peripherals - Version 1 (PROFIBUS communication profile)
DS	Data record
ESD	Electrostatic sensitive devices
EMC	Electromagnetic compatibility
EPROM	Erasable Programmable Read-Only Memory
FB	Functions block
FC	Function
FW	Firmware (software running on the IQ Sense module)
FEPROM	Flash Erasable Programmable Read-Only Memory
GSD	Device master file
EPS	Encoder Power Supply
BNS	Background Noise Suppression See glossary: → Reflecting light sensor with background noise suppression
HW	Hardware

Abbrevia-tions	Definitions
ID&I	Identification and Information
I&M	Identification and Maintenance data
IM	Interface module
L+	Power supply connector 24 V DC
SI	Shipping insert
LED	Light Emitting Diode
M	Chassis ground terminal
M+	Measurement line, positive
M–	Measurement line, negative
MDS	Mobile data memory
MPI	MultiPoint Interface
OB	Organization block See glossary: → Organization block
OP	Operator Panel
OS	Operator System
PG	Programming device
PROFIBUS	Process Field Bus
PS	Power Supply module
RAM	Random Access Memory
RFID	Radio frequency identification system
SDB	System data block
SF	Error LED "Group error"
SFB	System Function Block
SFC	System Function
SLG	Read/write device
SM	Signal Module
PLC	Programmable Logic Controller
IF	Interface
SW	Software (program capable of being executed on a PC)
TD	Text Display

Glossary

Active sensor

See → Reflecting (light) sensor.

Backplane bus

The backplane bus is a serial data bus which is used by the modules for communication and supplies their required voltage. The modules are interconnected by means of bus connectors.

BERO

Name of the Siemens proximity switches

Cable break

Parameter in *STEP 7*. The cable break monitoring function is used to monitor the connection between an input and an encoder, or between an output and an actuator. The module detects a wire break by means of a current signal at the appropriately configured I/Os.

Code block

A code block in SIMATIC S7 contains part of the *STEP 7* user program, and a data block contains only data. Available code blocks: organization blocks (OBs), function blocks (FBs), functions (FCs), system function blocks (SFBs), system functions (SFCs).

Configuring

You configure the inserted modules either in *STEP 7*, or by means of a suitable programming software. You configure the basic properties of the DP slave or module (network parameters, I/O address space, for example).

Cycle times

Initially decisive for the cycle times in the communication of an 8xIQ Sense module with its → IQ Sense devices is the value returned by the IQ Sense device, i.e. the minimum cycle time returned by the sensor, for example. The cycle times are also influenced by the interference suppression group parameter (with IQ profile ID 1) and multiplex / sync operation (with IQ profile ID 128). The actual cycle time, however, is never lower than the time returned by the IQ Sense device.

Diagnostics alarm

Modules with diagnostics functions report system errors to the CPU by means of diagnostics alarms. The operating system of the CPU calls OB82 when it receives a diagnostics alarm.

Diagnostics buffer

The diagnostics buffer is a backup memory area the CPU uses to store diagnostics events in the order of their occurrence.

In *STEP 7* (**PLC > Module status**), the user can read the diagnostics buffer data in order to identify and eliminate the cause of an error.

Diagnostics data

The CPU logs all diagnostics events in the → diagnostics buffer. It also starts an error OB, if this is available.

Direct access

The CPU accesses modules directly via the → backplane bus, thus bypassing the → process image.

Hysteresis

Formed by the difference between the On and Off positions. The values of → BEROs with → IQ Sense interface lie between 1% and 15% of the physical hysteresis.

IntelliTeach

Preset of the On/Off positions by the controller: Each switching output can be assigned one or two switching positions by means of the → IQ Sense interface, which is based on the operating mode. These switching positions define the response of the switching outputs.

Interference suppression group

In order to prevent interference (e.g. as a result of stray light) of neighboring optoelectronic sensors, you can use the interference suppression group parameter to assign a separate interference suppression group to the **module.**

IQ profile ID

Based on the IQ Sense profile (IQ profile ID), users can connect a wide range of → IQ Sense devices, for example, optoelectronic sensors, ultrasonic sensors (pressure sensors, flow sensors, "Laser" sensors, etc.), identification systems. The user of an IQ Sense device benefits from a "standardized" (manufacturer–independent) view with respect to a corresponding class, for example, measuring transducers.

This classification is not primarily based on technological aspects, but rather on functionality:

- A measurement transducer returns → process data via the → IQ Sense interface

- The measurement transducer outputs up to two switching signals, which are transferred via the IQ Sense interface.

IQ Sense device

Sensor or actuator with → IQ Sense interface. Core functionality:

- Transfer of process data (such as range values) in relative form. These values are scaled to match the scaling range of the sensor.

- Transfer of two adjustable switching positions

- Preset of up to two switching positions (assignment of dynamic parameters, [3] IntelliTeach)

- Initiation of → Teach-in processes to determine both switching positions

- Preset sensor parameters (static parameters)

- Reporting of diagnostics events

- Transfer of internal or manufacturer-specific device data

- IQ Sense devices connected to a module, such as → Sonar-BERO, can be operated → in synchronous or → multiplex mode.

- Write data to MDS (Mobile data memory)

- Read data from MDS

- Initialize MDS

IQ Sense interface

The IQ Sense interfaces of the 8xIQ Sense module allow the easy and seamless integration of → IQ Sense devices into the S7 environment:

- Cost-effective integration of analog sensors

- Diagnostics information by means of standard software

- Configuration in *SIMATIC Manager* (*HW Config*, static parameters)

- Setting and editing parameters during program execution by means of function / function block (dynamic parameters)

- Documentation of the setting of IQ Sense devices directly in the S7 project

- Easy replacement of measuring transducers, for example.

RF 300

RF 300 represents the SIEMENS → RFID identification system with IQ Sense interface.
The RFID read/write device RF 310-R is designed to handle identification tasks of small assembly lines in rugged industrial environments, and operates in combination with the transponders of the RF 300 system (mobile data memory MDS). RF 310–R represents a budget-priced component for applications with low requirements of transmission speed and data volume. The device's small and compact housing dimensions allow installation in confined spaces, and offers features such as:

- contact-less reading of data from a data carrier (MDS)

- contact-less writing of data to a data carrier (MDS)

- consistent data exchange between the identification system and the automation system.

Multiplex operation

The IQ Sense ultrasonic sensors determine the process value → (distance) in sequential order, in order to exclude interference.

Operating mode

IQ profile ID 128 offers various modes which can be set in the configuration of static parameters. The set mode can not be changed during program execution. If an operating mode is not set, the IQ Sense device transfers only the process data.

Organization block

Organization blocks (OBs) form the interface between the CPU operating system and the application program. In these organization blocks, the user defines the sequence of execution of the application program.

Parameter assignment

This refers to the assignment of → parameters to inserted modules or → IQ Sense devices.

Parameters

1. Variable of a → code block

2. Variable for setting the properties of a module (one or several per module.) Each module is provided with a useful default parameter setting which users can edit in **STEP 7**.

Process alarm

A process alarm is triggered by alarm-triggering modules, based on certain events in the process (limit value out of hi or lo range; the module has completed the cyclic conversion of its channels.)

The process alarm is reported to the CPU. Based on the alarm priority, the system executes the corresponding → organization block.

Process data

Formed by all → process values transferred via the → IQ Sense interface.

Process image

The signal states of digital I/O modules are stored in a process image on the CPU.

We distinguish between the process images of inputs and outputs. Prior to the execution of the application program, the operating system reads the process image of inputs 0 (PII) from the input modules. After the program has been executed, the operating system transfers the process image of the outputs 0 (PIO) to the output modules.

Process value

Technology value normalized to the IQ Sense format.

Programming

Programming in this context refers to the → configuration → of the inserted modules and assignment of their parameters using a PG/PC.

Programming device

A programming device (PG) is designed as a compact industrial PC. It contains all elements for programming SIMATIC automation systems.

Reflecting (light) barrier

The light beam or pulse of the transmitter is directed onto a reflector. Any object interrupting the beam between the transmitter and receiver triggers a switching action of the output.

Reflecting (light) sensor

The light beam or pulse hits an object, and a diffuse signal is reflected. Part of this signal is reflected back to the integrated receiver of the same device. The output switches if the intensity of the received signal is sufficient.

Reflecting (light) sensor with background noise suppression

Reflecting light sensors with background noise suppression are capable of detecting objects within a certain range. All background signal will be suppressed.

RF 300

RF 300 represents the SIEMENS → RFID identification system with IQ Sense interface.

The RFID read/write device RF 310-R is designed to handle identification tasks of small assembly lines in rugged industrial environments, and operates in combination with the transponders of the RF 300 system (mobile data memory MDS). RF 310-R represents a budget-priced component for applications with low requirements of transmission speed and data volume. The device's small and compact housing dimensions allow installation in confined spaces, and offers features such as:

- contact-less reading of data from a data carrier (MDS)

- contact-less writing of data to a data carrier (MDS)

- consistent data exchange between the identification system and the automation system.

RFID

Radio frequency identification system for fully automated and contact-less data communication by means of electromagnetic waves 0 between the transponder (mobile data memory MDS, for example) and the read/write device (RF 310-R for → RF 300, for example).

Identification systems are successfully used to optimize material flow and production processes in industry, and for managing tasks in the warehouse and logistics area. Such an "identification system" returns information on recorded objects to the master control system. At the object, this requires the installation of a data memory unit (transponder) which contains the relevant object data, and is located within the detection range of a corresponding read/write device.

Sonar (Sound Navigation and Ranging)

Navigation and range measurement device for the acoustic location in particular of underwater objects (Reference: *Brockhaus, Naturwissenschaften und Technik*)

Sonar BERO

The SIEMENS Sonar BEROs are ultrasonic sensors used for the contacts-less detection of objects and range measurements at distances from 5 cm to 10 m. The device emits cyclic ultrasonic pulses which are reflected by the objects and surfaces. The device then determines the distance to the object, based on the time difference between the emission of pulses and receiving of the reflected pulses.

Objects to be detected can be solid, liquid, grainy or powdery. The material can be clear or colored, of any shape and with polished or dull finish.

The Sonar BERO internally checks the plausibility of preset parameters. If a parameter is faulty, the Sonar BERO signals a parameter error.

Switching frequency

Refers to the maximum number of signal transitions per second at the output.

Switching range

The term switching range refers to the distance at which a measuring plate approaching the active area of an → IQ Sense device triggers a signal transition.

Sync mode

The IQ Sense ultrasonic sensors determine the process value → (distance) precisely at the same time, in order to exclude interference.

System diagnostics

System diagnostics refers to the detection, evaluation and reporting of error events within the automation system. Examples of such errors are: Program errors and failures on the modules. System errors can be indicated with LED displays or in **STEP 7**.

System function

System functions (SFC) are integrated into the CPU operating system and can be called in the *STEP 7* application program as required.

Teach-in

Upon request, the → IQ Sense device determines a corresponding parameter. Depending on the set operating mode, the function determines one or two switching positions SPx.x, based on the "learned" Teach-in positions TPx.x. The current switching positions are also reported to the IQ Sense master.

Teach-in of switching positions

See → Teach-in.

Technology value

Recorded physical unit (range, for example) which was subject to a digital conversion (raw value).

Transponder

See → RFID.

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