SIEMENS

SIMATIC

ET 200M
Signal Modules for Process Automation

Configuration Manual

The following supplements are part of this documentation:

No.	Designation	Drawing number	Edition
1	Product information	A5E00201782-03	12/2004

This manual is part of the documentation package with the order number: 6ES7153-1AA00-8BA0

Edition 10/2004
A5E00085262-04

Safety Guidelines

This manual contains notices which you should observe to ensure your own personal safety as well as to avoid property damage. 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.

Danger

indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Warning

indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Caution

used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Caution

used without safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

Notice

used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesirable result or state.

When several danger levels apply, the notices of the highest level (lower number) are always displayed. If a notice refers to personal damages with the safety alert symbol, then another notice may be added warning of property damage.

Qualified Personnel

The device/system may only be set up and operated in conjunction with this documentation. Only qualified personnel should be allowed to install and work on the equipment. Qualified persons are defined as persons who are authorized to commission, to earth, and to tag circuits, equipment and systems in accordance with established safety practices and standards.

Intended Use

Please note the following:

Warning

This device and its components may only be used for the applications described in the catalog or technical description, and only in connection with devices or components from other manufacturers approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up and installed correctly, and operated and maintained as recommended.

Trademarks

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Preface

Purpose of the Documentation

This documentation provides you with support in using the signal modules for process automation. You will find all the information you require on using the modules in the PCS 7 process control system.

Target group

This documentation is aimed at those who want to install and use the modules described in an ET 200M and in the PCS 7 process control system.

Required Basic Knowledge

You need knowledge in the field of automation engineering to understand the documentation.

Validity of the Documentation

The manual is valid for the following modules:

- 6ES7321-7TH00-0AB0
- 6ES7322-8BH00-0AB0
- 6ES7322-8BH01-0AB0

Changes in Comparison to the Previous Version

In comparison to the previous version, we have reorganized the document and integrated the product information for 6ES7322-8BH01-0AB0 into the document.

Position in the Information Landscape

This manual is a component of the product package with the order number 6ES7153-1AA00-8AA0. The product package consists of the following manuals and their respective contents:

Manual ET 200M Distributed I/O System	Manual S7-300 Module Data	This manual ET 200M Distributed I/O Device, Signal Modules for Process Automation
• Mechanical Configuration • Installation and Wiring	• General Technical Specifications • Power Supply Modules • Digital Modules • Analog Modules • RS 485 Repeater • SIMATIC TOP Connect	• Overview of Usage in Process Automation • Parameter Assignment with SIMATIC PDM • Digital Modules

Electronic Manual

You will also find the manual in the SIMATIC Manual Collection (order number 6ES7998-8XC01-8YE0).

Organization of the Documentation

To help you find specific information quickly, the manual contains the following navigation aids:

- A comprehensive table of contents and a list of tables which are always provided at the beginning of the manual.
- A heading indicating the contents of each section is provided in the left-hand column on each page of each chapter.
- Following the chapters, you will find a glossary in which important technical terms used in the manual are defined.
- At the end of the manual you will find a detailed index which makes it easy for you to find the information you are looking for.

Special Notes

Some values in the technical specifications are specified with attributes. These attributes of the values of the technical specifications have the following meanings:

Attribute	Meaning
Minimum/ maximum	A minimum/maximum value represents the limit or operating value guaranteed by Siemens. This value must not be violated during operation within other limits.
Typical	The typical value is found under nominal conditions and an ambient temperature of 25° C. Component tolerances allow values above and below the typical values.
Approx.	The "approx." value is a value that has been rounded up or down (the weight of a module, for example).
Without attribute	Values without an attribute are nominal values, not values subject to tolerance.

Recycling and Disposal

The materials used in the signal modules for process automation can be recycled. Contact a certified disposal company for electronic refuse for recycling and disposal of your old equipment in an environmentally-friendly manner.

Table of contents

Tables

Overview

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1.1   Product Overview

Signal Modules for Process Automation

Signal modules for process automation are part of the S7-300 I/O module range which offers functions in addition to those of "standard" I/O modules:

- Technological functions
  - Pulse stretching
  - Flutter monitoring
- Enhanced diagnostics
- Provision of identification data

You can make full use of these additional functions in an ET 200M which is used in the PCS 7 process control system.

Declaration

The "signal modules for process automation" are referred to below as "process control modules".

1.2 Used together with other products

Hardware Requirements

You will require the IM 153-2 as a DP slave interface as of the following version

IM 153	Order number
IM 153-2	as of 6ES7 153-2AA02-0XB0, Version 07
IM 153-2 FO	as of 6ES7 153-2AB01-0XB0, Version 06

In a central configuration, you can also use the process control module central in an S7-300 with the following CPUs:

CPU	Order number
CPU 312C	as of 6ES7 312-5BD01-0AB0
CPU 312	as of 6ES7 312-1AD10-0AB0
CPU 313C	as of 6ES7 313-5BE01-0AB0
CPU 313C-2 PtP	as of 6ES7 313-6BE01-0AB0
CPU 313C-2 DP	as of 6ES7 313-6CE01-0AB0
CPU 314C-2 PtP	as of 6ES7 314-6BF01-0AB0
CPU 314C-2 DP	as of 6ES7 314-6CF01-0AB0
CPU 314	as of 6ES7 314-1AF10-0AB0
CPU 315-2 DP	as of 6ES7 315-2AG10-0AB0

Software Requirements

You will require the following to configure and assign parameters to the process control modules:

- STEP 7 as of V5.1 (SP1 or SP2) and SIMATIC PDM as of V5.1

- STEP 7 as of V5.1 SP3 (without SIMATIC PDM)

- PCS 7 as of V5.1 or V5.2/V5.2 SP1 and SIMATIC PDM as of V5.1

- PCS 7 V5.2 SP2 (without SIMATIC PDM)

- COM PROFIBUS as of V3.0 and SIMATIC PDM as of V5.1

- For use in third-party systems: Configuration software for the DP master and SIMATIC PDM as of V 5.1

Note

When using STEP 7 as of V5.1 SP3 and PCS 7 V 5.2 SP2, you must configure the modules of the process control system with STEP 7 in HW Config.

When using later versions of STEP 7, configuration is done with SIMATIC PDM as of V5.1. The subsequent chapter, in which the configuration with SIMATIC PDM is described, refers only to the STEP 7 Versions of V5.1 SP1 and 2 as well as PCS 7 V5.1, V5.2, V5.2 SP1.

After upgrading to STEP 7 V5.1 SP3 or PCS 7 SP2, you must reassign module parameters to process control modules already installed with STEP 7 (HW Config). You will then no longer be able to use the identification and information functions of the process control modules.

Identification Data

You can also access the identification data of the module with STEP 7 as of V5.2.

Upgrading from STEP 7 V5.1 without SP3 to STEP 7 V5.1 SP3

As of STEP 7 V5.1 SP3, parameters are assigned exclusively in HW Config.

The use of PDM is not allowed as soon as STEP 7 V 5.1 SP3 is installed on your engineering system.

If you have configured your modules with PDM until now, proceed as follows:

1. The modules should not be deleted in the configuration so that the I/O addresses and symbols are retained.

   If you delete and reconfigure the modules, the I/O addresses may be reassigned and the symbols are to be remodified.

2. Reconfigure all the channels of the modules in HW Config.

3. Download the configuration to the PLC.

Integration in the Process Control System

The following section applies to STEP 7 V 5.1 SP 1 and SP2 as well as for PCS 7 V 5.1, V 5.2, V5.2 SP 1.

PCS 7 is a powerful process control system. With PCS 7 and the process control modules, the ET 200M has a direct connection to the process control system. This is also evident from the following:

- Configuration of the process control modules with SIMATIC PDM (add-on package for STEP 7)

- The evaluation and continued processing of the input/output signals is performed by PCS 7 driver blocks in the DP master CPU.
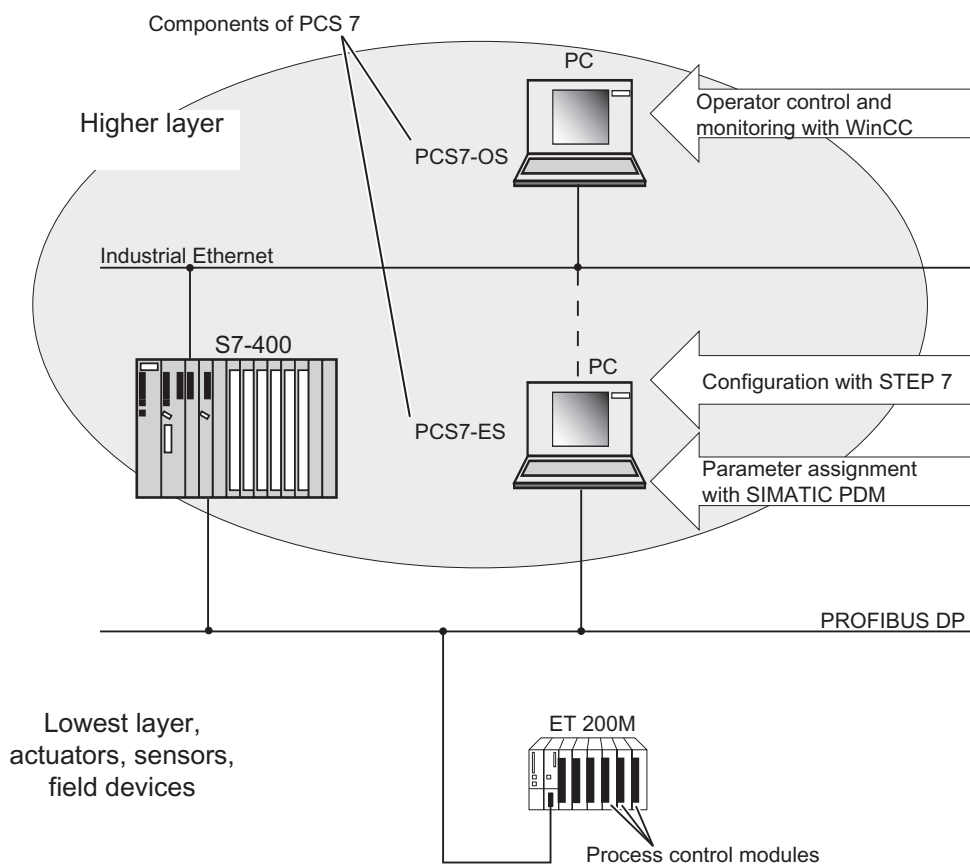
Figure 1-1   Integration in the process control system

Information about the PCS 7 Process Control System

You can find more detailed information on the PCS 7 process control system in the PCS 7documentation.

Project Engineering

2

Operating principle for configuration

The following section applies to STEP 7 V 5.1 SP 1 and SP2 as well as for PCS 7 V 5.1, V 5.2, V5.2 SP 1
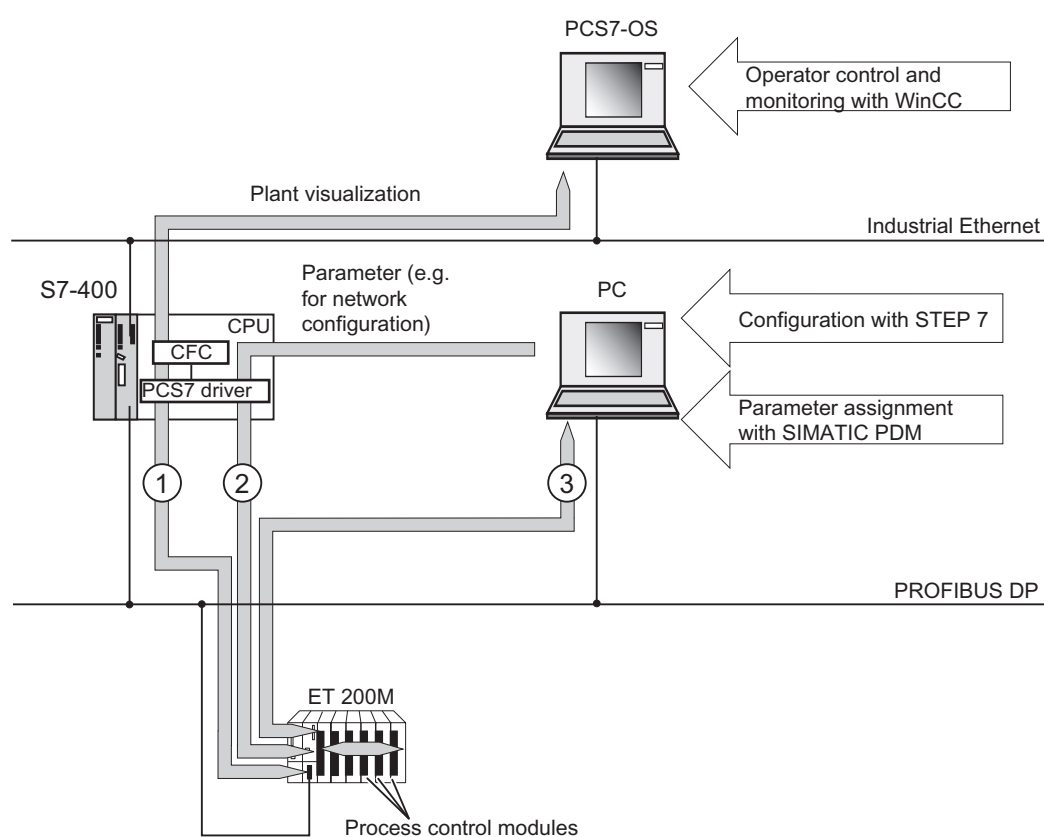
Figure 2-1   Operating principle for configuration

Number	Meaning	
1	Cyclic data communication:	• User data input/outputs and value status
2	Cyclic data communication:	• Configuration and bus parameters for network configuration (network configuration, for example) Diagnostic interrupts (only with S7, DP V1)
3	Cyclic data communication:	• Parameters of the process control modules • Informational data of the process control modules

Configuration

This step involves configuring and assigning parameters to the ET 200M using the programming device.

Configuring

You configure the ET 200M with STEP 7 / COM PROFIBUS or with appropriate configuration software. At configuration, you only set the basic features of the DP slave (the network parameters, for example).

Parameter Assignment

You assign parameters to the ET 200M and the inserted modules:

- You assign parameters to the ET 200M and "standard" I/O modules with STEP 7.
- You assign parameters to the process control modules with SIMATIC PDM.

Cyclic Data Communcation via PROFIBUS DP

Cyclic data communication takes place between the CPU (S7-400, for example) and the ET 200M. The following data is transferred:

- The cyclic user data of the inputs and outputs, including the value status of inputs
- The diagnostic interrupts

This data is prepared in the CPU by the PCS 7 driver and the CFC (Continuous Function Chart) for system visualization. This data is then presented on the OS by means of WINCC.

The parameters (for network configuration, for example) are also transferred cyclically.

Acyclic Data Communication via PROFIBUS DP

Acyclic data communication takes place between the process control modules of the ET 200M and the programming device/PC (SIMATIC PDM). The process control modules of the ET 200M are assigned parameters using this acyclic data communication. Informational data is also transferred and displayed in SIMATIC PDM .

- Diagnostics and Interrupts
- Data records (only with S7)

Software requirements

Table 2-1   Software requirements for configuration

Configuration software used	Version	Notes
STEP 7 and SIMATIC PDM (SIMATIC PDM is embedded in STEP 7 HW Config and available as an add-on package.) or PCS 7 (also contains STEP 7)	STEP 7 as of V5.1 SP1 SIMATIC PDM as of V5.1 (only for STEP 7 V5.1 SP1, SP2 and PCS 7 V5.1, V5.2, V5.2 SP1)	• Configuration with STEP 7. The ET 200M (IM 153-2 [1] and all the modules that can be used) is contained in the hardware catalog. • The SIMATIC PDM is automatically started in HW Config for parameter assignment.
STEP 7 and SIMATIC PDM (SIMATIC PDM is autonomous and available as a stand-alone version)	STEP 7 as of V5.1 SP1 SIMATIC PDM as of V5.1	• You require the DDB file for the ET 200M (IM 153-2 [1]) and you carry out configuration with STEP 7. • Parameter assignment with SIMATIC PDM
STEP 7 or PCS 7 (also contains STEP 7)	STEP 7 as of V5.1 SP3 PCS 7 as of V5.2 SP2	• Configuration and parameter assignment with STEP 7
COM PROFIBUS with SIMATIC PDM (SIMATIC PDM is autonomous and available as a stand-alone version)	COM PROFIBUS as of V3.0 SIMATIC PDM as of V5.1	• You require the DDB file for the ET 200M (IM 153-2 [1]) and you carry out configuration with COM PROFIBUS. • Parameter assignment with SIMATIC PDM
Other configuration software and SIMATIC PDM (SIMATIC PDM is autonomous and available as a stand-alone version)	Configuration software see manufacturer SIMATIC PDM as of V5.1	• You require the DDB file and you carry out configuration with appropriate configuration software. • Parameter assignment with SIMATIC PDM

[1] IM 153-2 as of 6ES7 153-2AA02; E07 or IM 153-2 FO as of 6ES7 153-2AB01; E06

Configuring

3

Requirements

The information in this section applies to:

- IM 153-2 as of 6ES7 153-2AA02-0XB0, Version 07
- IM 153-2 FO as of 6ES7 153-2AB01-0XB0, Version 06

Configuring

The table below describes the most important configuration steps:

Table 3-1   Configuring

	STEP 7 as of V5.1 SP1 or PCS 7 as of V5.1	STEP 7 as of V5.1	COM PROFIBUS as of V3.0 / other configuration software
Features	• The ET 200M (IM 153-2) is contained in the STEP 7 hardware catalog • Diagnostic interrupts and time stamping are supported • The ET 200M is integrated as an S7 DP slave	• You require the DDB file of the IM 153-2 • The ET 200M is integrated as a DP standard slave	
Procedure	1. Start the SIMATIC Manager. 2. Configure the ET 200M with HW Config. – Create a new project. – Drag the modules from the hardware catalog to the configuration table. 3. Save the configuration and download it to the DP master.	1. Start the SIMATIC Manager. 2. Integrate the DDB file in HW Config. 3. Configure the ET 200M with HW Config. – Create a new project. – Drag the modules from the hardware catalog to the configuration table. 4. Save the configuration and download it to the DP master.	1. Start COM PROFIBUS / configuration software. 2. Integrate the DDB file in COM PROFIBUS / configuration software. 3. Configure the ET 200M with COM PROFIBUS / configuration software. 4. Save the configuration and download it to the DP master.

Configuration Information

You can find additional information about configuration in the STEP 7 / COMPROFIBUS online help system.

DDB File in STEP 7 / COM PROFIBUS

The table below describes how to integrate the DDB file in SIMATIC S7 or SIMATIC S5 (COM PROFIBUS).

Table 3-2   DDB File in STEP 7 / COM PROFIBUS

STEP7	COM PROFIBUS as of V 3.0
1. Start STEP 7 and select the menu command **Options / Install New DDB File**. 2. Select the DDB file to be installed in the subsequent dialog box and confirm with OK. Result: The field device is displayed in the hardware catalog in the PROFIBUS-DP directory.	1. Copy the DDB file from ET 200M (IM 153-2) into the COM PROFIBUS directory: **...COMPB3\GSD** (default) Copy the Bitmap file into the directory: **...COMPB3\BITMAPS**Start COM PROFIBUS and call the menu command **File / Download GSD file**. Result: The ET 200M (IM 153-2) is displayed in the hardware catalog during slave configuration

Downloading the GSD File

You can download the GSD file for the ET 200M (IM 153-2) as follows:

- in the Internet at the address: www.ad.siemens.de/csi_e/gsd

- via modem with the telephone number +49 (911) 73 79 72

Parameter Assignment

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4.1 Parameter Assignment

Requirements

The information in this section applies to:

- IM 153-2 as of 6ES7 153-2AA02-0XB0, Version 07
- IM 153-2 FO as of 6ES7 153-2AB01-0XB0, Version 06

Procedure

The following table describes the most important steps for assigning parameters to process control modules:

Table 4-1   Parameter Assignment

	STEP 7 (as of V5.1 SP1 and SP2) with the SIMATIC PDM optional package (as of V5.1) or PCS 7 (as of V5.1, V5.2, V5.2 SP1)	SIMATIC PDM as of V5.1
Features	You assign parameters to the process control modules in the ET 200M.	
Requirements	SIMATIC PDM is already installed on the programming device/PC or PCS 7 ES.	SIMATIC PDM must be a stand-alone version
Procedure	1. You are still in HW Config. Double-click the first process control module in the configuration table. Result: SIMATIC PDM is started. 2. Set the parameters of the process control module with SIMATIC PDM. 3. In HW Config, double-click the next process control module in the configuration table. 4. Set the parameters of the process control module with SIMATIC PDM. 5. Repeat steps 3 and 4 until you have set all the parameters of the process control modules. 6. Save the parameters or, if you are online, download the parameters to the process control modules.	1. Start SIMATIC PDM. 2. Configure a point-to-point connection for the ET 200M. 3. Set the parameters for all the process control modules of the ET 200M with SIMATIC PDM. 4. Save the parameters or, if you are online, download the parameters to the ET 200M.

Note

Set the parameters with STEP 7 when using SIMATIC S7 or PCS 7. Set the parameters with SIMATIC PDM when using a DP standard master.

Startup Response

The modules have to be reconfigured if they are unplugged and plugged in again. Evaluate the unplugged/plugged interrupt in the user program for this purpose.

If a process control module is to operate with default parameters and if a bumpless module replacement is required in a plant, the new module has to be set to the default parameters beforehand.

The default parameter configuration activates the retentively stored parameters in the process control modules.

Note

This procedure also applies when no parameters are set in STEP 7.

Parameter Assignment Information

You can find additional information about parameter assignment in the SIMATIC PDM documentation.

4.2 Reconfiguration during runtime

Procedure

The following table describes the most important steps when changing the parameter assignment of the process control modules:

Table 4-2 Changing the parameter assignment

	STEP 7 (as of V5.1 SP1 and SP2) with the SIMATIC PDM optional package (as of V5.1) or PCS 7 as of V5.1, V5.2, V5.2 SP1	SIMATIC PDM as of V5.1
Features	You can reconfigure the process control modules during runtime (only with SIMATIC PDM).	
Requirements	SIMATIC PDM is already integrated on the programming device/PC or PCS 7 ES.	SIMATIC PDM must be a stand-alone version
Procedure	1. Start the STEP 7 SIMATIC Manager 2. Open the project in which you configured the ET 200M. 3. Double-click the process control module in HW Config in the configuration table you want to reconfigure. Result: SIMATIC PDM is started. 4. Download the parameters/identification data of the process control module to the programming device/PC. 5. Change the parameters/identification data. 6. Download the parameters/identification data to the process control module. 7. Check: Download the parameters/identification data of the process control module again to the programming device/PC and check the new configuration.	1. Start SIMATIC PDM. 2. Configure a point-to-point connection for the ET 200M. 3. Download the parameters/identification data of the process control module to the programming device/PC. 4. Change the parameters/identification data. 5. Download the parameters/identification data to the process control module. 6. Check: Download the parameters/identification data of the process control module again to the programming device/PC and check the new configuration.

Parameter Assignment Information

You can find additional information about parameter assignment in the SIMATIC PDM documentation.

Diagnostics

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5.1 Diagnostics Using the Process Image of Inputs

Introduction

In addition to the diagnostic messages by means of LED and module/DP diagnostics, the module 6ES7 321-7TH00-0AB0 also provides additional information on the validity of each input signal - the value status. The value status is stored in the process image as is the input signal.

Value status

The value status is additional binary information on a digital input signal. The value status is entered at the same time as the process signal in the process input image and provides information on the validity of the input signal. The value status is influenced by

- Sensor or power failure
- Wire break test, short-circuit in sensor line
- Flutter monitoring
- Diagnostics with sensor changeover contact

Digital input and value status assignment

In the process image, each input in the input word IW x of the module is assigned a value status in the subsequent IW x+2.
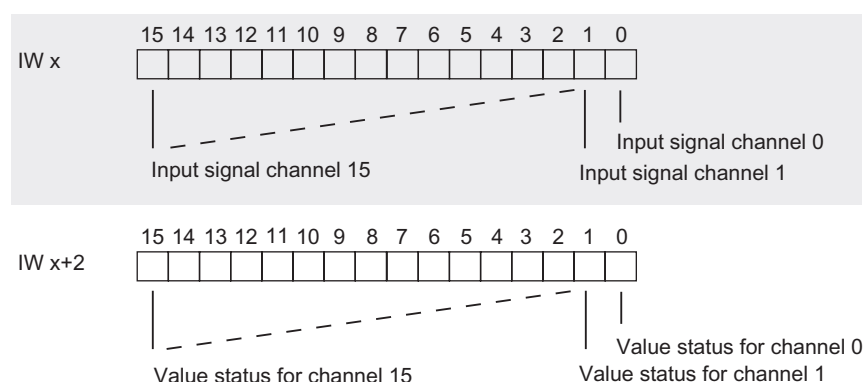
Figure 5-1   Digital input and value status assignment

Meaning of value status

The value status means:

- 0 = Signal invalid
- 1 = Signal valid

Evaluation of the Value Status in PCS 7

The value status is evaluated in your CFC program with block FC 277 "CH_DI: Digital Input". This module undertakes the processing of the digital input value of S7-300-Digital input modules.

How the value status gets into the block:

1. Link the symbol created with STEP 7 in the symbol table for the digital input channel with the VALUE input parameter.
2. Link the status symbol of the value of the digital input channel with the VALUE_QC input parameter
3. Set the PQC = TRUE input parameter

If you use the driver wizard in PCS 7 (as of V 5.1), steps 2 and 3 are executed automatically by PCS 7.

Information about FC 277 and Processing of the Input Signals

You can find a detailed description of the block and how the input signals are processed in the PCS7 documentation.

5.2 Diagnostic data

Organization of the Diagnostic Data

This chapter describes the organization of the diagnostic data in the system data. You need to be familiar with this organization if you want to evaluate the diagnostic data of the signal modules in the STEP 7 user program.

In PCS 7, the CFC diagnostic block carries out the evaluation of the diagnostic data automatically.

Further Sources

You can find a detailed description of the principle behind the evaluation of the diagnostic data of the signal modules in the user program and a description of the SFCs you can use to do this in the *System and Standard Functions* reference manual.

Data Records 0 and 1 of the System Data

The diagnostic data of a module is contained in the data records 0 and 1 of the system data area.

- Data record 0 contains 4 bytes of diagnostic data which are the same for all modules and describe the current status of an S7-300/ET 200M.

- Data record 1 contains:

  – 4 bytes of diagnostic data of data record 0 and

  – the remaining bytes containing the module-specific diagnostic data

Contents of the Diagnostic Data for Faults

The following generally applies: If an error occurs, the corresponding bit is set to "1".

Data Record 0 (Bytes 0 to 3)

The assignment of bytes 0 to 3 illustrated in the figure applies to the digital input and digital output modules.
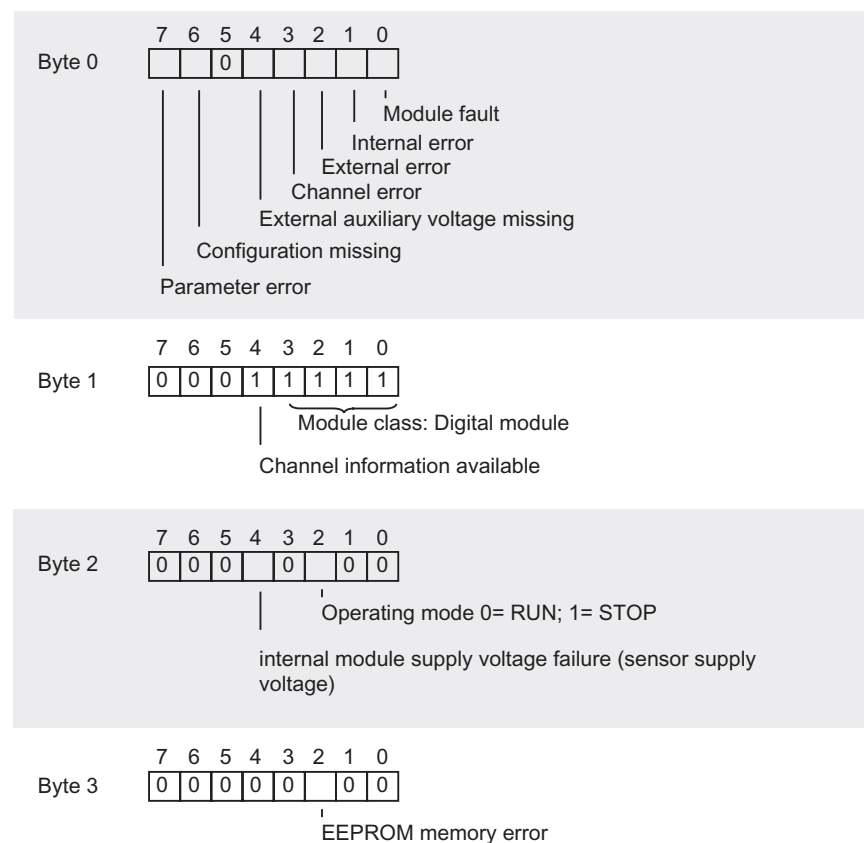
Figure 5-2   Diagnostic data record 0 (bytes 0 to 3)

Diagnostic data record 1 (as of byte 4) of the digital input module
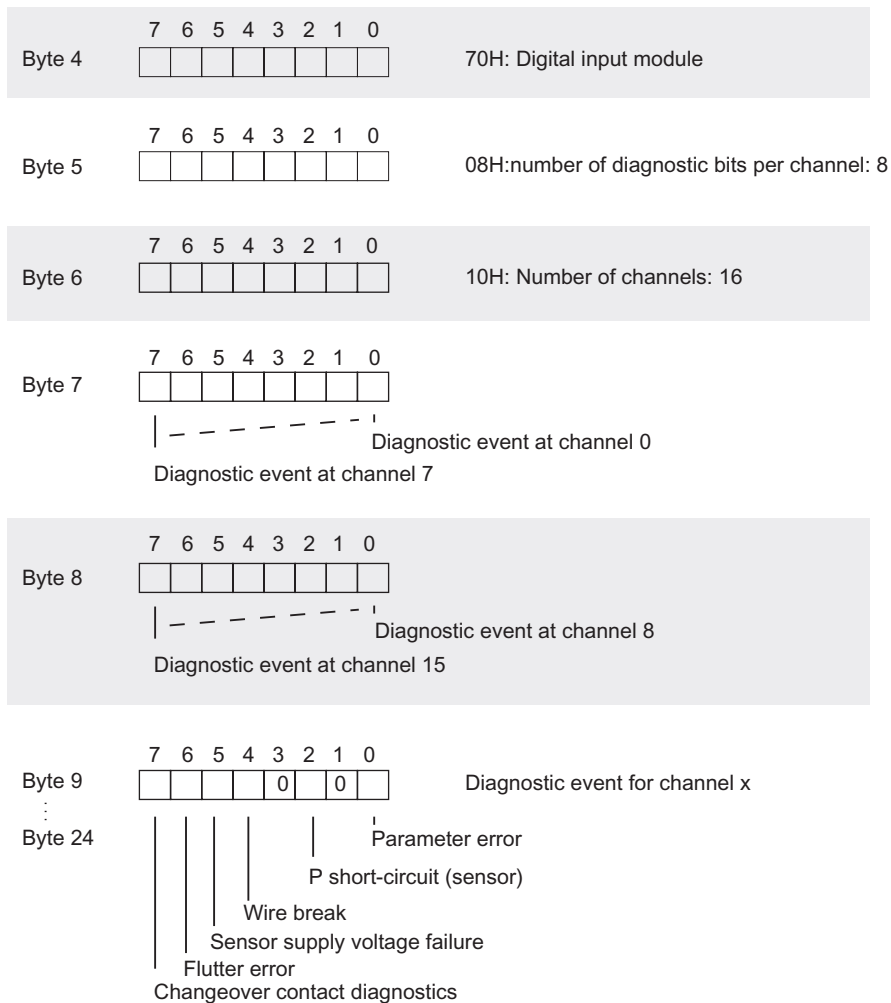
Figure 5-3   Diagnostic data record 1 (as of byte 4) of the digital input module

Diagnostic Data Record 1 (as of Byte 4) of the Digital Output Module
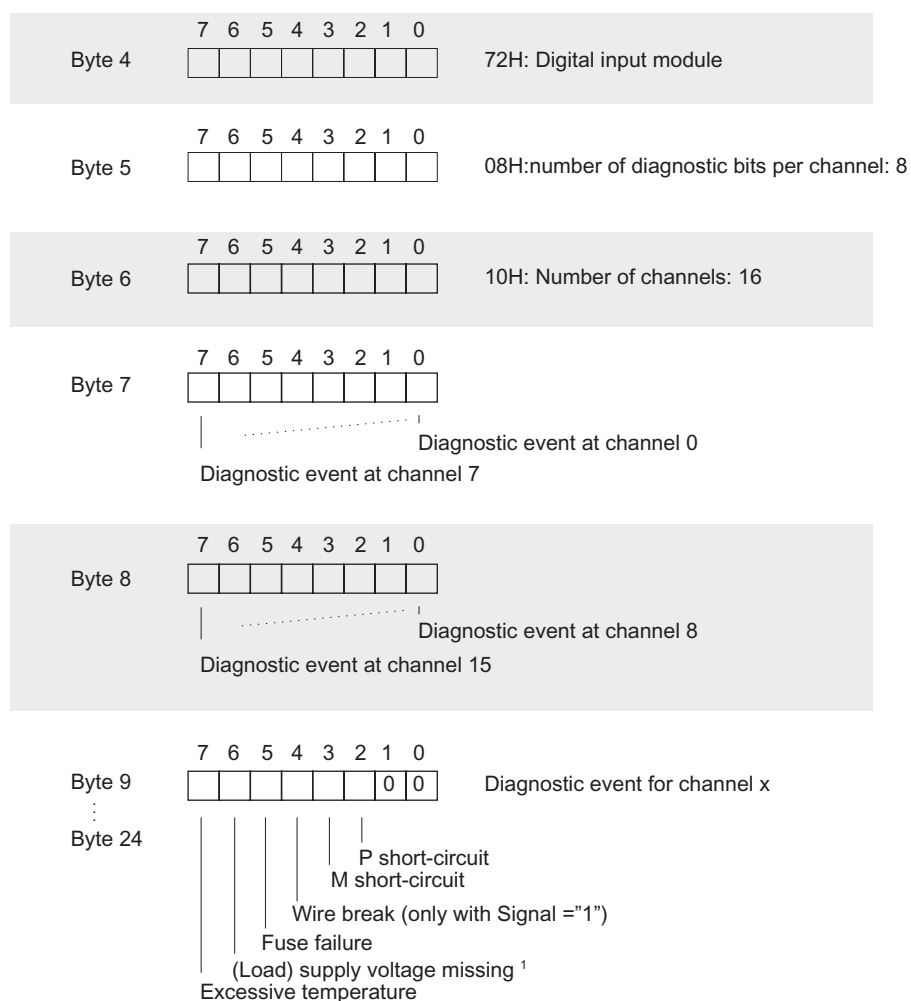
Figure 5-4   Diagnostic data record 1 (as of byte 4) of the digital output module

[1]   Each group of 4 channels have a common power supply. If a power supply error occurs, the error bits of all 4 channels are set.

Specifications

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6.1 General technical specifications

General Technical Specifications

The general specifications of the process control modules for process automation correspond to the general specifications of the S7-300 modules.

These include, for example:

- Standards, certificates and approvals
- Electromagnetic compatibility
- Transport and storage conditions
- Mechanical and climatic ambient conditions
- Information on insulation testing, safety class and degree of protection
- Nominal voltages

General Specifications for S7-300 Modules.

These can be found in the device manual, *S7-300, Module Data*.

6.2 Digital input module SM 321; DI 16 x NAMUR

6.2.1 Specifications

Order number

6ES7 321-7TH00-0AB0

Properties

The SM 321; DI 16xNAMUR has the following features:

- 16 inputs
- Connection for a wide variety of sensor types
  – NAMUR sensor according to NAMUR worksheet NA 01
- Process control functions
  – Pulse stretching
  – Flutter monitoring
- Value status
- Identification data
- Input nominal voltage 24 V DC

Inrush current

The SM 321; DI 16xNAMUR has an inrush current of 4 A.

We recommend you power the digital input module with its own power supply. So that you can make sure that no neighboring modules will be affected when the digital input module (e.g. by inserting the front connector after a module replacement while the device is in operation) is turned on.

Terminal Assignment and Block Diagram

In the figure, NAMUR sensors are connected to the inputs as an example. You can find out how to connect the other possible sensors in the section on sensors.
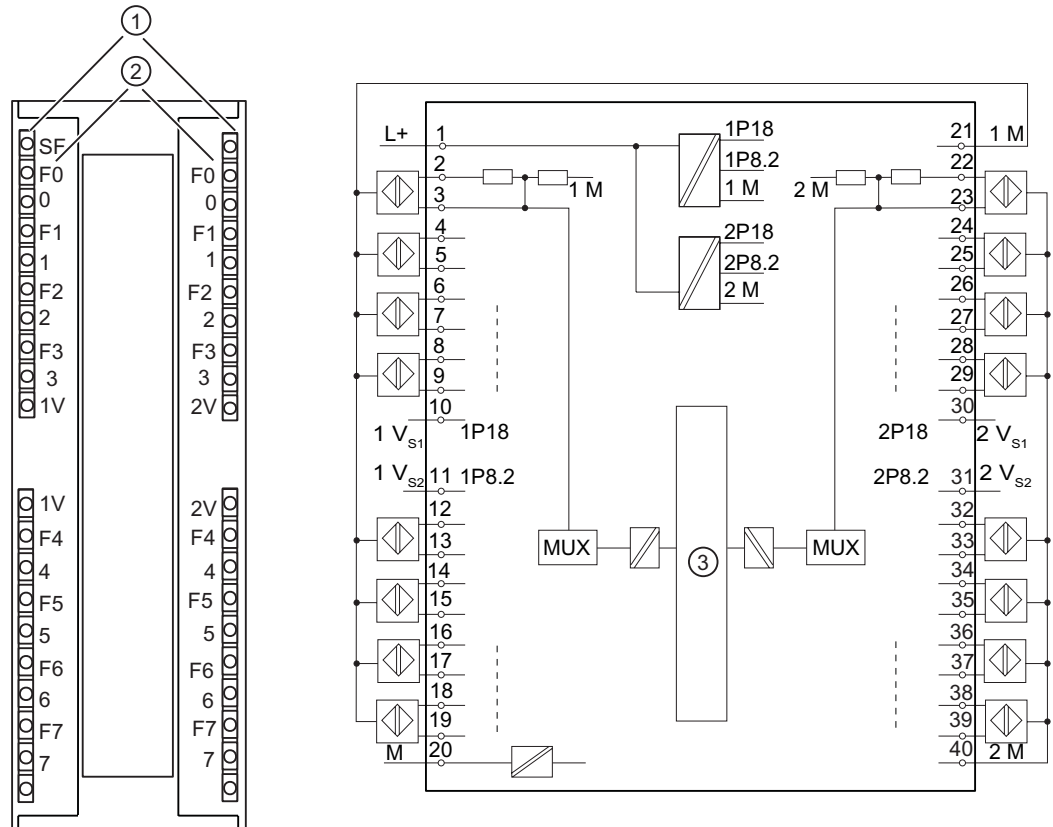
Figure 6-1   Module view and block diagram of the SM 321; DI 16 x NAMUR

Number	Meaning
1	Status LED - green
	Error LED - red
2	Channel number
	Numbers 0 to 7 on the right side correspond to channel numbers 8 to 15
3	Backplane bus connection

Specifications

Table 6-1   Technical specifications SM 321 DI 16xNAMUR

Specifications	
Dimensions and Weight	
Dimensions W x H x D (mm)	40 x 125 x 120
Weight	Approx. 200 g
Specifications for Specific Modules	
Number of inputs	16
Occupied address area	
• In the process-image input table	4 bytes
Cable length	
• Unshielded	Not permitted
• Shielded	Max. 200 m with 8.2 V sensor ($1V_{S1/2}$)
	Max. 400 m with 18 V sensor ($2V_{S1/2}$)
Voltages, Currents, Potentials	
Nominal load voltage L+	24 V DC
• Reverse polarity protection	Yes
Number of inputs that can be addressed simultaneously	
• Horizontal mounting up to 60° C	16
• Vertical mounting up to 40° C	16
Isolation	
• Between channels and backplane bus	Yes
• Between the channels In groups of	Yes 8
• Between power supply and sensor power supply	Yes
Permissible potential difference	
• Between the various circuits	75 V DC, 60 V AC
Insolation tested with	600 V DC
Power consumption	
• From the backplane bus	Max. 100 mA
• From the load voltage L+ (no load)	Typical 100 mA
• Inrush current (transient)	4 A
Power dissipation of the module	Typical 11 W
Status, Interrupts, Diagnostics	
Status LEDs	
• Inputs	Green LED per channel
• Sensor power supplies (V_s)	Green LED per output (V_s)
Interrupts	
• Diagnostic interrupt	Parameters can be assigned
Diagnostic functions	Parameters can be assigned
• Group error display	Red LED (SF)
• Channel error display	Red LED per channel (F)
• Diagnostic information readable	Possible

Specifications	
Sensor Power Supply Outputs	
Number of outputs	4
Output voltage	
• Loaded	$1V_{S1}$: 18 V $1V_{S2}$: 8.2 V $2V_{S1}$: 18 V $2V_{S2}$: 8.2 V
Output current	
• Nominal value	At 18 V: 190 mA At 8.2 V: 60 mA
• Permissible range	
Up to 60° C	At 18 V: 0 to 110 mA At 8.2 V: 0 to 60 mA
Up to 40° C	At 18 V: 0 to 190 mA At 8.2 V: 0 to 60 mA
Additional (redundant) supply	Not permitted
Short-circuit protection	Yes, electronic
Data for Selecting a Sensor	
Input voltage	
• Nominal value	18 V 8.2 V
Input current for NAMUR sensor	
• At signal "1"	2.1 to 7 mA
• At signal "0"	0.35 to 1.2 mA
Input current for 10 kΩ / 47 kΩ connected contact	
• At signal "1"	Typical 10 mA
• At signal "0"	0.35 to 1.2 mA
Input current for unconnected contact and 3 and 4-wire BEROs	
• At signal "1"	Typical 10 mA
• Permitted bias current	0.5 mA
Input delay	
• At "0" to "1"	2.5 to 3.5 ms
• At "0" to "1"	2.5 to 3.5 ms
Input characteristic curve	To IEC 1131, type 2
Connection of 2-wire BERO	Possible in accordance with NAMUR
Time/frequency	
Internal processing time for	
• Interrupt and diagnostics processing	Max. 2 ms (at default setting)
Input delay	
• Tolerated switchover time for changeover diagnostics	300 ms

6.2.2 Parameter

6.2.2.1 Parameters of the digital input module

Content of the Following Tables

The following tables contain

- all parameters and
- the identification data of the digital input module.

Parameters

You set the parameters for each channel in PDM or STEP 7 (HW Config). Entering the sensor type affects the channel group. This means, for example, that if you set a "NAMUR sensor" for channel 0, PDM then automatically also sets a "NAMUR sensor" for channel 1, etc.

Table 6-2   Parameters of the digital input module

Parameters	Value range	Default setting	Applicability
Diagnostics			
• Enabling: Diagnostic interrupt	Yes/no	No	Module
Channel x			
Sensor type	Channel deactivated One-way contact: NAMUR sensor One-way contact: Unconnected One-way contact: 10 kΩ One-way contact: 47 kΩ One-way contact: NAMUR sensor Changeover contact: Unconnected Changeover contact: 10 kΩ One-way contact: 47 kΩ	NAMUR sensor	Channel group
Group diagnostics	Yes/no	Yes	Channel
Pulse stretching	None; 0.5 s; 1 s; 2 s	No	Channel
Flutter monitoring	Yes/no	No	Channel
• Monitoring window	0.5 s; 1 s to 100s (can be set in 1 s increments)	2 s	
• Number of signal changes	From 2 to 31	5	

Group Diagnositics and Value Status

If you deactivate the group diagnostics for a channel, a channel error will not be indicated by the channel error LED and there will be no diagnostic entry. A channel error will, however, be displayed in the value status.

Identification Data

Table 6-3   Identification data of the digital input module

Identification Data	Value range	Default setting	Applicability
Device			
Manufacturer	reading	SIEMENS AG	Module
Device identification	reading	6ES7 321-7TH00-0AB0	Module
Device serial number	reading	Depends on the version	Module
Hardware revision	reading		Module
Software revision	reading		Module
Static revision no.	reading	–	Module
Installation date	Read/write (max. 16 characters)	–	Module
Operating unit			
TAG	Read/write (max. 32 characters)	–	Module
Description	Read/write (max. 32 characters)	–	Module

Note

Access to identification data is only possible with SIMATIC PDM.

Information about the Parameters

You can find detailed information on the parameters for pulse lengthening, flutter monitoring and identification data in the following sections.

6.2.2.2   Flutter monitoring

What is Flutter Monitoring?

Flutter monitoring is a process control function for digital input signals. It detects and reports unusual process control signal patterns such as a fluctuation in the input signal between"0" and "1"that occurs too often. The occurrence of such signal patterns indicates that the sensor is faulty or unstable.

Enabling Flutter Monitoring

You enable flutter monitoring by means of the "Diagnostics: Flutter error".

Tip: Also enable the group diagnostics when assigning parameters so that if there is a flutter error, a diagnostic interrupt is also reported in addition to the diagnostic entry.

Detecting Unusual Signal Patterns

A configurable monitoring window is available for each input channel. The monitoring window is started with the first change of the input signal. If the input signal changes more within the monitoring window than the configured number of signal changes, this is recognized as a flutter error. If a flutter error is not detected within the monitoring window, the monitoring window is started again at the next signal change.

Reporting a Flutter Error

If a flutter error occurs, the current signal state is entered in the process image and the value status of the signal is set to "invalid". In addition, the "flutter error" is entered as diagnostic information and an incoming diagnostic interrupt is triggered.

You must evaluate and process the value status and the diagnostic information in the user program.

Resetting a Flutter Error

If no further fluttering of the input signal is detected during the triple monitoring window, the diagnostic entry is removed and an outgoing diagnostic interrupt is triggered. The value status of the current signal in the process image is set to "valid".

Operating Principle

The following figure illustrates the principle behind flutter monitoring.

Parameter number of signal changes = 9

Parameter monitoring window t = x

3 x monitoring window t = 3x

Process signal

Detect

Diagnostics

Module diagnostics
"Flutter error" coming =
Report

Module diagnostics
"Flutter error" going =
Reset
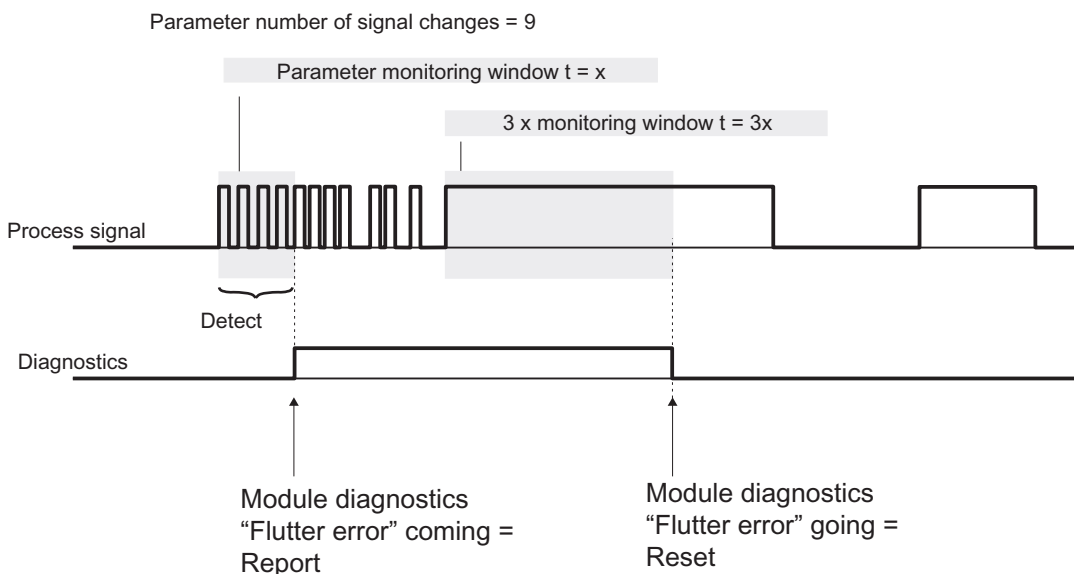
Figure 6-2   Principle behind flutter monitoring

Settings for Flutter Monitoring

You can find out which settings you can make for flutter monitoring in the parameter table and in the *SIMATIC PDM online help*.

6.2.2.3 Pulse stretching

What is pulse stretching?

Pulse stretching is a function for changing a digital input signal. A pulse at a digital input is extended to at least the configured length. If the input pulse is already longer than the configured length, it is not changed.

Principle Behind Pulse Stretching

The following figure illustrates with examples if and how input pulses are changed.

Parameter pulse stretching = T1

T1 for 0 -> 1 edge

T1 for 1 -> 0 edge

Process

"processed" input signal

Pulse is shorter as T1 and is stretched to T1

Pulse is longer than T1 and is not stretched

Figure 6-3   Principle behind pulse stretching

Process signal

"processed" Input signal

The second pulse occurring in in ongoing pulse stretching is delayed until the ongoing pulse stretching is completed.

Short pulses occurring during ongoing pulse stretching are ignored.

Figure 6-4   Example of pulse stretching

Note

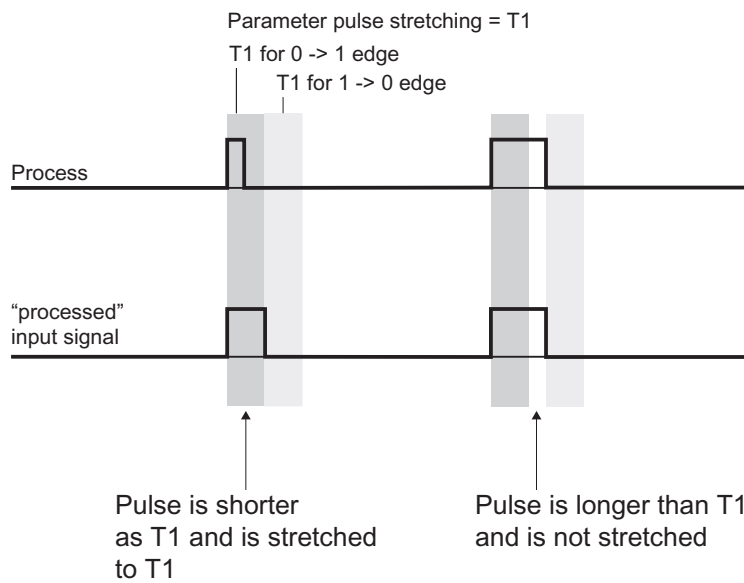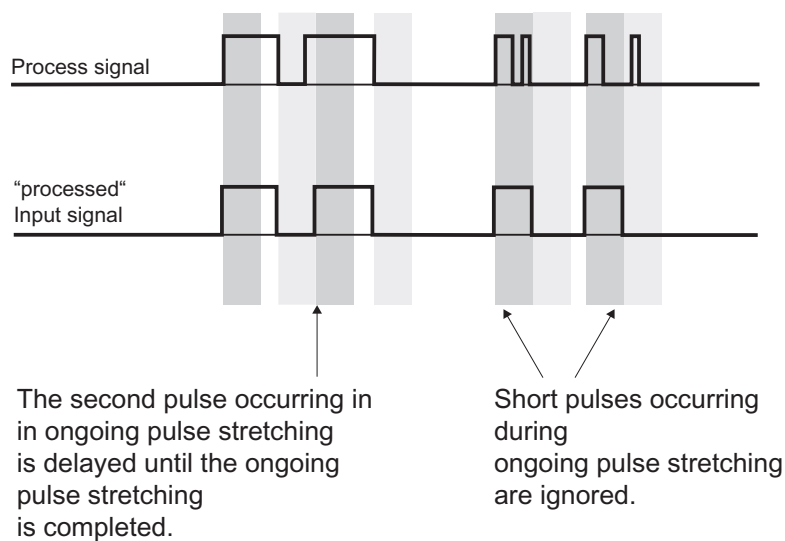If you configure pulse stretching for an input channel, this also affects the flutter monitoring enabled for this channel. The "pulse-stretched" signal is the input signal for flutter monitoring. Make sure therefore that the parameters for pulse stretching and flutter monitoring correspond to each other. By selecting the appropriate values for the parameters, you can customize the functions to suit your process as well as possible.

Settings for Pulse Stretching

You can find out which settings you can make for pulse stretching in the parameter table and in the *SIMATIC PDM online help*.

6.2.2.4 Identification Data

What are Identification Data?

Identification data is information stored in a module that supports the user with the following:

- Checking the configuration of a system
- Locating changes to the hardware of a system

Overview of Identification Data

Table 6-4   Overview of identification data

Identification Data	Description
Manufacturer	The name of the manufacturer is stored here.
Device identification	Order number of the module
Device serial number	The serial number of the module is stored here. This makes unique identification of the module possible.
Hardware revision	This indicates the module version. This is incremented when the version and/or firmware version of the module is/are incremented.
Software revision	This indicates the firmware version of the module. If the firmware version is incremented, then the version (hardware version) of the module is incremented as well.
Static revision no..	This gives you information on configured changes on the module. After each change, the static revision number is incremented.
Installation date	The date the module was installed. Enter the date here. DD.MM.YYYY format
TAG	Location of the module. Enter a unique identification for the module here.
Description	Free text stored in the module. You can enter additional information on the properties of the module here.

6.2.3 Sensor

6.2.3.1 Connection Guideline for Sensors

Because of the large number of sensors that can be connected to the digital input module, you must take the sensor load into account at configuration. You will find in this section:

- Recommendations on how to connect sensors
- An overview of the sensor-specific load
- A rule for the evaluation of the sensor-specific load
- An example

Sensors Can Be "Combined "

You can connect a wide variety of sensors to the SM 321; DI 16xNAMUR and these can also be "combined".

When you assign parameters, you can specify which sensors are to be connected to which channel group. The same sensor type is assigned to the channels of a channel group.

Changeover Contacts

Changeover contacts always occupy two adjacent inputs (for example, 0 and 1 or 2 and 3, etc.). Make sure you adhere to the following rule:

- Always connect the normally open contact to the "even" channel,
- Always connect the normally closed contact to "odd" channel.

2 Sensor Voltage Supplies: 18 V and 8.2 V

The SM 321; DI 16xNAMUR has two different sensor supply voltages. The following table shows you which sensor to attach to which sensor supply:

18 V	8.2 V
One-way contact or BERO connected to 10 kΩ/47 kΩ	NAMUR sensor or DIN 19234 sensor
Changeover contact or 4-wire BERO connected to 10 k/Ω47 kΩ	NAMUR sensor changeover contact or sensor DIN 19234 as changeover contact
One-way contact or 3-wire BERO unconnected	
Changeover contact or 4-wire BERO unconnected	

Calculating the Performance Factor for the Use of a BERO

We show you below which criteria a BERO should fulfill and how to calculate the performance factor in order to calculate the sensor load of the digital input module.

Technical Requirements for BERO

The following figure illustrates the connections of a BERO and the most important characteristic quantities.
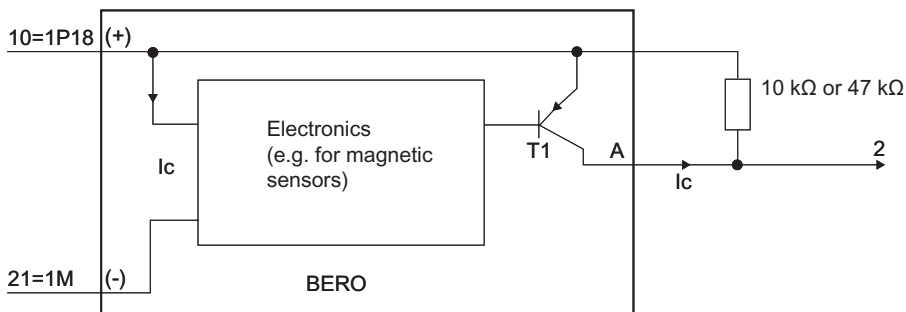
Figure 6-5   Connections and characteristic quantities of a BERO

Selection criteria:

- Operating voltage range (BERO terminal (+) and terminal (-)): 15 V to min. 20 V
- Transistor T1 functions as a switch (on/off)
- Protective measures:
    - Spurious switch-on pulse suppressed
    - Output A short circuit-proof
    - Reverse polarity protection
    - Wire break protection
    - Anti-inductive protection
    - Radio telephony protection
- Load capacity (T1) = 150 mA (at $T_A > 85°$ C)

Performance Factors for BEROs from the "Low-Voltage Controlgear, Switchgear and Systems" Catalog

You will find a value in the table below that you can use to calculate the sensor load easily if:

- You use sensors from the "Low-Voltage Controlgear, Switchgear and Systems" NSK catalog from SIEMENS

- I_C = 17 mA

You calculate the performance factor as follows: **LF = 0.281 + I_C x 9.5 = 0.442**

Table 6-5   Performance factors for BEROs and sensors

Sensor	Performance factor
NAMUR sensor or DIN 19234 sensor	0.099 x number of sensors
NAMUR sensor as changeover contact or sensor as changeover contact that comply with DIN 19234	0.099 x number of sensors
One-way contact 10 kΩ/47 kΩ	0.281 x number of sensors
Changeover contact 10 kΩ/47 kΩ	0.281 x number of sensors
One-way contact unconnected	0.281 x number of sensors
3-wire BERO unconnected	(0.281 + I_C x 9.5) x number of sensors
Changeover contact unconnected	0.281 x number of sensors
4-wire BERO unconnected	(0.281 + I_C x 9.5) x number of sensors
Constant	1,9

Rules on the Sensor Load

The following table shows you which conditions you must adhere to. The sensor load on channels 0 to 7 should be approximately the same as the sensor load on channels 8 to 15. Ensure when wiring the module that the load distribution is as symmetrical as possible: The sensor load on channels 0 to 7 should be approximately the same as the sensor load on channels 8 to 15.

Table 6-6   Rules on the sensor load

Sum of sensor values Channel 0 to 7 or Channel 8 to 15	Operation of the module with the desired sensor connection possible at an ambient temperature of	Note
≤ 3,7	- Max. 40° C: Yes - Max. 60° C: Yes	-
> 3,7	- Max. 40° C: Yes if the sum is ≤ 5.0 - Max. 60° C: No	Reduce the number of sensors until the sum is ≤ 3.7.
≤ 5,0	- Max. 40° C: Yes - Max. 60° C: No	-

Example

Using the following example of a module's planned sensor connections, we show you how the calculation is done.

Table 6-7 Example for sensor load

Channel	Sensor	Performance factor	Evaluation
0	NAMUR sensor	0.099	Desired sensor connection possible for channels 0 to 7
1	NAMUR sensor	0.099	
2	NAMUR sensor changeover contact	0,099	
3			
4	One-way contact 10 kΩ	0.281	
5	One-way contact unconnected	0,281	
6	One-way contact unconnected	0.281	
7	3-wire BERO unconnected	0.442*	
	Constant	1.9	
	Total:	**3.482**	
8	3-wire BERO unconnected	0.442*	Desired sensor connection possible when the module is used up to a maximum of 40° C
9	3-wire BERO unconnected	0.442*	
10	3-wire BERO unconnected	0.442*	
11	3-wire BERO unconnected	0.442*	
12	3-wire BERO unconnected	0.442*	
13	3-wire BERO unconnected	0.442*	
14	One-way contact unconnected	0.281	
15	Unassigned	-	
	Constant	1,9	
	Total	**4.833**	

* LF = 0.281 + 17 mA x 9.5 = 0.442

Evaluation

You should **not** apply the planned sensor connection above as follows:

- Can be used up to a maximum of 40° C but

- The sensor load is asymmetrical.

Remedy:

- When you use the module up to a maximum of 40° C: reassign the sensors to the channels so that the sensor load is as symmetrical as possible.

- When you use the module up to a maximum of 60° C: use an additional module to reduce the sensor load below the specified factor of 3.7.

6.2.3.2   Terminal Assignment Diagrams

Below you can find an illustration of how to connect each configured sensor type.

NAMUR sensor or DIN 19234 sensor

As an alternative to the NAMUR sensor, you can also connect a sensor that complies with DIN 19234.

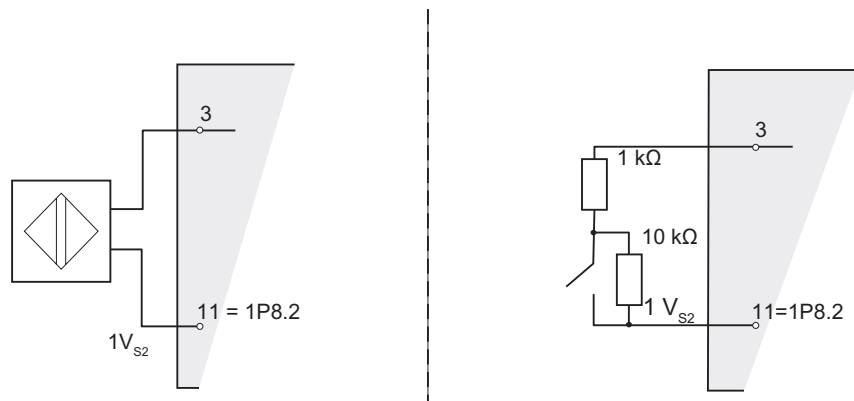In the following figure you see a connection example for Channel 0.

Figure 6-6   Connection Example for NAMUR Sensor

NAMUR sensor changeover contact or sensor DIN 19234 as changeover contact

As an alternative to the NAMUR Sensor changeover contact, you can also connect a sensor that complies with DIN 19234 as a changeover contact .

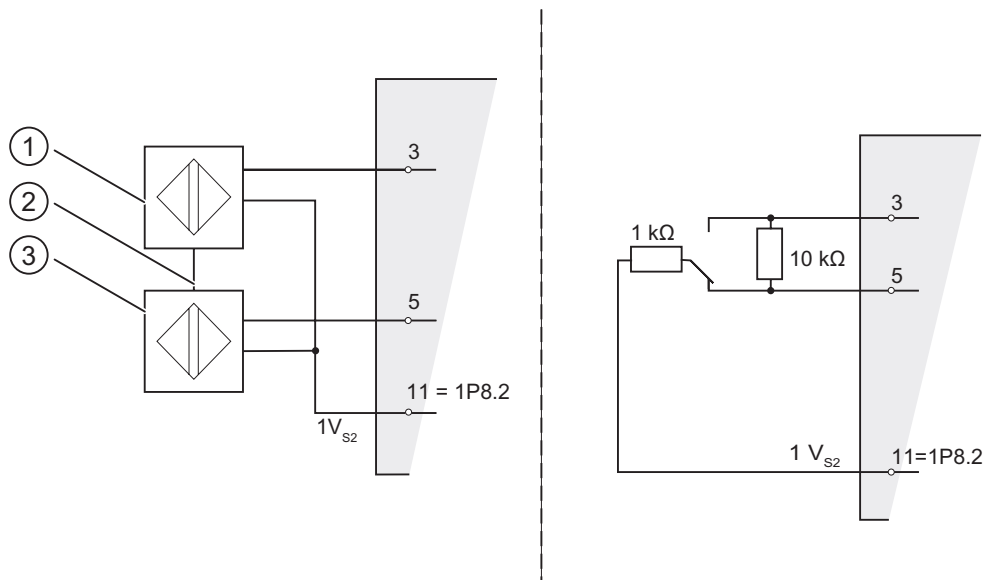In the following figure you see a connection example for Channels 0 and 1.

Figure 6-7   Connection example for NAMUR sensor as changeover contact

Number	Meaning
1	Normally open contact
2	Mechanical coupler
3	Normally closed contact

One-way contact kΩ/47 kΩ

As an alternative to a 10 kΩ/47 kΩ one-way contact you can connect a BERO, connected with 10 kΩ/47 kΩ.

In the following figure you see a connection example for Channel 0.

Figure 6-8   Connection example for one-way contact 10 kΩ/47 kΩ

R =   10 kΩ or 47 kΩ

Changeover contact 10 kΩ/47 kΩ

As an alternative to a 10 kΩ/47 kΩ changeover contact you can connect a 4-wire BERO, connected with 10 kΩ/47 kΩ.

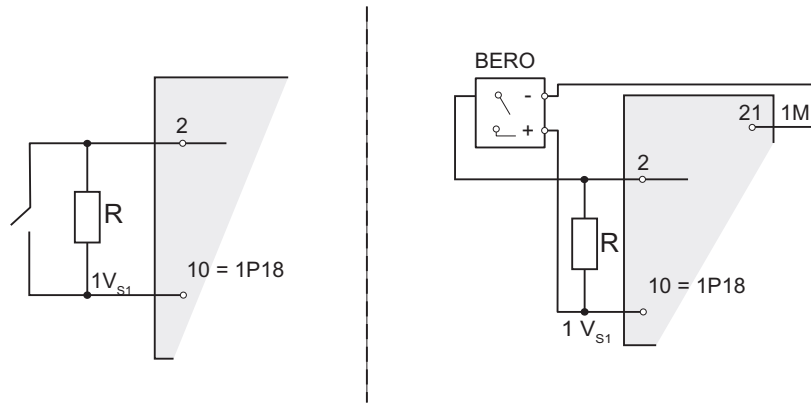In the following figure you see a connection example for Channels 0 and 1.

Figure 6-9   Connection example for changeover contact 10 kΩ/47 kΩ

R =   10 kΩ or 47 kΩ

One-way contact unconnected

As an alternative to an unconnected one-way contact, you can connect a 3-wire BERO.

In the following figure you see a connection example for Channel 0.

Figure 6-10   Connection example for one-way contact unconnected

Changeover contact unconnected

As an alternative to an unconnected changeover contact, you can connect a 4-wire BERO.

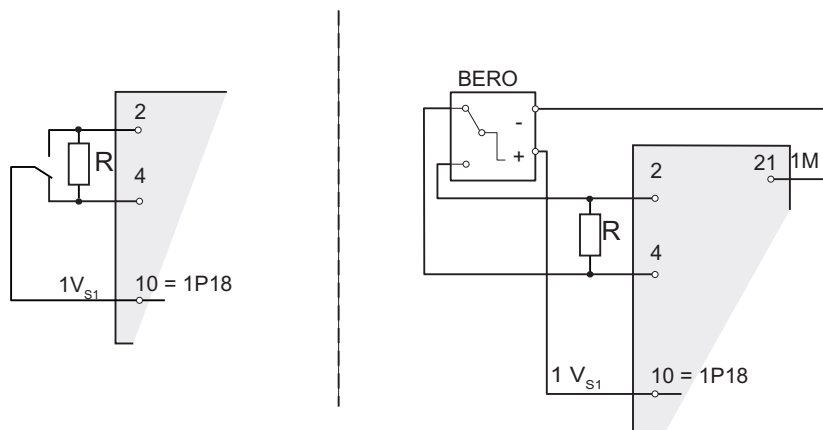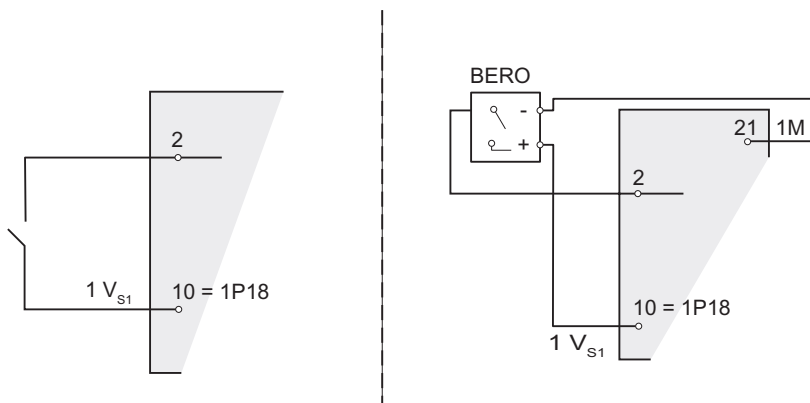In the following figure you see a connection example for Channels 0 and 1.
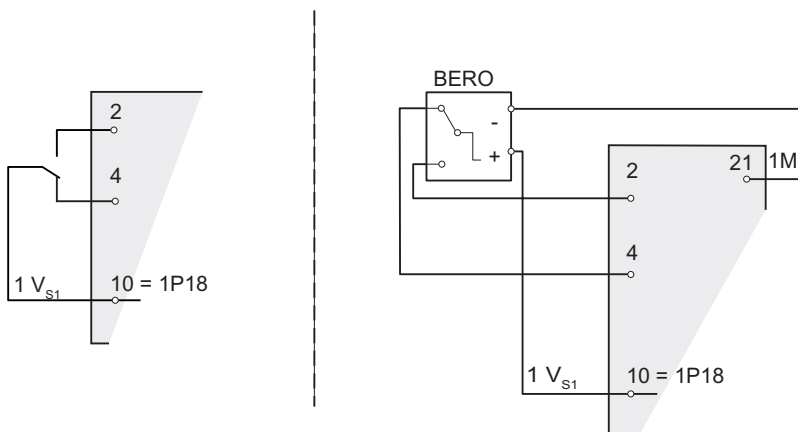

Figure 6-11   Connection example for changeover contact unconnected

6.2.4 Diagnostics of the Digital Input Module

6.2.4.1 Diagnostics of the Digital Input Module

In this section, you will find all the diagnostic messages of the digital input module that can occur in DP diagnostics and STEP 7 module diagnostics.

Diagnostic Messages, Causes and Remedies

The module reports diagnostics for each channel. A visual indication is given by the SF-LED.

You can activate/deactivate and configure the diagnostics using the "Group Diagnostics" parameters.".

Table 6-8   Diagnostic messages of the digital input module, causes and remedies

In DP diagnostics (channel-based)	Diagnostic message from module diagnostics	Possible cause	Remedy
Short-circuit (1_D)	P short-circuit (sensor)	Sensor voltage supply failure	Eliminate overload/short-circuit
		Short-circuit between the sensor line and the sensor voltage supply line	
Wire break (6_D)	Wire break	Interruption of the sensor line(s) or the sensor voltage supply line	Reestablish the connection
		Break in the bridging resistance	Eliminate interruption of the bridging resistance
		Defective sensor	Replace the sensor
Fault (9_D)	Flutter error	Flutter of sensor signal	Replace the defective sensor
			Reset the flutter monitoring
		Defective EEPROM	Replace the module
Sensor or load voltage missing (17_D)	Sensor voltage supply failure	Load voltage L+ of module missing	Connect load voltage L+
		Defective sensor voltage in module	Replace the module
External error (26_D)	Changeover contact diagnostics	Defective sensor	Replace the sensor
		Break in the bridging resistance	Eliminate interruption of the bridging resistance
		Short-circuit in sensor voltage supply and sensor line at changeover signal change	Eliminate short-circuit

Description of the Diagnostic Evaluation

You can find a detailed description of how to evaluate diagnostic information in the STEP 7 online help.

6.2.4.2 Diagnostics Based on the Sensor

Diagnostic Options

The following table shows you which sensor suppy diagnostics.

Table 6-9   Diagnostics depending on sensor

Diagnostics to...	NAMUR-compliant sensor	One-way contact	Changeover contact	3-Wire BERO	4-Wire BERO
Interruption of the sensor line or sensor voltage supply line	X	If connected	If connected	If connected	If connected
Break in the bridging resistance	X	If connected	If connected	If connected	If connected
Short-circuit between sensor line(s) and sensor voltage supply line	X	-	Changeover error at signal change	-	Changeover error at signal change
Load voltage L+ of module missing	X	X	X	X	X
Flutter of sensor signal	X	X	X	X	X
Defective sensor (normally open channel) = changeover contact error	With changeover contact	-	X	-	X

See also

Diagnostics Using the Process Image of Inputs (Page 5-1)

Diagnostic data (Page 5-2)

6.2.4.3   Diagnosis with sensor changeover contact

Brief description

In the case of diagnostics with a sensor of the changeover contact type, the module monitors switching between 2 input channels. If after the specified switchover time (see the technical specifications) there is no change in signal on the partner channel, the module generates diagnostics.

Purpose

You can use the diagnostics as follows:

- For diagnostics of the sensor
- To check that there was definitely a switchover between the normally open contact and the normally closed contact

Operating Principle

If the digital inputs of a channel group are configured as "changeover contacts", the module for this channel group carries out a diagnostics for the changeover contact type of sensor. The tolerated switchover time between the two channels is fixed at 300 ms and cannot be changed.

If the check is negative, then:

- The module identifies the value status of the normally open contact channel as "invalid".
- The module creates a diagnostic entry for the normally open contact channel.
- The module triggers a diagnostic interrupt.

The signal value of the channel for the normally open contact is updated. The value status of the normally open channel goes to BAD. If the partner channel changes within the switchover time, the test is aborted and the signal value at the normally open channel is updated. (The value status at the normally open channel is GOOD.)

The digital input signal for the normally closed contact channel is fixed "zero" regardless of the actual value in the process. The value status of the normally closed channel is always BAD.
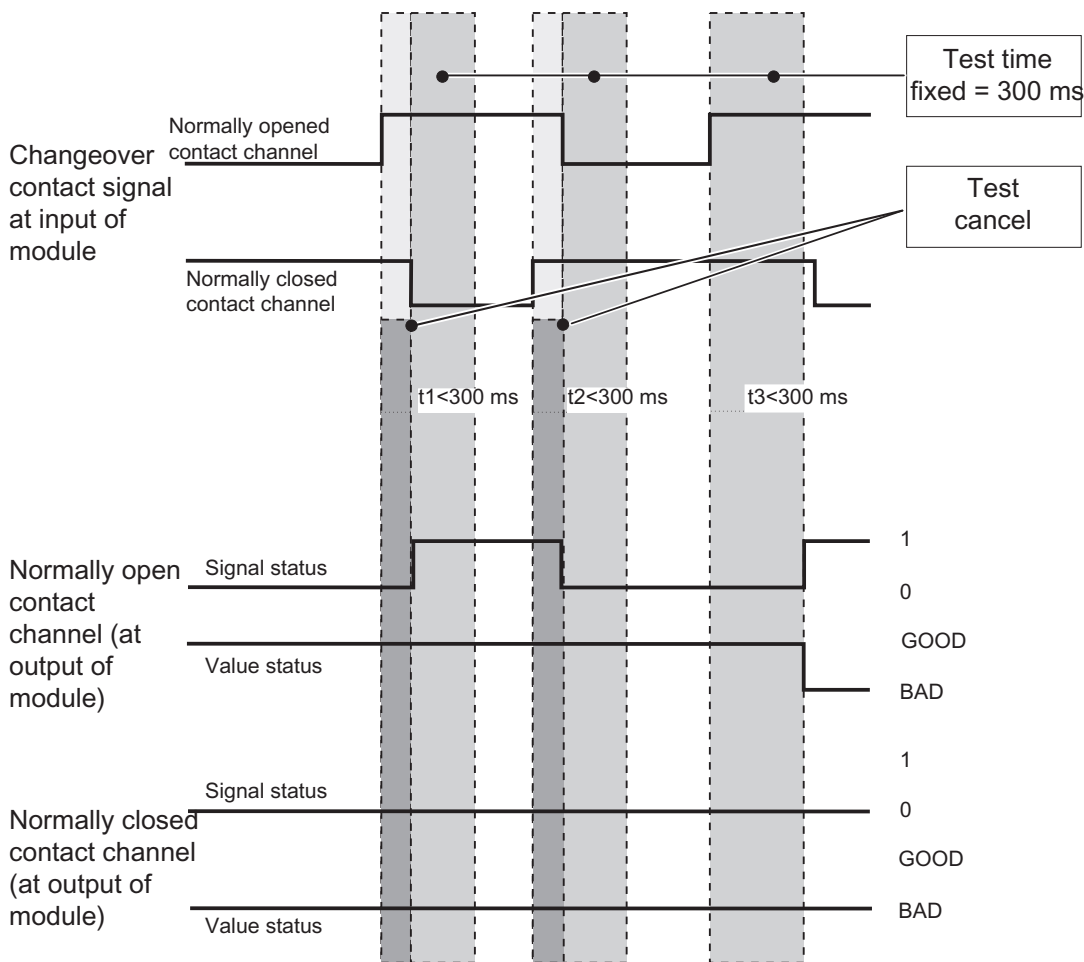
Figure 6-12   Signal response for changeover contact diagnostics

Note the following points in the diagnostics for the changeover contact type of sensor:

- If there is already an error on the normally open contact channel (a wire break, for example), the module no longer performs diagnostics for changeover contact errors.

- The following table lists additional points:

Table 6-10   Diagnostics with changeover contact sensor

Changeover contact	A negative result means...	
Changeover contact as NAMUR	• Short-circuit or • Wire break	In addition: Changeover contact or external error (in the case of DP diagnostics)
Changeover contact connected	• Defective sensor or short-circuit It is not possible to distinguish between a defective sensor and a short-circuit.	
Changeover contact unconnected	Caution: no difference possible between • signal "0" and wire break • signal "1" and short-circuit	

Diagnostics in the User Program

You can find out how to evaluate the diagnostics in the user program in the STEP 7 online help system.

6.3 Digital output module SM 322; DO 16 x DC 24 V/ 0.5 A

6.3.1 Specifications

Order number

6ES7 322-8BH00-0AB0

6ES7 322-8BH01-0AB0

Properties

The SM 322; DO 16xDC24V/0.5A has the following properties:

- 16 outputs, isolated in groups of 4
- A nominal load voltage of 24 V DC
- Configurable diagnostics
- Identification Data
- Wire break and short-circuit recognition at "0" signal (only with 6ES7 322-8BH01-0AB0)

Use with Rapid Counters

When the 24 V supply voltage is connected via a mechanical contact, the outputs of the SM 322; DO 16xDC24V/0.5A carry the signal for approx. 50 µs "1"-depending on the circuit. You must take this into account if you use the SM 322; DO 16xDC24V/0.5A with rapid counters.
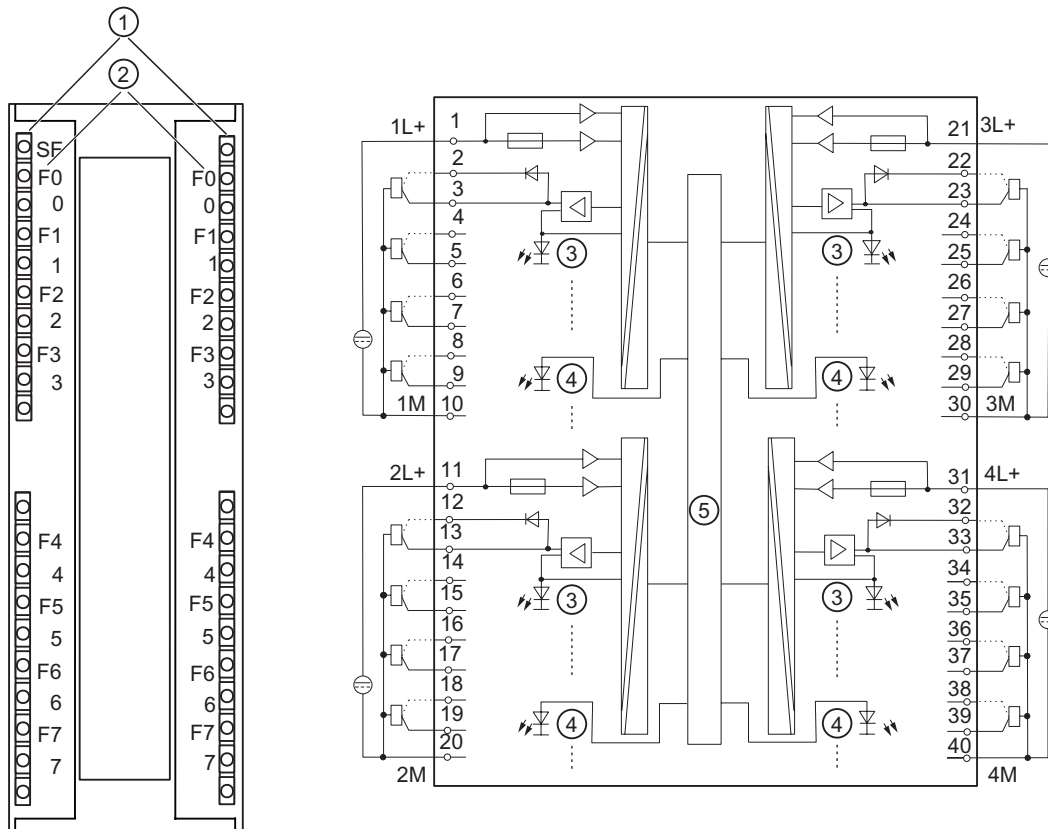
Terminal Assignment and Block Diagram

Figure 6-13   Module view and block diagram of the SM 322; DO 16xDC24V/0.5A

Number	Meaning
1	Status LED - green
	Error LED - red
2	Channel number
	Numbers 0 to 7 on the right side correspond to channel numbers 8 to 15
3	Channel status (green)
4	Channel error (red)
5	Backplane bus connection

Caution

Reverse polarity of the load voltage

In contrast to the response of the predecessor version, SM 322, with the order number 6ES7 322-8BH00-0AB0 the module fuse of the new SM 322 with the order number 6ES7 322-8BH01-0AB0 is destroyed if the polarity of the load voltage is reversed. The module then has to be sent in for repair.

When the polarity of the load voltage is reversed in the SM 322 with the order number 6ES7 322-8BH00-0AB0, the response of the output channels change: Unconnected channels output "1" instead of "0" and connected channels output "0" instead of "1"!

The module ignores the configured substitute values in each case.

Redundant Output Signals

The output with a series diode can be used for redundant control of an actuator. Redundant control can take place from 2 different modules without an external circuit. The two signal modules must have the same reference potential (M).

Note

Wire Break Detection

If the output with series diode is used for the SM 322 with the order number 6ES7 322-8BH00-0AB0, external P short-circuits cannot be recognized as a wire break.

If the output with series diode is used for the SM 322 with the order number 6ES7 322-8BH01-0AB0, external P short-circuits are recognized as a wire break.

Specifications

Table 6-11   Specifications SM 322; DO 16x DC24V/0.5A

Specifications	6ES7 322-8BH00-0AB0	6ES7 322-8BH01-0AB0
Dimensions and Weight	**6ES7 322-8BH00-0AB0**	**6ES7 322-8BH01-0AB0**
Dimensions W x H x D (mm)	40 x 125 x 120	
Weight	Approx. 200 g	
Specifications for Specific Module	**6ES7 322-8BH00-0AB0**	**6ES7 322-8BH01-0AB0**
Number of outputs	16	
Cable length		
• Unshielded	Max. 600 m	
• Shielded	Max. 1000 m	
Voltages, Currents, Potentials	**6ES7 322-8BH00-0AB0**	**6ES7 322-8BH01-0AB0**
Nominal load voltage L+	24 V DC	
• Reverse polarity protection	Yes	No (module is destroyed)
Total current of the outputs without a series diode (per group)		
• Horizontal mounting up to 60° C	Max. 2 A	
• Vertical mounting up to 40° C	Max. 2 A	
Total current of the outputs with a series diode (per group)		
• Horizontal mounting up to 40° C up to 60° C	Max. 1.2 A Max. 1 A	
• Vertical mounting up to 40° C	Max. 1 A	
Isolation		
• Between channels and backplane bus	Yes	
• Between the channels In groups of	Yes 4	
Permissible potential difference		
• Between the various circuits	75 V DC, 60 V AC	
Insolation tested with	600 V DC	
Power consumption		
• From the backplane bus	Max. 100 mA	
• From load voltage L+ (without load)	Max. 40 mA	Max. 60 mA
Power dissipation of the module		
• With diode	10 W	
• Without diode	3.5 W	

Specifications	6ES7 322-8BH00-0AB0	6ES7 322-8BH01-0AB0
Status, Interrupts, Diagnostics	6ES7 322-8BH00-0AB0	6ES7 322-8BH01-0AB0
Status LEDs	Green LED per channel	
Interrupts		
• Diagnostic interrupt	Parameters can be assigned	
Diagnostic functions	Parameters can be assigned	
• Group error display	Red LED (SF)	
• Channel error display	Red LED per channel (F)	
• Diagnostic information readable	Possible	
Data for Selecting an Actuator	6ES7 322-8BH00-0AB0	6ES7 322-8BH01-0AB0
Output voltage		
• At signal "1"	Min. L + (- 0.7 V)	
• At signal "0"	–	0.5 mA * R_L (R_L = load resistance value) max. 8.2 μm for R_L = infinite
Output current		
• At signal "1" Nominal value Permitted range	0.5 A 5 mA up to 600 mA	
• At signal "0" (residual current)	Max. 0.5 mA	
Output delay (with resistive load)		
• At "1" to "0"	Max. 2.7 ms (including module cycle time)	
• At "1" to "0"	Max. 2.7 ms (including module cycle time)	
Load resistor range	48 Ω bis 4kΩ	
Lamp load	Max. 5 W	Max. 5 W Cold resistance > 48 Ω Lamp loads with a cold resistance of < 48 Ω have to be connected to the outputs with series diodes.
Connecting 2 outputs in parallel		
• For redundant triggering of a load	Possible for outputs with series diodes	
• To increase performance	Not possible	
Control of a digital input	Possible	
Operating frequency		
• With resistive load	Max. 100 Hz	
• With inductive load, to IEC 947-5-1, DC 13	Max. 2 Hz	
• With lamp load	Max. 10 Hz	
Limit (internal) of the inductive circuit interruption voltage to	Typical L+ (-45 V)	
Short-circuit of an output	Yes, electronic	
• Response threshold	Typical 0.7 A	Typical 1.4 A

6.3.2 Tips and notes about the SM 322 with order number 6ES7 322-8BH01-0AB0

Lamps

Lamps which have a cold resistance lower than the minimum permissible resistance (48 Ω) have to be connected to the diode outputs.

This ensures that the diagnostic message M short circuit suppressed at "0" signal. The diagnosis P short circuit is no longer possible - wire break is signaled.

Load Impedances of the Actuators

The load impedances of the actuators have to lie in the range of 48 Ω to 4 kΩ.

Otherwise, a suitable resistor must be switched in parallel directly to the terminals of the actuators (take the maximum power loss at Signal "1" into account).

The permissible nominal voltage of the actuator must exceed 28.2 V.

The lower response threshold of the actuator has to be known in the operating temperature range or has to be determined by experiment. The output voltage of the module at "0" signal can be influenced by connection in parallel of a resistor directly to the actuator terminals. When selecting the resistor, the maximum power loss at "1" signal has to be taken into consideration.

The maximum power loss is calculated from the following equation:
$P_{max\_R_L}$ [W] = 795 [V^2] / R_L [Ω]

Note

Design Information

In order to achieve maximum protection in the module against EMC interference, it is advisable to design the ground wiring in star-type connection with an adequate cross-section.

6.3.3 Parameters of the digital output module

Parameters of the Digital Output Module

The following table lists all the parameters of the digital output module.

Note

Set the substitute value behavior in STEP 7 and the remaining parameters in PDM. When using STEP 7 as of V5.1 SP3 and PCS 7 as of V5.2 SP2, set all parameters with STEP 7 HW Config.

Table 6-12   Parameters of the digital output module

Parameters	Value range	Default setting	Applicability
Set in PDM:			
Diagnostics			
• Enabling: Diagnostic interrupt	Yes/no	No	Module
Diagnostics			
• Load voltage L+ missing	Yes/no	Yes	Channel group
• Group diagnostics	Yes/no	Yes	Channel
Set in STEP 7:			
Response at CPU-STOP	Substitute a value/ Keep last value	Substitute a value	Module
Substitute value	0/1	0	Channel

Identification Data

Table 6-13   Identification data of the digital output module

Identification Data	Value range	Default setting	Applicability
Device			
Manufacturer	reading	SIEMENS AG	Module
Device identification	reading	6ES7 322-8BH00-0AB0 or 6ES7 322-8BH01-0AB0	Module
Device serial number	reading	Depends on the version	Module
Hardware revision	reading		Module
Software revision	reading		Module
Static revision no.	reading	–	Module
Installation date	Read/write (max. 16 characters)	–	Module
Operating unit			
TAG	Read/write (max. 32 characters)	–	Module
Description	Read/write (max. 32 characters)	–	Module

Note

Access to identification data is only possible with SIMATIC PDM.

See also

Identification Data (Page 6-10)

6.3.4 Diagnostics of the Digital Output Module

Diagnostics

The module reports most diagnostics messages for each channel. Missing load voltage or the failure of fuse is reported for all 4 channels of the affected channel group.

Channel errors are signaled with the error indicator (Fx). As soon as at least one channel error indicator lights up, the common error indicator (SF) lights up.

You can activate/deactivate and the diagnostics using the "Group Diagnostics" parameter.

Diagnostic Messages, Causes and Remedies (6ES7 322-8BH00-0AB0)

Table 6-14   Diagnostic messages of the digital output module, causes and remedies

Diagnostic message in DP diagnostics (channel-based)	Diagnostic message from module diagnostics	Possible cause	Remedy
Short-circuit (1_D)	M short-circuit	Short-circuit of the output to M (channel group)	Eliminate short-circuit
	P short-circuit	Short-circuit of the output to L+ (channel group)	
Excessive temperature (5_D)	Excessive temperature	Output overload	Eliminate overload
		Short-circuit of the output to M	Eliminate short-circuit
Wire break (6_D)	Wire break	Interruption in the wire between the module and the actuator (only with "1" signal)	Reestablish the connection
		Channel unused (open)	Disable "wire break diagnostic" in the configuration of the channel
Fault (9_D)	Fuse failure	Module defective	Replace the module
Sensor or load voltage missing (17_D)	(Load) supply voltage missing	Load voltage L+ of module missing	Connect load voltage L+

Diagnostic Messages, Causes and Remedies (6ES7 322-8BH01-0AB0)

Table 6-15   Diagnostic messages of the digital output module, causes and remedies

Diagnostic messages in DP diagnostics (channel-based)	Diagnostic message from module diagnostics	Possible cause	Remedy
Output without series diode			
Short-circuit (1D)	M short-circuit (08H)	Short-circuit of the output to M	Eliminate short-circuit
	P short-circuit (04H)	Short-circuit of the output to L+	
Excessive temperature (5D)	Excessive temperature (80H)	Output overload	Eliminate overload
Wire break (6D)	Wire break (10H)	Interruption in the wire between the module and the actuator	Reestablish the connection
		Channel unused (open)	in the configuration for the channel Disable "Group Diagnostics"
Error (9D)	Fuse failure (20H)	Module defective	Replace the module
Sensor or load voltage missing (17D)	(Load) supply voltage missing (40H)	Load voltage L+ or M ground of the channel group missing	Connect load voltage L+ or ground
Output with series diode			
Short-circuit (1D)	M short-circuit (08H)	Short-circuit of the output to M *)	Eliminate short-circuit
Excessive temperature (5D)	Excessive temperature (80H)	Output overload *)	Eliminate overload
Wire break (6D)	Wire break (10H)	Interruption in the wire between the module and the actuator	Reestablish the connection
		Channel unused (open)	in the configuration for the channel Disable "Group Diagnostics"
		Short-circuit of the output to L+	Eliminate short-circuit
Error (9D)	Fuse failure (20H)	Module defective	Replace the module
Sensor or load voltage missing (17D)	(Load) supply voltage missing (40H)	Load voltage L+ or M ground of the channel group missing	Connect load voltage L+ or ground

*) only for output signal "1"

Note

The green channel status LED lights when there is 15 V or more at the output terminals of the module (from external power, for example).

M short-circuit and excessive temperature cannot be detected separately. Both errors are always displayed.

Response to M Short-circuit

If output signal = "1", the digital output module reports "M short-circuit".

If output signal = "0", the digital output module switches to the safer status and the status LED turns off.

Note

The digital output module reports a P short-circuit regardless of the signal status.

Description of the Diagnostic Evaluation

You can find a detailed description of how to evaluate diagnostic information in the STEP 7 online help.

Appendix

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

A.1 Dimension drawing

Dimension Drawing of the Signal Modules

The figure below shows a dimension drawing of the signal modules.

The appearance of the signal modules can vary. However, the specified dimensions are always the same.
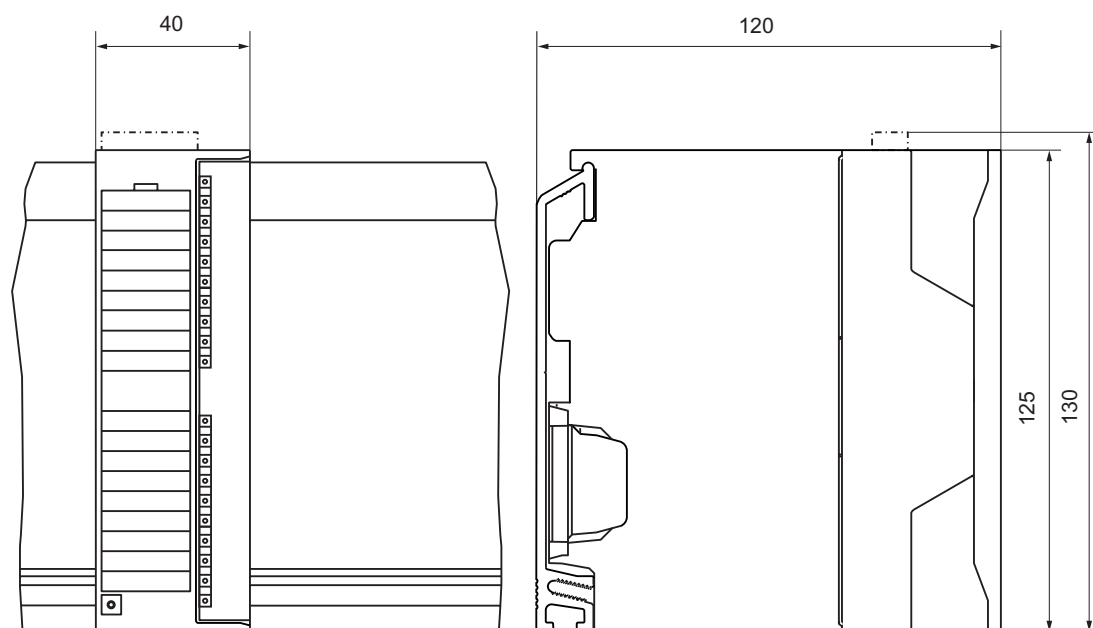
Figure A-1   Dimension drawing of the signal modules

Additional Dimension Drawings

... You can find dimension drawings of the modules and components of an S7-300 and ET 200M in the relevant manuals.

A.2   Service and Support

SIMATIC Technical Support

You can find technical support for all A&D projects:

- via the Internet with **Support Request:**
  http://www.siemens.com/automation/support-request

- E-mail: *adsupport@siemens.com*

- Telephone: +49 (0) 180 5050 222

- Fax: +49 (0) 180 5050 223

Further information about our technical support is available in the Internet at
http://www.siemens.com/automation/service&support

Service & Support In the Internet

In addition to our documentation, our extensive knowledge database is available on the Internet at:

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

where you will find the following:

- The latest product information, FAQs (Frequently Asked Questions), downloads, tips and tricks.

- The newsletter keeps you up-to-date with information relating to your products.

- The Knowledge Manager helps you find the documents you need.

- Users and specialists from around the world share their experience and knowledge in the Forum.

- You can find your local partner for Automation & Drives in our contacts database.

- Information about on-site services, repairs, spare parts and much more is available on our "Services" pages.

Further Support

For answers you cannot find to questions on how to use the products described in the manual, please consult your SIEMENS representative. You can find your local SIEMENS representative at the following internet address:

You contact partner is found under:

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

You can find the guide to the technical documentation for individual SIMATIC products and systems at:

http://www.siemens.de/simatic-tech-doku-portal

Training Center

We offer relevant courses to simplify your introduction to the world of the S7-300 automation system. Please contact your regional training center, or the central training center in D-90327 Nuremberg.

Telephone:+49 (911) 895-3200

http://www.sitrain.com

Glossary

BERO

A position switch that works without any touch or contact being involved. A distinction is drawn between inductive and capacitive BEROs.

Flutter monitoring

Flutter monitoring is a process control function for digital input signals. It detects and reports unusual process control signal patterns such as a fluctuation in the input signal between"0" and "1"that occurs too often. The occurrence of such signal patterns indicates that the sensor is faulty or unstable.

Identification Data

Identification data is information stored in a module that supports the user with the following:

- Checking the configuration of a system
- Locating changes to the hardware of a system

NAMUR

Normenausschuss für Mess- und Regelungstechnik (German standardization committee for measurement and control engineering)

Pulse stretching

Pulse stretching is a function for changing a digital input signal. A pulse at a digital input is extended to at least the configured length. If the input pulse is already longer than the configured length, it is not changed.

Sensor

Sensors are used for the precise detection of digital signals and paths, positions, speeds, revolutions, weights, etc.

Index

SIEMENS

Product Information on the Manual

- **S7-300 Programmable Controller; Module Specifications, as of Edition 02/2004 (A5E00105505)**

- **ET 200M Distributed I/O Device Signal Modules for Process Automation, as of Edition 10/2004 (A5E00085262)**

- **S7-300, ET 200M Programmable Controller, Modules with Intrinsically-Safe Signals, as of Edition 08/2003 (A5E00172008)**

Introduction

Parameterizable signal modules of the S7-300 product family mentioned in this product information document can be reparameterized online using STEP7 *HWCONFIG* in RUN mode of the CPU.

In other words, the module parameters can be changed without switching the CPU to STOP mode or affecting other modules.

The following prerequisites must be met in order to use this function:

- STEP7 as of Version 5.2

- Distributed use of the S7-300 modules described in the S7-400 programmable controller (CPUs as of V3.1 or CP 443-5 extended as of V5.0).

- Use of the ET 200M with the IM 153-2 as of 6ES7153-2BA00-0XB0 or 6ES7153-2BB00-0XB0

- Use of the IM 157 as of 6ES7157-0AA82-0XA00

You will find a detailed description of the prerequisites and principles of operation in the manual *Modifying the System during Operation via CiR* (visit `http://www.siemens.com/automation/service&support` and enter the entry ID: 14044916).

Reparameterization steps in RUN mode

Observe the reparameterization steps described in the above manual.

Note the peculiarities of certain modules described in the table.

Example 1:

To change a measuring range for modules, proceed as follows:

1. Change the user program so that the channel to be reparameterized is no longer evaluated, and download it to the CPU.

2. Change the measuring range for the module in HWCONFIG, and download the changed configuration to the CPU.

3. Adapt the user program to the changed channel, and download it to the CPU.

Example 2:

When reparameterizing certain modules (see the table), you should ensure that there is no pending diagnostic event (e.g. a wire break message) before carrying out reparameterization, since otherwise it may happen in some cases that outgoing diagnostic events are no longer reported. As a result, the SF LEDs on the CPU, IM, or module will continue to shine, for example, although the reparameterized module is working correctly. If such a situation does arise, however, the module must be removed and then plugged in again.

Notes on the table

There is a separate table for each manual that describes the technical specifications of the signal modules of the S7-300 product family.

The "Behavior of the Inputs/Outputs" column indicates the behavior of the inputs/outputs when reparameterization is carried out in RUN mode, provided they are not affected by reparameterization.

Module	Behavior of the inputs/outputs	Peculiarities when reparameterizing
S7-300 module specifications		
6ES7 321-7BH00-0AB0 **6ES7 321-7BH80-0AB0** SM 321; DI 16 × DC 24 V; with hardware interrupt and diagnostic interrupt	Supply the last valid process value before parameterization	---
6ES7 321-7BH01-0AB0 SM 321; DI 16 × DC 24 V; with hardware interrupt and diagnostic interrupt, clocked		
6ES7 322-8BF00-0AB0 **6ES7 322-8BF80-0AB0** SM 322; DO 8 × DC 24 V/ 0.5 A; with diagnostic interrupt	Output the last valid output value before parameterization	---
6ES7 322-5FF00-0AB0 SM 322;DO 8 × AC 120/230V/ 2A ISOL		
6ES7 322-5GH00-0AB0 SM 322; DO 16 × UC 24/48V		
6ES7 322-5HF00-0AB0 SM 322; DO 8 × Rel. AC 230V/5A		
6ES7 331-7NF00-0AB0 SM 331; AI 8 × 16 Bit	Supply the last valid process value before parameterization	SF LED shines: If there was a pending diagnosis before reparameterization, the SF LEDs (on the CPU, IM, or module) may still be shining although there is no longer a pending diagnosis and the module is working correctly. Remedy: • Only reparameterize when there is no pending diagnosis on the module, or • Remove the module, and then plug it in again
6ES7 331-7NF10-0AB0 SM 331; AI 8 × 16 Bit		
6ES7 331-7PF00-0AB0 SM 331; AI 8 × RTD		
6ES7 331-7PF10-0AB0 SM 331; AI 8 × TC		

Module	Behavior of the inputs/outputs	Peculiarities when reparameterizing
6ES7 332-5HD01-0AB0 SM 332; AO 4×12 Bit	Output the last valid output value before parameterization	SF LED shines: If there was a pending diagnosis before reparameterization, the SF LEDs (on the CPU, IM, or module) may still be shining although there is no longer a pending diagnosis and the module is working correctly. Remedy: • Only reparameterize when there is no pending diagnosis on the module, or • Remove the module, and then plug it in again
6ES7 332-5HB01-0AB0 **6ES7 332-5HB81-0AB0** SM 332; AO 2×12 Bit		
6ES7 332-5HF00-0AB0 SM 332; AO 8×12 Bit		---
6ES7 332-7ND00-0AB0 **6ES7 332-7ND01-0AB0** SM 332; AO 4×16 Bit		---

Module	Behavior of the inputs/outputs	Peculiarities when reparameterizing
ET 200M signal modules for process automation (PCS7)		
6ES7 321-7TH00-0AB0 SM 321; DI 16×NAMUR	Supply the last valid process value (including the value status) before parameterization	SF LED shines: If there was a pending diagnosis before reparameterization, the SF LEDs (on the CPU, IM, or module) may still be shining although there is no longer a pending diagnosis and the module is working correctly. Remedy: • Only reparameterize when there is no pending diagnosis on the module, or • Remove the module, and then plug it in again
6ES7 322-8BH00-0AB0 SM 322; DO 16×DC 24 V/0,5A	Output the last valid output value before parameterization	

Module	Behavior of the inputs/outputs	Peculiarities when reparameterizing
S7-300, ET 200, I/O modules with intrinsically-safe signals		
6ES7 321-7RD00-0AB0 SM 321; DI 4 × NAMUR	Supply the last valid process value before parameterization	SF LED shines: If there was a pending diagnosis before reparameterization, the SF LEDs (on the CPU, IM, or module) may still be shining although there is no longer a pending diagnosis and the module is working correctly. Remedy: • Only reparameterize when there is no pending diagnosis on the module, or • Remove the module, and then plug it in again
6ES7 322 5RD00-0AB0 SM 322; DO 4 × 15V/20mA	Output the last valid output value before parameterization	
6ES7 322-5SD00-0AB0 SM 322; DO 4 × 24V/10mA		---
6ES7 331-7RD00-0AB0 SM 331; AI 4 × 0/4...20mA		---
6ES7 331-7SF00-0AB0 SM 331; AI 8 × TC/4 × RTD	Supply the last valid process value before parameterization	---
6ES7 331-7TB00-0AB0 SM 331; AI 2 × 0/4...20mA HART		---
6ES7 332-5RD00-0AB0 SM 332; AO 4 × 0/4...20mA	Output the last valid output value before parameterization	SF LED shines: If there was a pending diagnosis before reparameterization, the SF LEDs (on the CPU, IM, or module) may still be shining although there is no longer a pending diagnosis and the module is working correctly. Remedy: • Only reparameterize when there is no pending diagnosis on the module, or • Remove the module, and then plug it in again
6ES7 332-5TB00-0AB0 SM 332; AO 2 × 0/4...20mA HART		---