MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Selected official pages for procurement and maintenance review

PRODUCT BRAND

Siemens

PRODUCT MODEL

6ES7321-7BH00-0AB0

Sixteen-Channel Digital Input Module. Relevant section pages: 55, 56, 57, 58, 59, 60, 61, 62, 63, 64. Adjacent model text on shared pages is outside this product reference.

OFFICIAL SOURCE

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SIEMENS

SIMATIC

S7-300 and M7-300 Programmable Controllers Module Specifications

Reference manual

This manual is part of the following documentation packages with order nos:
S7–300 Programmable Controller:
6ES7 398–8AA03–8BA0
ET 200M Distributed I/O Device:
6ES7 153–1AA00–8BA0

EWA 4NEB 710 6067-02 01

Edition 2

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Safety Guidelines

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:



Danger

indicates that death, severe personal injury or substantial property damage **will** result if proper precautions are not taken.



Warning

indicates that death, severe personal injury or substantial property damage **can** result if proper precautions are not taken.



Caution

indicates that minor personal injury or property damage can result if proper precautions are not taken.

Note

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:



Warning

This device and its components may only be used for the applications described in the catalog or the technical descriptions, and only in connection with devices or components from other manufacturers which have been 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.

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Disclaimer of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

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Preface

Purpose

The information contained in this manual will enable you to look up operator actions, function descriptions and the technical specifications of the signal modules, power supply modules and interface modules of the S7-300.

How to configure, assemble and wire these modules in an S7-300, M7-300 or ET 200M system is described in the installation manuals for each system.

Audience

This manual describes the modules of the S7-300 which are used in the S7-300, M7-300 and ET 200M systems. It includes data sheets for the signal modules, power supply modules and interface modules of the S7-300.

Modifications Since the Last Version

The following modifications have been made since the last version of the “Module Data” reference manual:

- new is Chapter 1.7 “SIMATIC Outdoor Modules” for use under extended environmental conditions
- new is Chapter 9 “SIMATIC TOP connect TPA”
- the following signal modules have been added:
  - SM 321; DI 32 x 120 VAC
  - SM 322; DO 32 x 120 VAC/1.0 A
  - SM 322; DO 8 x Rel. 230 VAC/5 A
  - SM 331; AI 8 x 16 Bit
  - SM 332; AO 4 x 16 Bit
  - SM 334; AI 4/AO 2 x 12 Bit
  - SM 338 POS input module

Note: You can recognize the previous version of this “Module Data” reference manual by the number EWA 4NEB 710 6067-0x in the footer.

The current number is: EWA 4NEB 710 6067-0x 01.

3.1.3 Digital Input Module SM 321; DI 16 × 24 VDC; with Process and Diagnostics Interrupts

Order Number

6ES7 321-7BH00-0AB0

Characteristics

The digital input module SM 321; DI 16×24 VDC with process and diagnostics interrupts has the following salient features:

- 16 input points, isolated in groups of 16
- 24 VDC rated input voltage
- Suitable for switches and 2/3/4-wire BEROs (proximity switches)
- 2 short-circuit-proof sensor supplies for 8 channels each
- External redundant power supply possible for sensors
- “Sensor supply (Vs) O.K.” status LEDs
- Group fault LED
- Configurable diagnostics
- Configurable diagnostics interrupt
- Configurable process interrupt
- Settable input delays

Use in

This I/O modules can be used in the

- **S7-300** (centralized configuration) with the CPU
  312 IFM from 6ES7 312-5AC00-0AB0, revision level 5
  313 from 6ES7 313-1AD00-0AB0, revision level 3
  314 from 6ES7 314-1AE01-0AB0, revision level 6
  314 IFM from 6ES7 314-5AE00-0AB0, revision level 1
  315 from 6ES7 315-1AF00-0AB0, revision level 3
  315-2 from 6ES7 315-2AF00-0AB0, revision level 3
  614 from 6ES7 614-1AH01-0AB3, revision level 6.
- **ET 200M** with the
  IM 153-1 from 6ES7 153-1AA02-0XB0, revision level 1
  IM 153-2 from 6ES7 153-2Ax00-0XB0, revision level 1
  IM 153-3 from 6ES7 153-3AA00-0XB0, revision level 1
  and with the following **DP masters**:
  IM 308C from 6ES5 308-3UC11, revision level 3, and
  CPUs 41x from 6ES7 41x-2XG00-0AB0; revision level 2.

Terminal Connection Diagram

Figure 3-3 shows the terminal diagram and the block diagram of the SM 321; DI 16 × 24 VDC; with process and diagnostics interrupts.

Detailed technical specifications for the SM 321; DI 16 × 24 VDC with process and diagnostics interrupts follow on the next pages.

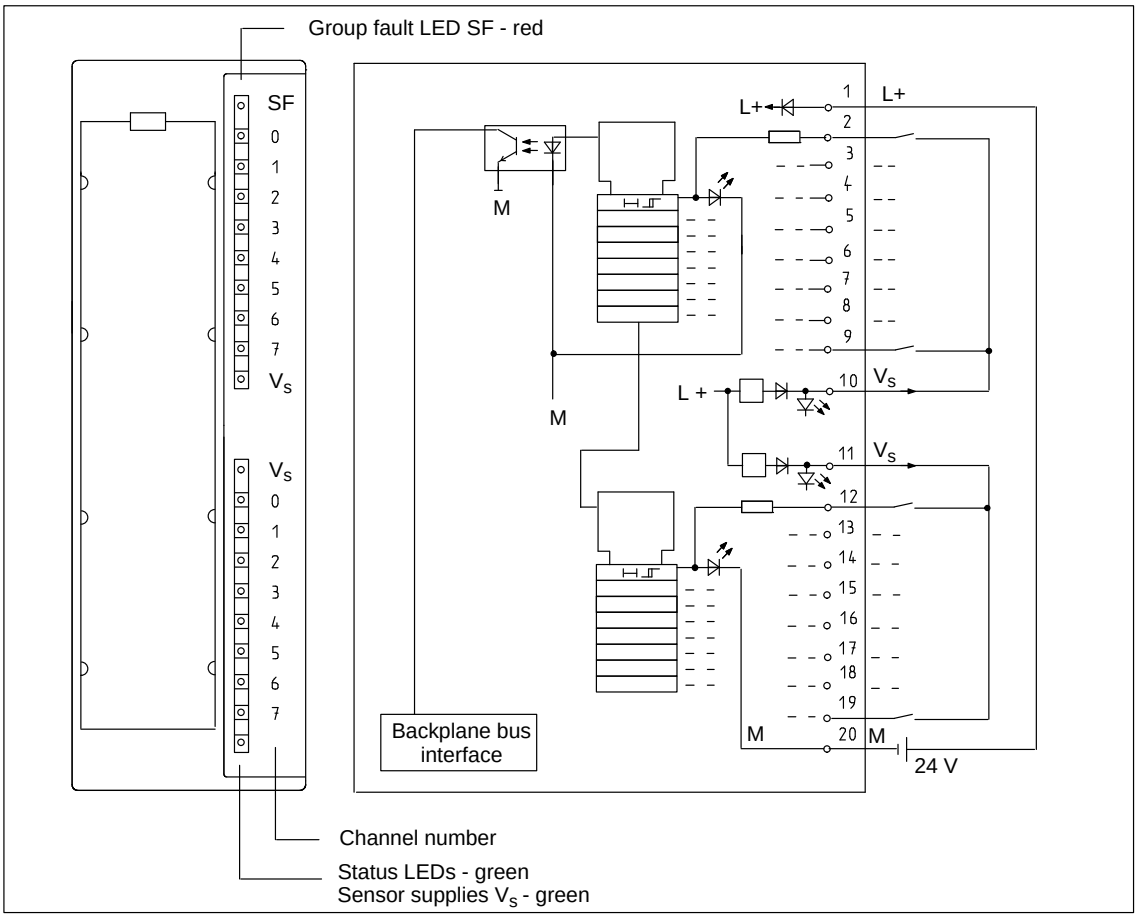


Figure 3-3 Module View and Block Diagram of the SM 321; DI 16 × 24 VDC with Process and Diagnostics Interrupts

Redundant Sensor Supply

Figure 3-4 shows how sensors can be supplied via Vs from an additional power source (e.g. from another module).

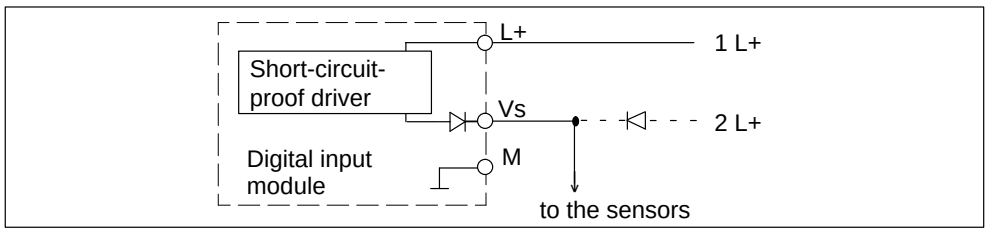


Figure 3-4 Terminal Connection Diagram for the Redundant Supply of Sensors

Dimensions and Weight	
Dimensions W × H × D	40 × 125 × 120 mm (1.56 × 4.88 × 4.68 in.)
Weight	approx. 200 g (7 oz.)
Module-Specific Data	
Number of input points	16
Length of cable	
• Unshielded	max. 600 m (654 yd.)
• Shielded	max. 1000 m (1090 yd.)
Voltages, Currents, Potentials	
Rated load voltage L +	24 VDC
• Reverse polarity protection	Yes
Number of input points that can be driven simultaneously	
• Horizontal installation up to 60 °C	16
• Vertical installation up to 40 °C	16
Galvanic isolation	
• between channels and backplane bus	Yes
• between the channels	No
• between load voltage L+ and sensor supply V_S	No
Permiss. potential differences	
• between different circuits	75 VDC 60 VAC
Insulation tested with	500 VDC
Current drawn	
• from backplane bus	max. 55 mA
• from load voltage L + (without sensor supply V_S)	max. 40 mA
Module power losses	typ. 4 W
Status, Interrupts, Diagnostics	
Status display	
• Inputs	Green LED per channel
• Sensor supplies (Vs)	Green LED per output
Interrupts	
• Process interrupt	Configurable
• Diagnostics interrupt	Configurable

Status, Interrupts, Diagnostics, continued	
Diagnostics functions	Configurable
• Group fault LED (SF)	Red LED
• Diagnostics information readable	Possible
Sensor Supply Outputs	
Outputs	2
Output voltage	
• with load	min. L+ (– 2.5 V)
Output current	
• Rated value	120 mA
• Permissible range	0 to 150 mA
Additional (redundant) supply	Permitted
Short-circuit protection	Yes, electronic
Sensor Selection Data	
Input voltage	
• Rated value	24 VDC
• for signal “1”	13 to 30 V
• for signal “0”	− 3 to 5 V
Input current	
• at signal “1”	typ. 7 mA
Input characteristic	to IEC 1131, type 2
Connection of 2-wire BEROs	Possible
• Permissible closed-circuit current	max. 1.5 mA
Time/Frequency	
Internal interrupt processing time without input delay for	
• interrupt processing only	max. 250 µs
• interrupt and diagnostics processing	max. 250 µs
Input delay	
• Configurable	Yes
• Rated value	typ. 0.1/0.5/3/15/ 20 ms
Input frequency (with 0.1 ms delay time)	≤ 2 kHz

Setting the Parameters

You set the parameters for the SM 321; DI 16 × 24 VDC with process and diagnostics interrupts using *STEP 7*. Table 3-3 indicates the digital module parameters that can be set. You must enter the settings when the CPU is in the STOP state. The parameters are transferred from the programming device to the CPU of the S7-300 and stored there. The CPU transfers them to the digital module.

You can also change some of the parameters in the user program with the SFC 55 (see Reference Manual *System and Standard Functions*).

According to the two alternative ways of setting the parameters, they are divided into

- Static parameters
- Dynamic parameters

Table 3-1 below describes the properties of the static and dynamic parameters.

Table 3-1 Static and Dynamic Parameters of the SM 321; DI 16 × 24 VDC with Process and Diagnostics Interrupts

Parameter	Settable with	Operating State of the CPU
Static	Programming device	STOP
Dynamic	Programming device	STOP
Dynamic	SFC 55 in user program	RUN

Default Settings

The SM 321; DI 16 × 24 VDC with process and diagnostics interrupts has the following default settings for diagnostics, interrupts, etc (see Table 3-3).

These default settings are active if you have not set any parameters with *STEP 7*.

Assignment of Sensor Supplies

The two sensor supplies are used to supply two groups of channels: inputs 0 to 7 and inputs 8 to 15. You can also set the diagnostics for the sensor supply in these channel groups (see Table 3-2).

Parameter Assignment

Table 3-2 shows the parameter assignment for the respective inputs of the SM 321; DI 16 × 24 VDC; with process and diagnostics interrupts. You can configure the module in these input groups (channel groups). You will need the numbers of the channel groups to configure the user program with SFCs (see also Figure A-3 in Appendix A).

Table 3-2 Assignment of Parameters to the 16 Digital Inputs of the SM 321; DI 16 × 24 VDC; with Process and Diagnostics Interrupts

Parameter...	Can be Set in the Following Channel Groups		Channel Group Number
Process interrupt (on falling or rising edge)	Inputs	0 and 1	0
		2 and 3	1
		4 and 5	2
		6 and 7	3
		8 and 9	4
		10 and 11	5
		12 and 13	6
		14 and 15	7
Diagnostics interrupt (sensor supply missing)	Inputs	0 to 7	-
		8 to 15	

Parameters of the Digital Input Module

Table 3-3 provides an overview of the parameters of the SM 321; DI 16 × 24 VDC with process and diagnostics interrupts and shows, which parameters

- are static or dynamic or
- can be set for the complete module or for one channel group each.

Table 3-3 Parameters of the SM 321; DI 16 × 24 VDC with Process and Diagnostics Interrupts

Parameter	SM 321; DI 16×DC24V; with Process and Diagnostics Interrupts			
	Value Range	Default	Type	Scope
Input delay (ms)	0.1/0.5/3/15/20	3	Static	Module
Enable				
• Process interrupt	Yes/no	No	Dynamic	Module
• Diagnostics interrupt	Yes/no	No	Dynamic	Module
Diagnostics				
• Sensor supply missing	Yes/no	No	Static	Channel group
Trigger for process interrupt				
• Rising edge	Yes/no	No	Dynamic	Channel group
• Falling edge	Yes/no	No	Dynamic	Channel group

Input Delay

Table 3-4 shows the possible settings and their tolerances for the input delay times of the SM 321; DI 16 × 24 VDC with process and diagnostics interrupts.

Table 3-4 Delay Times of the Input Signal of the SM 321; DI 16 × 24 VDC with Process and Diagnostics Interrupts

Input Delay	Tolerance
0.1 ms	87.5 to 112.5 µs
0.5 ms	0.43 to 0.57 ms
3 ms (default)	2.62 to 3.38 ms
15 ms	13.1 to 16.9 ms
20 ms	20 to 25 ms

Diagnostics

With the diagnostics feature you can determine if errors occur on signal acquisition.

Diagnostics Parameters

Use *STEP 7* to set the diagnostics parameters.

Diagnostics Evaluation

For the diagnostics evaluation, a distinction has to be made between configurable and non-configurable diagnostics messages. In the event of the configurable diagnostics message “Sensor supply missing” the diagnostics message is output only if diagnostics evaluation has been enabled (in parameter “diagnostics: sensor supply missing”).

In the event of non-configurable diagnostics messages, the diagnostics messages are always output, irrespective of the parameter settings.

Output of a diagnostics message triggers a diagnostics interrupt only if the diagnostics interrupt has been enabled in the relevant parameter.

Irrespective of the parameter configuration, the group fault (SF) LED will light up if errors have been detected, and the relevant Vs LED will be extinguished in case of a short circuit on the sensor supply.

The group fault (SF) LED also lights up in case of external errors (short circuit of sensor supply), independent of the operating status of the CPU (if power is on).

Diagnostics of Digital Input Module

Table 3-5 provides you with an overview of the diagnostics messages of the SM 321; DI 16 × 24 VDC with process and diagnostics interrupts. You enable the diagnostics parameters in *STEP 7* (see Table 3-3).

The diagnostics information is assigned either to the channel groups or to the module as a whole.

Table 3-5 Diagnostics Messages of the SM 321; DI 16 × 24 VDC with Process and Diagnostics Interrupts

Diagnostic Message	Scope of the Diagnostics	Configurable
Sensor supply missing	Channel group	Yes
External auxiliary power missing	Module	No
Internal auxiliary power missing	Module	
Fuse blown	Module	
Incorrect parameter on module	Module	
Watchdog timeout	Module	
EPROM error	Module	
RAM error	Module	
Process interrupt lost	Module	

Diagnostics Message Read-Out

You can read out the detailed diagnostics messages using *STEP 7*. Detailed diagnostics messages can be read out in the user program with the SFC 59 (see Appendix B and Reference Manual *System and Standard Functions*).

Error Causes and Error Correction

In Table 3-6, the diagnostics messages for the possible error causes and measures for error correction are listed.

Please note that the signal module must be configured so as to detect the missing sensor supply.

Table 3-6 Diagnostics Messages, Error Causes and Error Correction

Diagnostics Message	Possible Error Cause	Error Correction
Sensor supply missing	Overload of sensor supply	Eliminate overload
	Short circuit of sensor supply to M	Eliminate short circuit
External auxiliary power missing	Power supply L+ to module missing	Supply L+
Internal auxiliary power missing	Power supply L+ to module missing	Supply L+
	Fuse in module defective	Replace module
Fuse blown	Fuse in module defective	Replace module
Incorrect parameter on module	Illegal parameter transferred to module	Reconfigure module parameter
Watchdog time-out	Temporary high electromagnetic interferences	Eliminate interferences
	Module defective	Replace module
EPROM error	Temporary high electromagnetic interferences	Eliminate interferences and switch on/off power supply of CPU
	Module defective	Replace module
RAM error	Temporary high electromagnetic interferences	Eliminate interferences and switch on/off power supply of CPU
	Module defective	Replace module
Process interrupt lost	Quick succession of process interrupts cannot be processed by CPU	Change interrupt processing in CPU and reconfigure module parameters, if required

Interrupts

The following interrupts exist with the SM 321; DI 16 × 24VDC with process and diagnostics interrupts:

- Diagnostics interrupt
- Process interrupt.

Configuring Interrupts

Use *STEP 7* to configure the interrupts.

Default Setting

The default setting for interrupts is disabled.

Diagnostics Interrupt

If an error (for example, sensor supply missing) is detected or remedied, the module triggers a diagnostics interrupt, provided the diagnostics interrupt is enabled. The CPU interrupts the execution of the user program or of priority classes with low priority and processes the diagnostics interrupt block (OB 82).

Process Interrupt

Depending on the configuration, the module can trigger for each channel group a process interrupt, either in case of rising, falling or both edges of a signal state change. In the user program, you can use SFCs to find out which one of the two channels of a channel group has triggered the interrupt (see Reference Manual *System and Standard Functions*).

Pending process interrupts trigger process interrupt processing in the CPU (OB 40). The CPU interrupts the execution of the user program or of the priority classes with low priority. The signal module can buffer one interrupt per channel. If no priority classes with higher priority are to be processed, the buffered interrupts (of all modules) are processed in the sequence in which they have occurred.

Process Interrupt Lost

In an interrupt has been buffered for a channel and another interrupt occurs on that channel before it has been processed by the CPU, a diagnostics interrupt “process interrupt lost” is triggered.

More interrupts on this channel are not acquired until processing of the interrupt buffered on this channel has been executed.

Impact of the Power Supply and the Operating State

The input values on the SM 321; DI 16 × 24 VDC with process and diagnostics interrupts depend on the power supply of the digital module and the operating state of the CPU.

Table 3-7 provides you with an overview of these relationships.

Table 3-7 Dependence of the Input Values on the Operating State of the CPU and the Power Supply L+ of the SM 321; DI 16 × 24 VDC with Process and Diagnostics Interrupts

CPU Operating State		Power Supply L+ to Digital Module	Input Value of Digital Module
POWER ON	RUN	L+ exists	Process value
		L+ missing	0 signal
	STOP	L+ exists	Process value
		L+ missing	0 signal
POWER OFF	–	L+ exists	–
		L+ missing	–

A failure in the power supply to the SM 321; DI 16 × 24 VDC with process and diagnostics interrupts is always indicated by the group fault LED on the front panel of the module, and is also entered in the diagnostics log.

In case of a failure in the power supply L+ to the module, the input value is maintained for 20 to 40 ms before the 0 signal is transferred to the CPU. Power supply dips < 20 ms do not cause a change in the process value.

Note

If an external redundant source is applied simultaneously to the sensor supply (Vs), a failure in the internal sensor supply causes a failure of the internal and/or external sensor supply and/or a blown fuse to be indicated instead of a regular sensor supply failure.

The initiation of a diagnostics interrupt depends on the parameters (see Table 3-3).