

**SIEMENS**



# SIMATIC

**S7-1500 / ET 200MP**

Digital output module DQ 16x230VAC/2A ST Relais (6ES7522-5HH00-0AB0)

Manual

Edition

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Answers for industry.

# SIEMENS

## SIMATIC

S7-1500/ET 200MP  
Digital output module DQ  
16x230VAC/2A ST Relay  
(6ES7522-5HH00-0AB0)

Manual

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<b>⚠ DANGER</b>
indicates that death or severe personal injury <b>will</b> result if proper precautions are not taken.
<b>⚠ WARNING</b>
indicates that death or severe personal injury <b>may</b> result if proper precautions are not taken.
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indicates that minor personal injury can result if proper precautions are not taken.
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# Preface

## Purpose of the documentation

This manual supplements the system manuals:

- S7-1500 Automation System
- ET 200MP Distributed I/O System

Functions that relate in general to the systems are described in these system manuals.

The information provided in this manual and in the system/function manuals supports you in commissioning the systems.

## Conventions

**CPU:** When the term "CPU" is used in this manual, it applies to the CPUs of the S7-1500 automation system as well as to the interface modules of the ET 200MP distributed I/O system.

**STEP 7:** In this documentation, "STEP 7" is used as a synonym for all versions of the configuration and programming software "STEP 7 (TIA Portal)".

Please also observe notes marked as follows:

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### Note

A note contains important information on the product described in the documentation, on the handling of the product or on the section of the documentation to which particular attention should be paid.

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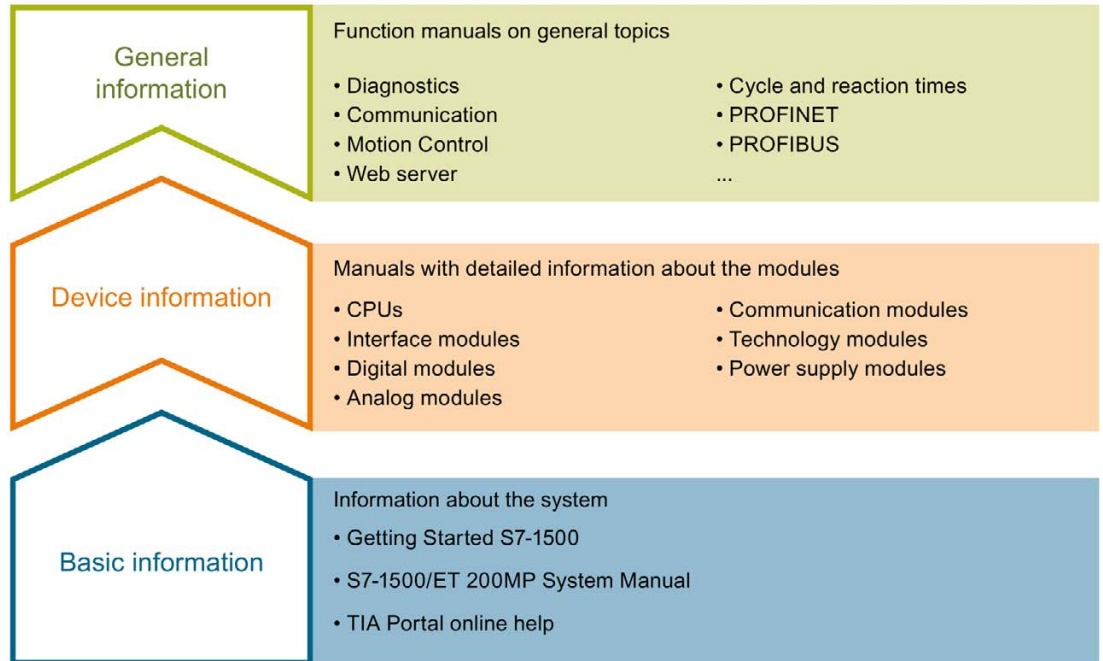
For legal reasons, we are obliged to publish the original text of the license conditions and copyright notices. Please read the information relating to this in the appendix.

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# Documentation guide

The documentation for the SIMATIC S7-1500 automation system and the SIMATIC ET 200MP distributed I/O system is arranged into three areas. This arrangement enables you to access the specific content you require.



## Basic information

The System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems. The STEP 7 online help supports you in the configuration and programming.

## Device information

Product manuals contain a compact description of the module-specific information, such as properties, wiring diagrams, characteristics and technical specifications.

## General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC S7-1500 and ET 200MP systems, e.g. diagnostics, communication, Motion Control, Web server.

You can download the documentation free of charge from the Internet (<http://www.automation.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/tech-doc-controllers/Pages/Default.aspx>).

Changes and supplements to the manuals are documented in a Product Information.

## Manual Collection S7-1500/ET 200MP

The Manual Collection contains the complete documentation on the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet (<http://support.automation.siemens.com/WW/view/en/86140384>).

## My Documentation Manager

The My Documentation Manager is used to combine entire manuals or only parts of these to your own manual.

You can export the manual as PDF file or in a format that can be edited later.

You can find the My Documentation Manager on the Internet (<http://support.industry.siemens.com/My/ww/en/documentation>).

## Application examples

Application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus in individual products.

You can find application examples on the Internet (<https://support.industry.siemens.com/sc/ww/en/sc/2054>).

## CAX Download Manager

The CAX Download Manager is used to access the current product data for your CAX or CAE systems.

You configure your own download package with a few clicks.

In doing so you can select:

- Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files
- Manuals, characteristics, operating manuals, certificates
- Product master data

You can find the CAX Download Manager on the Internet (<http://support.industry.siemens.com/my/ww/en/CAXOnline>).

## TIA Selection Tool

With the TIA Selection Tool, you can select, configure and order devices for Totally Integrated Automation (TIA).

This tool is the successor of the SIMATIC Selection Tool and combines the known configurators for automation technology into one tool.

With the TIA Selection Tool, you can generate a complete order list from your product selection or product configuration.

You can find the TIA Selection Tool on the Internet (<http://w3.siemens.com/mcmts/topics/en/simatic/tia-selection-tool>).



## Product overview

### 2.1 Properties

#### Article number

6ES7522-5HH00-0AB0

#### View of the module

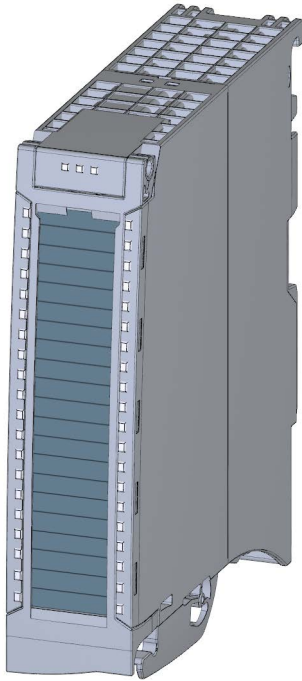


Figure 2-1 View of the DQ 16x230VAC/2A ST module

### Properties

The module has the following technical properties:

- 16 digital outputs (relays)
- Supply voltage of the 24 V DC relay coils
- Rated output voltage 230 V AC (24 V DC up to 120 V DC/24 V AC up to 230 V AC)
- Rated output current 2A (per channel)
- Configurable substitute values (per channel)
- Configurable diagnostics
- Suitable for solenoid valves, DC contactors, and indicator lights

The module supports the following functions:

Table 2- 1 Version dependencies of the module functions

Function	Firmware version of the module	Configuration software	
		STEP 7 V13, SP1 or higher with HSP 0119	GSD file in STEP 7 V12 or higher or STEP 7 V5.5 SP3 or higher
Firmware update	V1.0.0 or higher	X	--- / X
Identification data I&M0 to I&M3	V1.0.0 or higher	X	--- / X
Reconfiguration in RUN	V1.0.0 or higher	X	X
Module-internal Shared Output (MSO)	V1.0.0 or higher	X (PROFINET IO only)	X (PROFINET IO only)
Configurable submodules / submodules for Shared Device	V1.0.0 or higher	X (PROFINET IO only)	X (PROFINET IO only)

You can configure the module with STEP 7 and with a GSD file.

### Accessories

The following accessories are supplied with the module and can also be ordered separately as spare parts:

- Labeling strips
- U connector
- Universal front door

### Other components

The following component must be ordered separately:

Front connectors, including potential jumpers and cable ties

For more information on accessories, refer to the S7-1500/ET 200MP system manual (<http://support.automation.siemens.com/WW/view/en/59191792>).

## Wiring

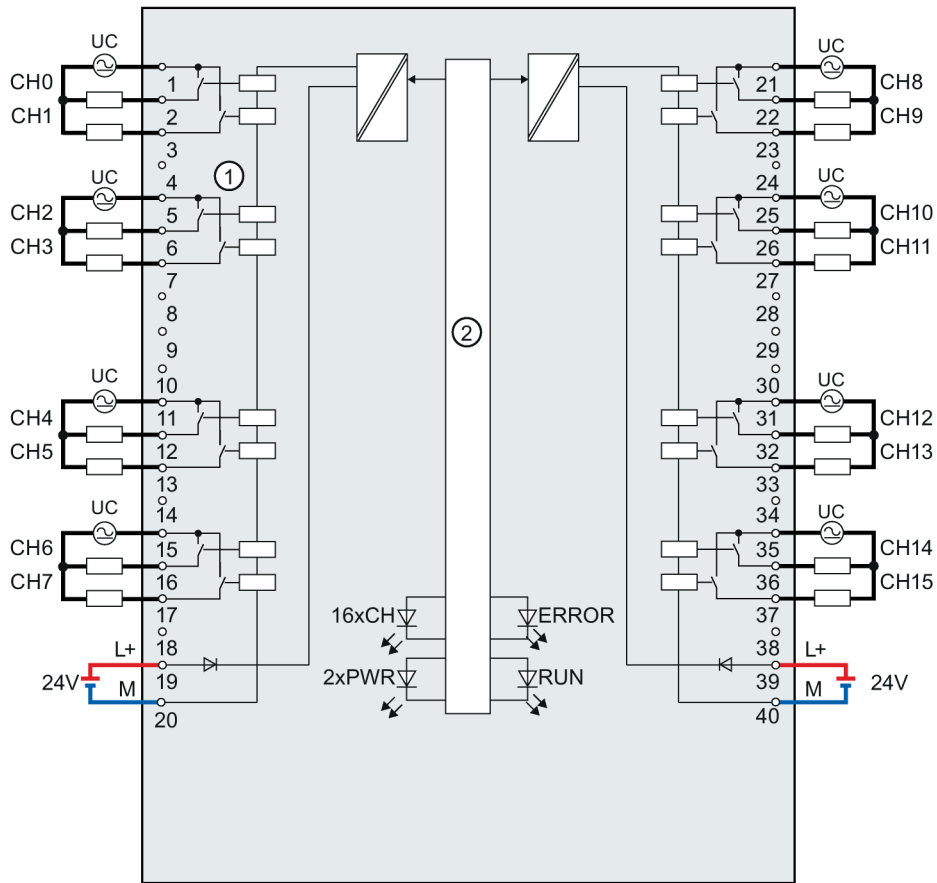
This section contains the block diagram of the module and outlines various wiring options. You will find information on wiring the front connector, establishing a cable shield, etc in the S7-1500/ET 200MP system manual (<http://support.automation.siemens.com/WW/view/en/59191792>) in section Wiring.

### Block diagram and terminal assignment

The example in the following figure shows the terminal assignment and the assignment of the channels. The individual channels are connected with a relay.

**Note**

Note that the 24 V DC supply voltage for this module must always be supplied by terminals 19/20 and 39/40. Use the supplied potential jumpers for this purpose.



- |    |   |       |                                       |
|----|---|-------|---------------------------------------|
| ①  | Relay 16x                               | CHx   | Channel or channel status LED (green) |
| ②  | Backplane bus interface                 | RUN   | Status display LED (green)            |
| L+ | Power supply 24 V DC for relay contacts | ERROR | Fault display LED (red)               |
| M  | Ground                                  | PWR   | Supply voltage POWER LED (green)      |

Figure 3-1 Block diagram and terminal assignment

**Tip: Using the potential jumpers**

Use the potential jumpers supplied with the front connector if you want to distribute the 24 V DC supply voltage to a neighboring module. This helps you to avoid having to terminate two wires to one terminal.

Proceed as follows:

1. Connect the 24 V DC supply voltage to terminals 19 and 20.
2. Insert the potential jumpers between terminals 19 and 39 (L+) and between terminals 20 and 40 (M).
3. Use the terminals 39 and 40 to loop the potential to the next module.

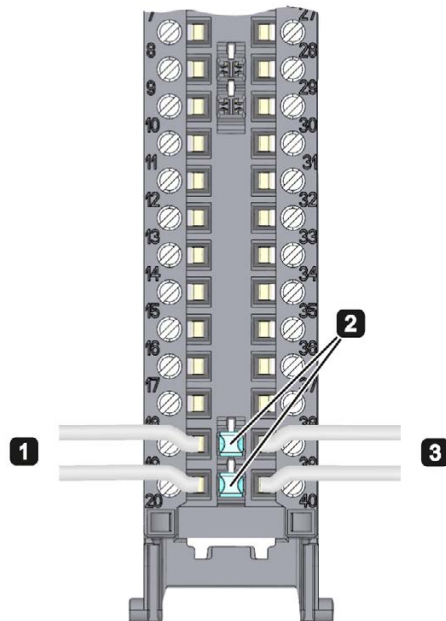


Figure 3-2 Using the potential jumpers

**Note**

Ensure that the maximum current load of 8 A per potential jumper is not exceeded.

## Parameters/address space

### 4.1 Parameters

#### DQ 16x230VAC/2A ST parameters

When you assign the module parameters in STEP 7, you use various parameters to specify the module properties. The table below lists the parameters that can be set. The effective range of the configurable parameters depends on the type of configuration. The following configurations are possible:

- Central operation with a S7-1500 CPU
- Distributed operation on PROFINET IO in an ET 200MP system
- Distributed operation on PROFIBUS DP in an ET 200MP system

For parameter assignment in the user program, the parameters are transferred to the module with the WRREC instruction (reconfiguration in RUN) using data records; see section Parameter assignment and structure of the parameter data records (Page 31).

Table 4- 1 Configurable parameters and their defaults

Parameter	Range of values	Default	Reconfigura- tion in RUN	Range of effectiveness with configuration software, e.g. STEP 7	
				Integrated in the hard- ware catalog STEP 7, V13 SP1 or higher with HSP 0119 or GSD file PROFINET IO	GSD file PROFIBUS DP
<b>Diagnostics</b>					
No supply voltage L+	Yes/No	No	Yes	Module	Module
<b>Reaction to CPU STOP</b>	<ul style="list-style-type: none"> <li>• Turn off</li> <li>• Keep last value</li> <li>• Output substitute value 1</li> </ul>	Turn off	Yes	Channel	Channel

## 4.2 Declaration of parameters

### No supply voltage L+

Enabling of the diagnostics at no or insufficient supply voltage L+.

### Reaction to CPU STOP

Determines the reaction of the output to the CPU going into STOP state or when the connection to the CPU is interrupted.

## 4.3 Address space

The module can be configured differently in STEP 7; see following table. Depending on the configuration, additional/different addresses are assigned in the process image output/input.

### Configuration options of DQ 16x230VAC/2A ST

You can configure the module with STEP 7 or with a GSD file.

When you configure the module by means of the GSD file, the configurations are available under different short designations/module names.

The following configurations are possible:

Table 4- 2 Configuration options

Configuration	Short designation/module name in the GSD file	Configuration software, e.g., STEP 7	
		Integrated in hardware catalog STEP 7 V13, SP1 or higher with HSP 0119	GSD file in STEP 7 as of V12 or STEP 7 as of V5.5 SP3
1 x 16-channel without value status	DQ 16x230VAC/2A ST	X	X
1 x 16-channel with value status	DQ 16x230VAC/2A ST QI	X	X
2 x 8-channel without value status	DQ 16x230VAC/2A ST S	X (PROFINET IO only)	X (PROFINET IO only)
2 x 8-channel with value status	DQ 16x230VAC/2A ST S QI	X (PROFINET IO only)	X (PROFINET IO only)
1 x 16-channel with value status for module-internal Shared Output with up to 4 submodules	DQ 16x230VAC/2A ST MSO	X (PROFINET IO only)	X (PROFINET IO only)

4.3 Address space

**Value status (Quality Information, QI)**

The value status is always activated for the following modules:

- DQ 16x230VAC/2A ST QI
- DQ 16x230VAC/2A ST S QI
- DQ 16x230VAC/2A ST MSO

An additional bit is assigned to each channel for the value status. The bit for the value status indicates if the output value specified by the user program is actually pending at the module terminal (0 = value is incorrect).

**Address space for configuration as 16-channel DQ 16x230VAC/2A ST QI**

The following figure shows the assignment of the address space for the configuration as a 16-channel module with value status. You can freely assign the start address for the module. The addresses of the channels are derived from the start address.

The letters "a to b" are printed onto the module. "For example, AB a" stands for module start address output byte a.

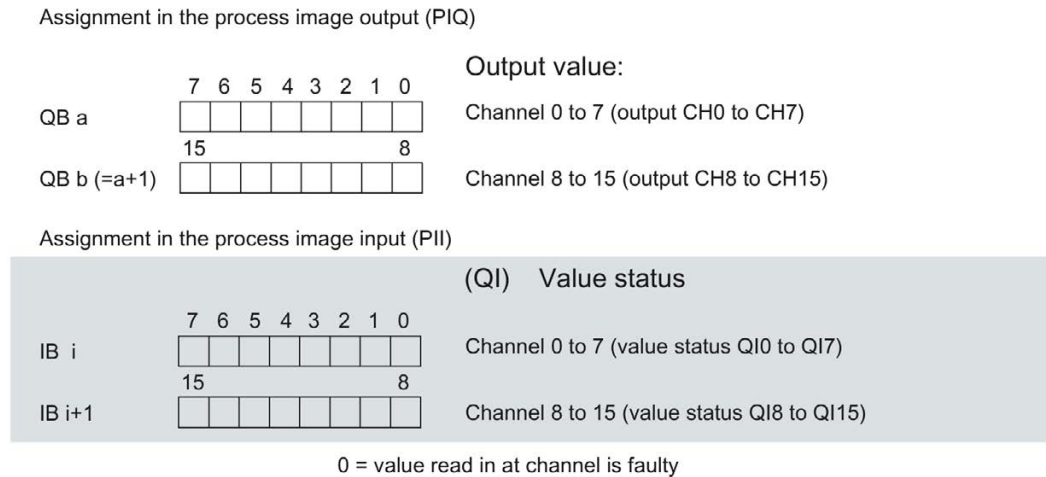


Figure 4-1 Address space for configuration as 16-channel DQ 16x230VAC/2A ST QI with value status





### Address space for configuration as 1 x 16-channel DQ 16x230VAC/2A ST MSO

For the configuration as a 1 x 16-channel module (module-internal Shared Output, MSO), channels 0 to 15 of the module are copied to multiple submodules. Channels 0 to 15 are then available with identical values in various submodules. These submodules can be assigned to up to four IO controllers when the module is used in a shared device:

- The IO controller to which submodule 1 is assigned has write access to outputs 0 to 15.
- The IO controllers to which submodule 2, 3, or 4 is assigned have read access to outputs 0 to 15.

The number of IO controllers depends on the interface module being used. Observe the information in the manual for the particular interface module.

#### Value status (Quality Information, QI)

The meaning of the value status depends on the submodule on which it occurs.

For the first submodule (=basic submodule), the value status 0 indicates that the value is incorrect or that the IO controller of the basic submodule is in STOP state.

For the 2nd to 4th submodule (=MSO submodule), the value status 0 indicates that the value is incorrect or one of the following errors has occurred:

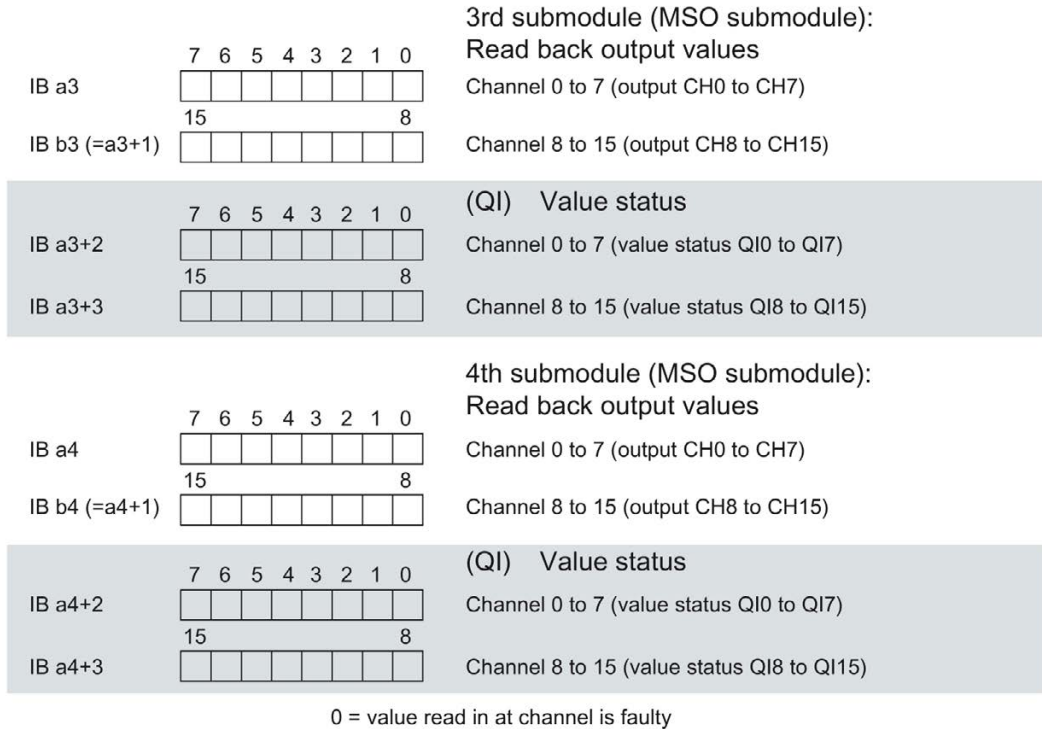
- The basic submodule is not yet configured (not ready).
- The connection between the IO controller and the basic submodule has been interrupted.
- The IO controller of the basic submodule is in STOP or POWER OFF state.



4.3 Address space

The figure below shows the assignment of the address space for submodules 3 and 4 and the value status.

Assignment in the process image input (PII) for 3rd and 4th submodule



0 = value read in at channel is faulty

Figure 4-4 Address space for configuration as 1 x 16-channel DQ 16x230VAC/2A ST MSO with value status

Reference

You will find information on the module-internal shared input/shared output (MSI/MSO) function in the function manual PROFINET with STEP 7 V13 (<http://support.automation.siemens.com/WW/view/en/49948856>) in the section Module-internal shared input/shared output (MSI/MSO).

## Interrupts/diagnostics alarms

### 5.1 Status and error displays

#### LED displays

The figure below shows the LED displays (status and error displays) of the DQ 16x230VAC/2A ST.

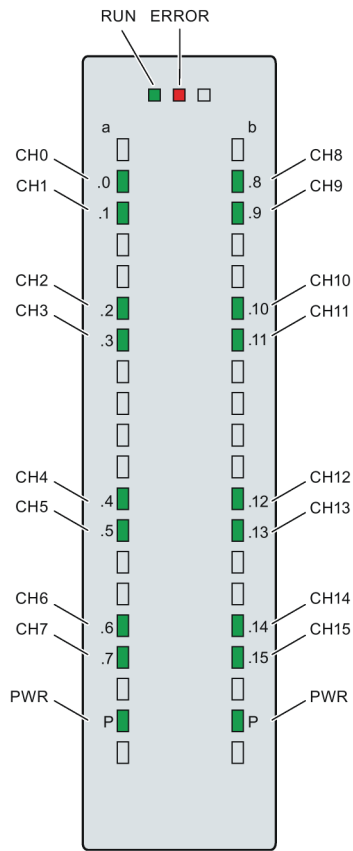


Figure 5-1 LED displays of the module DQ 16x230VAC/2A ST

### Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Corrective measures for diagnostics alarms can be found in the section Diagnostics alarms (Page 23).

### RUN and ERROR LED

Table 5- 1 RUN and ERROR status and error displays

LED		Meaning	Solution
RUN	ERROR		
□ Off	□ Off	Voltage missing or too low at backplane bus	<ul style="list-style-type: none"> <li>Switch on the CPU and/or the system power supply modules.</li> <li>Verify that the U connectors are inserted.</li> <li>Check whether too many modules are inserted.</li> </ul>
☀ Flashes	□ Off	The module starts and flashes until the valid parameter assignment is set.	---
■ On	□ Off	Module parameters assigned	
■ On	☀ Flashes	Indicates module error because supply voltage L+ is missing	Check the supply voltage L+ at the terminals 19 and 20 or 39 and 40.
☀ Flashes	☀ Flashes	Hardware defective	Replace the module.

### PWR LED

Table 5- 2 PWR status display

LED PWR	Meaning	Solution
□ Off	Supply voltage L+ too low or missing	Check the supply voltage L+ at the terminals 19 and 20 or 39 and 40.
■ On	Supply voltage L+ is present and OK	---

### CHx LED

Table 5- 3 CHx status display

LED CHx	Meaning	Solution
□ Off	0 = Status of the output signal	---
■ On	1 = Status of the output signal	---

## 5.2 Interrupts

Digital output module DQ 16x230VAC/2A ST supports diagnostics interrupts.

### Diagnostics interrupt

The module generates a diagnostic interrupt at the following event:

- No supply voltage L+
- Parameter assignment error

For more information on the error event, refer to the error OB with the "RALRM" instruction (read additional interrupt info) and to the STEP 7 online help.

## 5.3 Diagnostics alarms

### Diagnostics alarms

A diagnostics alarm is output for each diagnostics event and the ERROR LED flashes on the module. The diagnostics alarms can, for example, be read from the diagnostics buffer of the CPU. You can evaluate the error codes with the user program.

If the module is operated distributed with PROFIBUS DP in an ET 200MP system, you have the option to read out diagnostics data with the instruction RDREC or RD\_REC using data record 0 and 1. The structure of the data records is available on the Internet in the "Manual for interface module IM 155-5 DP ST (6ES7155-5BA00-0AB0)".

Table 5- 4 Diagnostics alarms, their meaning and corrective measures

Diagnostics alarm	Error code	Meaning	Corrective measures
Parameter assignment error	10H	The module cannot evaluate parameters for the channel Incorrect parameter assignment	Correct the parameter assignment
No load voltage	11H	Supply voltage L+ of the module is missing	Connect supply voltage L+ to module/channel

## Technical specifications

### Technical specifications of the DQ 16x230VAC/2A ST

	6ES7522-5HH00-0AB0
Product type designation	DQ 16x230VAC/2A ST (relay)
<b>General information</b>	
Hardware version	E01
Firmware version	V1.0.0
<b>Product function</b>	
I&M data	Yes; I&M0 to I&M3
<b>Engineering with</b>	
STEP 7 TIA Portal can be configured/integrated as of version	V13 SP1 / -
STEP 7 can be configured/integrated as of version	V5.5 SP3 / -
PROFIBUS as of GSD version/GSD revision	V1.0 / V5.1
PROFINET as of GSD version/GSD revision	V2.3 / -
<b>Operating mode</b>	
MSO	Yes
<b>Supply voltage</b>	
Rated value (DC)	24 V
Valid range, low limit (DC)	20.4 V
Valid range, high limit (DC)	28.8 V
Polarity reversal protection	Yes
<b>Power</b>	
Power consumption from the backplane bus	0.8 W
<b>Power loss</b>	
Power loss, typ.	5 W
<b>Digital outputs</b>	
Number of outputs	16
Sinking output	Yes
Sourcing output	Yes
Short-circuit protection	No
Control of a digital input	Yes
<b>Switching capacity of outputs</b>	
With lamp load, max.	50 W (230 V AC), 5 W (24 V DC)



	6ES7522-5HH00-0AB0
<b>Output current</b>	
For signal "1" rated value	2 A
For signal "1" permitted range, min.	10 mA; 10 V
For signal "1" permitted range, max.	2 A; thermal continuous current
For signal "0" residual current, max.	0 A
<b>Parallel switching of 2 outputs</b>	
For logic operations	Yes
For increased performance	No
For redundant control of a load	Yes
<b>Switching frequency</b>	
With resistive load, max.	1 Hz
With inductive load, max.	0.5 Hz
With lamp load, max.	1 Hz
<b>Total current of outputs</b>	
Current per channel, max.	2 A; see additional description in the manual
Current per group, max.	2 A; see additional description in the manual
Current per module, max.	32 A; see additional description in the manual
<b>Relay outputs</b>	
Number of relay outputs	16
Rated input voltage of relay coil L+ (DC)	24 V
Current consumption of relays (coil current of all relays), max.	150 mA
External fuse for relay outputs	Circuit breaker B10 / B16
Contact connection (internal)	No
Size of motor starter according to NEMA, max.	5
Number of switching cycles, max.	See additional description in the manual
Relay approved acc. to UL 508	No
Switching capacity of the contacts	
• With inductive load, max.	2 A; see additional description in the manual
• With resistive load, max.	2 A; see additional description in the manual
<b>Cable length</b>	
Shielded, max.	1000 m
Unshielded, max.	600 m
<b>Isochronous mode</b>	
Isochronous mode (application synchronized up to terminal)	No
<b>Interrupts/diagnostics/status information</b>	
Substitute values can be applied	Yes
<b>Interrupts</b>	
Diagnostics interrupt	Yes

<b>6ES7522-5HH00-0AB0</b>	
<b>Diagnostics alarms</b>	
Diagnostics	Yes
Monitoring of supply voltage	Yes
Wire break	No
Short-circuit	No
<b>Diagnostics indicator LED</b>	
RUN LED	Yes; green LED
ERROR LED	Yes; red LED
Monitoring of supply voltage (PWR LED)	Yes; green LED
Channel status display	Yes; green LED
For channel diagnostics	No
For module diagnostics	Yes; red LED
<b>Electrical isolation</b>	
<b>Electrical isolation of channels</b>	
Between the channels	No
Between the channels, in groups of	2
Between the channels and the backplane bus	Yes
Between the channels and the load voltage L+	Yes
<b>Permitted potential difference</b>	
Between different circuits	75 V DC/60 V AC (basic insulation) between the backplane bus and the supply voltage L+; 250 V AC between the channels and the supply voltage L+; 250 V AC between the channels and the backplane bus; 500 V AC between the channels
<b>Insulation</b>	
Insulation tested with	Between the channels: 2500 V DC; between the channels and backplane bus: 2500 V DC; between L+ and backplane bus 707 V DC (type test)
<b>Distributed operation</b>	
Prioritized startup	Yes
<b>Dimensions</b>	
Width	35 mm
Height	147 mm
Depth	129 mm
<b>Weights</b>	
Weight, approx.	350 g

### Details on the number of switching cycles

The following tables list the permissible number of switching cycles depending on the applied voltage and current load. Different values apply in each case to resistive and inductive loads.

Table 6- 1 Switching capacity and service life of relay contacts for resistive load

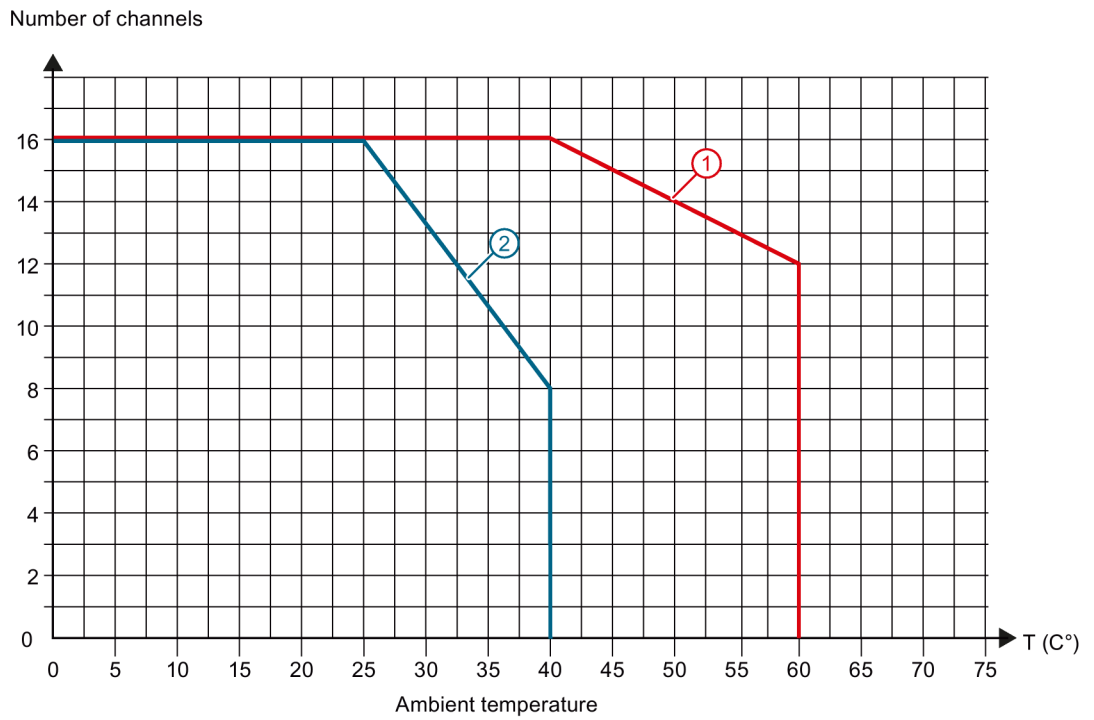
For resistive load		
Voltage	Current	Number of switching cycles (typ.)
24 V DC	2.0 A	0.1 million
	1.0 A	0.2 million
	0.5 A	1.0 million
60 V DC	0.5 A	0.2 million
120 V DC	0.2 A	0.6 million
24 V AC	1.5 A	1.5 million
48 V AC	1.5 A	1.5 million
60 V AC	1.0 A	1.5 million
120 V AC	2.0 A	1.0 million
	1.0 A	1.5 million
	0.5 A	2.0 million
230 V AC	2.0 A	1.0 million
	1.0 A	1.5 million
	0.5 A	2.0 million

Table 6- 2 Switching capacity and lifetime of the relay contacts for inductive load

For inductive load		
Voltage	Current	Number of switching cycles (typ.)
24 V DC	2.0 A	0.05 million
	1.0 A	0.1 million
	0.5 A	0.5 million
60 V DC	0.5 A	0.1 million
120 V DC	0.2 A	0.3 million
24 V AC	1.5 A	1.0 million
48 V AC	1.5 A	1.0 million
60 V AC	1.5 A	1.0 million
120 V AC	2.0 A	0.7 million
	1.0 A	1.0 million
	0.5 A	1.5 million
230 V AC	2.0 A	0.7 million
	1.0 A	1.0 million
	0.5 A	1.5 million

### Power reduction (derating) of outputs according to number of channels

The following graphs show the loading capacity of the relay contacts in relation to the mounting position and the ambient temperature. The total current of the outputs remains unaffected.



- ① Horizontal mounting position
- ② Vertical mounting position

Figure 6-1 Information on power reduction of outputs according to number of channels

# Dimensional drawing

# A

The dimension drawing of the module on the mounting rail, as well as a dimension drawing with open front cover, are provided in the appendix. Always observe the specified dimensions for installation in cabinets, control rooms, etc.

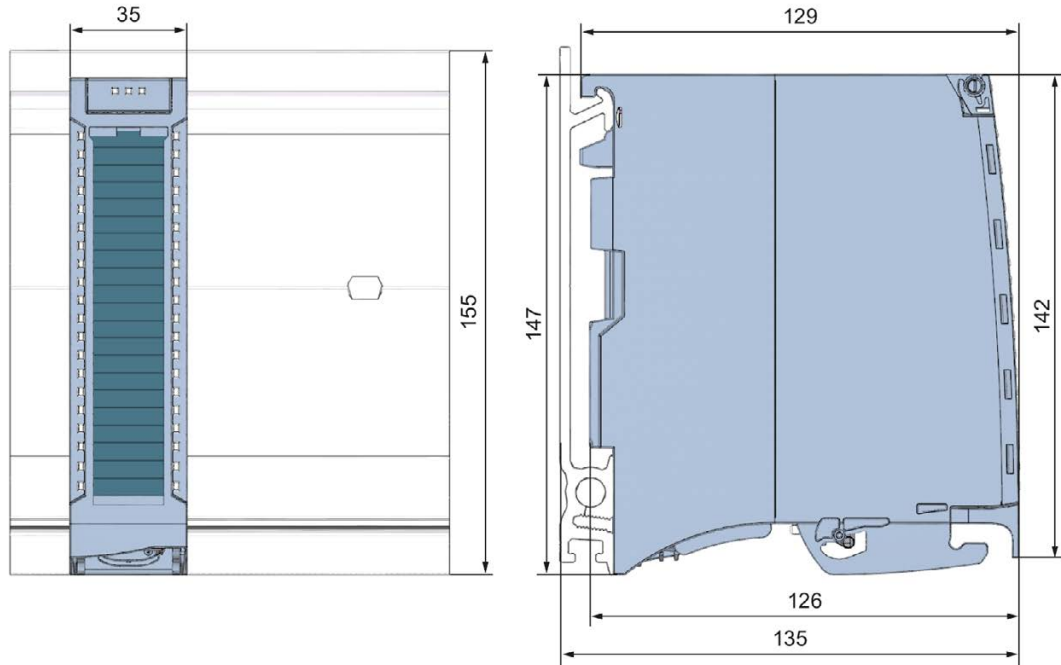


Figure A-1 Dimension drawing of the DQ 16x230VAC/2A ST module

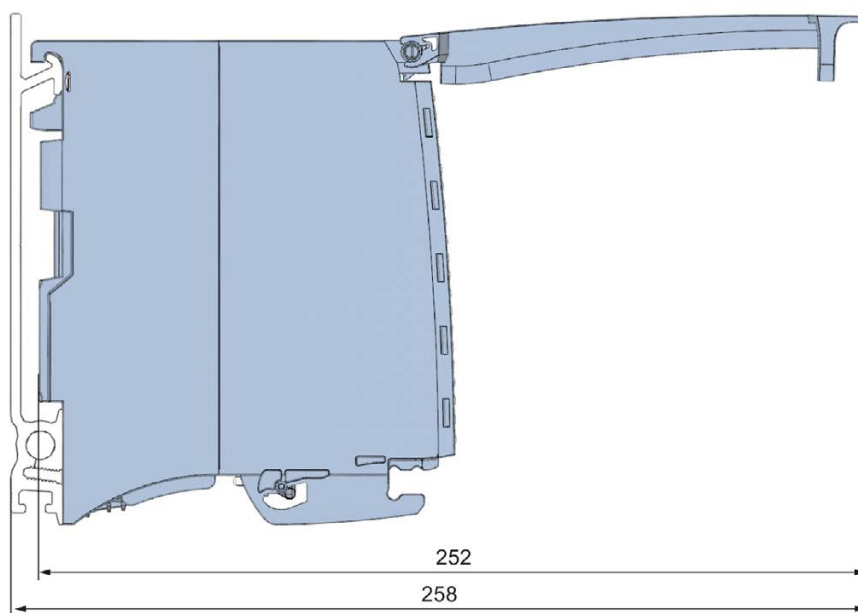


Figure A-2 Dimension drawing of the DQ 16x230VAC/2A ST module, side view with open front cover

## Parameter data records

### B.1 Parameter assignment and structure of the parameter data records

The data records of the module have an identical structure, regardless of whether you configure the module with PROFIBUS DP or PROFINET IO.

#### Dependencies for configuration with GSD file

When a GSD file is used to configure a module, dependencies can arise when "assigning the parameters".

There are no dependencies for this module. You can assign the individual parameters in any combination.

#### Parameter assignment in the user program

You have the option to reconfigure the module in RUN (e.g. the response of selected channels to the CPU STOP state can be changed in RUN without having an effect on the other channels).

#### Changing parameters in RUN

The WRREC instruction is used to transfer the parameters to the module using data records 64 to 79. The parameters set in STEP 7 are not changed in the CPU, which means the parameters set in STEP 7 are valid again after a restart.

The parameters are only checked for plausibility by the module after the transfer.

#### STATUS output parameter

The module ignores errors that occurred during the transfer of parameters with the WRREC instruction and continues operation with the previous parameter assignment. However, a corresponding error code is written to the STATUS output parameter.

The description of the WRREC instruction and the error codes is available in the STEP 7 online help.

#### Operation of the module behind a PROFIBUS DP interface module

If the module is operated behind a PROFIBUS DP interface module, the parameter data records 0 and 1 are not read back. You get the diagnostics data records 0 and 1 for the read back parameter data records 0 and 1. You can find more information in the Interrupts section of the PROFIBUS DP interface module device manual on the Internet.

### **Assignment of data record and channel**

For the configuration as a 1 x 16-channel module, the parameters are located in data records 64 to 79 and are assigned as follows:

- Data record 64 for channel 0
- Data record 65 for channel 1
- ...
- Data record 78 for channel 14
- Data record 79 for channel 15

For the configuration as a 2 x 8-channel module, the module has 2 submodules with eight channels each. The parameters for the channels are located in data records 64 to 71 and are assigned as follows:

- Data records 64 to 71 for channels 0 to 7 (submodule 1)
- Data records 64 to 71 for channels 8 to 15 (submodule 2)

Address the respective submodule for data record transfer.



## Data record structure

The example in the figure below shows the structure of data record 64 for channel 0. The structure of channels 1 to 16 is identical. The values in byte 0 and byte 1 are fixed and may not be changed.

Enable a parameter by setting the corresponding bit to "1".

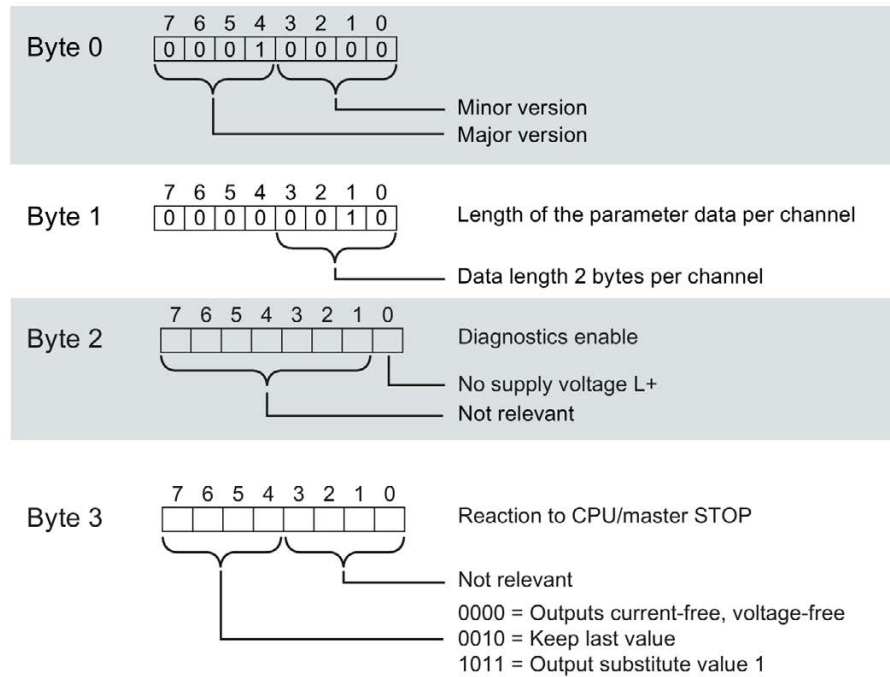


Figure B-1 Structure of data record 64: Bytes 0 to 3

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