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SIMATIC

S7-1500

Digital output module DQ 16x24VDC/0.5A ST (6ES7522-1BH00-0AB0)

Manual

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Answers for industry.

SIEMENS

SIMATIC

S7-1500/ET 200MP DQ 16x24VDC/0.5A ST Digital Output Module (6ES7522-1BH00-0AB0)

Manual

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Legal information

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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.

Changes compared to previous version

Changes described in this manual, compared to the previous version:

- Module integrated in hardware catalog STEP 7 (TIA Portal) V13, Update 3 or higher with the functions:
 - Module-internal shared output (MSO) for Shared Device
 - Configurable submodules, e.g., for Shared Device
- Appendix Open Source Software amended

Conventions

The term "CPU" is used in this manual both for the CPUs of the S7-1500 automation system, as well as for interface modules of the ET 200MP distributed I/O system.

Please also observe notes marked as follows:

Note

A note contains important information regarding the product described in the documentation or its handling, or draws special attention to a section of the documentation.

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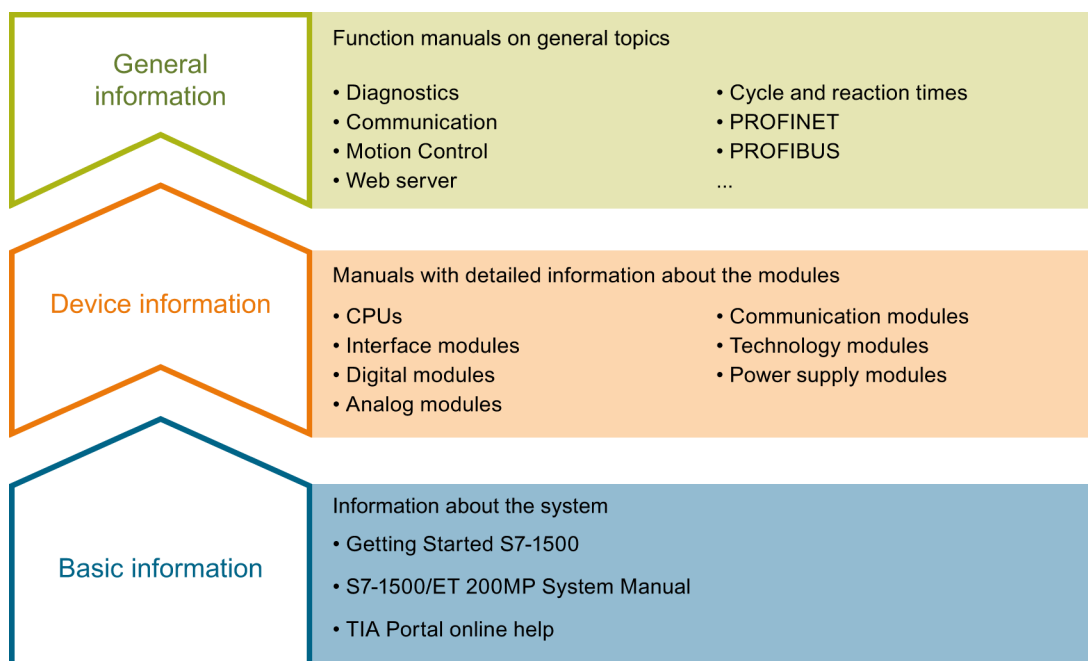
For legal reasons, we are obliged to publish the original text of the license conditions and copyright notices. Please read the information relating to this in the appendix.

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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

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

Manuals contain a compact description of the module-specific information, such as properties, terminal diagrams, characteristics, 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

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

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You can find Applications & Tools on the Internet
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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

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(<http://support.automation.siemens.com/WW/view/en/42455541>).

Product overview

2.1 Properties

Article number

6ES7522-1BH00-0AB0

View of the module

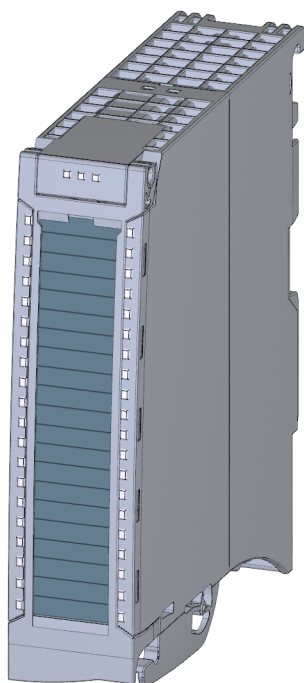


Figure 2-1 View of the DQ 16x24VDC/0.5A ST module

Properties

The module has the following technical properties:

- 16 DO; electrically isolated in groups of 8
- Rated output voltage 24 V DC
- Rated output current 0.5 A per channel
- Assignable substitute values (per channel)
- Assignable diagnostics (per channel group)
- 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 (TIA Portal)	GSD file in STEP 7 (TIA Portal) V12 or higher, or STEP 7 V5.5 SP3 or higher
Firmware update	V1.0.0 or higher	V12 or higher	X
Identification data I&M0 to I&M3	V1.0.0 or higher	V12 or higher	X
Parameter assignment in RUN	V1.0.0 or higher	V12 or higher	X
Isochronous mode	V1.0.0 or higher	V12 or higher	---
Module-internal Shared Output (MSO)	V2.0.0 or higher	V13 Update 3 or higher (PROFINET IO only)	X (PROFINET IO only)
Configurable submodules / submodules for Shared Device	V2.0.0 or higher	V13 Update 3 or higher (PROFINET IO only)	X (PROFINET IO only)
Configurable after interface module IM 155-5 DP ST	V2.0.0 or higher	V13 or higher	X

You can configure the module with STEP 7 (TIA Portal) 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

You can find more information on accessories in the S7-1500 Automation System (<http://support.automation.siemens.com/WW/view/en/59191792>) system manual and the ET 200MP Distributed I/O System (<http://support.automation.siemens.com/WW/view/en/59193214>) system manual.

Wiring

This section contains the block diagram of the module and outlines various connection options.

For more information on front connector wiring and creating cable shields, for example, refer to the "Wiring" section in the S7-1500 Automation System (<http://support.automation.siemens.com/WW/view/en/59191792>) and ET 200MP distributed I/O system (<http://support.automation.siemens.com/WW/view/en/59193214>) system manuals.

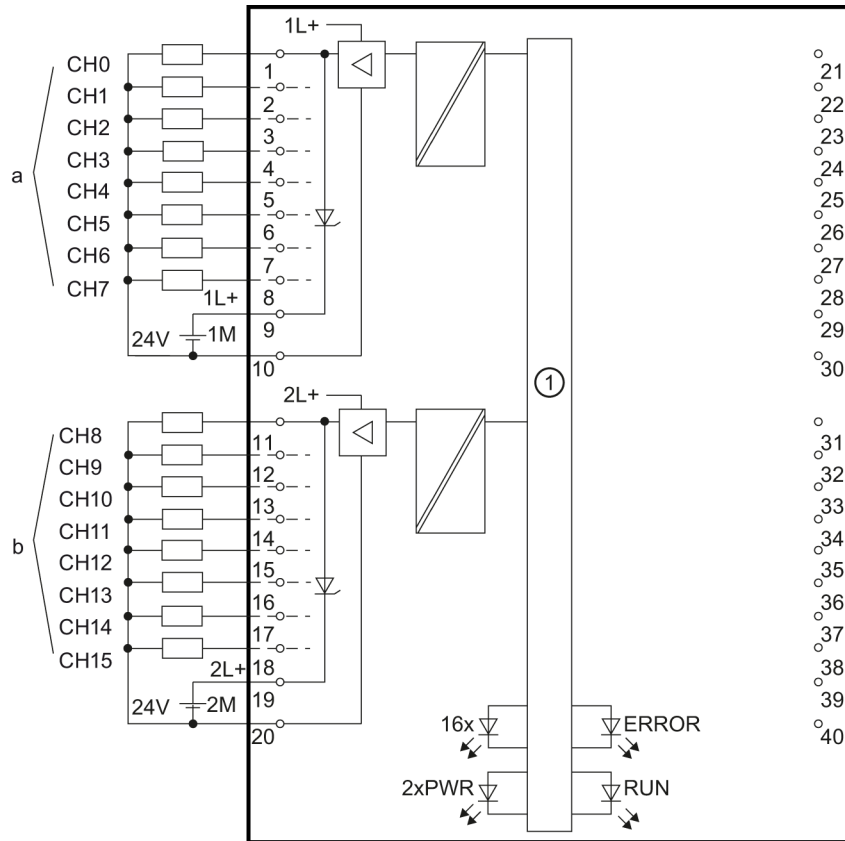
Abbreviations used

Meaning of the abbreviations used in the following figures:

xL+	Supply voltage connection
xM	Ground connection
CHx	Channel or display of the channel status
PWRx	Display for the supply voltage (POWER)

Block diagram and terminal assignment

The example in the following figure shows the terminal assignment and channel addressing (output byte a and output byte b).



① Backplane bus interface

Figure 3-1 Block diagram and terminal assignment

Note

Upon activation of the 24 V supply voltage, there is a "1" signal at the module outputs for approx. 50 μ s.

Tip: Using the potential jumpers

If you want to supply both load groups with the same potential (non-isolated), use the potential jumpers supplied with the front connector. 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
 - 9 and 29 (L+)
 - 10 and 30 (M)
 - 19 and 39 (L+)
 - 20 and 40 (M)
3. Insert the jumpers between terminals 29 and 39, as well as 30 and 40.
4. Use the terminals 19 and 20 to distribute the potential to the next module.

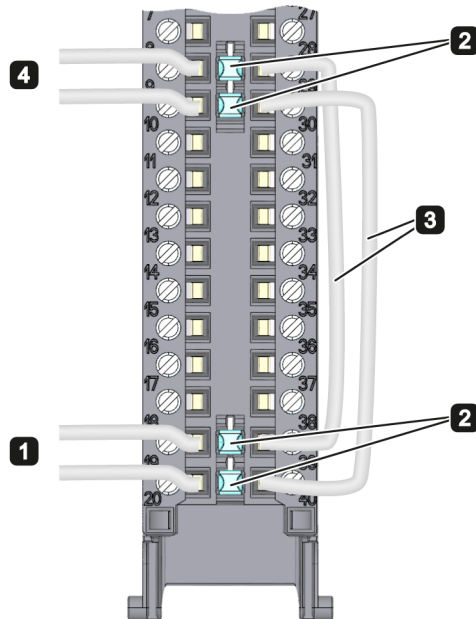


Figure 3-2 Using the potential jumpers

Note

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

Parameters/address space

4.1 Parameters

DQ 16x24VDC/0.5 ST parameters

When you assign the module parameters in STEP 7, you use various parameters to specify the module properties. The following table lists the configurable parameters. 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 using the WRREC instruction (parameter reassignment in RUN) and data records; see chapter Parameter assignment and structure of the parameter data records (Page 30).

Table 4- 1 Configurable parameters and their defaults

Parameters	Range of values	Default setting	Parameter assignment in RUN	Scope with configuration software, e.g., STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Diagnostics					
• Missing supply voltage L+	Yes/No	No	Yes	Channel group	Channel group
• Short circuit to M	Yes/No	No	Yes	Channel group	Channel group
Reaction to CPU STOP	<ul style="list-style-type: none"> • Turn off • Keep last value • Output substitute value 1 	Turn off	Yes	Channel	Channel

4.2 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 of the outputs/inputs.

Configuration options of DQ 16x24VDC/0.5A ST

You can configure the module with STEP 7 (TIA Portal) or with a GSD file.

When you configure the module by means of the GSD file, the configurations are available under different abbreviations/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 (TIA Portal)	
		Integrated in hardware catalog STEP 7 (TIA Portal)	GSD file in STEP 7 (TIA Portal) V12 or higher or STEP 7 V5.5 SP3 or higher
1 x 16-channel without value status	DQ 16x24VDC/0.5A ST	V12 or higher	X
1 x 16-channel with value status	DQ 16x24VDC/0.5A ST QI	V12 or higher	X
2 x 8-channel without value status	DQ 16x24VDC/0.5A ST S	V13 Update 3 or higher (PROFINET IO only)	X (PROFINET IO only)
2 x 8-channel with value status	DQ 16x24VDC/0.5A ST S QI	V13 Update 3 or higher (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 16x24VDC/0.5A ST MSO	V13 Update 3 or higher (PROFINET IO only)	X (PROFINET IO only)

Value status (Quality Information, QI)

The value status is always activated for the following module names:

- DQ 16x24VDC/0.5A ST QI
- DQ 16x24VDC/0.5A ST S QI
- DQ 16x24VDC/0.5A 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).

Special characteristics of short-circuit to ground

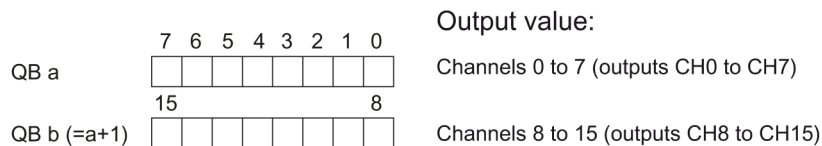
If a channel is short-circuited, all bits of the corresponding value status input byte are set to 0. The module signals all channels of the relevant byte as faulty.

Address space for configuration as 16-channel DQ 16x24VDC/0.5A ST

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 d" are printed onto the module. "For example, AB a" stands for module start address output byte a.

Assignment in the process image output (PIQ)



Assignment in the process image input (PII)



0 = Read-in value for the channel is invalid

Figure 4-1 Address space for configuration as 16-channel DQ 16x24VDC/0.5A ST with value status

Address space for configuration as 2 x 8-channel DQ 16x24VDC/0.5A ST S QI

For the configuration as a 2 x 8-channel module, the channels of the module are divided into multiple submodules. The submodules can be assigned to different IO controllers when the module is used in a shared device.

The number of usable submodules is dependent on the interface module used. Please observe the information in the manual for the particular interface module.

Contrary to the 1 x 16-channel module configuration, each of the two submodules has a freely assignable start address. The addresses for the respective value status of a submodule can also be assigned by the user.

Assignment in the process image output (PIQ)

		Output value:									
		7	6	5	4	3	2	1	0		
QB a		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Channels 0 to 7 (outputs CH0 to CH7)	1st submodule
		15				8					
QB b		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Channels 8 to 15 (outputs CH8 to CH15)	2nd submodule

Assignment in the process image input (PII)

		(QI) Value status									
		7	6	5	4	3	2	1	0		
IB i		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Channels 0 to 7 (value status QI0 to QI7)	1st submodule
		15				8					
IB j		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Channels 8 to 15 (value status QI8 to QI15)	2nd submodule

0 = Read-in value for the channel is invalid

Figure 4-2 Address space for configuration as 2 x 8-channel DQ 32x24VDC/0.5A ST S QI with value status

Address space for configuration as 1 x 16-channel DQ 16x24VDC/0.5A 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 usable submodules is dependent on the interface module 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.

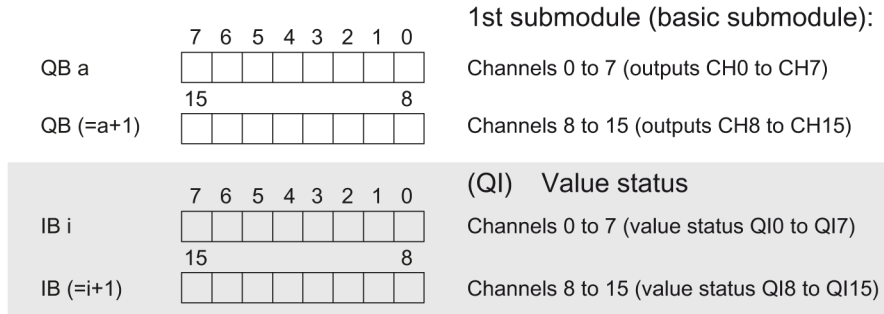
For the first submodule (=basic submodule), the value status 0 indicates that the value is incorrect or that the IO controller of the basic submodule is in STOP state.

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:

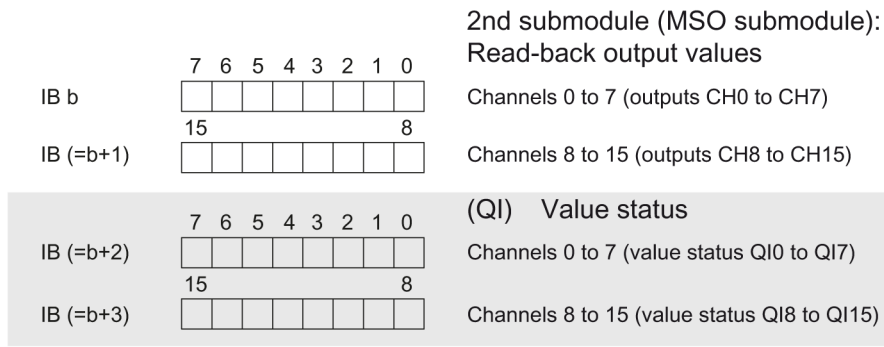
- The basic submodule is not yet configured (not ready).
- The connection between the IO controller and the basic submodule has been interrupted.
- The IO controller of the basic submodule is in STOP or POWER OFF state.

The following figure shows the assignment of the address space for submodules 1 and 2 and the value status.

Assignment in the process image output (PIQ) for 1st submodule



Assignment in the process image input (PII) for 2nd submodule



0 = Read-in value for the channel is invalid

Figure 4-3 Address space for configuration as 1 x 16-channel DQ 16x24VDC/0.5A ST S MSO with value status

4.2 Address space

The following figure shows the assignment of the address space with submodules 3 and 4 and the value status.

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

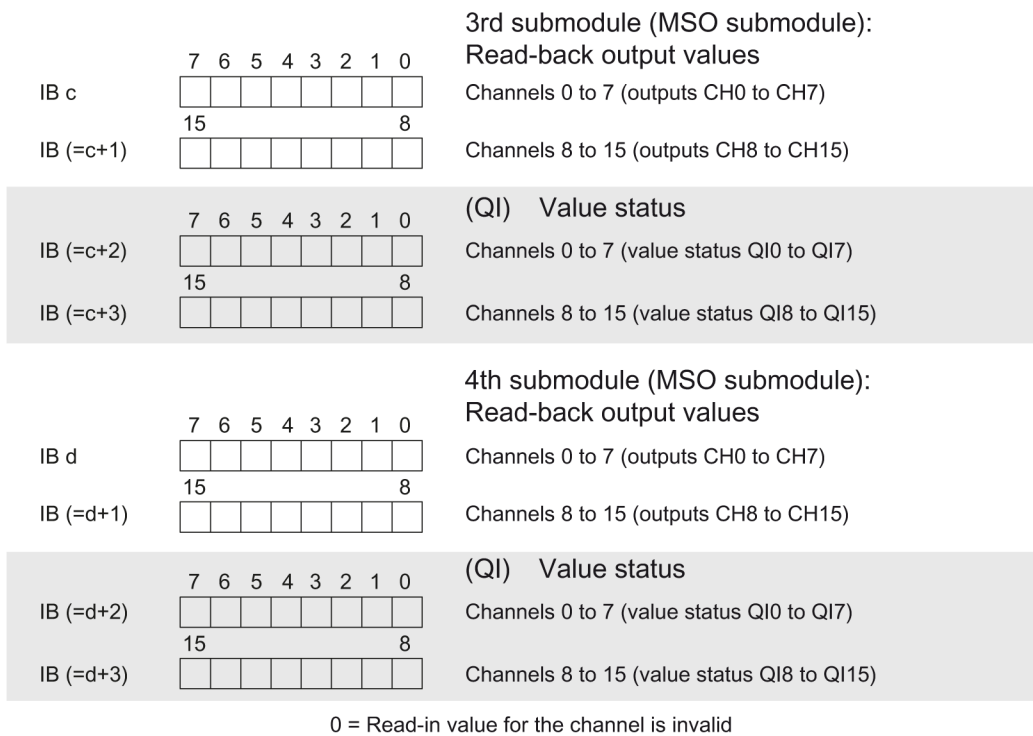


Figure 4-4 Address space for configuration as 1 x 16-channel DQ 16x24VDC/0.5A ST S MSO with value status

Interrupts/diagnostics alarms

5.1 Status and error displays

LED displays

The following figure shows the LED displays (status and error displays) of DQ 16x24VDC/0.5A ST.

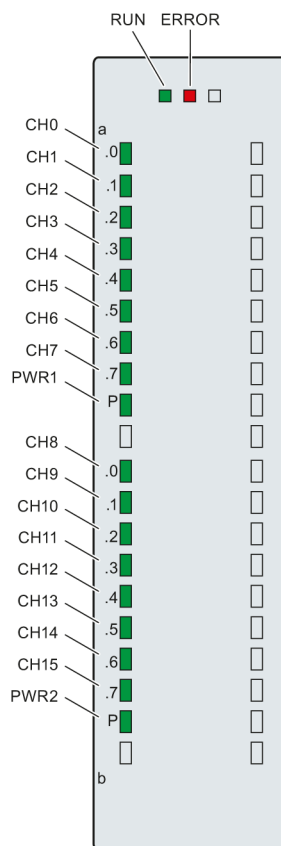


Figure 5-1 LED displays of the module DQ 16x24VDC/0.5A ST

Meaning of the LED displays

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

RUN and ERROR LED

Table 5- 1 Status and error displays RUN and ERROR

LED		Meaning	Remedy
RUN	ERROR		
□ Off	□ Off	Voltage missing or too low at backplane bus	<ul style="list-style-type: none"> Switch on the CPU and/or the system power supply modules. Verify that the U connectors are inserted. Check to see if too many modules are inserted.
☀ Flashes	□ Off	The module starts and flashes until the valid parameter assignment is set.	---
■ On	□ Off	Module is configured	---
■ On	☀ Flashes	Indicates module errors (at least one error at one channel, e.g., short-circuit to ground).	Evaluate the diagnostics data and eliminate the error (e.g., check the cables).
☀ Flashes	☀ Flashes	Hardware defective	Replace the module.

PWR1 and PWR2 LED

Table 5- 2 PWR1 and PWR2 status indication

LED PWRx	Meaning	Remedy
□ Off	Supply voltage L+ too low or missing	Check the L+ supply voltage.
■ On	Supply voltage L+ is present and OK	---

CHx LED

Table 5- 3 CHx status display

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

5.2 Interrupts

Digital output module DQ 16x24VDC/0.5A ST supports diagnostic interrupts.

Diagnostic interrupt

The module generates a diagnostic interrupt at the following events:

- Missing supply voltage L+
- Short-circuit to ground

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
Short circuit to M	1H	Short-circuit or overload at the channel	Check the wiring/actuator. Check the ambient temperature.
Load voltage missing	11H	Supply voltage L+ of the module is missing	Connect supply voltage L+ to module/channel

Technical specifications

Technical specifications of the DQ 16x24VDC/0.5A ST

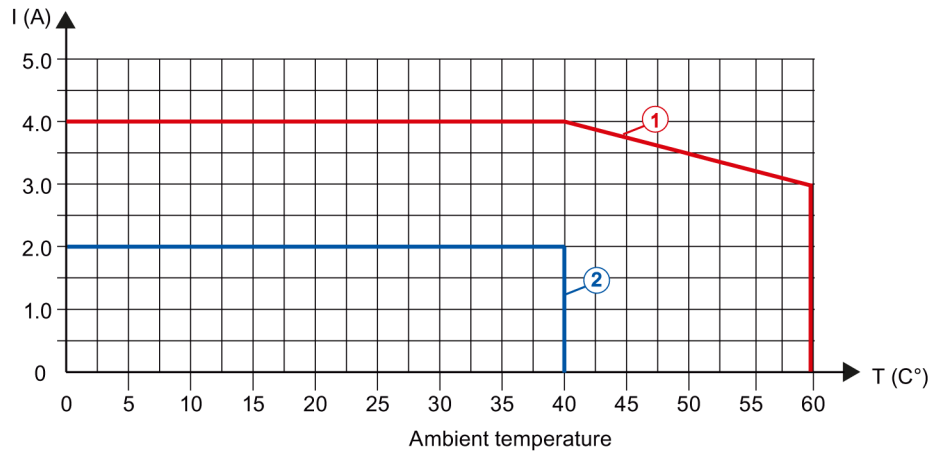
	6ES7522-1BH00-0AB0
Product type designation	DQ 16x24VDC/0,5A ST
General information	
Hardware version	E01
Firmware version	V2.0.0
Product function	
I&M data	Yes; IM0 to IM3
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	V12.0 / V12.0
STEP 7 can be configured/integrated as of version	as of V5.5 SP3 / -
Operating mode	
MSO	Yes
Supply voltage	
Type of supply voltage	DC
Rated value (DC)	24 V
Valid range, low limit (DC)	20.4 V
Valid range, high limit (DC)	28.8 V
Reverse polarity protection	Yes; through internal protection with 7 A per group
Input current	
Current consumption, max.	30 mA
Output voltage	
Rated value (DC)	24 V
Power	
Power consumption from the backplane bus	1.1 W
Power loss	
Power loss, typ.	2 W
Digital outputs	
Type of digital output	Transistor
Number of outputs	16
Switching to P potential	Yes
Digital outputs, configurable	Yes
Short-circuit protection	Yes; electronic clamping
<ul style="list-style-type: none"> Response threshold, typ. 	1 A
Limitation of inductive shutdown voltage to	L+ (-53 V)
Control of a digital input	Yes

6ES7522-1BH00-0AB0	
Switching capacity of outputs	
With resistive load, max.	0.5 A
With lamp load, max.	5 W
Load resistance range	
Low limit	48 Ω
High limit	12 kΩ
Output voltage	
Type of output voltage	DC
for signal "1", min.	L+ (-0.8 V)
Output current	
for signal "1" rated value	0.5 A
for signal "1" permissible range, max.	0.5 A
for signal "0" residual current, max.	0.5 mA
Output delay with resistive load	
"0" to "1", max.	100 μs
"1" to "0", max.	500 μs
Parallel switching of 2 outputs	
For logic operations	Yes
For increased performance	No
For redundant control of a load	Yes
Switching frequency	
With resistive load, max.	100 Hz
With inductive load, max.	0.5 Hz; acc. to IEC 947-5-1, DC13
With lamp load, max.	10 Hz
Total current of outputs	
Max. current per channel	0.5 A; (see additional description in the manual)
Max. current per group	4 A; (see additional description in the manual)
Max. current per module	8 A; (see additional description in the manual)
Cable length	
Cable length shielded, max.	1000 m
Cable length unshielded, max.	600 m
Isochronous mode	
Isochronous mode (application synchronized up to terminal)	Yes
Execution and activation time (TCO), min.	70 μs
Bus cycle time (TDP), min.	250 μs
Interrupts/diagnostics/status information	
Substitute values can be applied	Yes
Interrupts	
Diagnostics interrupt	Yes

6ES7522-1BH00-0AB0	
Diagnostics alarms	
Diagnostics	Yes
Monitoring of supply voltage	Yes
Wire break	No
Short-circuit	Yes
Fuse blown	No
Diagnostics indicator LED	
RUN LED	Yes; green LED
ERROR LED	Yes; red LED
Monitoring of supply voltage	Yes; green LED
Channel status display	Yes; green LED
For channel diagnostics	No
For module diagnostics	Yes; red LED
Electrical isolation	
Electrical isolation of channels	
Between the channels	No
Between the channels, in groups of	8
Between the channels and the backplane bus	Yes
Permitted potential difference	
Between different circuits	75 V DC / 60 V AC (basic isolation)
Isolation	
Isolation tested with	707 V DC (type test)
Distributed mode	
Prioritized startup	Yes
Dimensions	
Width	35 mm
Height	147 mm
Depth	129 mm
Weights	
Weight, approx.	230 g

Power reduction (derating) to aggregate current of outputs (per group)

The following derating graphs show the loading capacity of the outputs in relation to the mounting position and the ambient temperature.



- ① Horizontal mounting position
- ② Vertical mounting position

Figure 6-1 Details on aggregate current of outputs (per group)

Dimensional drawing

A

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

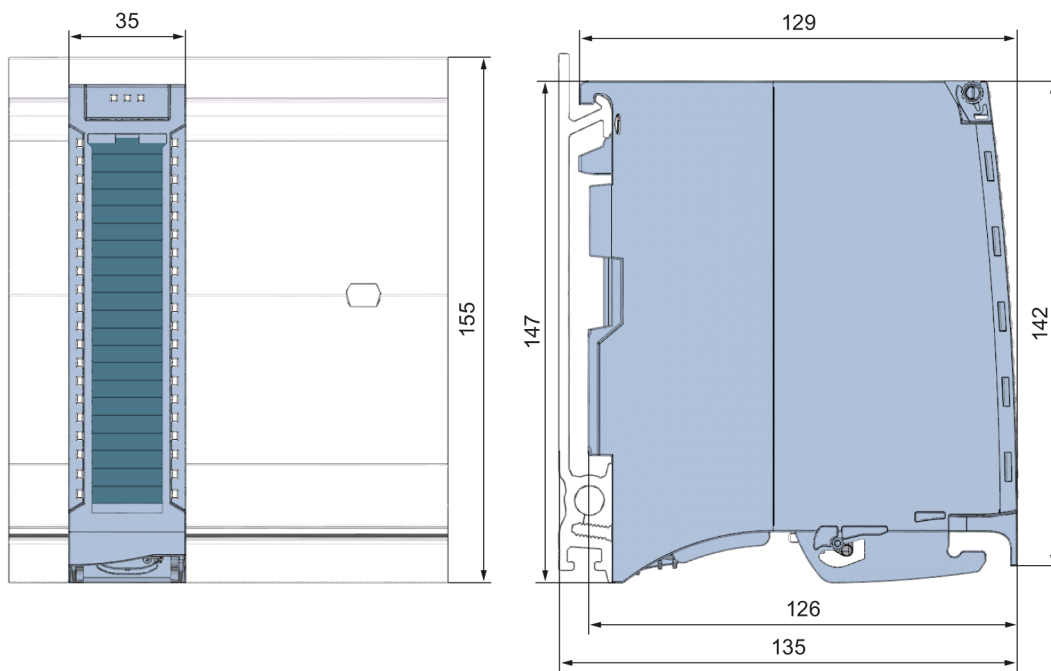


Figure A-1 Dimensional drawing of the DQ 16x24VDC/0.5A ST module

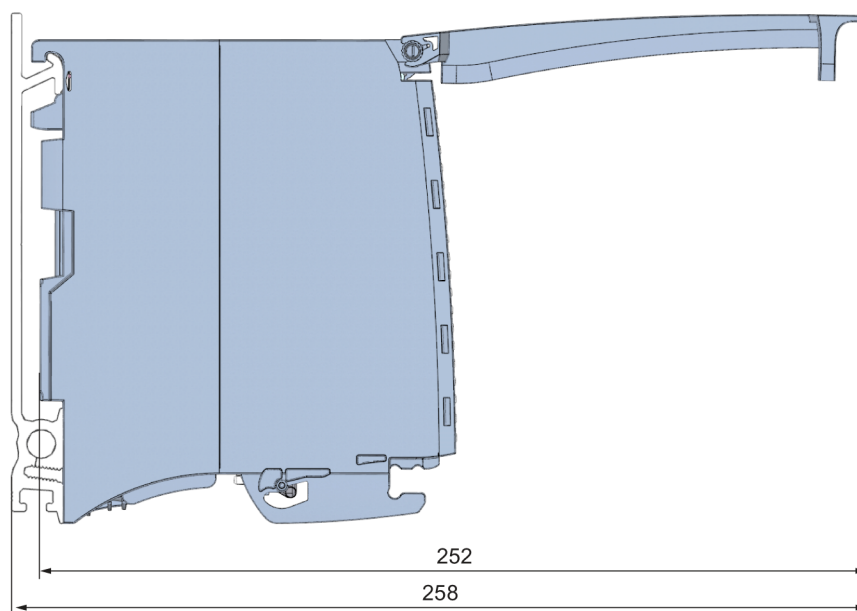


Figure A-2 Dimensional drawing of the DQ 16x24VDC/0.5A ST module, side view with open front cover

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 modules 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)

Parameter assignment in RUN

The WRREC instruction is used to transfer the parameters to the module using data records 64 to 78. The parameters set in STEP 7 do not change in the CPU, which means the parameters set in STEP 7 are still valid after a restart.

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

Output parameter STATUS

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 (<http://support.automation.siemens.com/WW/view/en/78324181>).

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 following figure shows the structure of data record 64 for channel 0. The structure of channels 1 to 15 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".

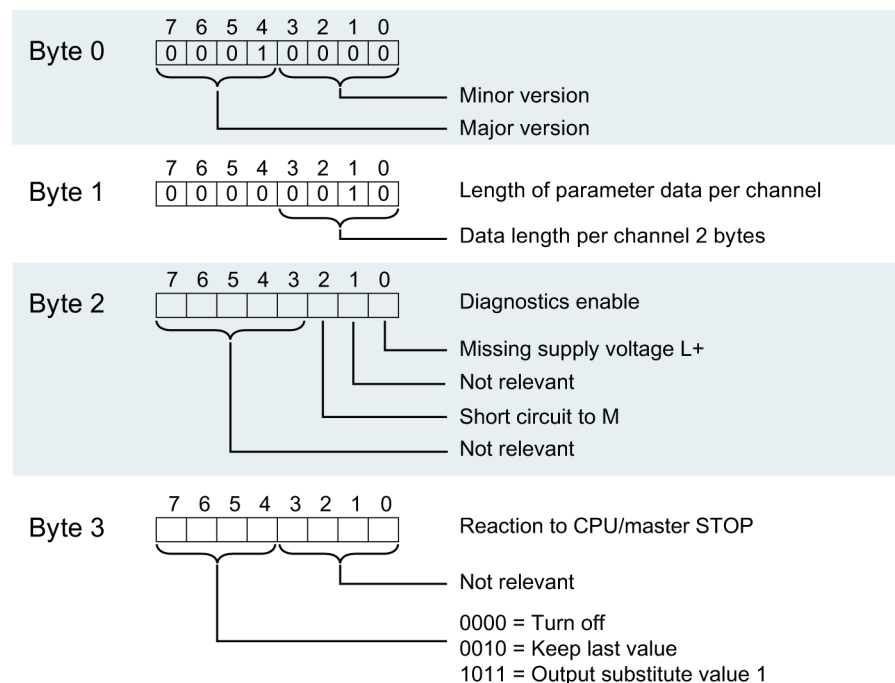


Figure B-1 Structure of data record 64: Bytes 0 to 3



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