



Edition

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EQUIPMENT MANUAL

SIMATIC

S7-1500/ET 200MP

Digital output module DQ 8x230VAC/2A ST Triac
(6ES7522-5FF00-0AB0)

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SIMATIC

S7-1500/ET 200MP Digital output module DQ 8x230VAC/2A ST Triac (6ES7522-5FF00-0AB0)

Equipment Manual

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Warning notice system

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

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

Purpose of the documentation

This manual supplements the system manual S7-1500/ET 200MP (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

Functions that relate in general to the systems are described in this system manual.

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

Changes compared to previous version

Compared to the previous version, this manual contains the following change:

The module features a switching cycle counter as of firmware version V2.2.0.

Conventions

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

Please also observe notes marked as follows:

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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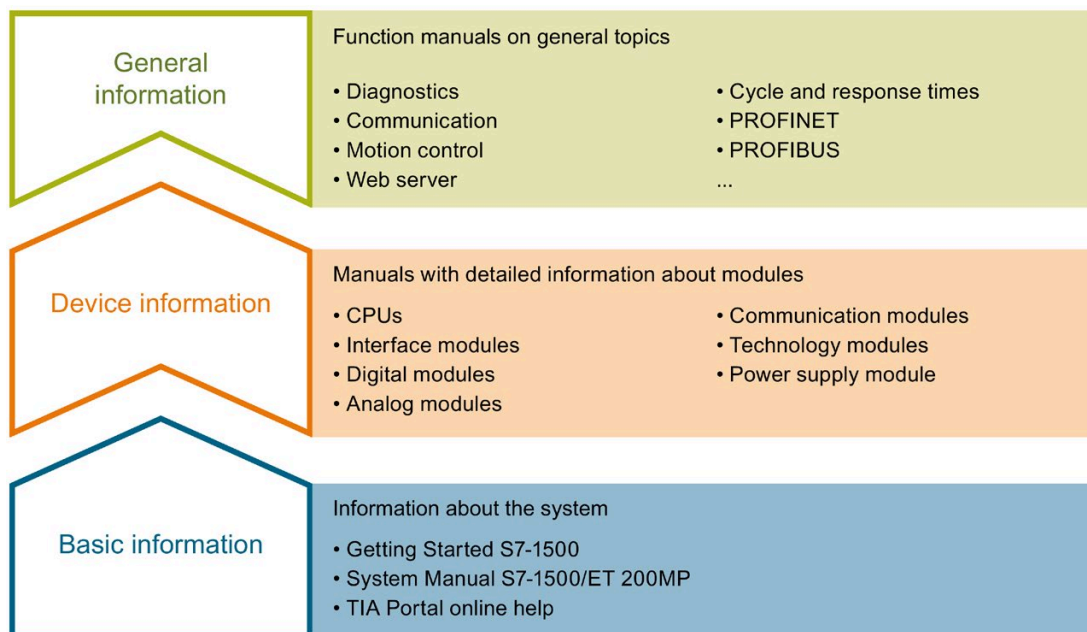
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Documentation guide

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, OPC UA.

You can download the documentation free of charge from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109742691>).

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

You can download the product information free of charge from the Internet (<https://support.industry.siemens.com/cs/us/en/view/68052815>).

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 (<https://support.industry.siemens.com/cs/ww/en/view/86140384>).

SIMATIC S7-1500 comparison list for programming languages

The comparison list contains an overview of which instructions and functions you can use for which controller families.

You can find the comparison list on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/86630375>).

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Application examples

The 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 on individual products.

You will find the application examples on the Internet (<https://support.industry.siemens.com/cs/ww/en/ps/ae>).

Product overview

2.1 Properties

Article number

6ES7522-5FF00-0AB0

View of the module

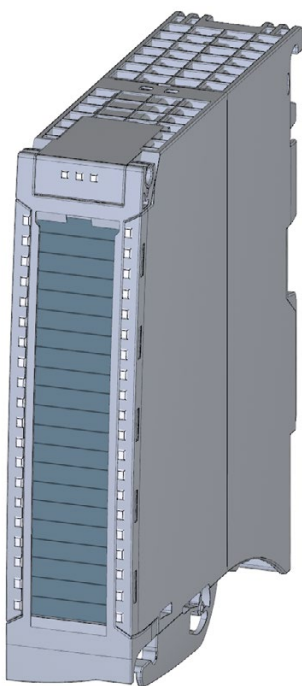


Figure 2-1 View of the DQ 8x230VAC/2A ST module

Properties

The module has the following technical properties:

- 8 digital outputs (Triac)
- Rated output voltage 120 V/230 V AC
- Rated output current 2 A
- Configurable substitute values (per channel)
- Suitable for solenoid valves, DC contactors, indicator lights and smaller single phase drives
- Switching cycle counter for connected actuators, e.g. solenoid valves

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
Module-internal Shared Output (MSO)	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
Switching cycle counter	V2.2.0 or higher	V16, Update 4 or higher with HSP 0343 or V17 or higher with HSP 0343 (PROFINET IO only, central operation with a S7-1500 CPU is supported)	X (PROFINET IO only)

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

Accessories

The following components 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 can be ordered separately:

Front connectors, including potential jumpers and cable ties

You can find more information on accessories in the system manual S7-1500/ET 200MP (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

2.2 Functions

2.2.1 Switching cycle counter

The function records the number of switching cycles of the output and thus the switching cycles of a connected actuator, such as those of solenoid valves. When the specified number of switching cycles is reached, the "Limit value warning" maintenance interrupt is triggered, provided it is configured and enabled. When replacing the actuator, you can reset the switching cycle counter from the user program.

When replacing modules, you have the option of pre-initializing the switching cycle counter from the user program.

Typical areas of application:

- Recording the number of switching cycles of the connected devices, e.g. solenoid valves or load contactors
- Predictive maintenance

Advantages

- You configure this function instead of programming.
- "Monitoring" of each individual channel is possible. You can select which outputs are "monitored".
- You can adapt the plant configuration flexibly and individually.
- Easy to service and maintain. You can enable and disable the switching cycle counter via the user program.
- Increase in plant availability. You can schedule actuator replacement in advance for the next maintenance cycle.

Requirement

Firmware version as of V2.2.0 of the module.

Configuration

You configure the switching cycle counter with the following parameters:

- Switching cycle counter enabled/disabled
- Trigger maintenance interrupt when the limit is reached
- Set limit for maintenance alarm

Principle of operation

The module counts the switching cycles by evaluating the rising edges of an output signal. If the module detects a rising edge, the switching cycle counter (24-bit) for the respective channel is incremented. After an overflow of the switching cycle counter, it starts again with 0.

If you activate the "Maintenance switching cycles" parameter, the "Limit warning" of the maintenance interrupt is triggered when the limit is exceeded. Alternatively, activate the maintenance alarm in the parameter data records starting at DS 64.

The current counter states are stored on the module cyclically (approx. every 20 seconds) and retentively. The switching cycle counters are reset each time the module is restarted (power off/on).

You activate the function with the "Switching cycle counter" parameter or in the parameter data sets starting at DS 64.

You can read the current counter states with data set DS 129. Data set DS 129 contains the counter status for each channel in UDINT format.

You can read the limits for each channel in UDINT format with data set DS 130.

Data set DS 131 enables you to overwrite the current counter value for each switching cycle counter.

You can set a limit for each switching cycle counter with the "Switching cycle limit" parameter or with data set DS 131.

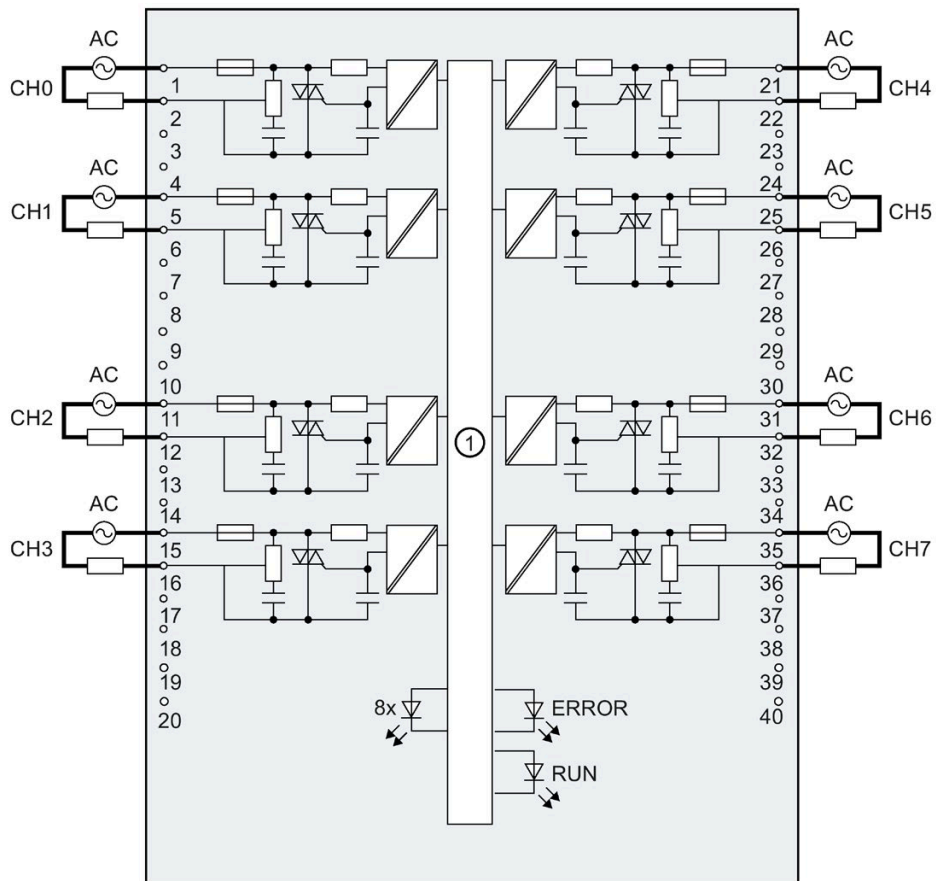
This section contains the block diagram of the module and outlines various wiring options. You can find information on wiring the front connector, creating a cable shield, etc. in the Wiring section of the system manual S7-1500/ET 200MP (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

Note

Do not insert the potential jumpers included with the front connector!

Wiring and block diagram

The example in the following figure shows the terminal assignment and the assignment of the channels.



- ① Backplane bus interface
- CHx Channel or channel status LED (green/red)
- RUN Status display LED (green)
- ERROR Error display LED (red)

Figure 3-1 Block diagram and terminal assignment

Parameters/address space

4.1 Parameters

DQ 8x230VAC/2A 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 26).

Table 4-1 Configurable parameters and their defaults

Parameter	Range of values	Default	Parameter assignment in RUN	Scope with configuration software, e.g., STEP 7 (TIA Portal)	
				Integrated in the hardware catalog STEP 7 or GSD file PROFINET IO	GSD file PROFIBUS DP
Diagnostics					
• Switching cycle counter maintenance	Yes/No	No	Yes	Channel (V16, Update 4 or higher)	---
Output parameters					
• Reaction to CPU STOP	<ul style="list-style-type: none"> • Turn off • Keep last value • Output substitute value 1 	Turn off	Yes	Channel	Channel
• Switching cycle counter	Yes/No	No	Yes	Channel (V16, Update 4 or higher)	---
• Switching cycle counter limit	0 ... 16777214	0	Yes	Channel (V16, Update 4 or higher)	---

4.2 Declaration of parameters

Switching cycle counter maintenance

You use this parameter to enable the maintenance alarm "Limit value warning" when the switching cycle counter limit is violated.

You configure the limit with the parameter "Switching cycle limit" for each channel CHx.

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.

Switching cycle counter

Channel-by-channel enable of switching cycle counter (Page 10).

Switching cycle counter limit

Defines the limit channel-by-channel. If this value is exceeded, the "Limit value warning" maintenance interrupt is signaled.

Enter an integer value between 0 and 16777214. Refer to the data sheet of the connected actuator. Recommendation: Instead of entering the maximum value, set the value, e.g., to 80% or 90% of the maximum value. You then have enough time to preventatively change the actuator.

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 8x230VAC/2A 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 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 (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 8-channel without value status	DQ 8x230VAC/2A ST	X	X
1 x 8-channel with value status for module-internal Shared Output with up to 4 submodules	DQ 8x230VAC/2A 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 DQ 8x230VAC/2A ST MSO module.

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 8-channel DQ 8x230VAC/2A ST

The following figure shows the assignment of the address space for the configuration as a 8-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 on the module; "QB a", for example, stands for module start address output byte a.

Assignment in the process image output (PIQ)

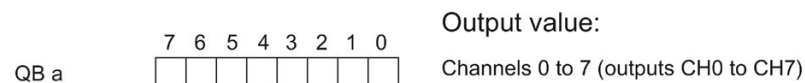


Figure 4-1 Address space for configuration as 8-channel DQ 8x230VAC/2A ST

Address space for configuration as 1 x 8-channel DQ 8x230VAC/2A ST MSO

For the configuration as a 1 x 8-channel module (module-internal Shared Output, MSO), channels 0 to 7 of the module are copied to multiple submodules. Channels 0 to 7 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 7.
- The IO controllers to which submodule 2, 3, or 4 is assigned have read access to outputs 0 to 7.

The number of usable IO controllers depends on the interface module used. Please 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 involved.

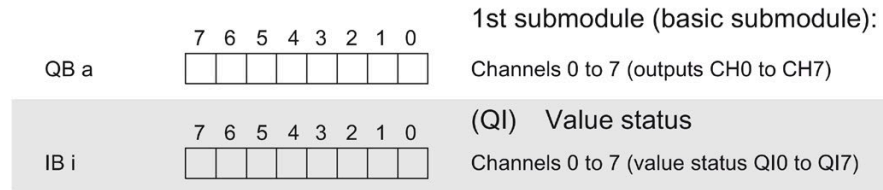
For the first submodule (=basic submodule), the value status 0 indicates that the value is incorrect or that the IO controller of the basic submodule is in STOP state.

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:

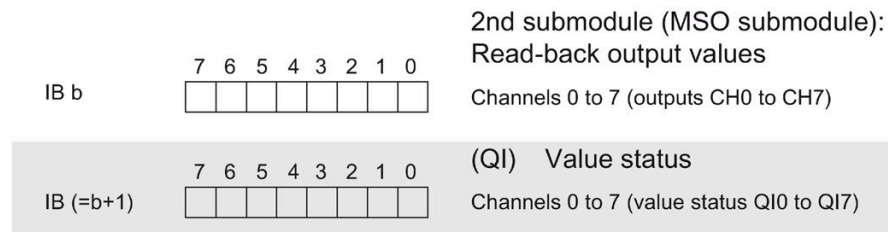
- The basic submodule is not yet configured (not ready).
- The connection between the IO controller and the basic submodule has been interrupted.
- The IO controller of the basic submodule is in STOP or POWER OFF state.

The following figure shows the assignment of the address space for submodules 1, 2, 3, and 4 and the value status.

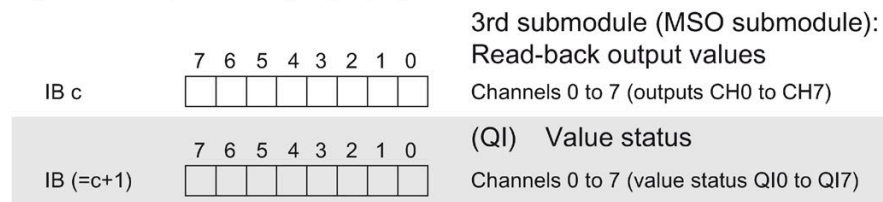
Assignment in the process image output (PIQ) for 1st submodule



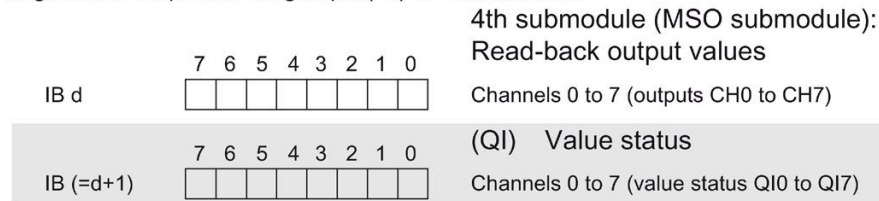
Assignment in the process image input (PII) for 2nd submodule



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



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



0 = Read-in value for the channel is invalid

Figure 4-2 Address space for configuration as 1 x 8-channel DQ 8x230VAC/2A ST S MSO with value status

Reference

You can find information on the Shared Input/Output (MSI/MSO) function in the section Module-Internal Shared Input/Output (MSI/MSO) of the PROFINET (<https://support.industry.siemens.com/cs/ww/en/view/49948856>) Function Manual.

Diagnostic alarms

5.1 Status and error displays

LED displays

The following figure shows the LED displays (status and error displays) of DQ 8x230VAC/2A ST.

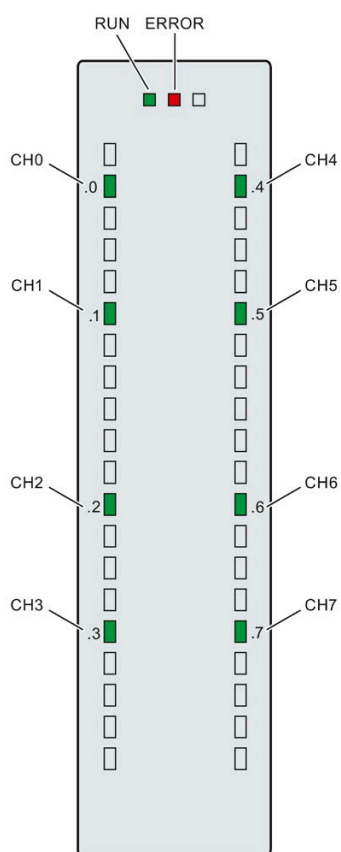


Figure 5-1 LED displays of the module DQ 8x230VAC/2A ST

Meaning of the LED displays

The following table explains the meaning of the status and error displays.

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	---
☀ Flashes	☀ Flashes	Hardware defective	Replace the module.

CHx LED

Table 5-2 CHx status display

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

5.2 Diagnostics alarms

Diagnostics alarms

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

Table 5-3 Diagnostics alarms, their meaning and corrective measures

Diagnostics alarm	Error code	Meaning	Corrective measures
Limit value warning	17 _H	The configured limit for switching cycles has been exceeded.	<ul style="list-style-type: none"> Replace actuator as a precautionary measure Reset counter with DS131

Technical specifications

Technical specifications of the DQ 8x230VAC/2A ST

The following table shows the technical specifications as of 12/2021. You can find a data sheet including daily updated technical specifications on the Internet (<https://support.industry.siemens.com/cs/de/en/pv/6ES7522-5FF00-0AB0/td?dl=de>).

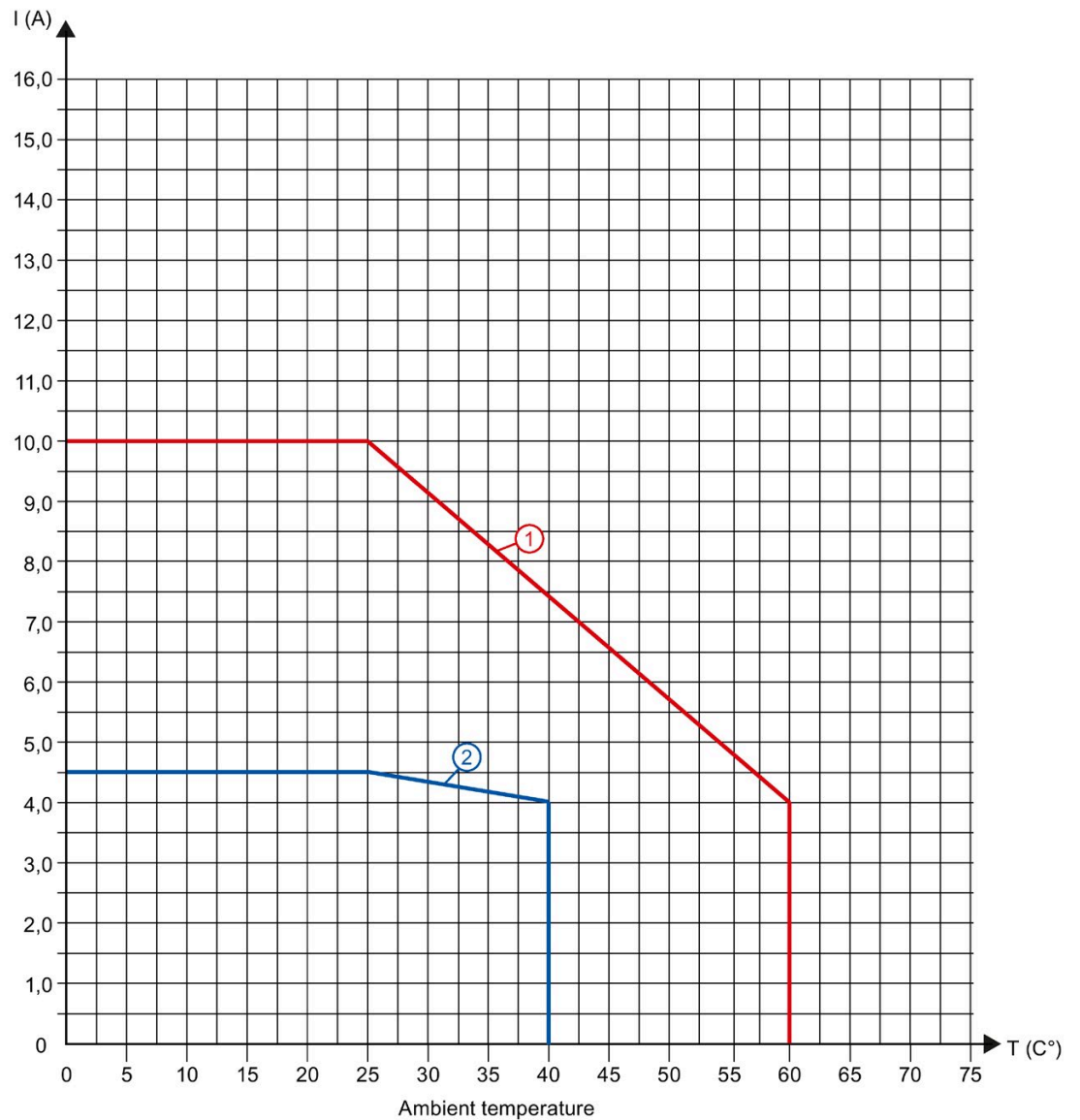
Article number	6ES7522-5FF00-0AB0
General information	
Product type designation	DQ 8x230 V AC/2A ST (triac)
HW functional status	From FS01
Firmware version	V2.2.0
<ul style="list-style-type: none"> FW update possible 	Yes
Product function	
<ul style="list-style-type: none"> I&M data 	Yes; I&M0 to I&M3
<ul style="list-style-type: none"> Isochronous mode 	No
<ul style="list-style-type: none"> Prioritized startup 	Yes
Engineering with	
<ul style="list-style-type: none"> STEP 7 TIA Portal configurable/integrated from version 	V12 / V12
<ul style="list-style-type: none"> STEP 7 configurable/integrated from version 	V5.5 SP3 / -
<ul style="list-style-type: none"> PROFIBUS from GSD version/GSD revision 	V1.0 / V5.1
<ul style="list-style-type: none"> PROFINET from GSD version/GSD revision 	V2.3 / -
Operating mode	
<ul style="list-style-type: none"> DQ 	Yes
<ul style="list-style-type: none"> DQ with energy-saving function 	No
<ul style="list-style-type: none"> PWM 	No
<ul style="list-style-type: none"> Oversampling 	No
<ul style="list-style-type: none"> MSO 	Yes
<ul style="list-style-type: none"> Integrated operating cycle counter 	Yes
output voltage / header	
Rated value (AC)	230 V; 120/230 V AC, 50/60 Hz
Power	
Power available from the backplane bus	0.9 W
Power loss	
Power loss, typ.	10.8 W

Article number	6ES7522-5FF00-0AB0
Digital outputs	
Type of digital output	Triac
Number of digital outputs	8
Current-sourcing	Yes
Digital outputs, parameterizable	Yes
Short-circuit protection	No
<ul style="list-style-type: none"> built-in fuse 	6.3 A melting fuse, slow-blow
Size of motor starters according to NEMA, max.	5
Switching capacity of the outputs	
<ul style="list-style-type: none"> with resistive load, max. 	2 A
<ul style="list-style-type: none"> on lamp load, max. 	50 W
Output voltage	
<ul style="list-style-type: none"> for signal "1", min. 	L1 (-1.5 V) at maximum output current; L1 (-8.5 V) at minimum output current
Output current	
<ul style="list-style-type: none"> for signal "1" rated value 	2 A
<ul style="list-style-type: none"> for signal "1" permissible range, min. 	10 mA
<ul style="list-style-type: none"> for signal "1" permissible range, max. 	15 A; max. 1 AC cycle
<ul style="list-style-type: none"> for signal "0" residual current, max. 	2 mA
Output delay with resistive load	
<ul style="list-style-type: none"> "0" to "1", max. 	1 AC cycle
<ul style="list-style-type: none"> "1" to "0", max. 	1 AC cycle
Parallel switching of two outputs	
<ul style="list-style-type: none"> for logic links 	No
<ul style="list-style-type: none"> for uprating 	No
<ul style="list-style-type: none"> for redundant control of a load 	Yes
Switching frequency	
<ul style="list-style-type: none"> with resistive load, max. 	10 Hz
<ul style="list-style-type: none"> with inductive load, max. 	0.5 Hz
<ul style="list-style-type: none"> on lamp load, max. 	1 Hz
Total current of the outputs	
<ul style="list-style-type: none"> Current per channel, max. 	2 A; see additional description in the manual
<ul style="list-style-type: none"> Current per group, max. 	2 A; see additional description in the manual
<ul style="list-style-type: none"> Current per module, max. 	10 A; see additional description in the manual
Cable length	
<ul style="list-style-type: none"> shielded, max. 	1 000 m
<ul style="list-style-type: none"> unshielded, max. 	600 m

Article number	6ES7522-5FF00-0AB0
Interrupts/diagnostics/status information	
Diagnostics function	No
Substitute values connectable	Yes
Alarms	
• Diagnostic alarm	No
• Maintenance interrupt	Yes
Diagnoses	
• Monitoring the supply voltage	No
• Wire-break	No
• Short-circuit	No
Diagnostics indication LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• Monitoring of the supply voltage (PWR-LED)	No
• Channel status display	Yes; green LED
• for channel diagnostics	No
• for module diagnostics	Yes; red LED
Potential separation	
Potential separation channels	
• between the channels	Yes
• between the channels, in groups of	1
• between the channels and backplane bus	Yes
• Between the channels and load voltage L1	Yes
Permissible potential difference	
between different circuits	250 V AC between the channels and the backplane bus; 500 V AC between the channels
Isolation	
Isolation tested with	3 100 V DC
Standards, approvals, certificates	
Suitable for safety functions	No
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	0 °C
• horizontal installation, max.	60 °C
• vertical installation, min.	0 °C
• vertical installation, max.	40 °C
Dimensions	
Width	35 mm
Height	147 mm
Depth	129 mm
Weights	
Weight, approx.	290 g

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

The following graphs show the loading capacity of the outputs in relation to the mounting position of the S71500 automation system/ET 200MP distributed I/O system and the ambient temperature.



- ① Horizontal mounting of the system
- ② Vertical mounting of the system

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

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.

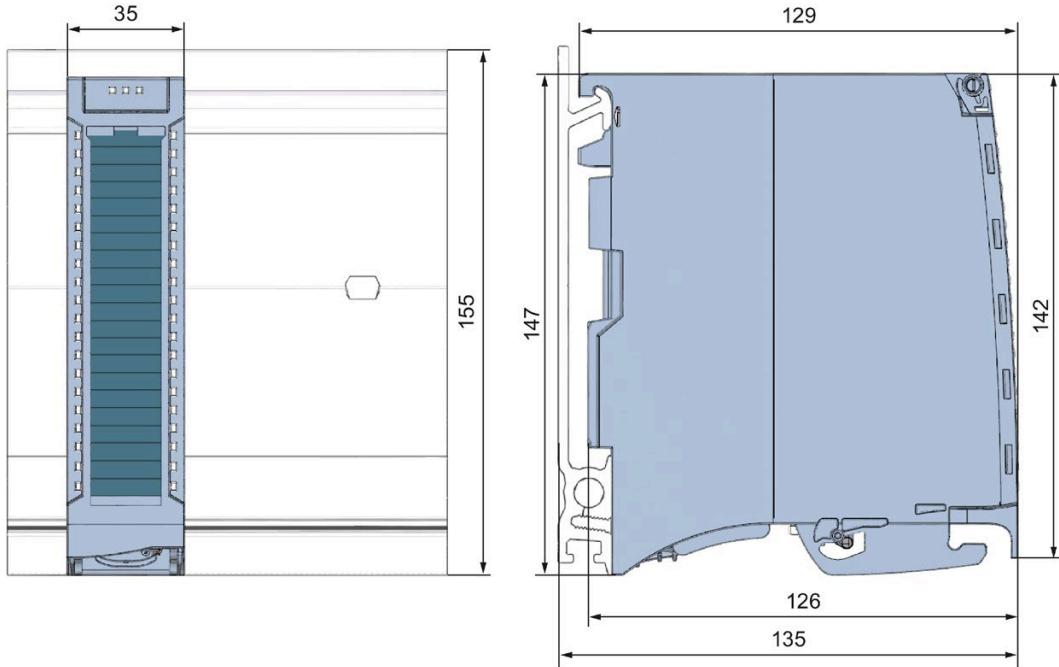


Figure A-1 Dimensional drawing of the DQ 8x230VAC/2A ST module

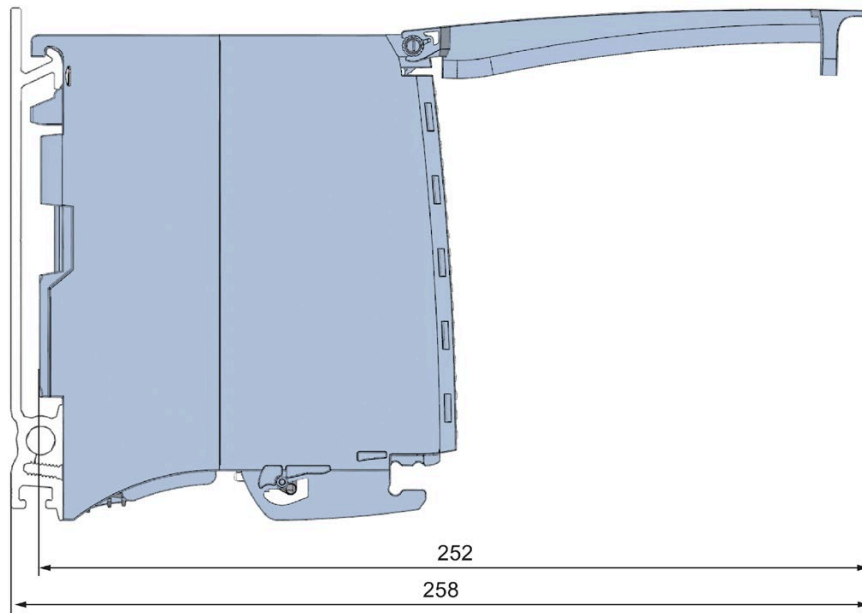


Figure A-2 Dimensional drawing of the DQ 8x230VAC/2A ST module, side view with open front cover

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 71. 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 obtain the diagnostics data records 0 and 1 with the read back parameter data records 0 and 1. You can find more information in the Interrupts section of the manual for the PROFIBUS DP interface module in the Internet (<http://support.automation.siemens.com/WW/view/en/78324181>).

Assignment of data record and channel

The channel parameters of the module are included in data records 64 to 71 and are assigned as follows:

- Data record 64 for channel 0
- Data record 65 for channel 1
- Data record 66 for channel 2
- Data record 67 for channel 3
- Data record 68 for channel 4
- Data record 69 for channel 5
- Data record 70 for channel 6
- Data record 71 for channel 7

Assignment of data records for the switching cycle counter

The parameters for the switching cycle counter are located in the data records 129 to 131 and are assigned as follows:

- Data record 129 for channel 0 to 7 to read the counter values
- Data record 130 for channel 0 to 7 to read the limit values
- Data record 131 for channels 0 to 7 to specify the limit values for the counters and to overwrite the current counter values

Structure of data sets 64 to 71

The figure below shows the structure of data set 64 for channel 0 as an example. The structure is identical for channels 1 to 7. 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".

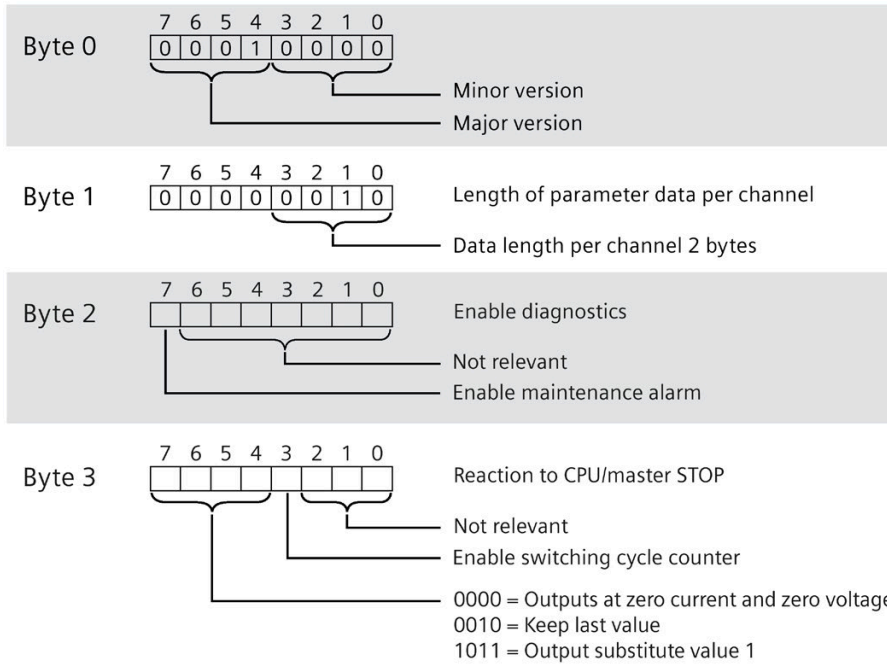


Figure B-1 Structure of data record 64: Bytes 0 to 3

Structure of data set 129

You can read the current states of the switching cycle counters with data set 129. The counter status is supplied for each channel in UDINT format.

The following figure shows you the structure of data set 129.

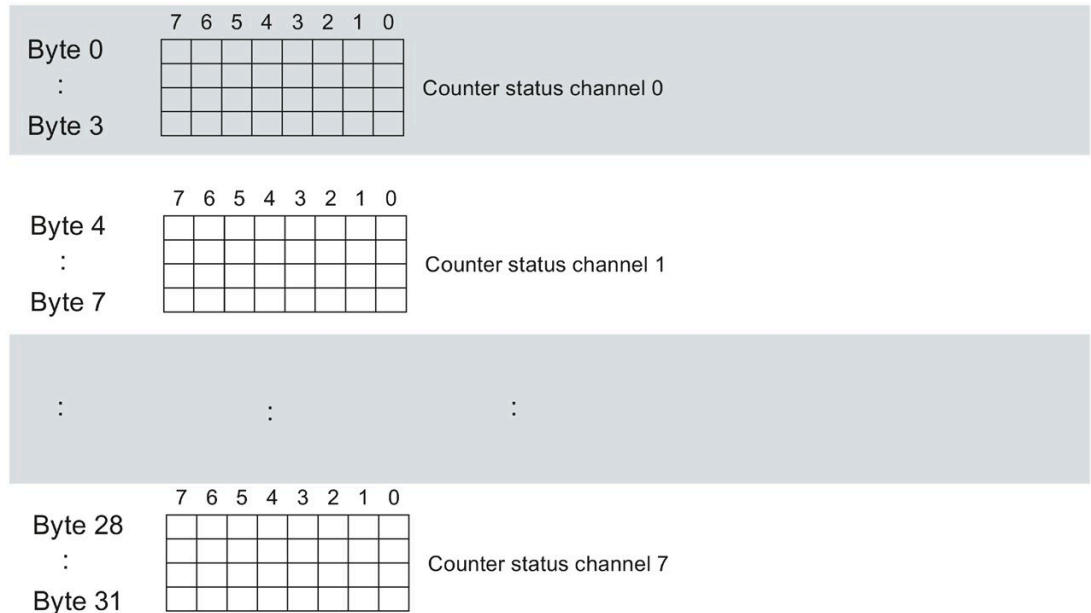


Figure B-2 Structure of data set 129: Byte 0 to 31

Structure of data set 130

The limits of the switching cycle counters are read out with data set 130. The set value is supplied for each channel in UDINT format.

The following figure shows you the structure of data set 130.

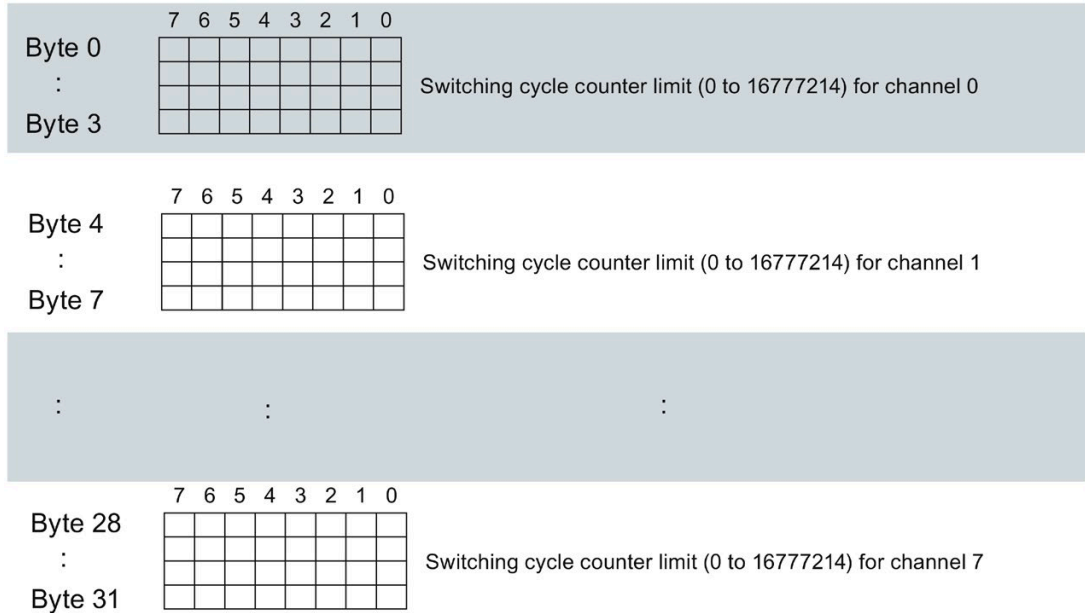


Figure B-3 Structure of data set 130: Byte 0 to 31

Structure of data set 131

The following figure shows you the structure of data set 131.

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

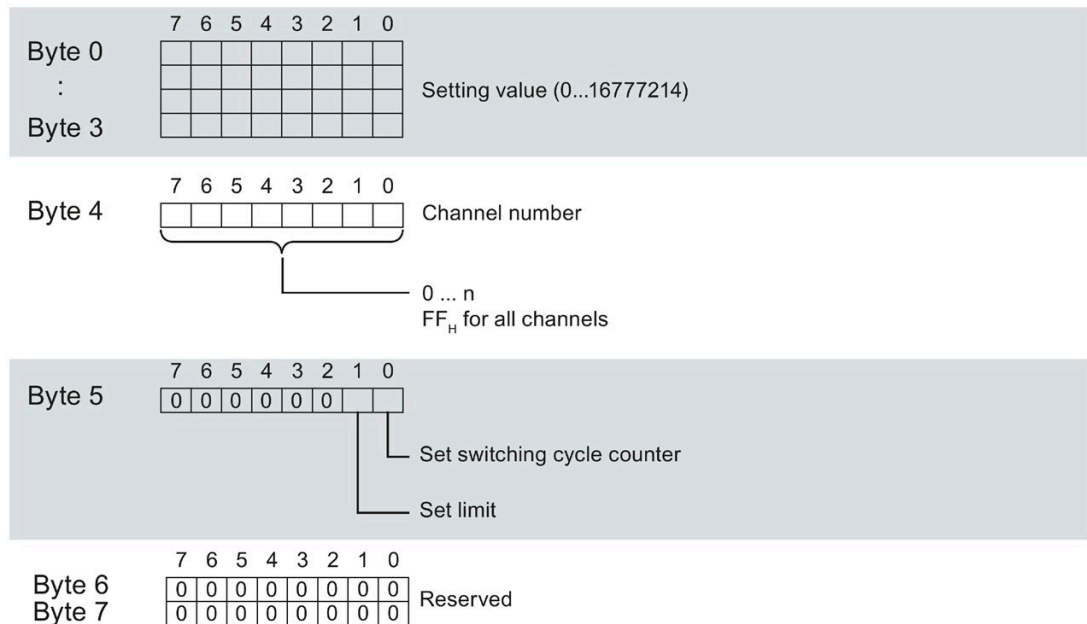


Figure B-4 Structure of data set 131: Bytes 0 to 7