

SIEMENS



SIMATIC

ET 200AL

Interface module IM 157-1 DP (6ES7157-1AA00-0AB0)

Manual

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SIMATIC

ET 200AL Interface module IM 157-1 DP (6ES7157-1AA00-0AB0)

Manual

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This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER

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

WARNING

indicates that death or severe personal injury **may** 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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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 ET 200AL distributed I/O system (<https://support.industry.siemens.com/cs/ww/en/view/89254965>) system manual. Functions that are generally applicable to the ET 200AL distributed I/O system are described there.

The information provided in the present manual, the system manual and the function manuals enables you to commission the ET 200AL distributed I/O system.

Conventions

Please also observe notes marked as follows:

Note

Indicates important product information to which particular attention should be paid.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

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To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under (<http://www.siemens.com/industrialsecurity>).

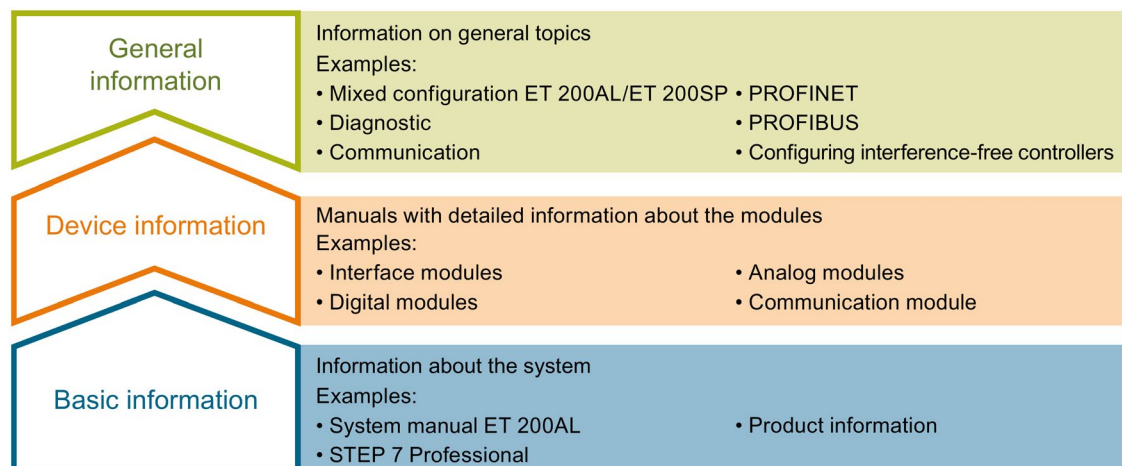
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Documentation guide

The documentation for the SIMATIC ET 200AL 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 ET 200AL distributed I/O system. 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, terminal diagrams, characteristics and technical specifications.

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC ET 200AL distributed I/O system, e.g. diagnostics, communication, Motion Control, Web server.

You can download the documentation free of charge from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109742667>).

Manual Collection ET 200AL

The Manual Collection contains the complete documentation on the SIMATIC ET 200AL 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/95242965>).

"mySupport"

With "mySupport", your personal workspace, you make the best out of your Industry Online Support.

In "mySupport", you can save filters, favorites and tags, request CAx data and compile your personal library in the Documentation area. In addition, your data is already filled out in support requests and you can get an overview of your current requests at any time.

You must register once to use the full functionality of "mySupport".

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In the Documentation area in "mySupport" you can 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 "mySupport" - Documentation on the Internet (<http://support.industry.siemens.com/My/ww/en/documentation>).

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In the CAx data area in "mySupport", you can access the current product data for your CAx or CAe system.

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 "mySupport" - CAx data on the Internet (<http://support.industry.siemens.com/my/ww/en/CAxOnline>).

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/sc/ww/en/sc/2054>).

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/mcms/topics/en/simatic/tia-selection-tool>).

Product overview

2.1 Properties

Article number

6ES7157-1AA00-0AB0

View of the module

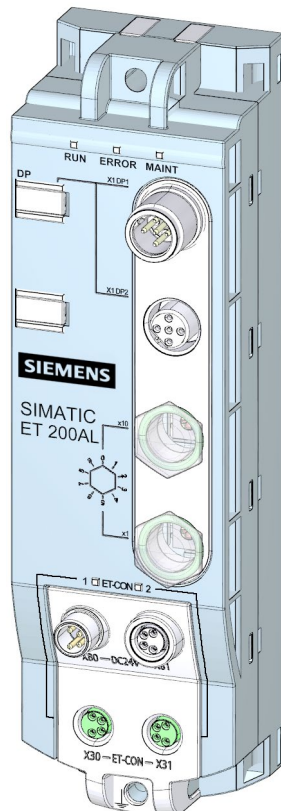


Figure 2-1 View of the IM 157-1 DP interface module

Properties

The module has the following technical properties:

- Connects the ET 200AL distributed I/O system with PROFIBUS DP
- 24 V DC supply voltage
- Operation as DP1 slave possible
- Direct data exchange (data exchange broadcast)
- Support for 2 ET-Connection lines
- Dimensions: 45 x 159 mm

The functions supported by the module are found in the chapter Functions (Page 12).

Maximum configuration

The module has the following maximum configuration:

- 244 bytes input data
- 244 bytes output data
- 32 I/O modules, up to 16 I/O modules can be connected for each ET-Connection line

Accessories

The following component is included with the module in the packaging:

- Identification labels

Other components

The following component can be ordered as spare part:

- Identification labels

The following components can be ordered as accessories:

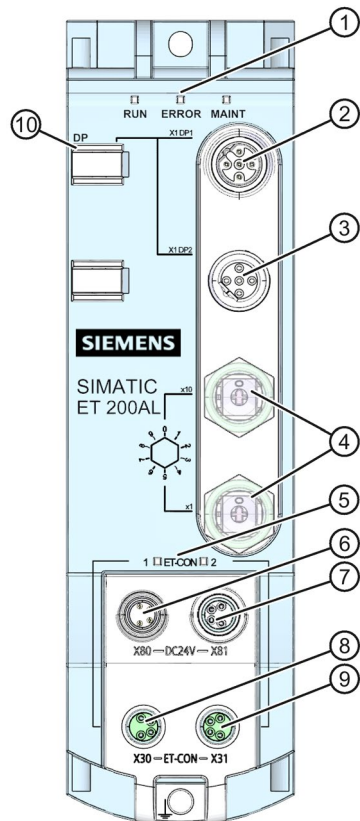
- Connectors
- Cables
- Stripping Tool for PROFIBUS
- Stripping Tool for ET-Connection
- M8 sealing cap
- M12 sealing cap

See also

You will find additional information on accessories and the other components in the Accessories/Spare parts section of the ET 200AL Distributed I/O System (<http://support.automation.siemens.com/WW/view/en/89254965>) system manual.

2.2 Operator controls and display elements

The figure below shows the operator control and display elements of the interface module IM 157-1 DP.



- ① RUN, ERROR, MAINT: LED displays for the current operating status and diagnostics status
- ② X1 DP1: 1st PROFIBUS interface
- ③ X1 DP2: 2nd PROFIBUS interface
- ④ Rotary coding switch for setting the PROFIBUS address
- ⑤ ET-CON1, ET-CON2: LED displays for ET-Connection
- ⑥ X80: Connector for infeed of the supply voltage (POWER input)
- ⑦ X81: Socket for loop-through of the supply voltage (POWER output)
- ⑧ X30: Socket for ET-Connection1
- ⑨ X31: Socket for ET-Connection2
- ⑩ DP: LED displays for the current operating status of the PROFIBUS interfaces

Figure 2-2 Operator controls and display elements

2.3 Functions

2.3.1 PROFIBUS DP

Introduction

The interface module supports the following PROFIBUS DP functions:

- Operation as DPV0 and DPV1 slave
- Identification data I&M0 to I&M3
- Firmware update
- Configuration control by means of the user program

PROFIBUS DP

The PROFIBUS DP interface is used for connection to CPUs. With PROFIBUS DP you can set up extended subnets.

PROFIBUS is the network for the cell and field area in the open, manufacturer-independent communication system SIMATIC NET. Physically, PROFIBUS is an electrical network based on a shielded two-wire cable or an optical network based on a fiber optic cable.

Data transmission via PROFIBUS DP features a standardized interface (EN 50170 Vol. 2) for the transmission of process input and process output data between SIMATIC S7 and field devices (DP slaves).

The transmission behavior via PROFIBUS DP is characterized by cyclical data exchange between the DP master and the DP slaves.

Reference

You will find more information on PROFIBUS DP in the STEP 7 online help and in the Function Manual PROFIBUS with STEP 7 V13

(<http://support.automation.siemens.com/WW/view/en/59193579>).

2.3.2 Configuration control (option handling)

Properties

Configuration control allows you to prepare your distributed I/O system for future extensions or options. Configuration control means that you can configure the planned maximum configuration of your distributed I/O system in advance and vary it later in a flexible manner by means of the user program.

Reference

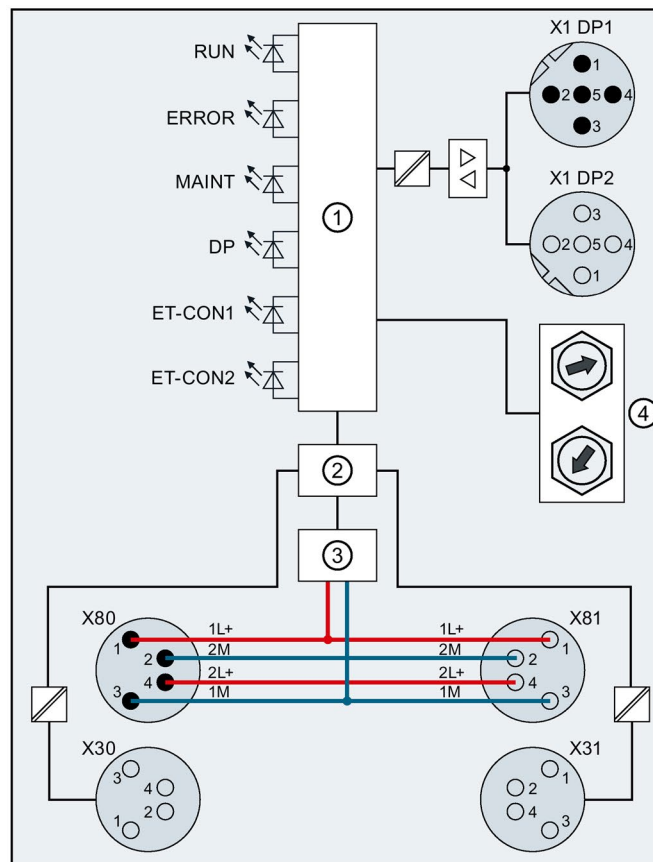
You can find more information on configuration control

- In the system manual ET 200AL Distributed I/O System (<https://support.industry.siemens.com/cs/ww/en/view/89254965>)
- On the Internet under the following link: Application collection (<https://support.industry.siemens.com/cs/ww/en/view/29430270>).
- In the STEP 7 online help.

Wiring

3.1 Terminal and block diagram

The image below shows the terminal and block diagram of the IM 157-1 DP interface module.



①	Electronics	1L+	Supply voltage 1L+ (non-switched)
②	ET-Connection interface	1M	Ground 1M (non-switched)
③	Internal supply voltage	2L+	Load voltage 2L+ (switched)
④	Rotary coding switch for PROFIBUS addresses	2M	Ground 2M (switched)
X1 DP1	1. PROFIBUS interface	RUN	LED operating state (green)
X1 DP2	2. PROFIBUS interface	ERROR	LED diagnostics status (red)
X80	Infeed of supply voltages	MAINT	LED diagnostics status (yellow)
X81	Loop-through of supply voltages	DP	PROFIBUS LED (green)
X30	Infeed of the ET-Connection	ET-CON1, ET-CON2	ET-Connection LEDs (green)
X31	Loop-through of the ET-Connection		

Figure 3-1 Terminal and block diagram

3.2 Pin assignment

Note

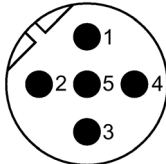
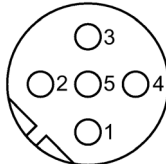
Color coding

The sockets for ET-Connection and the power supply of the modules are color-coded. These colors correspond to the colors of the offered cables.

Pin assignment of the sockets for PROFIBUS

The following table shows the pin assignment of the connectors and sockets for the connection of PROFIBUS.

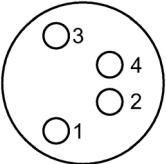
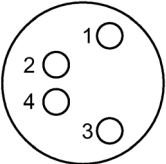
Table 3- 1 Pin assignment for PROFIBUS

Pin	Assignment		Front view of the connector X1 DP1	Front view of the socket X1 DP2
	X1 DP1 connector (feed in)	X1 DP2 Socket (loop-through)		
1	-	Supply plus P5V*		
2	Data cable A			
3	Data reference potential M5*			
4	Data cable B			
5	Functional earth FE			
Shield- ing	Functional earth FE			
* The voltage may only be used for supplying the external terminating resistor. It is not permitted to loop-through the voltage by means of a cable to the next connector.				

Pin assignment of the sockets for ET-Connection

The table below shows the pin assignments of the 2 sockets for the connection of ET-Connection.

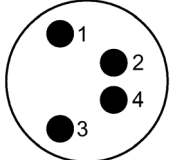
Table 3- 2 Pin assignment for ET-Connection

Pin	Assignment		Assignment of the wire color of the bus line cable for ET-Connection	Front view of the sockets	
	X30 socket (ET-Connection1)	X31 socket (ET-Connection2)		X30	X31
1	RXP	RXP	Yellow		
2	TXP	TXP	White		
3	TXN	TXN	Blue		
4	RXN	RXN	Orange		
Shielding	Functional earth FE		-		

Pin assignment of the connector for infeed of the supply voltage

The following table shows the pin assignment of the connector for infeed of the supply voltage.

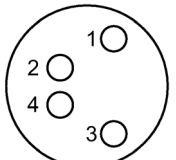
Table 3- 3 Pin assignment of the supply voltage connector

Pin	Assignment	Assignment of the wire color of the power line cable	Front view of the connector
	X80 connector (power input)		
1	Supply voltage 1L+ (non-switched)	Brown	
2	Ground 2M (switched)	White	
3	Ground 1M (non-switched)	Blue	
4	Load voltage 2L+ (switched)	Black	

Pin assignment of the socket for loop-through of the supply voltage

The table below shows the pin assignment of the socket for loop-through of the supply voltage.

Table 3- 4 Pin assignment of the supply voltage socket

Pin	Assignment	Assignment of the wire color of the power line cable	Front view of the socket
	X81 Socket (power output)		
1	Supply voltage 1L+ (non-switched)	Brown	
2	Ground 2M (switched)	White	
3	Ground 1M (non-switched)	Blue	
4	Load voltage 2L+ (switched)	Black	

NOTICE

ET-Connection/supply voltage

Observe the correct wiring of the M8 sockets for ET-Connection and the supply voltage.

Mixing up the ET-Connection connectors and the connectors for the supply voltage can destroy the module.

3.3 Configuring PROFIBUS DP address and terminating resistor

Properties

Use the PROFIBUS address to specify at which address the ET 200AL distributed I/O system is addressed on the PROFIBUS DP.

The PROFIBUS DP address is configured for the ET 200AL distributed I/O system with a rotary coding switch on the front of the housing.

Requirements

The following requirements apply:

- Each address is only assigned once on the PROFIBUS DP.
- The configured PROFIBUS DP address must match the PROFIBUS address defined in the configuration software.
- A change of the PROFIBUS DP address is only valid after POWER ON/POWER OFF on the IM 157-1 DP interface module.

Required tools

You need the following tools to configure the PROFIBUS DP address:

- 14 mm socket wrench
- 2.5 mm screwdriver

Setting the PROFIBUS DP address

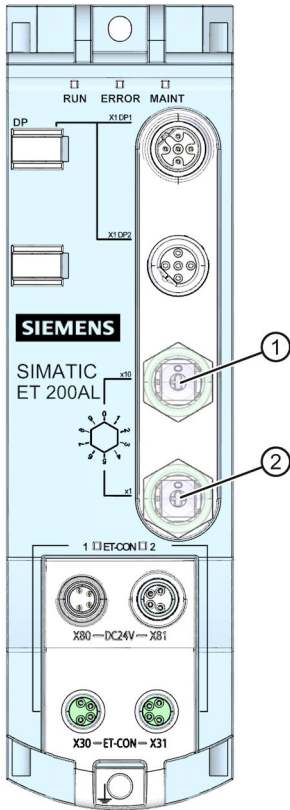
Configurable PROFIBUS DP addresses are 1 to 99.

Proceed as follows to configure the PROFIBUS DP address:

1. Remove the two M12 sealing caps from the rotary coding switches (use 14 mm socket wrench, if needed).
2. Configure the desired PROFIBUS DP address with a screwdriver on the rotary coding switches.
 - Top rotary coding switch: Tens digit
 - Bottom rotary coding switch: Ones digit
3. Screw the two M12 sealing caps back onto the thread to protect the rotary coding switches (torque: 0.5 to 0.8 Nm).
4. Switch the supply voltage off and on again (POWER OFF/POWER ON).

3.3 Configuring PROFIBUS DP address and terminating resistor

The figure below shows the rotary coding switches for configuring the PROFIBUS DP address.



- ① Rotary coding switch for PROFIBUS DP (tens digit)
- ② Rotary coding switch for PROFIBUS DP address (ones digit)

Figure 3-2 Setting the PROFIBUS address

The following table shows how to set PROFIBUS address 26 as an example.

Table 3- 5 Setting of the PROFIBUS address

	Tens digit	Position 2
	Ones digit	Position 6

Connecting the terminating resistor for PROFIBUS DP

Terminate a PROFIBUS DP segment, on both of its ends, which means on the first and last device of the segment, with its characteristic impedance. There are two different terminating resistors available for this purpose, for sockets and for connectors.

The figure below shows typical use of a terminating resistor.

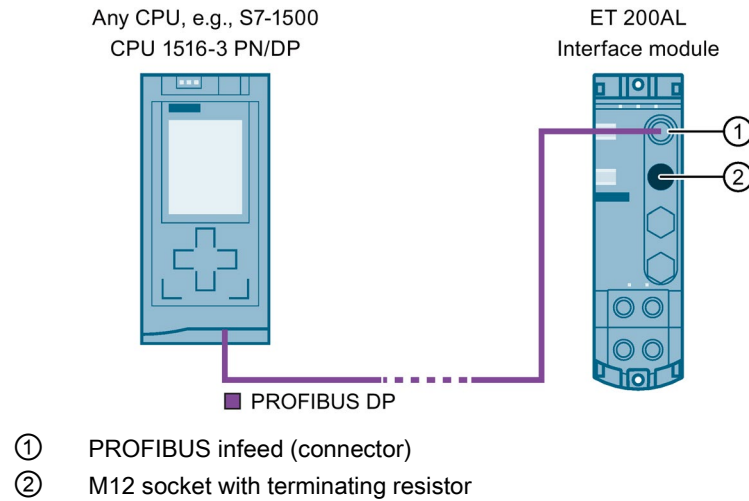


Figure 3-3 Terminating resistor

Parameters

4.1 Parameters

The following table shows the parameters for the IM 157-1 DP interface module.

Table 4- 1 Parameters

Parameters	Value range	Default ²	Efficiency range
Configuration control ¹	• Disable • Enable	Disable	ET 200AL
Startup if preset configuration does not match actual configuration	• Disable • Enable	Disable	ET 200AL
Diagnostics interrupt	• Disable • Enable	Enable	ET 200AL
Hardware interrupt	• Disable • Enable	Enable	ET 200AL
Pull/plug module interrupt	• Disable • Enable	Enable	ET 200AL

¹ Note that the "Startup if preset configuration does not match actual configuration" parameter is always activated when you use configuration control.

² The defaults apply to the default startup. If no other parameters are specified by the DP master, the interface module IM 157-1 DP starts up with these parameters.

4.2 Explanation of the parameters

Configuration control

You can use this parameter to enable the configuration control function in the ET 200AL distributed I/O system.

Note**Configuration control**

The configuration control function can only be used if you set the "Startup if preset configuration does not match actual configuration" parameter to "YES".

Note**Configuring the enable**

If you configure the enable, the ET 200AL distributed I/O system requires a control data record 196 from the user program in order for the ET 200AL distributed I/O system to operate the I/O modules.

Additional information is available in the section Configuration control (option handling).

Startup if preset configuration does not match actual configuration

Enabled parameter

If the preset/actual configuration differ, **a** data exchange occurs between the DP master and the ET 200AL distributed I/O system.

Disabled parameter

If the preset/actual configuration differ, **no** data exchange occurs between the DP master and the ET 200AL distributed I/O system.

Note**More than 16 I/O modules in real configuration per ET-Connection line**

The preset/actual configuration do not match parameter is valid for 16 I/O modules per ET-Connection line.

Up to 16 I/O modules are recognized per line. Additional I/O modules are not recognized. A diagnostics alarm is not issued for these I/O modules. All I/O modules in the actual system after the 16th I/O module remain unconfigured (LED DIAG flashes green) and are not involved in the data exchange.

Diagnostics interrupt

You can use this parameter to enable or disable diagnostics interrupts.

Hardware interrupt

You can use this parameter to enable or disable hardware interrupts.

Pull/plug module interrupt

You can use this parameter to enable or disable pull/plug module interrupts.

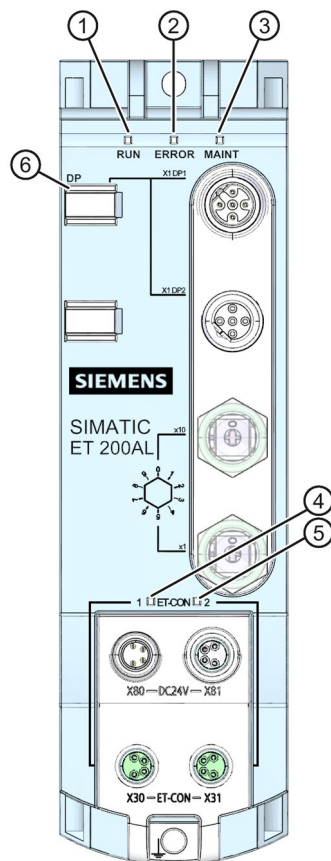
Interrupts, error messages, diagnostics and system alarms

5

5.1 Status and error displays

LED displays

The figure below shows the LED displays (status and error displays) of the IM 157-1 DP interface module.



- | | | |
|---|---------|----------|
| ① | RUN | (green) |
| ② | ERROR | (red) |
| ③ | MAINT | (yellow) |
| ④ | ET-CON1 | (green) |
| ⑤ | ET-CON2 | (green) |
| ⑥ | DP | (green) |

Figure 5-1 LED displays

Meaning of the LEDs

The following tables set out the meaning of the status and error displays. Corrective measures for diagnostics alarms can be found in the section Diagnostics alarms (Page 35).

LED RUN, LED ERROR, LED MAINT

Table 5- 1 Status and error displays of the LEDs RUN, ERROR, MAINT

LEDs			Meaning	Solution
RUN	ERROR	MAINT		
 Off	 Off	 Off	Supply voltage at interface module missing or too low	Check the supply voltage or switch it on on the interface module.
 On	 On	 On	Test of LEDs during startup: The three LEDs light up simultaneously for approximately 0.25 s.	-
 Flashes	 Off	 Off	Interface module is deactivated.	Activate the interface module with the configuration software or the user program.
			Interface module is not configured.	Configure the interface module with the configuration software.
			ET 200AL starts up.	-
			ET 200AL is being assigned parameters.	-
 On	Not relevant	Not relevant	ET 200AL is currently exchanging data with the DP master.	-
Not relevant	 Flashes	Not relevant	Group error and group error channels	Evaluate the diagnostics and eliminate the error.
			The preset configuration does not correspond to the actual configuration of the ET 200AL.	Check the configuration of the ET 200AL to see whether a module is missing, defective or if a module that is not configured is connected to ET-CON1 or ET-CON2.
			Parameter assignment error in the I/O module	Evaluate the display of the module status in STEP 7 or in STEP 7 (TIA portal) and correct the errors in the I/O module.
Not relevant	Not relevant	 On	Maintenance is demanded.	Execute maintenance
 Flashes	 Flashes	 Flashes	Hardware or firmware faulty. ¹	Replace the interface module.
 Flashes	Not relevant	Not relevant	Firmware is loading (all LEDs remain in their current state while the firmware update is being written)	---

¹ LED DP off

DP LED

Table 5- 2 Status display of the DP LED

DP LED	Meaning	Solution
 Off	There is no connection between the PROFIBUS interface of your PROFIBUS device and a communication partner (e.g. DP master).	Check whether the bus cable to the DP master is disconnected.
 On	There is no connection between the PROFIBUS interface of your PROFIBUS device and a communication partner (e.g. DP master).	-

LED ET-CON1, LED ET-CON2

Table 5- 3 Status displays of the LEDs ET-CON1 and ET-CON2

LEDs		Meaning	Solution
ET-CON1	ET-CON2		
 Off		There are no I/O modules available at the respective ET-Connection or the modules do not have supply voltage.	Check the wiring for the ET-Connection or the supply voltage for the I/O module.
 On		A communications connection to at least one IO module at the corresponding ET-Connection is available.	-

5.2 Interrupts

5.2.1 Evaluating interrupts

Introduction

With certain process statuses/errors, the DP slave in each case creates an interrupt block with the corresponding information in the diagnostics frame (DPV1 interrupt mechanism). Regardless of this, the diagnostic status of the DP slave is displayed in the identifier-related diagnostics, in the module status, and in the channel diagnostics.

Interrupts in DPV1 mode

The ET 200AL distributed I/O system supports the following interrupts:

- Diagnostics interrupts
- Hardware interrupts
- Pull/plug module interrupt

5.2.2 Trigger a diagnostics interrupt

For an incoming or outgoing event (for example, wire break on a channel of an I/O module), the interface module triggers a diagnostics interrupt if the I/O modules were configured accordingly and "Enable:diagnostics interrupt" is set.

The CPU interrupts user program execution and processes the diagnostics interrupt OB (OB 82). The event that triggered the interrupt is entered in the start information of the diagnostics interrupt OB.

5.2.3 Triggering a hardware interrupt

When a hardware interrupt occurs, the CPU interrupts execution of the user program and processes the hardware interrupt OB, for example OB 40. The event that triggered the interrupt is entered in the start information of the hardware interrupt OB.

Note

Diagnostics "Hardware interrupt lost" (from I/O module)

Do not use hardware interrupts for technological purposes (e.g., cyclical generation of hardware interrupts).

If the hardware interrupt load is too high, hardware interrupts can get lost depending on the number of I/O modules and the communication load.

5.2.4 Triggering an insert/remove module interrupt

When an insert/remove module interrupt occurs, the CPU interrupts execution of the user program and processes the insert/remove module interrupt OB (OB 83). The event that triggered the interrupt is entered in the start information of the insert/remove OB.

The pull/plug OB (OB 83) is also triggered for all subsequent I/O modules, because the ET-Connection and/or the power supply is interrupted.

5.2.5 Structure of data records

Definition

The interrupt section of the slave diagnostics indicates the interrupt type and the event that led to an interrupt being triggered. The interrupt section comprises 62 bytes including an interrupt header.

Position in the diagnostics frame

The interrupt section is located after the channel diagnostics.

Data records

The diagnostics data of a module are located in the data records 0 and 1:

- Data record 0 contains 4 bytes of diagnostics data that describe the current status of the distributed I/O system. Data record 0 is part of the header information of the OB 82 (local data bytes 8 to 11).
- Data record 1 contains 4 bytes of diagnostics data that are also available in data record 0.

The figure below shows the structure of data record 0.

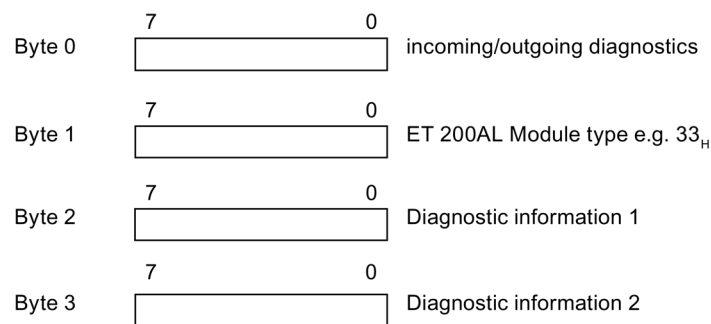


Figure 5-2 Structure of data record 0

5.2 Interrupts

The figure below shows the structure of data record 1.

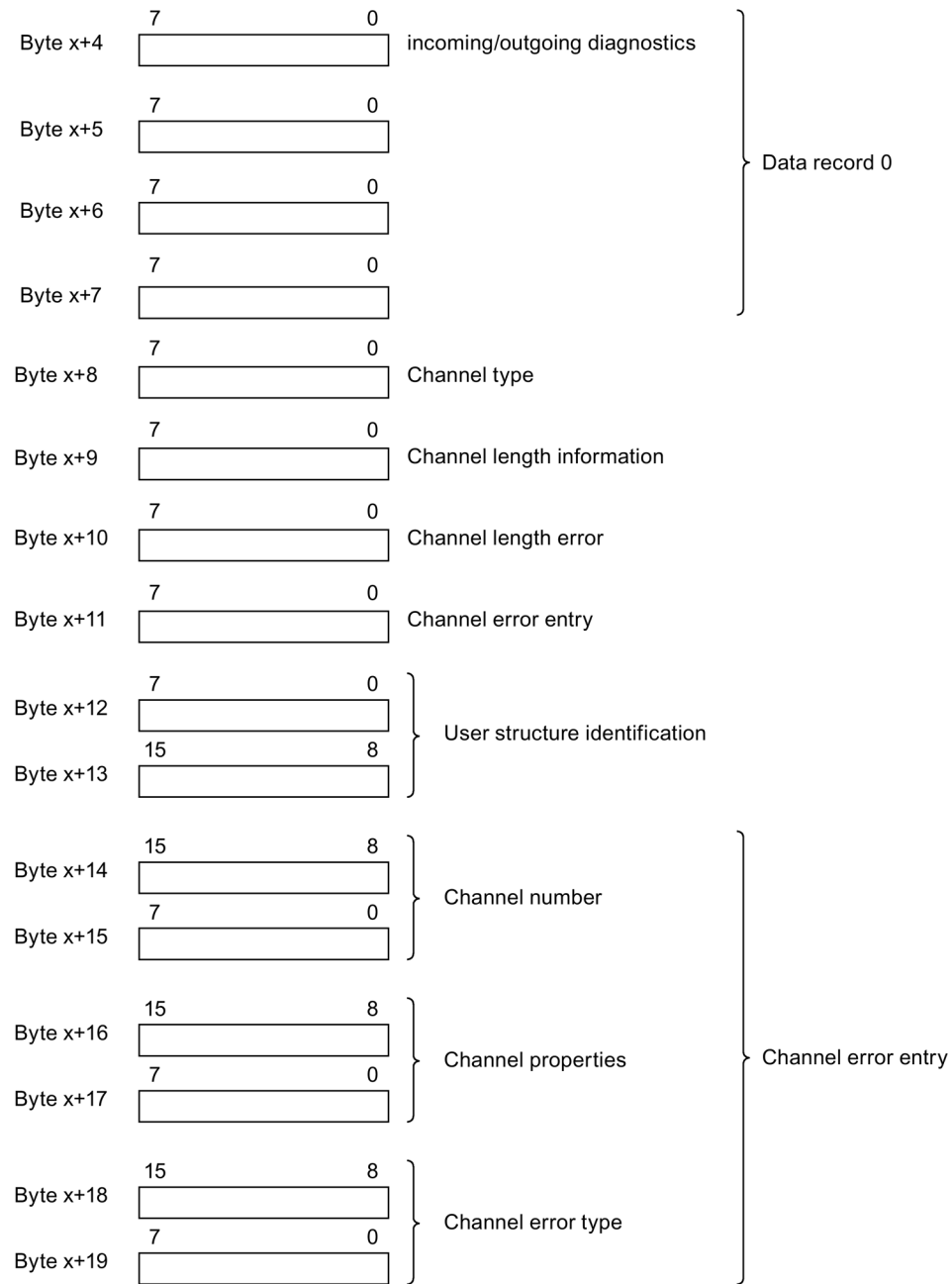


Figure 5-3 Structure of data record 1

Reading data records

You have the option to read out data records 0 and 1 via SFC 59 (RD_REC) or SFB 52 (RDREC). The data length of data record 1 is up to 240 bytes. In this case, data record 1 contains up to 38 channel fault entries.

Note the figures below in this section.

Contents

The contents of the interrupt information depend on the interrupt type:

- In the case of diagnostics interrupts, diagnostics data record 1 (up to 58 bytes) is sent as interrupt status information (starting from byte x+4).
- The length of the interrupt status information for hardware interrupts is 4 bytes.

Structure of interrupts

The figure below shows the structure of the interrupt section for the ET 200AL distributed I/O system.

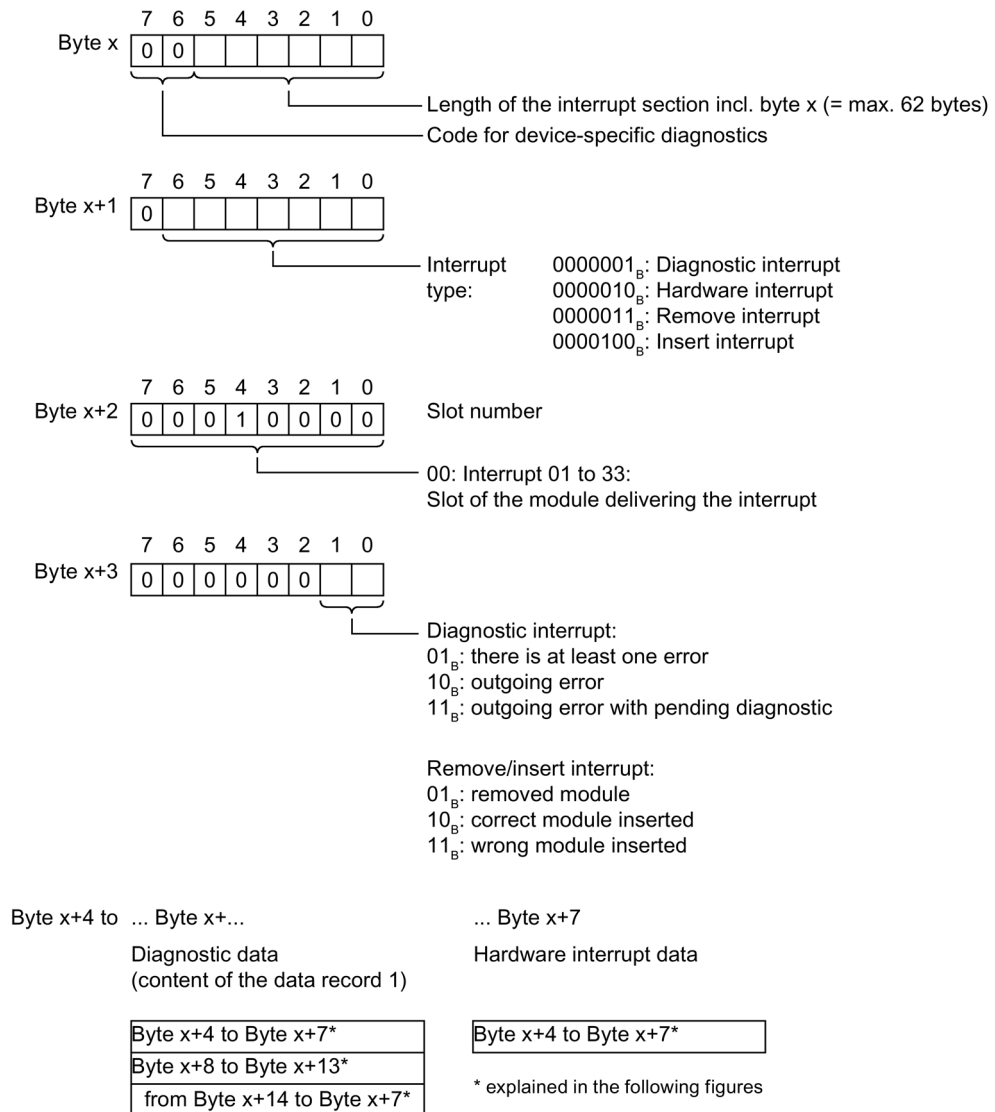


Figure 5-4 Structure of the interrupt status of the interrupt section

Diagnostics interrupt, byte x+4 to x+7

The figure below shows the structure of the diagnostics interrupt of byte x+4 to byte x+7.

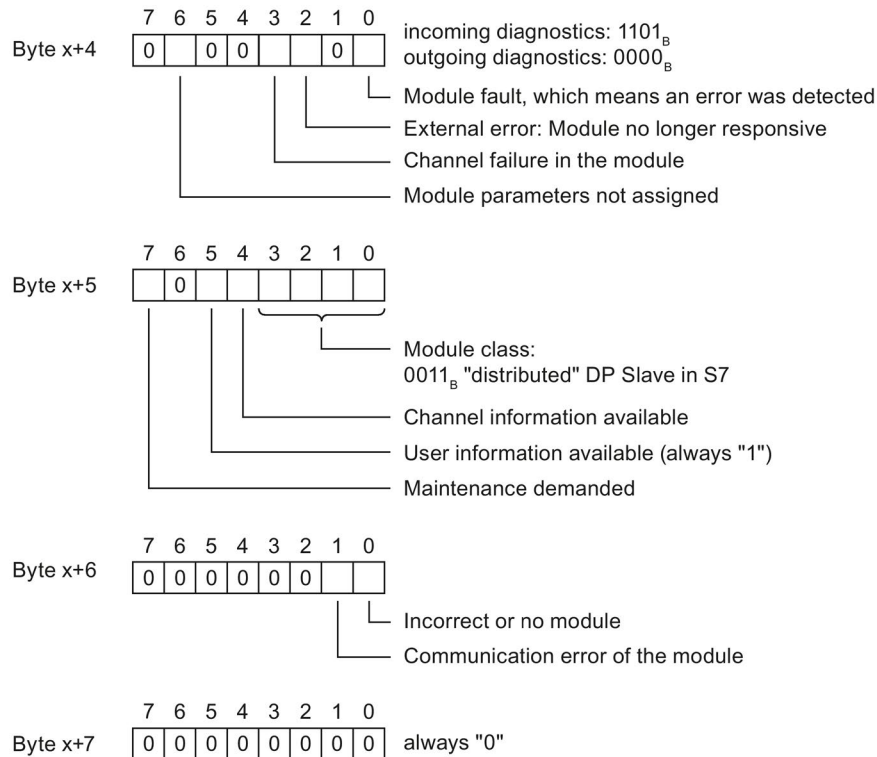


Figure 5-5 Structure of bytes x+4 to x+7 for diagnostics interrupt

Diagnostics interrupt, starting at byte x+8

The figure below shows the structure of the diagnostics interrupt starting at byte x+8.

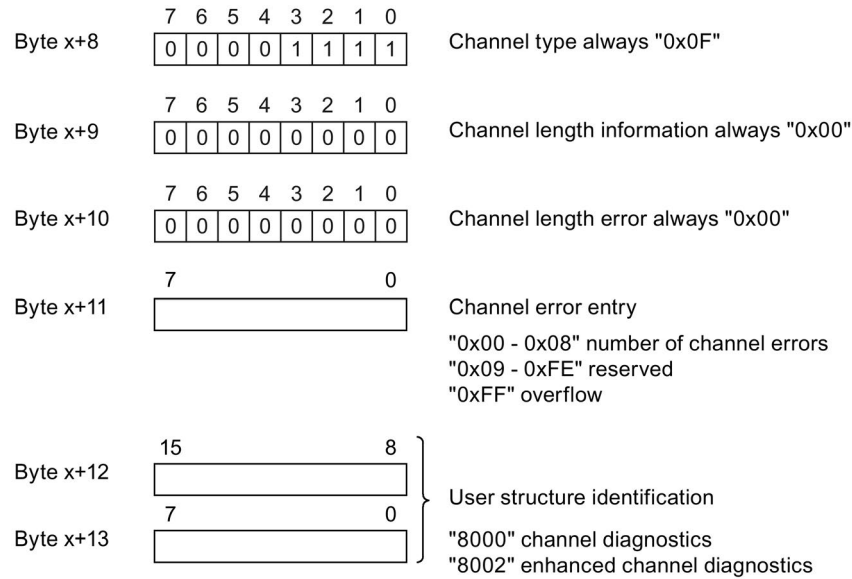


Figure 5-6 Structure starting at byte x+8

Diagnostics interrupt from the modules, starting at byte x+14

The channel error entries start from byte x+14. A channel fault entry is 6 bytes long and can follow 8 times starting at byte x+14.

If you read the channel faults with an SFB or SFC, then 38 channel diagnostics are possible.

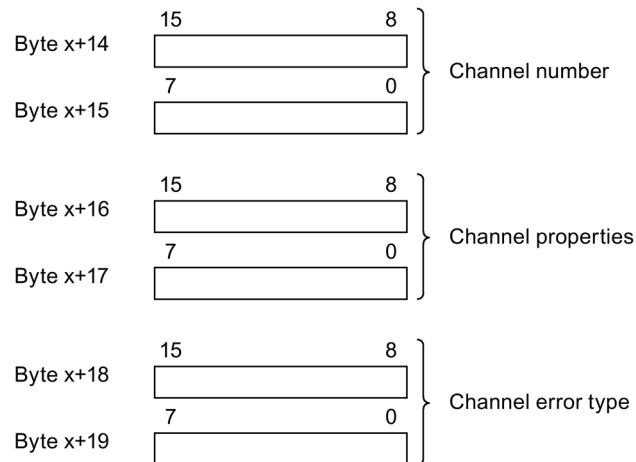


Figure 5-7 Structure starting from byte x+14

5.2 Interrupts

The following table is used to explain the channel error entries.

	Description	
Channel number	0 ... 63: Channel number for channel error 0x8000: Entire submodule	
Channel properties	Bits 0 to 7	00 _H : Free data type 01 _H : bit 02 _H : 2 bit 03 _H : 4 bit 04 _H : byte 05 _H : word 06 _H : double word 07 _H to FF _H : Reserved
	Bit 8	0: Channel 1: Channel group
	Bit 9, 10	00 _H : Diagnostics 01 _H : Maintenance demanded 02 _H : Maintenance required 03 _H : Reserved
	Bit 11, 12	00 _H : Channel error-free 01 _H : Incoming diagnostics 02 _H : Outgoing diagnostics 03 _H : Outgoing diagnostics, but other diagnostics are also pending on this channel
	Bits 13 to 15	00 _H : Reserved 01 _H : Input channel 02 _H : Output channel 03 _H : Input/output channel
Channel error type	Explanations are available in the device manuals, in the section "Diagnostic alarms".	

Example of a diagnostics interrupt

The figure below shows an example of a diagnostics interrupt.

Example:

I/O module AI 4xU/I/RTD reports on channel 1 the diagnostic interrupt
"High limit exceeded"

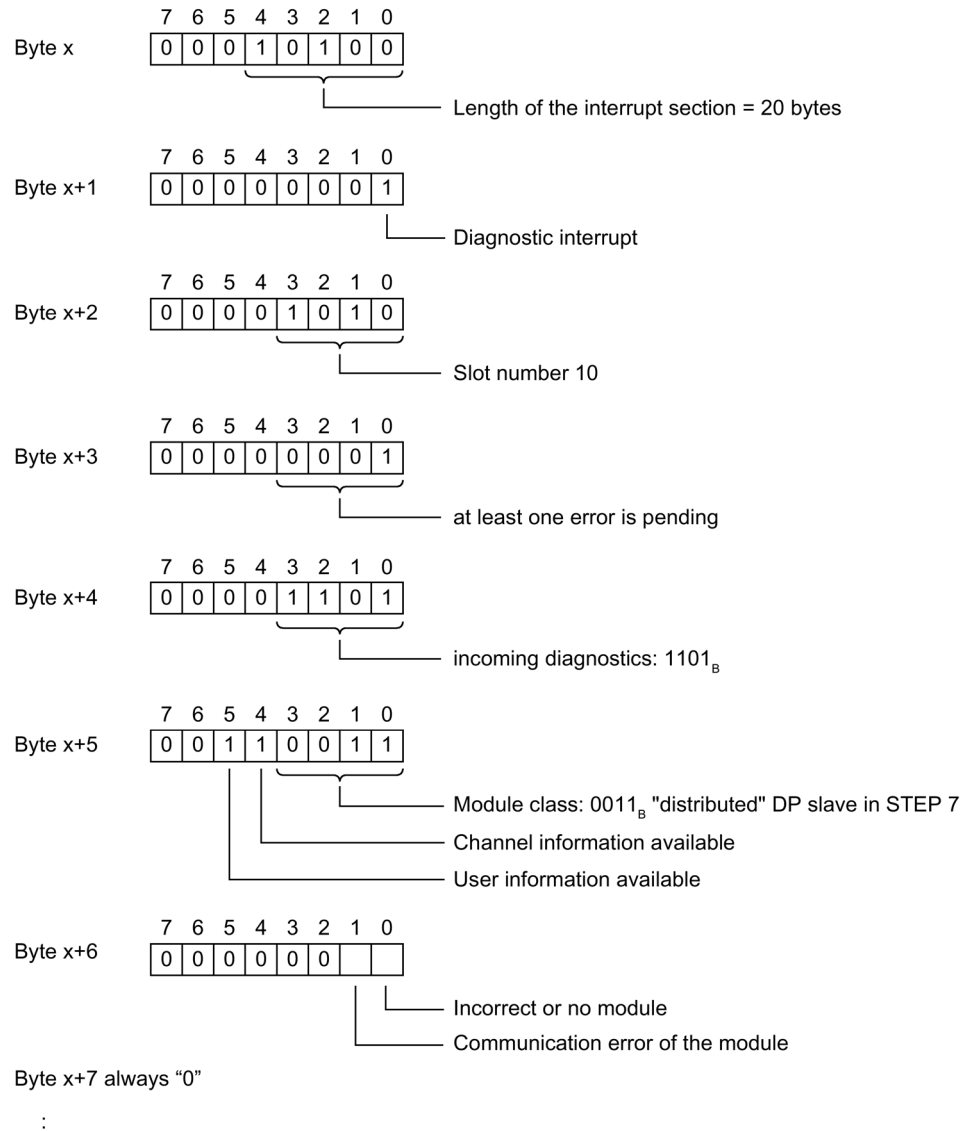


Figure 5-8 Example of a diagnostics interrupt (part 1)

5.2 Interrupts

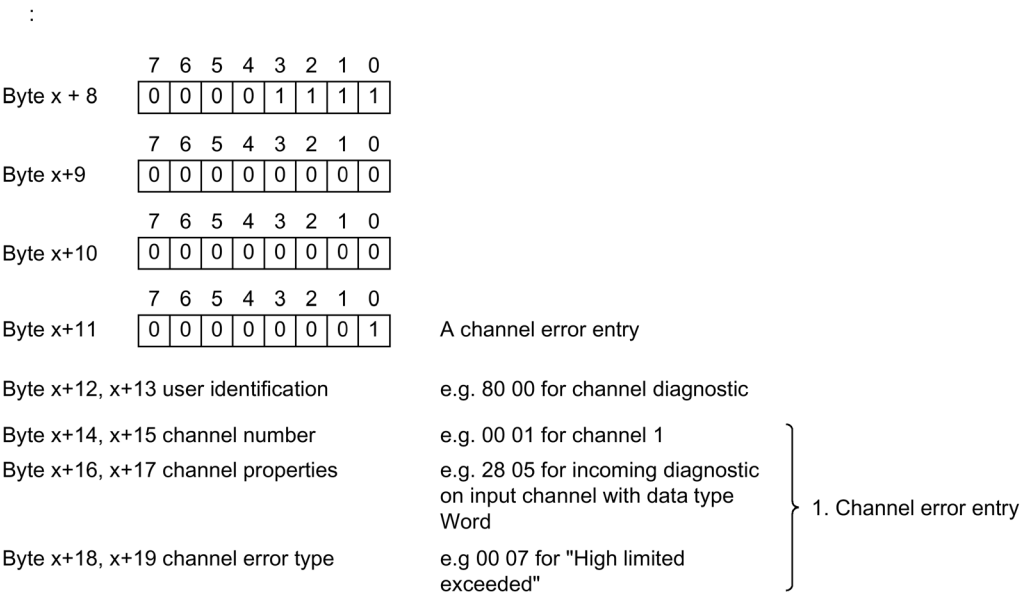


Figure 5-9 Example of a diagnostics interrupt (part 2)

Hardware interrupt of digital and analog input modules, bytes x+4 to x+7

The figure below shows the structure of a hardware interrupt.

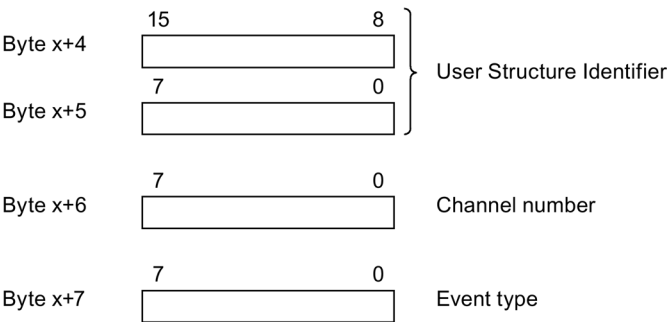


Figure 5-10 Structure as of Byte x+4 for hardware interrupt

Note

Byte x+4

You will find the event type in the device manual of the module that triggered the hardware interrupt.

5.3 Alarms

5.3.1 Diagnostics alarms

Actions after a diagnostics alarm in DPV1 mode

The error is entered in the channel diagnostics in the diagnostics frame:

- In DPV1 mode, diagnostics can be reported as diagnostics interrupts.
- After a diagnostics alarm, this is
 - entered in the diagnostics frame as a diagnostics interrupt block (always only one interrupt).
 - Stored in the diagnostics buffer of the CPU.
- The ERROR LED of the interface module flashes.
- OB 82 is called. If OB 82 is not available, the CPU goes into STOP mode.
- Acknowledgment of the diagnostics interrupt (a new interrupt is possible thereafter).

Length of the diagnostics frame

- The maximum frame length for the ET 200AL distributed I/O system with IM157-1 DP interface module (DPV1 mode) is 244 bytes.
- The minimum frame length is 6 bytes.

Reading out the diagnostics data

Table 5- 4 Reading the diagnostics with STEP 7

Automation system with DP master	Application	See...
SIMATIC S7/M7	Slave diagnostics in plain text in "DP Slave Diagnostics" tab on STEP 7 interface	"Hardware diagnostics" in STEP 7 online help
	"DP NRM_DG" instruction (SFC 13) Reading out slave diagnostics (store in the data area of the user program)	SFC: see STEP 7 online help
	"RD_REC" instruction (SFC 59) Reading out data records of the S7 diagnostics data (store in the data area of the user program)	See System and Standard Functions reference manual
	"RDREC" instruction (SFC 52) Reading data records from the DP slave	SFB: refer to STEP 7 online help (system functions/function blocks)
	"RALRM" instruction (SFC 54) Receiving interrupts from the interrupt OBs	SFB: refer to STEP 7 online help (system functions/function blocks)

5.3.2 Slave diagnostics

The figure below shows the structure of the slave diagnostics.

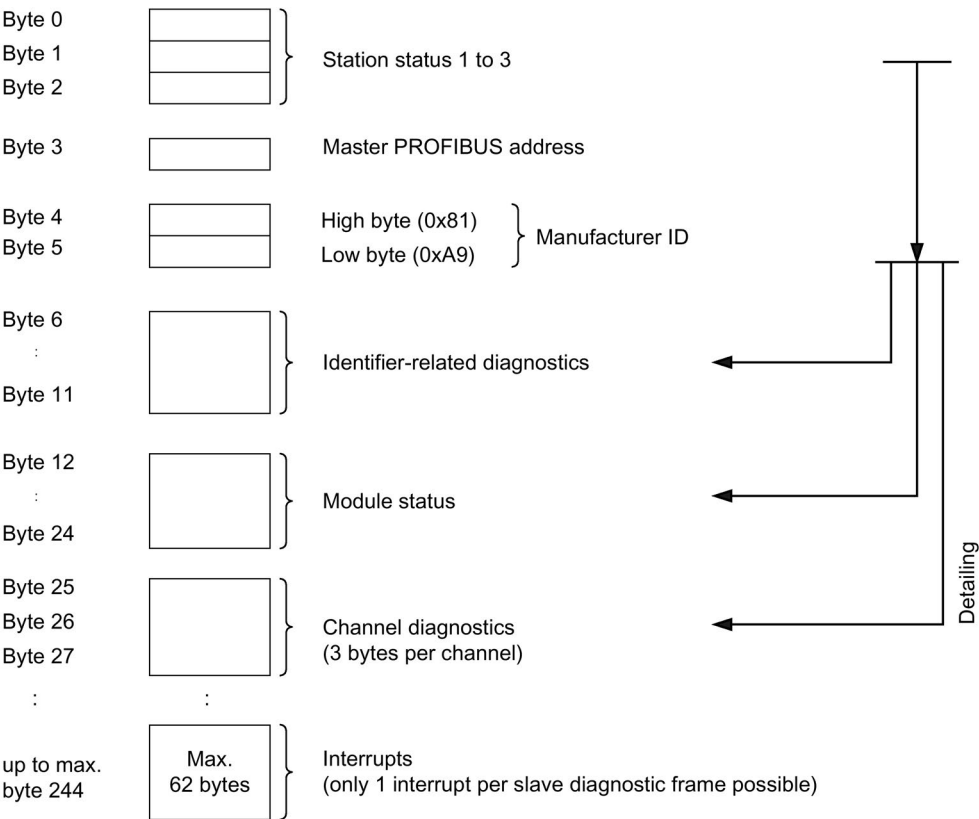


Figure 5-11 Structure of the slave diagnostics

Note

The length of the diagnostics frame varies with the IM 157-1 DP (depending on parameter assignment) between 6 and 244 bytes in DPV1 mode.

You can identify the length of the last received diagnostics frame in STEP 7 from the RET_VAL parameter in SFC 13.

5.3.3 Station statuses 1 to 3

The following tables show station status 1 to 3 and provide an overview of the status of a DP slave.

Structure of station status 1 (byte 0)

Table 5- 5 Structure of station status 1 (byte 0)

Bit	Meaning	Cause/Solution
0	1: The DP slave is not responding to the DP master.	• Correct PROFIBUS address set on the DP slave? • Bus connector connected? • Is the DP slave connected to the voltage supply? • RS485 repeater properly configured?
1	1: The DP slave is not yet ready to exchange data.	• Wait; the DP slave is currently starting up.
2	1: The configuration data transferred from the DP master to the DP slave does not match the DP slave configuration.	• Has the correct station type or the correct DP slave configuration been entered in the configuration software?
3	1: External diagnostics is available. (Group diagnostics display)	• Evaluate the ID-specific diagnostics, the module status, and/or the channel diagnostics. As soon as all errors have been eliminated, bit 3 is reset. The bit is set again when there is a new diagnostics alarm in the bytes of the aforementioned diagnostics.
4	1: The requested function is not supported by the DP slave (e.g. changing the PROFIBUS address using software).	• Check the configuration.
5	1: The DP master cannot interpret the response of the DP slave.	• Check the bus configuration.
6	1: The DP slave type does not match the software configuration.	• Has the correct station type been entered in the configuration software?
7	1: Parameters have been assigned to the DP slave by a different DP master (not the one that currently has access to the DP slave).	• The bit is always 1, for example, if you access the DP slave with the programming device or another DP master. • The PROFIBUS address of the DP master that assigned parameters to the DP slave is located in the "Master PROFIBUS address" diagnostics byte.

Structure of station status 2 (byte 1)

Table 5- 6 Structure of station status 2 (byte 1)

Bit	Meaning	
0	1:	The DP slave parameters need to be reassigned.
1	1:	A diagnostics alarm is pending. The DP slave will not operate until the problem is eliminated (static diagnostics alarm).
2	1:	The bit on the DP slave is always "1".
3	1:	The watchdog is activated for this DP slave.
4	1:	The DP slave has received the control command "FREEZE". ¹
5	1:	The DP slave has received the control command "SYNC". ¹
6	0:	Bit is always "0".
7	1:	The DP slave is disabled, that is, it has been removed from the processing in progress.
¹ The bit is updated only if another diagnostics alarm also changes.		

Structure of station status 3 (byte 2)

Table 5- 7 Structure of station status 3 (byte 2)

Bit	Meaning	
0 to 6	0:	Bits are always set to "0".
7	1:	- There are more diagnostic alarms pending than the DP slave is able to store. - The DP master cannot enter all the diagnostics alarms sent by the DP slave in its (channel) diagnostics buffer.

5.3.4 Master PROFIBUS address

The following is stored in the diagnostic byte Master PROFIBUS address:

- The PROFIBUS address of the DP master that assigned the parameters to the DP slave.
- The PROFIBUS address of the DP master that has read and write access to the DP slave.

The master PROFIBUS address is found in byte 3 of the slave diagnostics.

5.3.5 Manufacturer ID

The manufacturer ID contains a code specifying the type of the DP slave.

The following table shows the structure of the manufacturer ID (bytes 4, 5).

Table 5- 8 Description of the manufacturer ID

Byte 4	Byte 5	Manufacturer ID
81 _H	A9 _H	IM 157-1 DP interface module

5.3.6 Identifier-related diagnostics

The identifier-related diagnostics indicates whether modules of the ET 200AL distributed I/O system have errors or not. Identifier-related diagnostics starts at byte 6 and comprises 6 bytes.

The figure below shows how the identifier-related diagnostics for the ET 200AL distributed I/O system is structured with the IM 157-1 DP interface module.

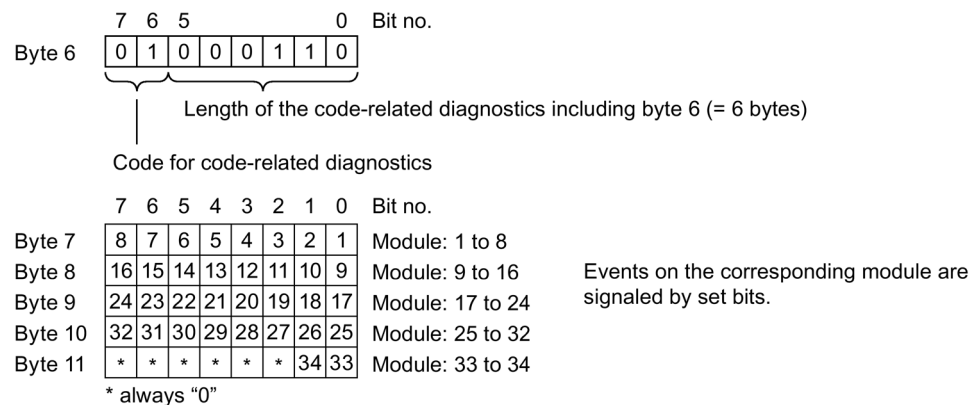


Figure 5-12 Structure of the identifier-related diagnostics

5.3.7 Module status

The module status indicates the status of the configured modules and provides more information on the identifier-related diagnostics with respect to the configuration. The module status begins after the identifier-related diagnostics and comprises 13 bytes.

The figure below shows how the module status for the ET 200AL distributed I/O system is structured with the IM 157-1 DP interface module.

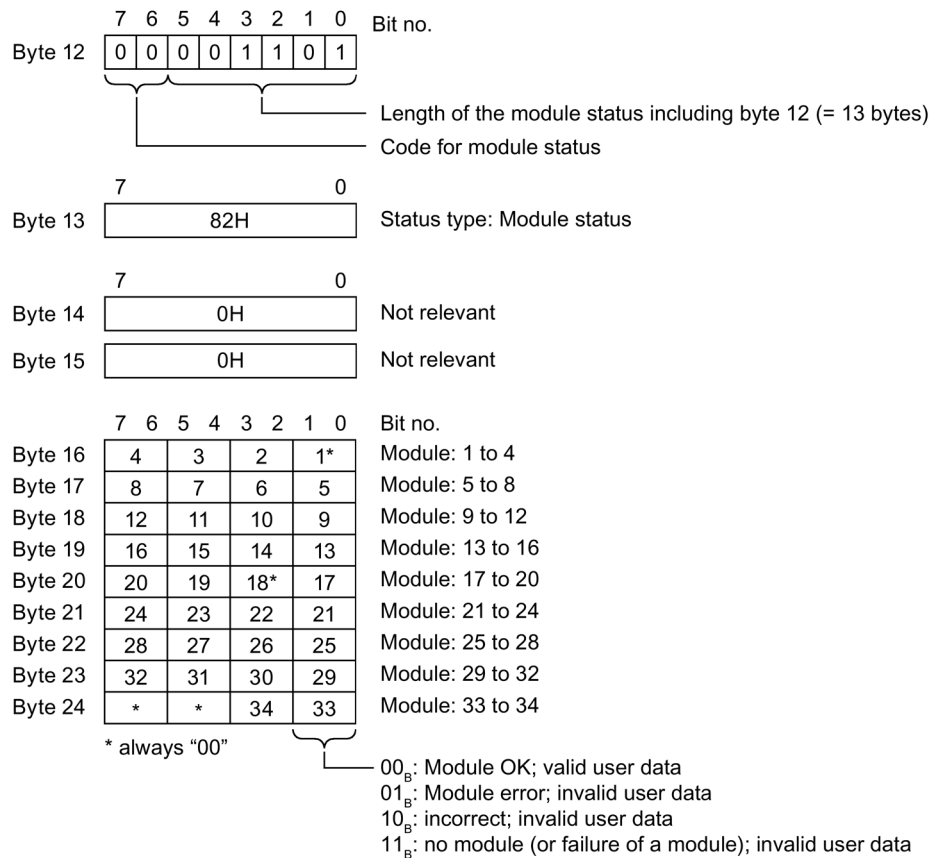


Figure 5-13 Module status structure

5.3.8 Channel diagnostics

Function

Channel diagnostics provides information about channel errors in modules and details of the identifier-related diagnostics. Channel diagnostics begins after the module status. Channel diagnostics does not affect the module status.

The figure below shows how the channel diagnostics for the ET 200AL distributed I/O system is structured with the IM 157-1 DP interface module.

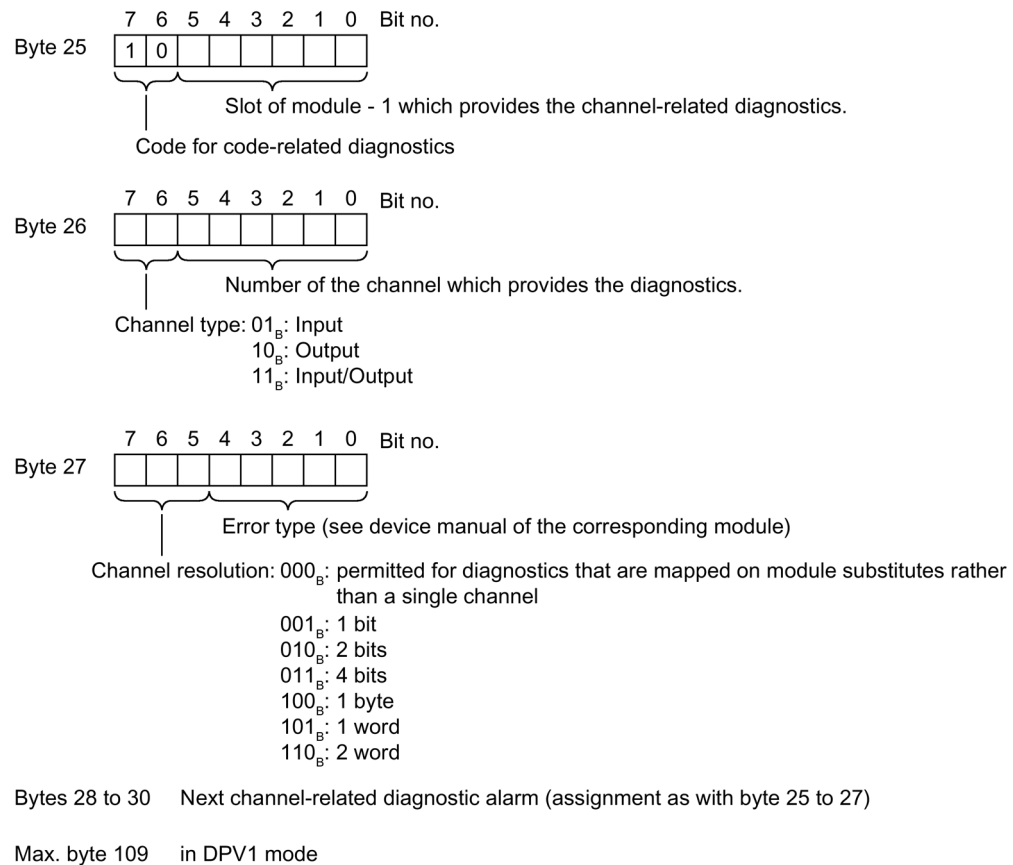


Figure 5-14 Structure of channel diagnostics

Technical specifications

Technical specifications of the interface module IM 157-1 DP

	6ES7157-1AA00-0AB0
General information	
Product type designation	IM 157-1 DP
Hardware functional status	E01
Firmware version	V1.0.x
Vendor identifier (VendorID)	81A9H
Product function	
I&M data	Yes; I&M0 to I&M3
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	as of STEP 7 V13 SP1
STEP 7 can be configured/integrated as of version	V5.5 SP4 Hotfix 3 or higher
PROFIBUS as of GSD version/GSD revision	GSD as of revision 5
Configuration control	
Via data record	Yes
Supply voltage	
Load voltage 1L+	
Rated value (DC)	24 V
Low limit of permitted range (DC)	20.4 V
High limit of permitted range (DC)	28.8 V
Reverse polarity protection	Yes; against destruction
Input current	
Current consumption (rated value)	50 mA
From load voltage 1L+ (unswitched current)	4 A; maximum value
From load voltage 2L+, max.	4 A; maximum value
Power loss	
Power loss, typ.	1.7 W
Address area	
Address space per station	
Address space per station, max.	244 bytes
Interfaces	
Number of PROFIBUS interfaces	1
1st interface	
Interface type	PROFIBUS DP

	6ES7157-1AA00-0AB0
Interface hardware	
RS 485	Yes
M12 port	Yes; 2x M12 b-coded
Protocols	
PROFIBUS DP slave	Yes
Interface hardware	
RS 485	
Transmission rate, max.	12 Mbps
Protocols	
PROFIBUS	
Services	
• SYNC capability	Yes
• FREEZE capability	Yes
• Direct data exchange (data exchange broadcast)	Yes
• DPV0	Yes
• DPV1	Yes
Interrupts/diagnostics/status information	
Interrupts	Yes
Diagnostics functions	Yes
Diagnostics indicator LED	
RUN LED	Yes; green LED
ERROR LED	Yes; red LED
MAINT LED	Yes; yellow LED
Connection display DP	Yes; green LED
Electrical isolation	
Between load voltages	Yes
between PROFIBUS DP and all other circuit components	Yes
Insulation	
Insulation tested with	707 V DC (type test)
Degree of protection and protection class	
Degree of protection according to EN 60529	
• IP65	Yes
• IP67	Yes
Ambient conditions	
Ambient temperature during operation	
Min.	-25 °C
Max.	55 °C

	6ES7157-1AA00-0AB0
Connection technology	
Power supply	M8, 4-pin
ET-Connection	
ET-Connection	M8, 4-pin, shielded
Dimensions	
Width	45 mm
Height	159 mm
Depth	46 mm
Weights	
Weight, approx.	211 g

Dimension drawing

The figure below shows the dimension drawing of the IM 157-1 DP interface module in the front and side view.

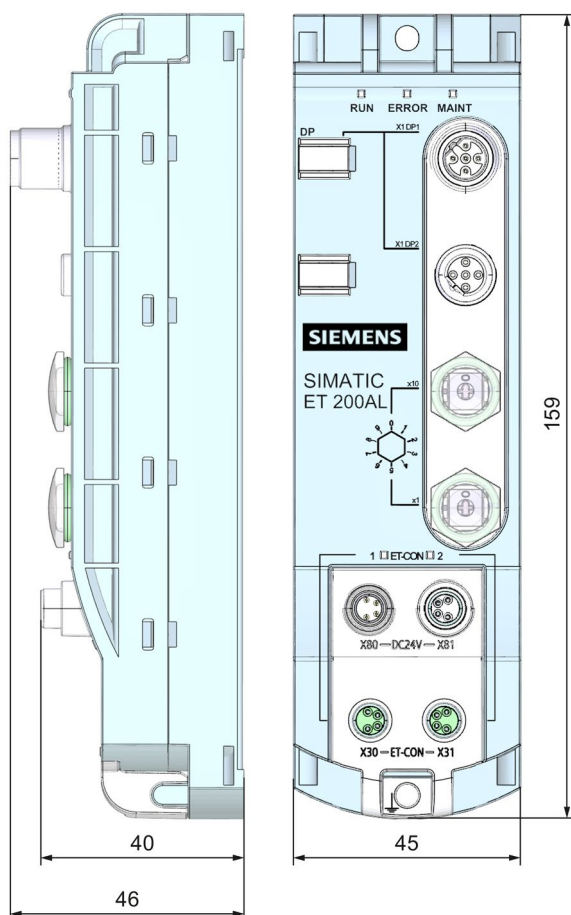


Figure A-1 Dimension drawing

Cycle times

The following figure shows the cycle times at ET-Connection based on the number of I/O modules.

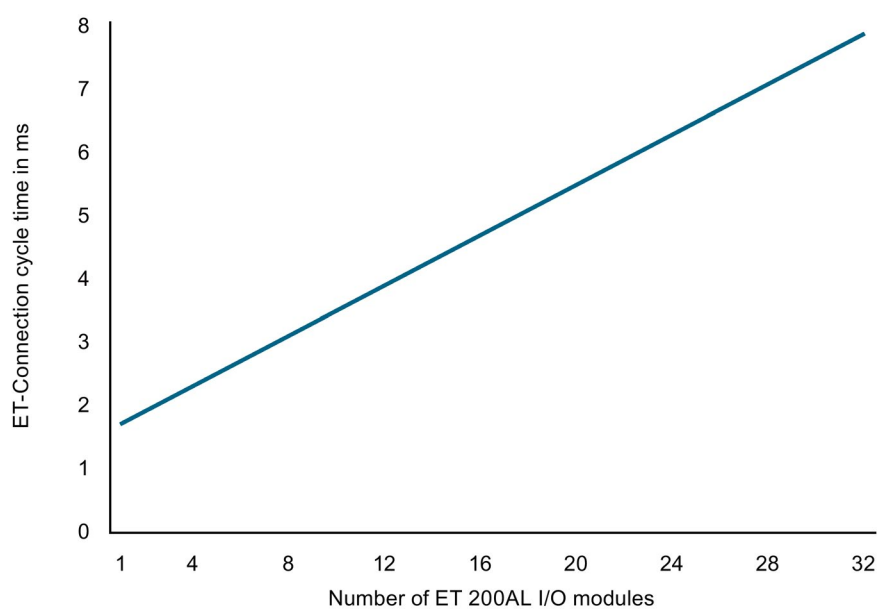


Figure B-1 Cycle times

The cycle time is independent of the PROFIBUS transmission rate.