SIEMENS

SENTRON

Measuring Devices 7KM

Manual Module PAC 4DI/2DO

Edition 10/2018

siemens.com/lowvoltage

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SENTRON

7KM measuring device
PAC 4DI/2DO expansion module

Manual

Legal information

Warning notice system

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.

> ⚠ **CAUTION**
>
> indicates that minor personal injury can result if proper precautions are not taken.

> **NOTICE**
>
> indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

> ⚠ **WARNING**
>
> Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Disclaimer of Liability

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.

Table of contents

Introduction

<div style="text-align: right; font-size: 3em;">1</div>

1.1 Scope of delivery

Included in package:

- 1 x 7KM PAC 4DI/2DO expansion module
- 1 x operating instructions

1.2 Latest information

Up-to-the-minute information

You can find further support on the Internet:

Website (https://support.industry.siemens.com/my/ww/en/requests)

Information about third-party software

This product, solution or service ("product") includes the third-party software components listed below. This is either open source software that is licensed under a license approved by the Open Source Initiative (www.opensource.org (https://opensource.org/)), or under a license ("OSS") defined as comparable by Siemens, and/or it is commercial software or freeware. With regard to the OSS components, the relevant OSS license conditions take precedence over all other conditions applicable to this product. SIEMENS makes the OSS components of this product available to you at no extra cost.

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Siemens AG

Energy Management, Low Voltage & Products

Siemensstrasse 10

93055 Regensburg

Germany

Internet: Technical Assistance (https://support.industry.siemens.com/My/ww/en/requests)

Subject: Open source request (please state product name and version, as applicable)

SIEMENS can charge a fee of up to 5 euros for processing the request.

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Safety information

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

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions only form one element of such a concept.

The customer is responsible for preventing unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the Internet if necessary and only to the extent necessary and with appropriate protective measures (e.g. use of firewalls and network segmentation) in place.

Additionally, Siemens' guidelines on appropriate security measures should be observed. For more information about industrial security, please visit

Industrial security (http://www.siemens.com/industrialsecurity)

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends applying product updates as soon as they are available and always using the latest product versions. Using versions that are obsolete or are no longer supported can increase the risk of cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at

Siemens Industrial Security RSS Feed (http://www.siemens.com/industrialsecurity).

General safety information

⚠ DANGER
Hazardous voltage.
Will cause death or serious injury.
Turn off and lock out all power supplying this equipment before working on this device.

Note

Only qualified personnel are allowed to install, commission or service this device.

- Wear the prescribed protective clothing.
- Observe the general equipment regulations and safety regulations for working on high-voltage installations (e.g. DIN VDE, NFPA 70E) as well as national or international regulations.
- Check that all connections are correctly made before startup.
- Before power is applied to the device for the first time, it must have been located in the operating area for at least two hours in order to reach temperature balance and avoid humidity and condensation.
- The limits given in the technical data must not be exceeded even during commissioning or testing.
- Condensation on the device is not permissible during operation.

Note

These operating instructions do not purport to cover all details or variations in equipment, or to provide for every possible contingency in connection with installation, operation, or maintenance. Should additional information be desired, or should particular problems arise that are not handled in detail in the operating instructions, please contact Technical Support for the information you require.
Technical Support (https://support.industry.siemens.com/My/ww/en/requests).

Description

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2.1   Area of application

The expansion module has been designed for use in combination with the 7KM PAC devices. The guidelines for the 7KM PAC devices also apply to the expansion module.

2.2   Performance features of the PAC 4DI/2DO module

You expand the digital inputs and digital outputs of measuring devices with the SENTRON PAC 4DI/2DO expansion module.

Overview:

- Plug-in expansion module for SENTRON PAC devices
- Does not require an external power supply
- Configuration via:
    - SENTRON PAC Power Monitoring Device
    - SENTRON powerconfig
- Connected using screw terminals
- Four digital inputs with:
    - Functions as on the SENTRON PAC
    - Active input circuit.
      This enables optional connection without an external power supply.
- Two digital outputs with:
    - Functions as on the SENTRON PAC

2.3 Design
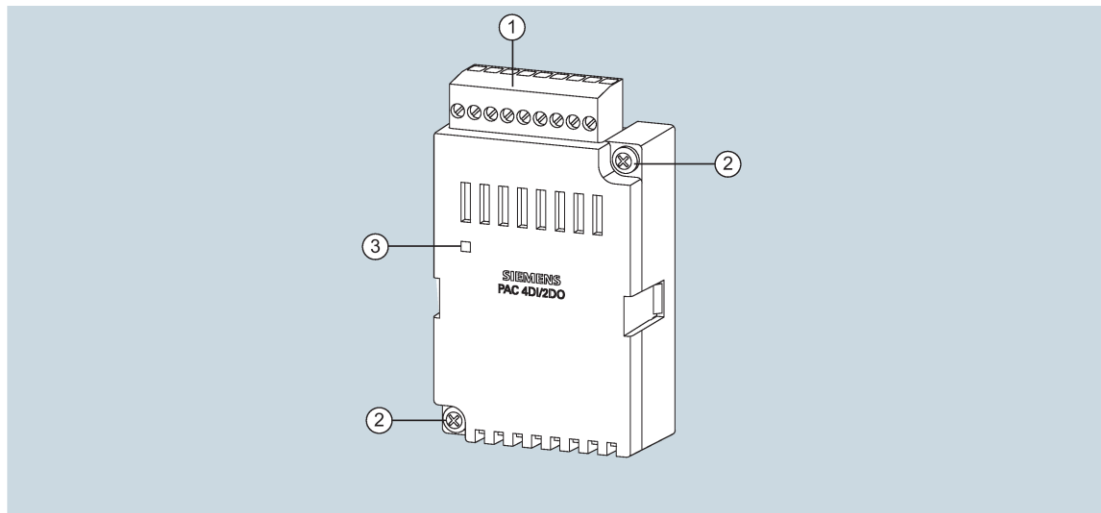
①   Screw terminals
②   Screws for installing the 4DI/2DO expansion module
③   Diagnostic LED

Diagnostic LED

The diagnostic LED indicates the communication status.

LED

- Static ON (green)

  The PAC 4DI/2DO expansion module is ready for operation.

- OFF

  The PAC 4DI/2DO expansion module is not ready for operation.

Installation

<div style="text-align: right; font-size: large;">3</div>

3.1 Warning

⚠ WARNING
Hazardous voltage.
The use of damaged devices may result in death, serious injury, or property damage.

3.2 Installation location

The expansion module is inserted in the slot labeled "MOD1" and/or "MOD2" on the rear panel of the PAC devices.

NOTICE
Condensation may cause the device to malfunction.
The device must be in the operating environment for at least two hours before use to prevent condensation due to sudden temperature changes.

3.3 Installation steps

Install the expansion module before starting up the PAC device.

⚠ CAUTION
Electrostatic discharge
The expansion modules contain electronic components that can be irreparably damaged by electrostatic discharge.
When handling modules, make sure that all objects in the handling environment (persons, workstation and packaging) are properly grounded. Do not touch the module contacts.

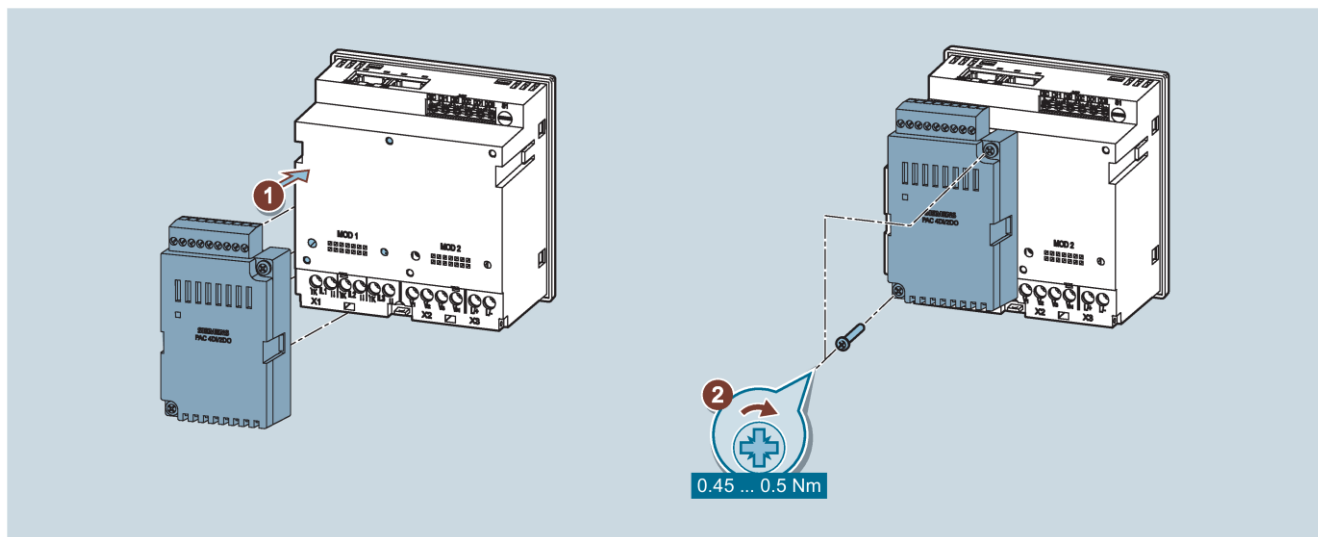| NOTICE |
|---|
| **Overheating of the device** |
| The expansion module can overheat if the ventilation slits are covered. Overheating shortens the service life of the expansion module. |
| Ensure that the ventilation slits are not covered. |

Figure 3-1   Mounting the expansion module

Connection

4

4.1   Safety information

> ⚠️ **DANGER**
>
> **Hazardous voltage.**
>
> **Will cause death or serious injury.**
>
> Turn off and lock out all power supplying this equipment before working on this device.
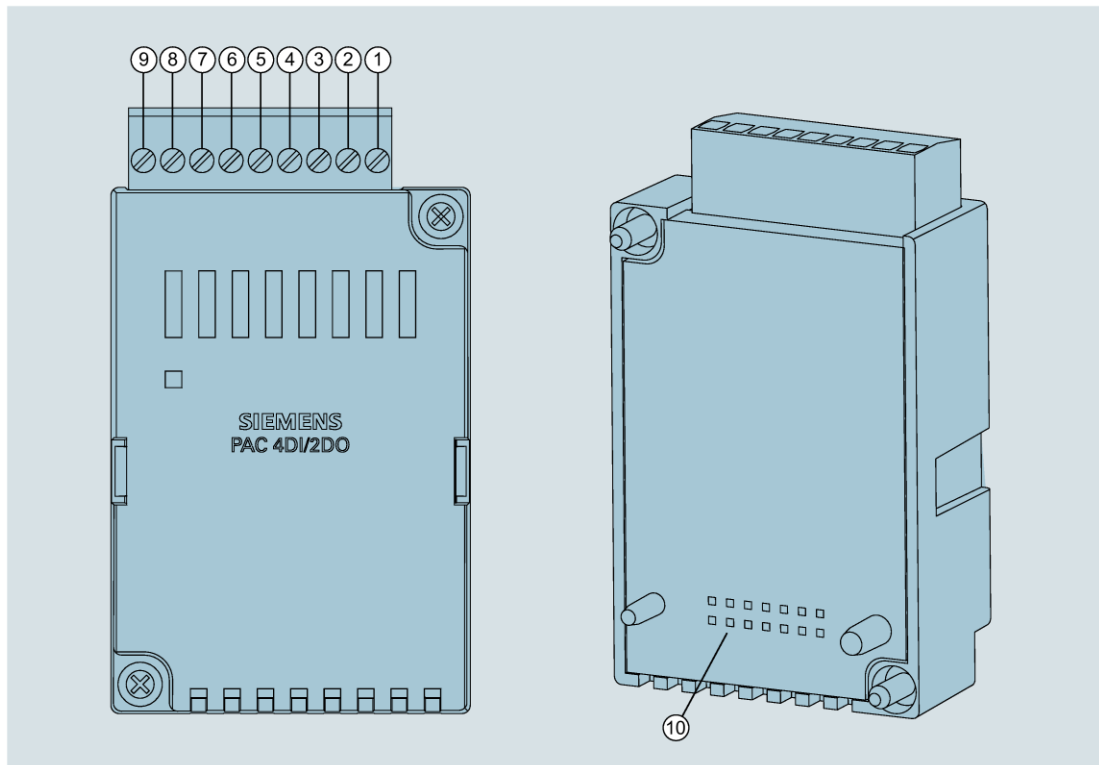
4.2 Connections

Terminal labeling

Figure 4-1   Terminal labeling with screw terminal

Number	Terminal	Function
①	FE	Functional ground connection
②	DIC	Digital input common
③	DI3	Digital input 3
④	DI2	Digital input 2
⑤	DI1	Digital input 1
⑥	DI0	Digital input 0
⑦	DOC	Digital output common
⑧	DO1	Digital output 1
⑨	DO0	Digital output 0
⑩	—	Interface to PAC device

The "functional ground" connection discharges EMC interference affecting the digital input and output.

Connect the functional ground to the equipotential bonding strip in the control cabinet. Keep the connecting cable as short as possible.

Example connections

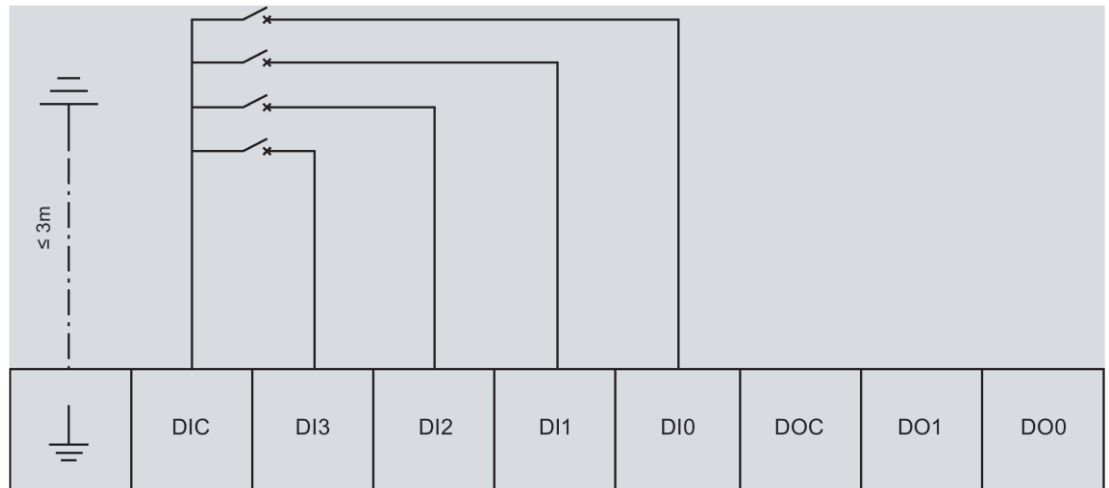Several example connections for the 4DI/2DO expansion module can be found below.

Digital inputs

Figure 4-2   Terminal assignment with switching of the digital inputs with internal power supply
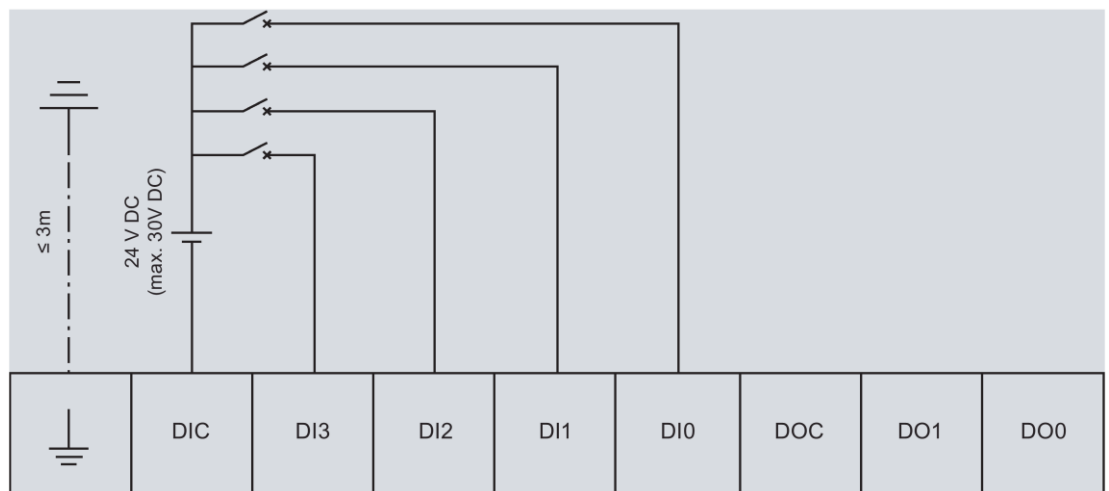

Figure 4-3   Terminal assignment with switching of the digital inputs with external power supply
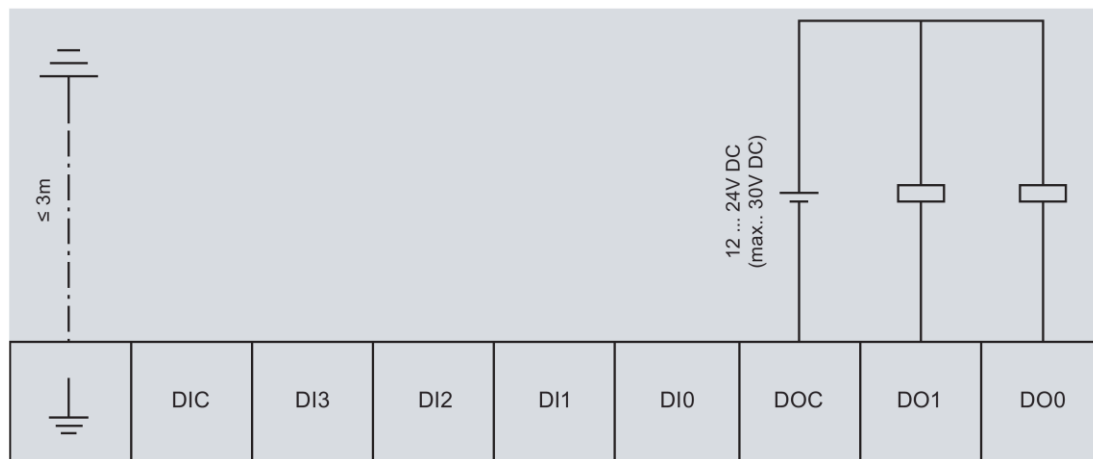
Digital outputs

Figure 4-4   Terminal assignment with switching of the digital outputs

Commissioning 5

5.1 Overview

Requirements

1. The expansion module has already been installed.

2. The expansion module and the PAC device have been connected up correctly.

Note

Check the connections

Failure to connect up the device correctly can result in malfunctions and failure of the device.

Before you start commissioning the device, check that all connections are correct.

Note

When performing an insulation test of the entire installation with AC or DC, disconnect the device before starting the test.

5.2 Setting expansion module parameters

The parameters for the expansion module can be set either directly on the PAC display or via the communication interface of the PAC device using the SENTRON "powerconfig" configuring software.

The SENTRON powerconfig configuration software can be downloaded from the Industry Online Support Website (https://support.industry.siemens.com/cs/ww/en/view/63452759).

Setting parameters on the PAC device

When the SENTRON PAC 4DI/2DO expansion module is mounted on the SENTRON PAC Power Monitoring Device, you can make the configuration settings for the external digital inputs and digital outputs.
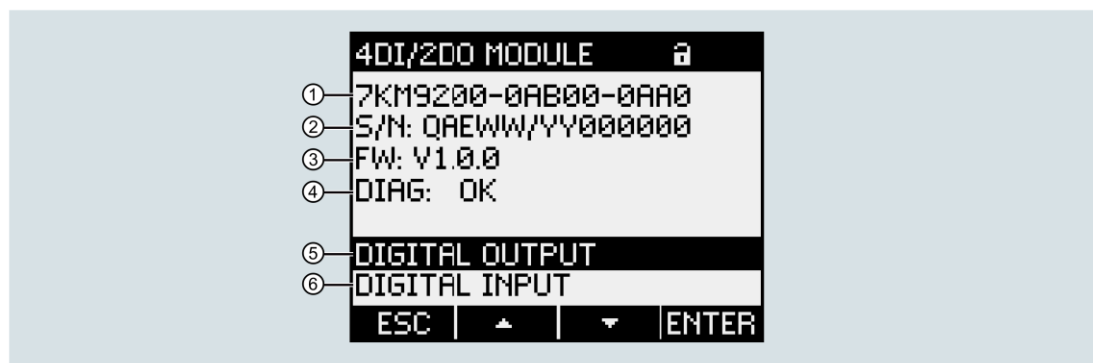
Select the menu item "SETTINGS" in the SENTRON PAC device menu.

In the menu item "EXPANSION MODULES" select the "4DI/2DO MODULE" that you want to configure.

For unambiguous module identification, the expansion module slot "MOD 1" or "MOD 2" that is used is specified in addition to the module designation.
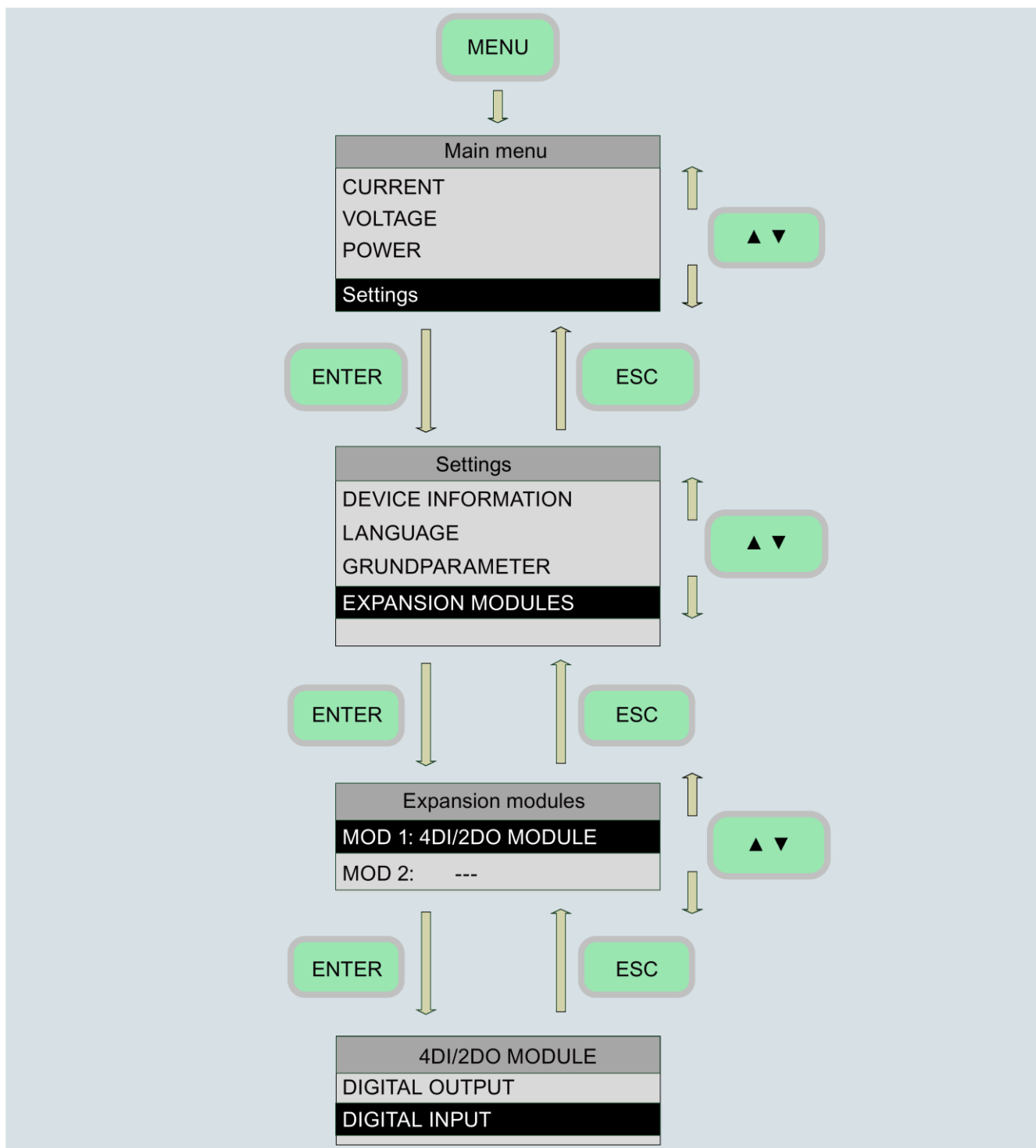
Configuration menu

①	Article number
②	Serial number of the expansion module
③	Firmware version of the expansion module
④	Status
⑤	Configuration menu: Digital Outputs
⑥	Configuration menu: Digital Inputs

Figure 5-1   Configuring the SENTRON PAC 4DI/2DO expansion module using keys

The external digital inputs and digital outputs are configured like the internal digital inputs and digital outputs.

Table 5- 1   Status in the "DIAG" field with meaning

Status	Meaning	Remedy
INIT	The expansion module is in the initialization phase.	—
OK	The expansion module is ready for operation.	—
FW_UPD	The firmware update of the expansion module has been carried out but not correctly completed.	Wait until the firmware update has been completed, or carry out another firmware update of the expansion module.
COM_ERR	Internal communications error	1. Restart the device. Disconnect the power supply briefly for this purpose. 2. Replace the expansion module and/or the device.
SYS_ERR	The hardware and/or firmware of the SENTRON PAC and the SENTRON PAC 4DI/2DO expansion module do not match.	Please contact Support.

Digital output

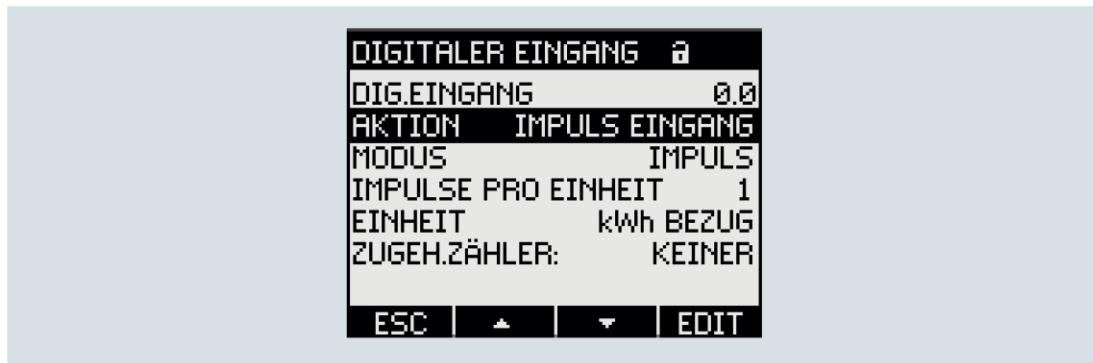```
DIGITALER AUSGANG 🔒35.0
DIG.AUSGANG   0.0
AKTION   ENERGIEIMPULS
MODUS   IMPULS
QUELLE   kWh BEZUG
EINHEIT   1kWh
IMPULSE PRO EINHEIT   1
IMPULS LÄNGE   100ms
 ESC | + | - | OK
```

| Selection | Range | Factory default setting |
|-----------|-------|-------------------------|
| DIG.OUTPUT | Depending on the expansion, multiple digital outputs are available:<br>• 0.0: PAC internal output<br>• 0.1: PAC internal output<br>• 4.0: 4DI/2DO output on the MOD1 expansion slot<br>• 4.1: 4DI/2DO output on the MOD1 expansion slot<br>• 8.0: 4DI/2DO output on the MOD2 expansion slot<br>• 8.1: 4DI/2DO output on the MOD2 expansion slot | — |
| ACTION | • OFF:<br>Output is switched off.<br>• DEVICE ON:<br>Output signals that the device is switched on.<br>• REMOTE CONTROL:<br>Output is controlled by remote access.<br>• DIRECTION OF ROTATION:<br>Output is activated by a clockwise rotating electrical field and remains active for as long as the field is rotating in this direction.<br>• SYNC:<br>Synchronization of other devices.<br>• LIM.VIOLATION:<br>The output is switched on by a limit violation and remains active while the limit violation prevails.<br>• ENERGY PULSE:<br>The output outputs the parameterized number of pulses or edges per energy unit. | OFF |

| MODE (only with ENERGY PULSE) | Pulses or edges are output. <br> • PULSE: <br> Pulses are output. <br> • EDGE: <br> Edges are output. | PULSE |
|---|---|---|
| SOURCE (with LIM.VIOLATION) | Selects the limit value whose status is output to the digital output. <br> • LIMIT LOGIC <br> • LIMIT 0 - 11 | LIMIT LOGIC |
| SOURCE (only with ENERGY PULSE) | Selects the type of cumulated power (active energy or reactive energy): <br> • kWh IMPORT <br> • kWh EXPORT <br> • kVarh IMPORT <br> • kVarh EXPORT <br> The reference values at which a pulse or an edge is output are defined in the fields "UNIT" and "PULSES PER UNIT". | kWh IMPORT |
| UNIT (only with ENERGY PULSE) | Value of the cumulated power at which a configurable number of pulses or edges is output. The number of pulses or edges to be output is defined in the field "PULSES PER UNIT" or "EDGES PER UNIT". <br> • 1, 10, 100, 1000 kVarh or kW | 1 |
| PULSES PER UNIT (only with ENERGY PULSE) | Number of pulses to be output per unit. The reference unit is defined in the "UNIT" field. <br> • 1 … 999 | 1 |
| PULSE LENGTH | Length of the pulse. <br> • 30 … 500 ms <br> The minimum length of the pulse pause corresponds to the pulse duration specified. | 100 ms |

**Digital input**



| Selection | Range | Factory default setting |
|---|---|---|
| DIG.INPUT | Depending on the expansion level, multiple digital inputs are available. <br><br> • 0.0: PAC internal input <br> • 0.1: PAC internal input <br> • 4.0: 4DI/2DO input on the MOD1 expansion slot <br> • 4.1: 4DI/2DO input on the MOD1 expansion slot <br> • 4.2: 4DI/2DO input on the MOD1 expansion slot <br> • 4.3: 4DI/2DO input on the MOD1 expansion slot <br> • 8.0: 4DI/2DO input on the MOD2 expansion slot <br> • 8.1: 4DI/2DO input on the MOD2 expansion slot <br> • 8.2: 4DI/2DO input on the MOD2 expansion slot <br> • 8.3: 4DI/2DO input on the MOD2 expansion slot | — |

| Selection | Range | Factory default setting |
|-----------|-------|-------------------------|
| ACTION | • NONE:<br>The input is switched off.<br><br>• WRITE PROTECTION:<br>The input is used as write protection. Auxiliary voltage is required at the input.<br><br>• PULSE INPUT:<br>Counting of input pulses.<br><br>Note: A universal counter can be parameterized for pulse counting. In the device settings "ADVANCED > UNIVERSAL COUNTER", set the "SOURCE" field to the value "DIG. INPUT".<br><br>• HT/LT SWITCHING:<br>High/Low tariff switching. Low tariff if input active.<br><br>• TIMESYNC:<br>Synchronization of time, "top of minute"<br>The internal clock is put forward or back, depending on whether the time is up to 30 seconds fast or slow. If a pulse is not received for 20 minutes, an event is recorded.<br>If changes were made in the "Date/Time" screen, the synchronization pulse does not take effect until the screen is closed.<br><br>• DEMAND SYNC:<br>Synchronization of power demand.<br><br>• STATUS:<br>One event is recorded for each switching operation.<br><br>• START/STOP:<br>Starts or stops the counters specified under "Target". This depends on whether the associated digital input is active or inactive.<br>If it is active, the action starts.<br>If it is inactive, the action stops.<br><br>• COPY&RESET:<br>Copies and resets the counters specified under "Target". For this purpose, the associated digital input is switched from inactive to active.<br><br>• RESET:<br>Copies and resets the counters specified under "Target". For this purpose, the associated digital input is switched from inactive to active. | NONE |

| Selection | Range | Factory default setting |
|---|---|---|
| MODE<br>(only with PULSE INPUT) | Counting of pulses or edges.<br><br>• PULSE:<br>  Pulses are counted.<br>• EDGE:<br>  Edges are counted. | PULSE |
| PULSES PER UNIT<br>(only with PULSE INPUT) | Number of pulses that must be received per unit in order for the counter to be incremented by "1". The reference unit is defined in the "UNIT" field.<br><br>• 1 … 999 | 1 |
| UNIT<br>(only with PULSE INPUT) | Unit to be counted when counting the pulses or edges received:<br><br>• kWh (active energy)<br>• kvarh (reactive energy)<br>• "TEXT"<br><br>"TEXT" stands for a user-definable unit, e.g. $m^3/h$ or pieces. The text sequence used to name the unit must be defined via the communication interface. The defined text sequence is displayed in the "TEXT" field when you select "TEXT". | |
| TEXT<br>(only with PULSE INPUT → TEXT) | Text sequence used to name the unit to be counted. See "UNIT" field. | |
| TARGET | You will find more detailed information in the following table. | |
| RELATED COUNTER | The associated user-defined pulse counter is displayed here independently of the action selected.<br><br>This function is only available if at least one SENTRON PAC 4DI/2DO expansion module is plugged into the SENTRON PAC. | |

| Target | Description | START/STOP | COPY/RESET | RESET |
|---|---|---|---|---|
| PROCESS&PULSE | Relates to:<br><br>• All process energy counters<br>• The process operating hours counter<br>• All pulse counters | — | — | x |
| PULSE COUNTER | All pulse counters | — | — | x |
| PULSE COUNTER 1 ... n | Specific pulse counter | — | — | x |
| PROCESS COUNTER | All process energy counters | x | x | x |
| PROCESS COUNTER kWh / kVAR / kVAh | Specific process energy counter | — | x | x |

A more detailed description of the function and parameterization of the digital inputs and outputs can be found in the PAC4200 Manual:

- PAC4200 Manual
  (https://support.industry.siemens.com/cs/document/34261595/systemhandbuch-sentron-multifunktionsmessger%C3%A4t-sentron-pac4200?dti=0&dl=de&lc=en-WW)

## 5.3 Access via MODBUS

The module can be accessed via the Modbus protocol. The following functions are available:

- Reading out the status of the digital inputs
- Reading out the status of the digital outputs
- Determining and configuring the type of use of the digital inputs
- Determining and configuring the type of use of the digital outputs

More detailed information can be found in the PAC Manual:

- PAC4200 Manual
  (https://support.industry.siemens.com/cs/document/34261595/systemhandbuch-sentron-multifunktionsmessger%C3%A4t-sentron-pac4200?dti=0&dl=de&lc=en-WW)

# Service and maintenance 6

## 6.1 Troubleshooting guide

| Fault | Remedy |
| --- | --- |
| Diagnostic LED is off. | 1. Check whether the PAC 4DI/2DO expansion module is correctly connected to the PAC Power Monitoring Device.<br>2. Switch on the power supply to the PAC Power Monitoring Device.<br>3. Replace the expansion module and/or the PAC device. |
| The module cannot be successfully configured using the SENTRON powerconfig configuring software | • Check the PAC communications settings (IP address, protocol, subnet, gateway)<br>• The firewall may be preventing access to the PAC device |

## 6.2 Warranty

**Procedure**

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**Note**

**Loss of warranty**

Opening the device invalidates the Siemens warranty. Return nonconforming or damaged devices to Siemens.

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If the device is nonconforming or damaged, proceed as follows (only during the warranty period):

1. Uninstall the device.

2. Pack the device in a suitable manner to prevent it from being damaged during transport.

3. Return the device to Siemens. You can obtain the address from:

- Your Siemens sales partner

- Technical Assistance (https://support.industry.siemens.com/My/ww/en/requests)

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**Note**

The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment, or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

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# Technical specifications

# 7

## 7.1 Technical specifications

**Supply voltage**

No external supply voltage is required. The expansion module is supplied via the PAC device.

**Digital inputs and digital outputs**

**Digital inputs**

Table 7- 1    Technical data of the digital inputs

|  |  | Values |
| --- | --- | --- |
| Quantity |  | 4 |
| Type |  | Internal power supply (typically 12 V DC) |
| External operating voltage |  | 0 ... 30 V DC (optional) |
| Input resistance | "1" signal detection | ≤ 1 kΩ |
|  | "0" signal detection | ≥ 100 kΩ |
| Input current | "1" signal detection | ≥ 2.5 mA |
|  | "0" signal detection | ≤ 0.5 mA |
| Maximum switching rate |  | 20 Hz |

### Digital outputs

Table 7- 2     Technical data of the digital outputs

|  |  | **Values** |
|---|---|---|
| Quantity |  | 2 |
| Type |  | Bidirectional |
| Design/function |  | Switching output or pulse output in accordance with IEC 62053-31 Class B |
| Rated voltage |  | 0 ... 30 V DC, typical 24 V DC (SELV or PELV supply) |
| Output current | For "1" signal | Depends on the load and the external power supply |
|  | Continuous load | ≤ 50 mA (=thermal overload protection) |
|  | Transient overload | ≤ 130 mA for 100 ms |
|  | For "0" signal | ≤ 0.2 mA |
| Internal resistance |  | Typically 55 Ω |
| Maximum switching rate |  | 20 Hz |
| Short-circuit protection |  | Yes |

## Connection elements

Table 7- 3     Conductor cross-section

|  | mm$^2$ | AWG |
|---|---|---|
| Rigid | 0.14 … 1.5 | 26 … 12 |
| Flexible | 0.14 … 1.5 | 26 … 12 |
| Flexible with end sleeve, without plastic sleeve | 0.25 … 1.5 | 24 … 16 |
| Flexible with end sleeve and plastic sleeve | 0.25 … 0.5 | 24 … 20 |
| Tightening torque | 0.22 … 0.25 Nm / 0.94 ... 2.21 lb-in ||

Table 7- 4     Two conductors of same cross-section

|  | mm$^2$ | AWG |
|---|---|---|
| Rigid | 0.08 … 0.5 | 28 … 20 |
| Flexible | 0.08 … 0.75 | 28 … 19 |
| Flexible with end sleeve, without plastic sleeve | 0.25 … 0.34 | 24 … 22 |
| Flexible with TWIN end sleeve and plastic sleeve | 0.5 | 20 |
| Tightening torque | 0.22 … 0.25 Nm / 0.94 ... 2.21 lb-in ||

## Dimensions and weight

| Enclosure dimensions (inserted in PAC device) W x H x D | 43 mm x 70.3 mm x 22 mm |
|---|---|
| Enclosure dimensions (not inserted in PAC device) W x H x D | 43 mm x 70.3 mm x 29.5 mm |
| Weight | 37 g |
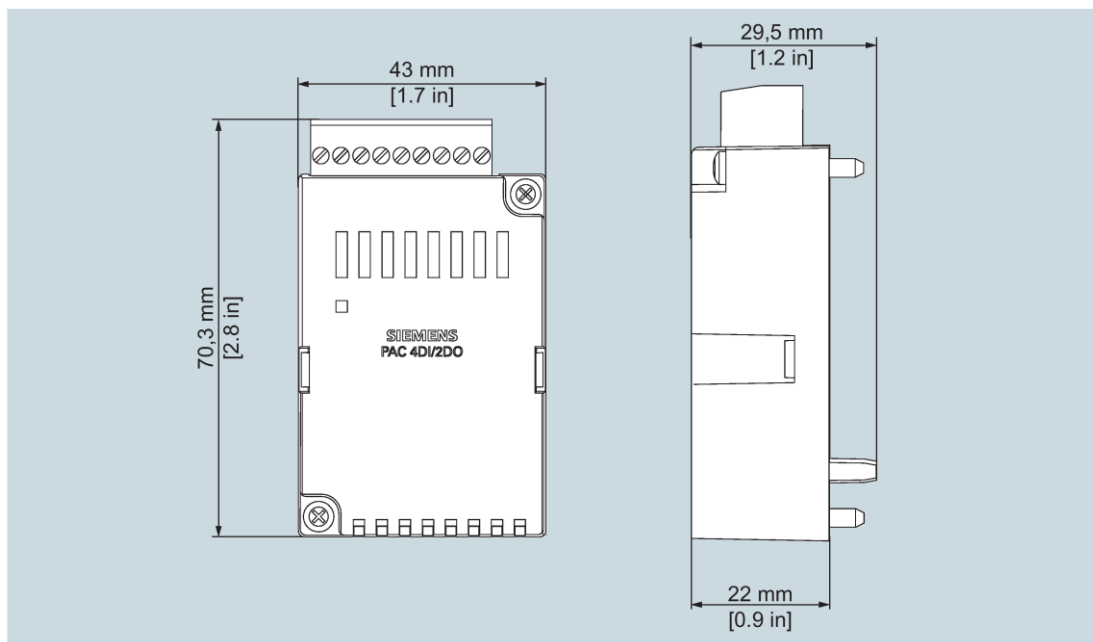


## Degree of protection

| | |
|---|---|
| Insulation voltage | max. 500 V |
| Degree of protection according to IEC 60529 | IP 20 |
| Pollution degree | 2 |

### Note

Further technical specifications, mechanical specifications and electrical specifications as well as ambient and environmental conditions are identical to those of the SENTRON PAC measuring device. You can find more information in the operating instructions and manual for the SENTRON PAC Power Monitoring Device PAC 4200 (https://support.industry.siemens.com/cs/document/34261595/sentron-pac4200-power-monitoring-device-system-manual?dti=0&lc=en-WW).

## Ambient conditions

The device may only be operated within enclosed dry rooms. Condensation on the device is not permissible during operation.

Temperature range

| | |
|---|---|
| Ambient temperature during operating phase | -10 ... +55 °C |
| Ambient temperature during transport and storage | -25 ... +70 °C |
| Relative humidity | 0 ... 95% |
| Environmental conditions | as defined by IEC 60068 |

## Approvals

| | |
|---|---|
| CE | **CE conformity**<br>Applicable guidelines and standards can be taken from the EU Declaration of Conformity at the following link: https://support.industry.siemens.com/cs/document/109750386/declaration-of-conformity-ec-eu-declaration-of-conformity-manufacturer?dti=0&lc=en-WW. |
| RCM | **Approvals for Australia and New Zealand**<br>Regulatory Compliance Mark |
| EAC | **Approval for Eurasian Customs Union** |
| c UL us | Products bearing this mark meet both Canadian (CSA) and American (UL) requirements. |

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# Further Information

Always at your disposal: our extensive support
**www.siemens.com/online-support**

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Online