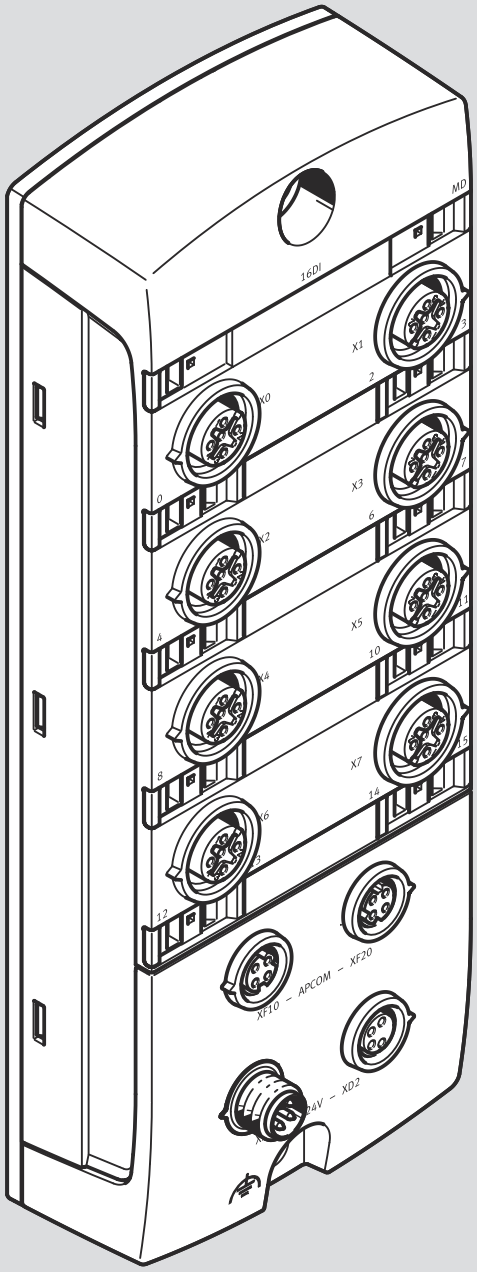
# CPX-AP-I-16DI-M12-5P
## Digital input module




FESTO

Operating instructions

8219794

8219794
2025-10
[8219796]

Original instructions

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# Table of contents


**1 About this document . . . 5**
1.1 Applicable documents . . . 5
1.2 Product version . . . 5
1.3 Specified standards . . . 5

**2 Safety . . . 5**
2.1 Safety instructions . . . 5
2.2 Intended use . . . 5
2.3 Training of qualified personnel . . . 6
2.4 UL certification . . . 6

**3 Additional information . . . 6**

**4 Product overview . . . 6**
4.1 Product design . . . 6
4.2 Connecting elements . . . 7
4.3 Product labelling . . . 8
4.4 LED displays . . . 8

**5 Function . . . 9**
5.1 Digital inputs . . . 9

**6 Assembly . . . 9**

**7 Installation . . . 9**
7.1 Connecting cables . . . 9

**8 Commissioning . . . 10**

**9 Parameterisation . . . 10**

**10 Diagnostics . . . 11**
10.1 LED displays . . . 11
10.2 Diagnostic messages . . . 11
10.2.1 Application-specific diagnostic functions . . . 12

**11 Technical data . . . 13**
11.1 Technical data, general . . . 13
11.2 Technical data, electrical . . . 14

# 1 About this document

## 1.1 Applicable documents

| Document | Contents |
|---|---|
| Operating instructions for the modules in a remote I/O system CPX-AP-I | Information on using the modules |

Tab. 1: Applicable documents

## 1.2 Product version

This document refers to the following product versions:

| Product | Version |
|---|---|
| CPX-AP-I-16DI-M12-5P | Digital input module CPX-AP-I-16DI-M12-5P revision 1 or later |

Tab. 2: Product version

The product version can be determined from the product labelling.

> There may be an updated version of this document for this or later product versions ➔ www.festo.com/sp.

## 1.3 Specified standards

| Version | |
|---|---|
| IEC 60204-1:2016-10 | EN 60204-1:2018-09 |
| IEC 61131-2:2017-08 | EN 60529:1991-10 |

Tab. 3: Standards specified in the document

# 2 Safety

## 2.1 Safety instructions

- Only use the product if it is in perfect technical condition.
- Observe the identifications on the product.
- Store the product in a cool, dry environment protected from UV and corrosion. Keep storage times short.
- If there is a connection to other circuits at one of the connections for inputs or outputs, the circuits must also comply with SELV/PELV.
- Before working on the product, switch off the power supply and secure it against being switched on again.

## 2.2 Intended use

The product described in this document is intended solely for use in a remote I/O system CPX-AP.
Use the product only as follows:

- Use only in an industrial environment. Outside of industrial environments, e.g. in commercial and mixed-residential areas, actions to suppress interference may have to be taken.
- Use only in combination with modules and components that are approved for the applicable product variant ➔ www.festo.com/catalogue.

## 2.3 Training of qualified personnel

Work on the product may only be carried out by qualified personnel who can evaluate the work and detect dangers. The qualified personnel have skills and experience in dealing with electrical (open-loop) control technology.

## 2.4 UL certification

The information in the operating instructions for the remote I/O system CPX-AP-I in combination with the UL inspection mark on the product is also applicable to ensure compliance with the certification conditions of Underwriters Laboratories Inc. (UL) for USA and Canada ➔ 1.1 Applicable documents.

# 3 Additional information

- Contact the regional Festo contact if you have technical problems
  ➔ www.festo.com.
- Accessories ➔ www.festo.com/catalogue.

# 4 Product overview

## 4.1 Product design

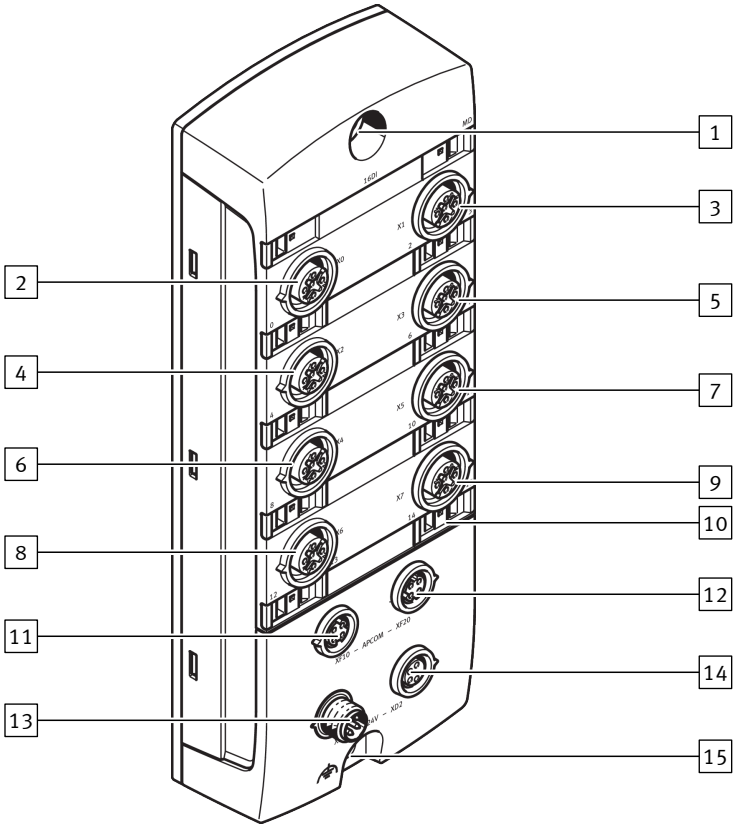
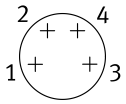



Fig. 1: Product design

1. Mounting front top
2. Connection [X0]: input 0, 1
3. Connection [X1]: input 2, 3
4. Connection [X2]: input 4, 5
5. Connection [X3]: input 6, 7
6. Connection [X4]: input 8, 9
7. Connection [X5]: input 10, 11
8. Connection [X6]: input 12, 13
9. Connection [X7]: input 14, 15
10. Inscription label attachment (optional)

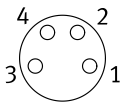
11 Connection [XF10]: system communication
12 Connection [XF20]: system communication forwarding
13 Connection [XD1]: power supply
14 Connection [XD2]: forwarding supply
15 Front bottom mounting with functional earth connection

## 4.2 Connecting elements

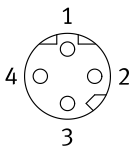
| **Power supply connection [XD1]** | | |
|---|---|---|
| M8 plug, 4-pin, A-coded | | Signal |
|  | 1 | +24 V DC logic supply PS |
| | 2 | 0 V DC load supply PL |
| | 3 | 0 V DC logic supply PS |
| | 4 | +24 V DC load supply PL |

Tab. 4: Power supply connection

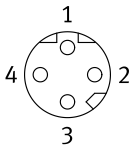
For information on power supply, see operating instructions for remote I/O system CPX-AP-I ➔ 1.1 Applicable documents.

| **Connection for voltage forwarding [XD2]** | | |
|---|---|---|
| M8 socket, 4-pin, A-coded | | Signal |
|  | 1 | +24 V DC logic supply PS |
| | 2 | 0 V DC load supply PL |
| | 3 | 0 V DC logic supply PS |
| | 4 | +24 V DC load supply PL |

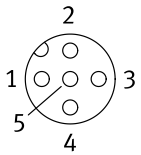
Tab. 5: Connection for voltage forwarding

| **Connection for system communication [XF10]** | | | |
|---|---|---|---|
| Socket M8, 4-pin, D-coded | | Signal | |
|  | 1 | TX– | Transmitted data – |
| | 2 | RX+ | Received data + |
| | 3 | TX+ | Transmitted data + |
| | 4 | RX– | Received data – |

Tab. 6: Connection for system communication

| **Connection for system communication forwarding [XF20]** | | | |
|---|---|---|---|
| Socket M8, 4-pin, D-coded | | Signal | |
|  | 1 | RX– | Received data – |
| | 2 | TX+ | Transmitted data + |
| | 3 | RX+ | Received data + |
| | 4 | TX– | Transmitted data – |

Tab. 7: Connection for system communication forwarding

| Connection for inputs [X0] ... [X7] | | |
|---|---|---|
| M12 socket, 5-pin, A-coded | | Signal |
|  | 1 | +24 V DC sensor supply |
| | 2 | Input 1, 3, 5, 7, 9, 11, 13, 15 |
| | 3 | 0 V DC sensor supply |
| | 4 | Input 0, 2, 4, 6, 8, 10, 12, 14 |
| | 5 | Functional earth FE |

Tab. 8: Connection for inputs

If there is a connection to other circuits at one of the connections for inputs or outputs, the circuits must also comply with SELV/PELV.

## 4.3 Product labelling

The product labelling is located on the side panel of the module. The Data Matrix code is on the connection side. Scanning the printed Data Matrix Code with an appropriate device opens the Festo Internet page with documents appropriate for the product. Alternatively, the Product Key (11-digit alphanumeric code on the product labelling) can be entered in the search field ➔ www.festo.com/sp.

## 4.4 LED displays

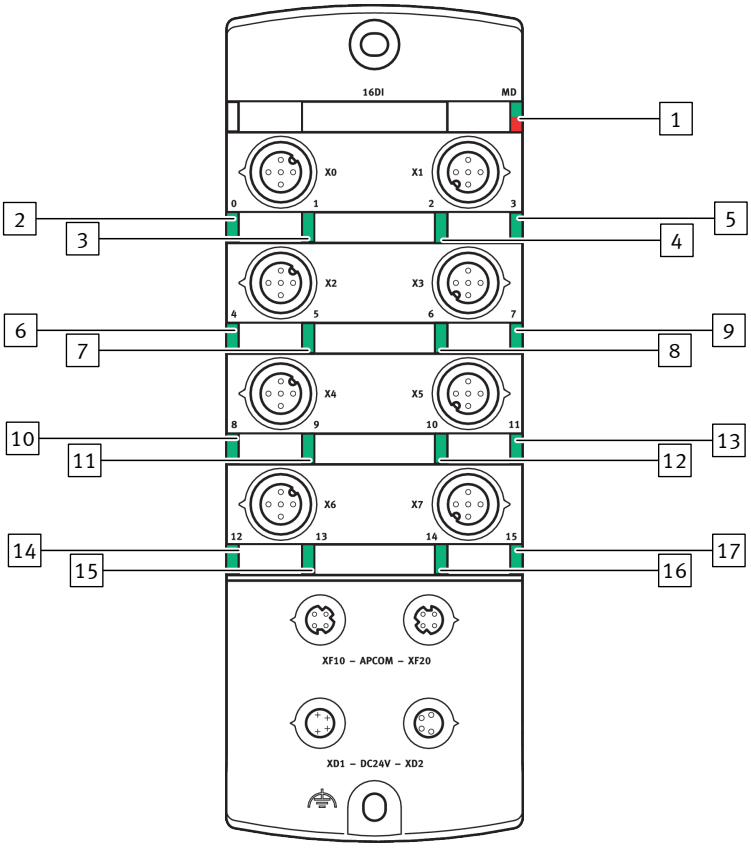



Fig. 2: LED displays

1 LED [MD]: module diagnostics
2 LED [X0]: input 0 status
3 LED [X0]: input 1 status
4 LED [X1]: input 2 status
5 LED [X1]: input 3 status
6 LED [X2]: input 4 status
7 LED [X2]: input 5 status
8 LED [X3]: input 6 status
9 LED [X3]: input 7 status
10 LED [X4]: input 8 status

11 LED [X4]: input 9 status
12 LED [X5]: input 10 status
13 LED [X5]: input 11 status
14 LED [X6]: input 12 status
15 LED [X6]: input 13 status
16 LED [X7]: input 14 status
17 LED [X7]: input 15 status

# 5 Function

**Function description**

The module provides 16 digital inputs in one remote I/O system CPX-AP.
The module response can be parameterised.
Status and error messages are indicated by LED displays on the module and reported to the bus interface via system communication.

## 5.1 Digital inputs

The digital inputs are used to connect sensors, thereby enabling the recording and further processing of digital input signals. The sensors are supplied with a voltage of 24 V DC via the module and return a logic 0 or logic 1 to the inputs.
The sensor supply has an electronic fuse for protection against short circuit or overload. If this electronic fuse is triggered, the sensor supply of the module is switched off and the error is shown by an LED indicator on the module. After the short circuit or the overload has been cleared, the sensor supply is switched on again automatically. The electronic fuse of the module is a slow-blow type. Sensors with a higher short-term current requirement can therefore also be connected.

# 6 Assembly

- Carry out assembly in accordance with the operating instruction for remote I/O system CPX-AP-I ➔ 1.1 Applicable documents.

# 7 Installation

## 7.1 Connecting cables

**⚠ WARNING**

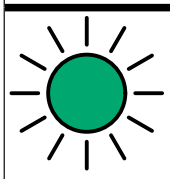
**Risk of injury due to electric shock.**
- For the electric power supply, use SELV or PELV circuits that guarantee a reliable electric disconnection from the mains network.
- Observe IEC 60204-1/EN 60204-1.

1. Switch off the power supply.
2. Use a suitable torque screwdriver with socket to tighten union nuts.
   – For example, use PHOENIX CONTACT SAC BIT M8-D10 with a tightening torque of 0.4 Nm ± 15% for M8. Different from the information for connecting cables.
   – For example, use PHOENIX CONTACT SAC BIT M12-D15 with a tightening torque of 0.6 Nm ± 10% for M12. Different from the information for connecting cables.
3. Seal unused connections with cover caps.

# 8 Commissioning

- Commissioning of the remote I/O system CPX-AP-I in accordance with the remote I/O system CPX-AP-I operating instructions ➔ 1.1 Applicable documents.

**Response of the display components of the module after error-free commissioning**

| [MD] | |
|---|---|
|  Green light | |

Tab. 9: Response of the LED displays of the module after error-free commissioning

# 9 Parameterisation

Various parameters are available for reading out information about the modules in a remote I/O system CPX-AP-A or CPX-AP-I and for configuring the modules for the application.
Write access to the parameters is typically implemented by the higher-level controller using the device descriptions specific to the host system.

**Parameters**

| ID | Parameters | Number of instances[1] | Data type | Access[2] | Array size |
|---|---|---|---|---|---|
| Standard parameters | | | | | |
| 246 | Fieldbus serial number | 1 | UINT32 | ro | - |
| 791 | Product key | 1 | CHAR | ro | 12 |
| 960 | Firmware version | 1 | CHAR | ro | 30 |
| 20000 | Module code | 1 | UINT32 | ro | - |
| 20085 | Measured value of temperature AP-ASIC | 1 | INT16 | ro | - |
| 20087 | Current value of the logic supply (PS) 24 V DC. | 1 | UINT16 | ro | - |
| 20088 | Current value of the load supply (PL) 24 V DC. | 1 | UINT16 | ro | - |
| 20093 | Hardware version | 1 | UINT8 | ro | - |
| 20118 | Application-specific identification | 1 | CHAR | rw, rem | 32 |
| 11295004 | I&M 2 Date of installation | 1 | CHAR | rw, rem | 17 |
| Channel parameter inputs | | | | | |
| 20014 | Input debounce time<br>– 0: 0.1 ms<br>– 1: 3 ms (factory settings)<br>– 2: 10 ms<br>– 3: 20 ms | 1 | ENUM_ID | rw | - |
| 20294 | Condition counter limit value input | 16 | UINT32 | rw, rem | - |
| 20295 | Condition counter actual value input | 16 | UINT32 | rw, rem | - |

1) Counting starting at 0.
2) ro = read only; rw = read write; rem = remanent

Tab. 10

# 10 Diagnostics

## 10.1 LED displays

| Module diagnostics [MD] | | |
|---|---|---|
| LED | Meaning | Remedy |
| Off | Logic supply PS not available. | Check connection of logic supply PS. |
| Green light | Module diagnostics not active | – |
| Flashing green 0.5 Hz | Module diagnostics active<br>"Information" degree of severity<br>e.g. switching off load supply PL | – |
| Flashing red 0.5 Hz | Module diagnostics active<br>"Warning" degree of severity<br>e.g. parameterisation error | Take appropriate remedial action,<br>e.g. check parameterisation. |
| Red light | Module diagnostics active<br>"Error" degree of severity<br>e.g. undervoltage in logic supply PS | Take appropriate remedial action,<br>e.g. check logic supply PS. |
| Fast flashing red 2 Hz | Module ramp-up not yet completed.<br>System communication not yet initialised. | – |
| Fast flashing green 2 Hz | Module identification (service function) | – |

Tab. 11: Module diagnostics LED [MD]

| Status of input | | |
|---|---|---|
| LED | Meaning | Remedy |
| Green light | Input active (logic 1)<br>Logic 1 at input | – |
| Off | Input inactive (logic 0)<br>Logic 0 at input | – |

Tab. 12: LED status of input

## 10.2 Diagnostic messages

For all diagnostics messages of the remote I/O system and for information on grouping and displaying the diagnostic messages see the operating instructions for remote I/O system ➔ 1.1 Applicable documents.
The following table contains the diagnostic messages of the digital input module.

| ID hex (dec) | Message | Description | Remedy | Diagnostics status |
|---|---|---|---|---|
| 01 \| 01 \| 010B (16843019) | Short circuit/overload in sensor supply | A short-circuit/overload of the sensor supply was detected | – Check sensor for correct function, in particular for current consumption.<br>– Check sensor wiring. | Error |
| 02 \| 01 \| 0016 (33619990) | Undervoltage in logic supply (PS) 24 V DC | Undervoltage of the logic supply (PS) 24 V DC was detected. | – Check the power supply (logic) | Error |
| 02 \| 01 \| 0017 (33619991) | Overvoltage in logic supply (PS) 24 V DC | Overvoltage of the logic supply (PS) 24 V DC was detected. | – Check the power supply (logic) | Error |
| 08 \| 01 \| 0124 (134283556) | Communication to AP master interrupted | The communication to the AP Master is interrupted. | – Restart AP Master.<br>– Check communication AP connecting cable. | Error |
| 08 \| 01 \| 0130 (134283568) | Output process data watchdog of the AP module expired | Output process data watchdog of the AP module expired | – Restart AP system.<br>– Check cable. | Error |
| 08 \| 01 \| 0131 (134283569) | Input process data watchdog of the AP module expired | Input process data watchdog of the AP module expired. | – Restart AP system.<br>– Check cable. | Error |
| 08 \| 01 \| 01A2 (134283682) | System state emergency operation mode | System initialisation (module detection) has failed. The system is in maintenance mode. I/O function is not available. | – Restart system<br>– Update firmware to the latest version<br>– Contact Festo Service | Error |
| 0C \| 01 \| 02B9 201392825 | Application condition counter threshold reached | The set threshold of the application has been reached. | – Perform application-dependent maintenance work and reset condition counters<br>– Increase condition counter threshold | Maintenance required |

Tab. 13: Diagnostic messages

### 10.2.1 Application-specific diagnostic functions

**Switching cycle counter (Condition counter)**

The module provides a channel-based switching cycle counter. A diagnostic message is sent when the switching cycle counter reaches the critical limit (set point). The diagnostic message can be used as a trigger for all types of maintenance work in the application (e.g. reminder of lubrication or replacement of parts). The diagnostic message has the diagnostic status Maintenance and is deactivated by default.

- Every channel is assigned an actual value memory and a critical limit memory: fieldbus parameters ID 20294 and ID 20295.
- The switching cycle counter is incremented at every rising edge of the switching signal.
- The switching cycle counter counts up to its maximum value of 0xFF.FF.FF.FF. The switching cycle counter then remains at the maximum value. There is no overflow.
- If the critical limit is reached or exceeded, the channel-based diagnostic message ID0C|01|01B5 (201392565) is sent.
- The diagnostic message can be cancelled by setting the critical limit to a value higher than the current actual value. Or the actual value or the critical limit can be set to 0.
- The diagnostic message ID0C|01|01B5 (201392565) is deactivated if the critical limit memory has the value 0 (factory setting).

# 11 Technical data

## 11.1 Technical data, general

| General technical data | | |
|---|---|---|
| Certificates, declaration of conformity | | ➔ www.festo.com/sp |
| Dimensions (length × width × height) | [mm] | 170 × 60 × 35 |
| Ambient temperature | [°C] | –20 ... +60 |
| Storage temperature | [°C] | –40 ... +70 |
| Max. storage time | [years] | 2 |
| Humidity (non-condensing) | [%] | 5 ... 95 |
| Assigned address space (inputs/outputs) | [Byte] | 2/– |
| Module code (hex/dec) | | 0x2136/8502 |
| Module identification | | CPX-AP-I-16DI-M12-5P |
| Degree of protection in accordance with EN 60529 | | IP65/IP67, if all cables are connected and connections that are not required are closed with cover caps. |
| Electromagnetic compatibility | | See declaration of conformity ➔ www.festo.com/sp |
| Mounting position | | Any |

Tab. 14: General technical data

### Digital inputs

| Digital inputs | | |
|---|---|---|
| No. of inputs | | 16 |
| Type in accordance with IEC 61131-2 | | 3 (24 V DC) |
| Max. cable length | [m] | 30 |
| Design | [V DC] | 0 ... 30, positive logic (PNP) |
| Logic level (logic 0/1) | [V DC] | ≤ 5/ ≥ 11 |
| Input debounce time | | Parameterisable |
| Electrical isolation between the channels | | No |
| Electrical isolation between inputs and PS | | No |
| Sensor supply | | |
| Sensor power supply SEN | [V DC] | 24 ± 25%<br>If there is a connection to other circuits at one of the connections for the inputs, the circuits must also comply with SELV/PELV. |
| Voltage drop at short-circuit protection (reduction SEN) | [V DC] | ≤ 1 |
| Reverse polarity protection 24 V SEN against 0 V SEN | | Yes |
| Potential difference between 0 V SEN external and 0 V SEN internal | | Not permissible |
| Sensor power supply short circuit protection | | |
| Short-circuit protection | | Electronic |
| Trigger level | [A] | > 1.8 |
| Characteristic | | Slow-blow |
| Response after end of overload | | Automatic recovery |

Tab. 15: Digital inputs

## 11.2 Technical data, electrical

| **Power supply** | | |
|---|---|---|
| Logic supply PS | | |
| Logic supply PS | [V DC] | 24 ± 25% |
| Intrinsic current consumption at nominal operating voltage 24 V from PS | [mA] | Typically 38 |
| Undervoltage detection in logic supply PS | | |
| Trigger level | [V] | 17.2 |
| Hysteresis | [V] | 0.3 |
| Overvoltage detection in logic supply PS | | |
| Trigger level | [V] | > 30 |

Tab. 16: Power supply

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