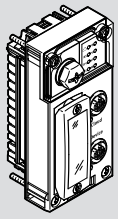
CPX-IOT
Gateway



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Operating instructions

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Translation of the original instructions

1 Applicable documents

All available documents for the product ➔ www.festo.com/sp.

Document	Table of contents
CPX system description (CPX-SYS-...)	– Detailed information on the CPX terminal. – General information on the [PS] and [SF] LEDs. – General information on the equipotential bonding of the functional earth.
Application notes	➔ www.festo.com/sp – Enter 'CPX-IOT' keyword. – Expert knowledge on the product application. – Commissioning instructions

Tab. 1: Applicable documents

2 Safety

2.1 Safety instructions

- Use the product in its original status without any unauthorised modifications.
- Use the product only within the limits defined by the technical data.
- Before working on the product: switch off the power supply and secure it against being switched back on.
- Observe the handling specifications for electro-statically sensitive devices.
- Only commission a module that is completely mounted and connected.

2.2 Intended use

The product is intended for use in an industrial environment as a gateway between Industrial Ethernet networks and an on-premise MQTT broker.
Outside industrial environments, e.g. in commercial and residential/mixed-use areas, it may be necessary to take measures to suppress radio interference.

2.3 Training of qualified personnel

Work on the product should only be conducted by qualified personnel. The qualified personnel must be familiar with installation of electrical control systems.

3 Additional information

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

4 Product overview

4.1 Licence information

This product uses open-source software.

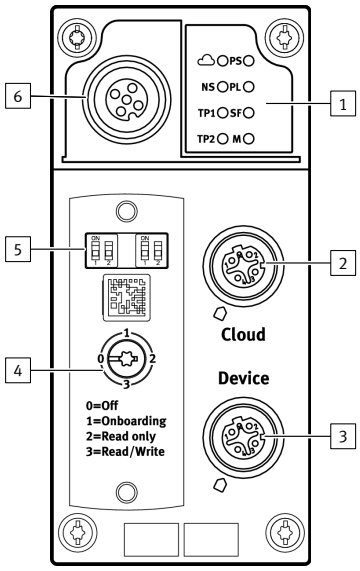
Licence	Version
GNU General Public License	Version 2
GNU Lesser General Public License	Version 2.1

Tab. 2: Open-source software

The licence conditions of the GPL, LGPL and the other open-source licences can be viewed via the integrated web server of the product:
1. Connect the gateway to a computer at the 'Device' network connection.
2. Call up the web server and log in ➔ 7.2 Parameterisation.
https://‹IP_address_of_the_network_connection_'Device'›/cgi-bin/system-about

4.2 Structure

4.2.1 Product design



1 LED displays
2 "Cloud" network connection
3 "Device" network connection
4 Rotary switch for the operating mode
5 DIL switches
6 Interface to the CPX terminal

Fig.1

4.2.2 LED displays

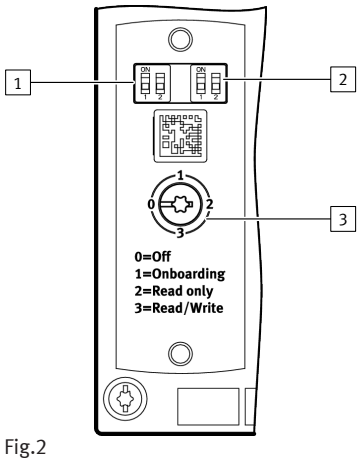
Network-specific LED displays		Gateway-specific LED displays	
Cloud (blue)	'Cloud' network status	PS (green)	'operating power supply' status
NS (red/green)	'Device' network status	PL	reserved
TP1 (green)	'Cloud' connection status (Link/Traffic)	SF (red)	System errors
TP2 (green)	'Device' connection status (Link/Traffic)	M (yellow)	Module status

Tab. 3: LED displays

Normal operating status
Behaviour of the LED displays in the normal operating status:
- The [PS] and [NS] LEDs are green.
- The [Cloud] LED is blue.
- The [TP1] and/or [TP2] LEDs are steady green or flashing green.
- The [PL], [SF] and [M] LEDs are off.

Module location
The [PS], [PL] and [NS] flash synchronously.

4.2.3 Switching elements



1 DIL switch 1
2 DIL switch 2
3 Rotary switch for the operating mode

Fig.2

DIL switches

DIL switch 1		Description
ON 1 2	1: OFF 2: OFF (delivery status)	reserved
ON 1 2	1: ON 2: ON	reserved

Tab. 4: DIL switch 1

DIL switch 2		Description
ON 1 2	1: OFF 2: OFF (delivery status)	reserved
ON 1 2	1: OFF 2: ON	reserved

DIL switch 2		Description
	1: ON 2: OFF	➔ 8.2.2 Resetting web server SSL certificates to factory setting
	1: ON 2: ON	➔ 8.2.1 Reset gateway to factory setting

Tab. 5: DIL switch 2

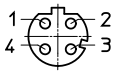
Rotary switch for the operating mode

Switching position		Operating mode/function
	0: Off	– 'Cloud' network connection is deactivated (interface switched off). – No communication with the MQTT broker network and no communication with field devices.
	1: Onboarding	reserved
	2: Read only	– Gateway sends process data of the configured field devices to configured MQTT brokers. – Manual adding of field devices is enabled. – Automatic adding of field devices via the Auto-Scan function is blocked. – Removal of field devices is blocked.
	3: Read/Write	– The gateway sends process data from the configured field devices to the MQTT broker network. – Manual adding of field devices is enabled. – Automatic adding of field devices via the Auto-Scan function is enabled. – Parameters of connected devices can be changed.

Tab. 6: Rotary switch for the operating mode

4.2.4 Network connections

There are 2 Industrial Ethernet interfaces on the gateway for connection to an MQTT broker and for the Industrial Ethernet network with connection to field devices. The 'Cloud' and 'Device' network connections. Both connections have auto-negotiation and crossover detection.
The following table shows the pin allocation with deactivated Crossover detection:

Connection	Pin	Cloud		Device	
		Signal	Explanation	Signal	Explanation
	1	TD+	Transmitted data +	RD+	Received data +
	2	RD+	Received data +	TD+	Transmitted data +
	3	TD–	Transmitted data –	RD–	Received data –
	4	RD–	Received data –	TD–	Transmitted data –
	Shielding[1)]	FE, Shield	Functional earth	FE, Shield	Functional earth

1) connected to functional earth via RC link

Tab. 7: Network connections

4.2.4.1 MQTT broker

The connection to an MQTT broker is established via the 'Cloud' network connection.

4.2.4.2 Fieldbus protocol and field devices

The 'Device' network connection can be used to connect field devices with an Industrial Ethernet connection directly to the Gateway, e.g. bus nodes or controllers (controller, PLC) with protocols such as PROFINET, EtherNet/IP or OPC UA.

4.2.5 Connection technology

The M12 socket [6] (➔ Fig. 1) can be used to connect a CPX terminal without network connection, i.e. without Industrial Ethernet connection, directly to the gateway.

Connection	Connecting hardware	Cover cap
'Cloud' network connection	NECU-M-S-D12G4-C2-ET plug	ISK-M12
'Device' network connection		
Interface to the CPX terminal without network connection	NEBC-M12G5-S-1.5-N-M12G5 connecting cable	

Tab. 8: Connection technology

5 Assembly

⚠ WARNING

Risk of injury due to electric shock.

- For the electric power supply, use PELV circuits that guarantee a reliable electric disconnection from the mains network.
- Observe IEC 60204-1/EN 60204-1.
- Connect all circuits for the operating and load voltage supply.

NOTICE

Material damage due to incorrect mounting.

Select screws that are suitable for the material of the interlinking block:

- Polymer: thread-grooving screws
- Metal: screws with metric thread

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When ordering a single gateway, all the required screws are included.

The gateway is mounted in an interlinking block of the CPX terminal.

- Version 1:
  Gateway in an interlinking block with system supply, e.g. CPX-GE-EV-S-...
- Version 2:
  Gateway in an interlinking block without system supply between two end plates with system supply, e.g. CPX-EPL-EV-S-...

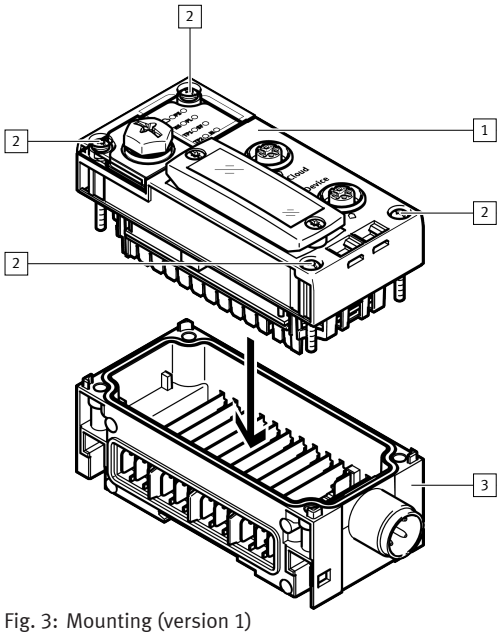

Fig. 3: Mounting (version 1)

1 Gateway CPX-IOT
2 Screw
3 Interlinking block (with system supply)

1. Check the seal and the seal surfaces.
2. Replace damaged seal.
3. Push the gateway carefully and without tilting into the interlinking block up to the stop.
4. Screw the screws into the existing thread.
5. Tighten the screws in crosswise.
   – Tightening torque: 1 Nm ± 10%

6 Installation

6.1 General information about installation

⚠ WARNING

Risk of injury due to electric shock.

- For the electric power supply, use PELV circuits that guarantee a reliable electric disconnection from the mains network.
- Observe IEC 60204-1/EN 60204-1.
- Connect all circuits for the operating and load voltage supply.

NOTICE

Short circuit as a result of ingress of liquids or foreign matter.

Damage to the electronics or malfunction.

- Use connection hardware with the required degree of protection.
- Use cover caps to seal unused connections.
- Only operate the product with cover for DIL and rotary switches mounted.

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The operating and load voltage supply is via an interlinking block with system supply or via an end plate with system supply.
Information on power supply:
➔ System description of the CPX terminal (CPX-SYS)
➔ Pin allocation power supply connection (CPX-PIN-BEL)

Comply with the handling specifications for electro-statically sensitive devices.

NOTICE

Unauthorised Access to the Device Can Cause Damage or Malfunction.

- When connecting the device to a network, protect the network from unauthorised access.
  Standards for security in information technology can be used for network protection measures, e.g. IEC 62443, ISO/IEC 27001.

7 Commissioning

7.1 Selecting operating mode of the gateway

A gateway operating mode must be selected to establish a connection to an MQTT broker ➔ Rotary switch for the operating mode.
The rotary switch must be set to [Read only] or [Read/Write] to establish a connection to the MQTT broker and to the field devices.

7.2 Parameterisation

The gateway is parameterised via the integrated web server of the gateway.

Alternatively, certain settings can be made via the ‘Festo Field Device Tool’ (FFT) or via the ‘Festo Automation Suite’ (FAS).

1. Connect the gateway to a PC or notebook via the ‘Device’ network connection.
2. Call the web server:
   https://‹IP_address_of_the_network_connection_‘Device’›
   ↳ The warning that the web server does not have a secure SSL certificate is displayed.

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   A server certificate suitable for the IT infrastructure can be installed in the ‘Configuration’ › ‘Web server SSL certificate’ menu bar.
3. Logging in:
   – User name: admin
   – Password (factory setting): CPX-IOT Product Key on the type plate, e.g. 3S7PMM2M93V

7.3 Configuring MQTT broker

1. Call the web server:
   https://‹IP_address_of_the_network_connection_‘Device’›
2. To parameterise the MQTT broker, select ‘MQTT’ > ‘Broker Configuration’ in the menu bar.
3. To perform a connection test, select ‘MQTT’ > ‘Send Test Message’ in the menu bar.

7.4 Configure field device or IOT data source

1. Call the web server:
   https://‹IP_address_of_the_network_connection_‘Device’›
2. To configure field devices or IOT data sources, select ‘Devices’ > ‘Manage Devices’ in the menu bar.

7.5 Querying firmware information

The firmware version and firmware updates can be queried via the ‘Festo Field Device Tool’ (FFT) or the ‘Festo Automation Suite’ (FAS).

7.6 Performing firmware update

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Firmware, software or configuration files ➔ www.festo.com/sp.

1. Enter ‘Festo Field Device Tool’ into search.
2. Select software in the ‘Software/Downloads’ section.
3. Download and install the current version of the ‘Festo Field Device Tool’.

8 Malfunctions

8.1 Diagnostics

8.1.1 ‘Cloud’ network status

LED status		Meaning	Error handling
blue light	ON / OFF	Normal operating status: Network connection to MQTT broker established.	—
flashes blue 1x	ON / OFF	Establishment or restoration of a connection to the MQTT broker.	—
flashes blue 2x	ON / OFF	Network error	– Check configuration, e.g. DHCP address assignment, static IP address.
off	ON / OFF	No connection to the MQTT broker.	– Check network connection.

Tab. 9: ‘Cloud’ network status (LED with cloud symbol)

8.1.2 ‘Device’ network status

LED status		Meaning	Error handling
green light	ON / OFF	Normal operating status: The gateway is connected with field devices.	—
flashing green	ON / OFF	No connection to field devices: The gateway has received an IP address, but is not yet connected with field devices.	– Check configuration. – Check module status. – Restart module. – Repeat Onboarding.
red light	ON / OFF	Communication with the field devices has failed: non-permitted network configuration, e.g. already used IP address set.	– Check configuration, e.g. DHCP address assignment, static IP address.
flashing red	ON / OFF	Communication with the field devices has failed: Network connection faulty, e.g. connecting cable interrupted.	– Check device connection.
off	ON / OFF	The gateway is offline.	– Check network connection.

Tab. 10: ‘Device’ network status ([NS] LED)

8.1.3 Module status

LED status		Meaning	Error handling
off	ON / OFF	Normal operating status: The gateway is in the [Off], [Read only] or [Read/Write]➔ Rotary switch for the operating mode operating mode	—
flashes yellow 3x	ON / OFF	Onboarding devices active: The gateway performs a network scan. The gateway is in the [Read/Write] operating mode ➔ Rotary switch for the operating mode.	—
yellow light	ON / OFF	The gateway is in the [Off] or [Onboarding] operating mode. There is no communication with the MQTT broker and no communication with field devices ➔ Rotary switch for the operating mode.	– Set rotary switch to [Read only] or [Read/Write].

Tab. 11: Module status ([M] LED)

8.1.4 ‘Cloud’ connection status

LED status		Meaning	Error handling
green light	ON / OFF	Normal operating status: Network connection established.	–
flashing green	ON / OFF	Data traffic[1)]	–
off	ON / OFF	No network connection	– Check network connection.

1) The flashing frequency depends on the traffic.

Tab. 12: ‘Cloud’ connection status ([TP1] LED)

8.1.5 ‘Device’ connection status

LED status		Meaning	Error handling
green light	ON / OFF	Normal operating status: Network connection to the field devices has been established.	–
flashing green	ON / OFF	Data traffic[1)]	–
off	ON / OFF	No network connection	– Check network connection.

1) The flashing frequency depends on the traffic.

Tab. 13: ‘Device’ connection status ([TP2] LED)

8.1.6 ‘operating power supply’ status

LED status		Meaning	Error handling[1)]
green light	ON / OFF	Normal operating status: Operating voltage applied.	–

LED status		Meaning	Error handling[1)]
 flashing green		Undervoltage: Operating voltage outside the tolerance range.	– Rectify undervoltage.
 off		Operating voltage is not present.	– Check operating voltage supply.

1) General information on the PS LED ➔ System description of CPX terminal (CPX-SYS)

Tab. 14: ‘Operating power supply’ ([PS] LED)

8.1.7 System errors

LED (red)	Sequence	Meaning	Error handling
 off		Normal operating status: No error	–
 flashes red 1x		Minor error/information (error class 1)	➔ System description of the CPX terminal (CPX-SYS)
 flashes red 2x		Error (error class 2)	
 flashes red 3x		Serious error, internal error, e.g. hardware error (error class 3)	

Tab. 15: System errors ([SF] LED)

8.2 Malfunction messages

8.2.1 Reset gateway to factory setting

1. Switch off the power supply.
2. Set DIL switch 2 to [ON].
3. Switch on the power supply.
   ↳ The [M] LED flashes quickly for a few seconds.

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   - Do not switch off the power supply.
   - Do not actuate the DIL switch.
4. If the LED [M] stops flashing, set the DIL switch 2 to [OFF].
   ↳ The gateway has returned to the factory setting.

8.2.2 Resetting web server SSL certificates to factory setting

1. Switch off the power supply.
2. Set DIL switch 2.1 to [ON].
3. Set DIL switch 2.2 to [OFF].
4. Switch on the power supply.
   ↳ The [M] LED flashes quickly for a few seconds.

   i
   - Do not switch off the power supply.
   - Do not actuate the DIL switch.
5. When the [M] LED stops flashing, set DIL switch 2 to [OFF].
   ↳ The web server SSL certificates are reset to factory settings.

9 Disassembly

1. Switch off the power supply and secure it against being switched on again.
2. Unscrew the screws.
3. Pull the gateway out of the interlinking block without tilting it.

10 Technical data

Property		Specification/value
General technical data		➔ System description of the CPX terminal (CPX-SYS)
Power supply		
Operating power supply $U_{EL/SEN}$	[V DC]	24 ± 25 %
Intrinsic current consumption at nominal operating voltage 24 V from operating voltage supply $U_{EL/SEN}$	[mA]	Typically 80 (internal electronics)
Mains buffering time	[ms]	10
Separation of network interface from operating voltage supply $U_{EL/SEN}$		Galvanic
Degree of protection by housing in accordance with IEC 60529, completely mounted, plug connector inserted or cover cap installed. With power supply connection:		
– via interlinking block		IP65/IP67
– via end plate		IP20
Connection technology		
Network connections		2 × sockets, M12, D-coded, 4-pin, SPEEDCON-compatible
Interface to terminal CPX without a network connection		1 × socket, M12, A-coded, 5-pin
Network-specific characteristics		
IP configuration (factory settings)	Cloud	DHCP
	Device	IP address: 192.168.0.1 Subnet mask: 255.255.255.0
Data transfer to the MQTT broker		MQTT version 3.1.1
Transmission technology		Industrial Ethernet, Switched Fast Ethernet
Specification		IEEE 802.3u (100Base-TX)
Transmission rate	[Mbit/s]	10/100 (full duplex/half duplex)
Crossover detection		Auto-MDI/MDI-X
Number of devices (‘Device’ network connection)		maximum 10 More devices can be operated depending on the application.
Cable specification		
Cable type		Ethernet twisted pair cable, shielded (Shielded Twisted Pair, STP)
Transmission class (Link Class)		Cat 5 category
Cable diameter[1)]	[mm]	6 ... 8
Wire cross section[1)2)]	[mm²]	0.14 ... 0.75
Cable length	[m]	maximum 100

1) When using the plug NECU-MS-D12G4-C2-ET
2) 22 AWG required for max. connection length between network participants (end-to-end link)

Tab. 16: Technical data