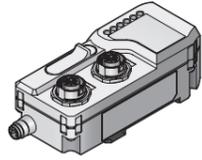


EtherCAT Communication Unit

**UC1-EC**

User's manual and EtherCAT configuration file (XML file) can be downloaded from the OPTEX FA website.  
<https://www.optex-fa.com>



- Thank you for purchasing this UC1-EC EtherCAT communication unit.
- Before using this product, please read this manual carefully to ensure proper use.
- Read this manual thoroughly, and then keep this manual at hand so that it can be used whenever necessary.
- The warranty period of this product is one year after delivery. However, any fault attributable to natural disasters or any other similar disasters or modification or repair will be excluded from the scope of the warranty.

**Safety Precautions**

Safety precautions for ensuring safe operation of this product are displayed as follows with the following symbols. Precautions listed here describe important information about safety. Make sure to follow them accordingly.

**Safety Symbols**

- WARNING** Indicates that any improper operation or handling may result in moderate or minor injury, and in rare cases, serious injury or death. Also indicates a risk of serious property damage.
- CAUTION** Indicates that any improper operation or handling may result in minor injury or property damage.

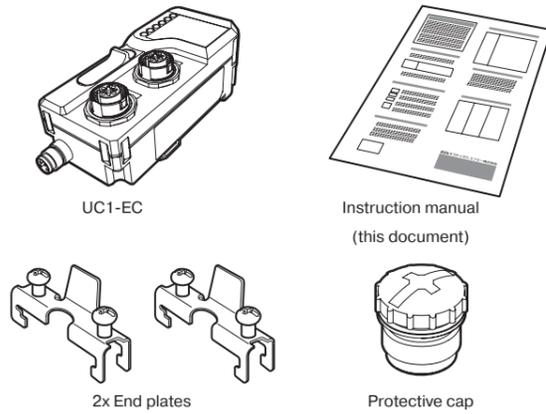
<b>WARNING</b>	
	Do not disassemble, repair, modify, deform under pressure, or attempt to incinerate this product. Doing so may cause injury or fire.
	This product is not explosion-proof and should not be used around flammable or explosive gases or liquids. Doing so may cause ignition resulting in an explosion or fire.
	Do not use air dusters or any spray that uses flammable gas around the product or on the inside of the product. Doing so may cause ignition resulting in an explosion or fire.
	Do not install this product in any of the following locations. Doing so may cause a fire, damage, or a malfunction. <ol style="list-style-type: none"> <li>1. Locations where dust, salt, iron powders, or vapor (steam) is present.</li> <li>2. Locations subjected to corrosive gases or flammable gases.</li> <li>3. Locations where oil or chemical splashes may occur.</li> <li>4. Locations where heavy vibrations or impacts may occur.</li> <li>5. Locations where the ambient temperature exceeds the rated range.</li> <li>6. Locations subject to rapid temperature changes (or where condensation occurs).</li> <li>7. Locations with strong electric or magnetic fields.</li> <li>8. Outdoor locations or locations subject to direct light.</li> </ol>
	This is a class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.
	This product is not intended for use with nuclear power, railways, aviation, vehicles, medical equipment, food-handling equipment, or any application where particular safety measures are required. Absolutely do not use this product for any of these fields.
	This product cannot be used in applications that directly or indirectly detect human bodies for the purpose of ensuring safety. Do not use this product as a detection device for protecting the human body.
	What to do in the event of a malfunction such as smoke being emitted from the product If you detect any malfunction including emission of smoke, abnormal smells or sounds, or the body becoming very hot, immediately stop operating the product and turn off the sensor power. Failure to do so may cause a fire. Repairing the product is dangerous and should in no way be performed by the customer. Contact an OPTEX FA sales representative for repairs.

- CAUTION**
- Make sure to turn the power off before wiring the cable or connecting/disconnecting the connector. Connecting or disconnecting while energized may damage the product or cause electric shock.
- Do not wire with high voltage cables or power lines. Doing so may cause malfunction or damage by induction.
- Do not bend the cable when below the freezing point. This may cause the cable to break.
- Do not drop the product or subject the product to strong impacts. Doing so may damage the product.
- Follow the instructions in this manual or the specified instruction manual when wiring the product or the dedicated controller for the correct wiring method. Incorrect wiring can damage the product or the controller, or cause a malfunction.
- When disconnecting the connector, be careful not to touch the terminals inside the connector, and do not allow foreign objects to enter the connector.
- Install this product as far away as possible from high-voltage equipment, power equipment, equipment that generates large switching surges, inverter motors, welders, or any equipment that can be a source of noise.
- When connecting or disconnecting the cable, make sure to hold it by the connector portion, and do not apply excessive force to the cable.

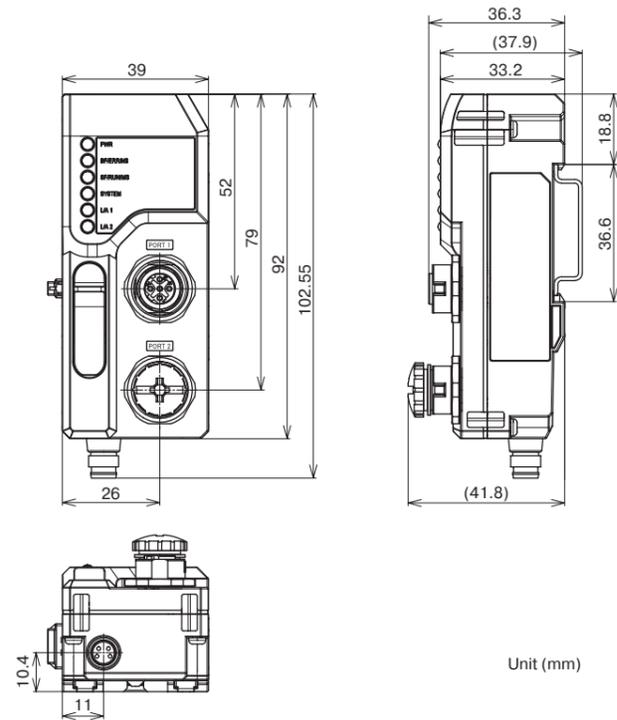
**NOTICE**

- After carefully considering the intended use, required specifications, and usage conditions, install and use the product within the specified ranges.
- All specifications may be changed without notice.
- When using this product, it is the responsibility of the customer to ensure necessary safety designs in hardware, software, and systems in order to prevent any threat to life, physical health, and property due to product malfunction or failure.
- Do not use this product for the development of weapons of mass destruction, for military use, or for any other military application. Moreover, if this product is to be exported, comply with all applicable export laws and regulations, including the "Foreign Exchange and Foreign Trade Act" and the "Export Administration Regulations," and carry out the necessary procedures pursuant to the provisions therein.
- For more details on conformity to the Restriction of Hazardous Substances Directive for this product, please contact an OPTEX FA sales representative. Before using this product, fully examine the applicable environmental laws and regulations, and operate the product in conformity to such laws and regulations. OPTEX FA does not assume any responsibility for damages or losses occurring as a result of noncompliance with applicable laws and regulations.

**1. Included Items**



**2. Dimensions**



**3. Connector Pin Layout**

	Ethernet connector (M12)	Power connector (M8)
1	Tx+	12 to 24 VDC
2	Rx+	Not used
3	Tx-	GND
4	Rx-	Not used

Make sure to turn the power off before wiring the cable or connecting/ disconnecting the connector.

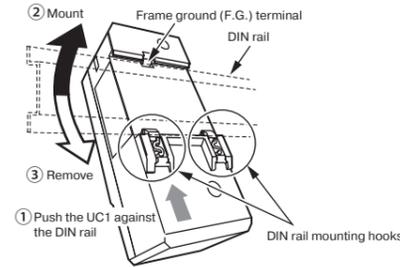
**4. Installation**

**Installing to DIN rail**

Install the UC1-EC on a grounded DIN rail whose surface can transmit power, and in the same way, install the fiber amplifiers and connect them.

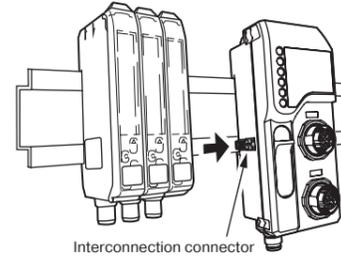
- Tips**
- Remove the power cable before proceeding with installation. In particular, make sure there is no power being transmitted when connecting and disconnecting the UC1-EC and devices that can be connected to it.

Align the DIN rail mounting hooks on the lower part of the back of the UC1-EC with the bottom of the DIN rail, and while pushing against the DIN rail in the direction indicated in ① below, set the UC1-EC onto the rail as indicated in ②.

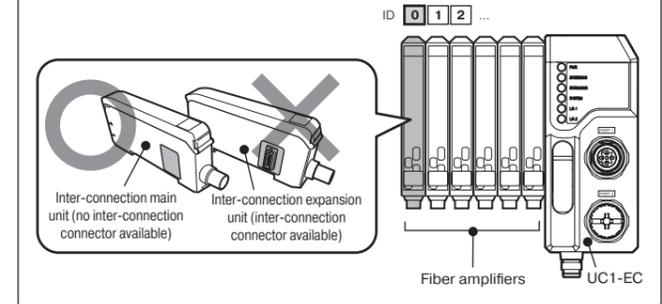


- Tips**
- If the installation on the DIN rail is incomplete, defects may occur in the connections with supported sensors and in the connection to the FG terminal. Check whether the DIN rail mounting hooks are firmly locked and whether the UC1-EC is securely mounted on the DIN rail.
- To remove the UC1-EC from the DIN rail, push the UC1-EC against the DIN rail in the direction indicated with ① and tilt the UC1-EC in the direction indicated with ③.

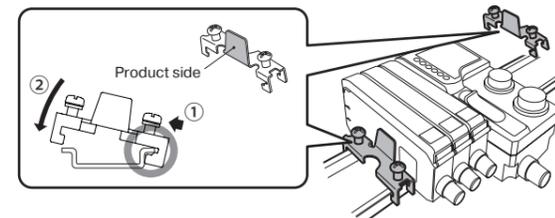
Mount the fiber amplifiers on the DIN rail in the same way, and connect them to the UC1-EC.



- Tips**
- When connecting the UC1-EC to digital fiber amplifiers, make sure to connect a main unit on the left end (ID = 0). If an expansion unit is connected on the left end, the inter-connection connector will be exposed, causing interference with the end plate. Also, fouling or damage on the interconnection connector may damage the fiber amplifiers.

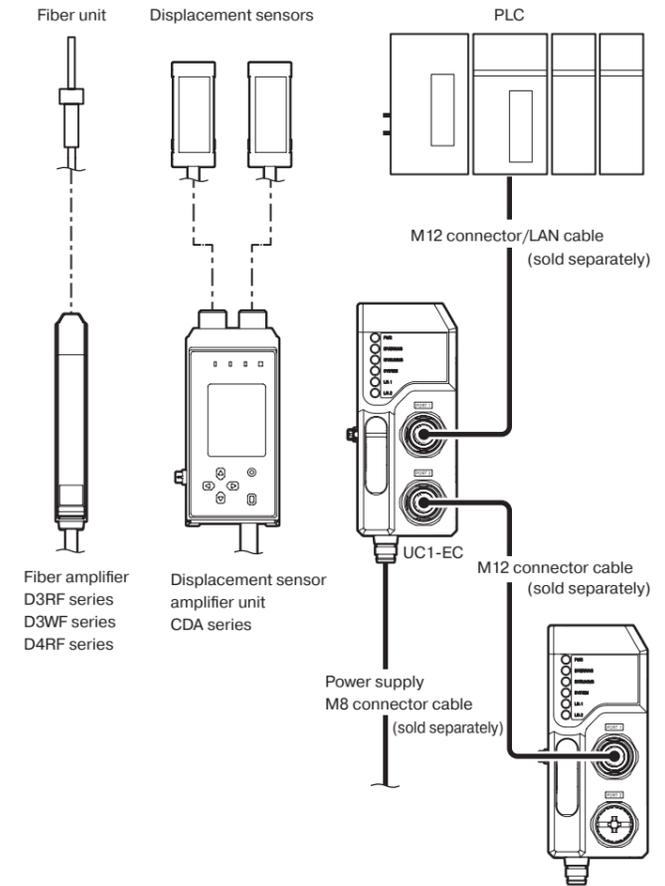


Attach end plates so as to sandwich the interconnected units, and secure with screws. The tightening torque should be 0.9 N·m or less. Orient the end plates so that the product side is against the UC1-EC and the fiber amplifiers, making sure to attach the left and right sides in opposite orientations. Attach the end plates by hooking the notched side on the DIN rail first, as shown in the following diagram.



**5. System Configuration Diagram**

To use this unit, connect it to D3RF/D3WF/D4RF series fiber amplifiers or CDA series displacement sensor amplifier units.



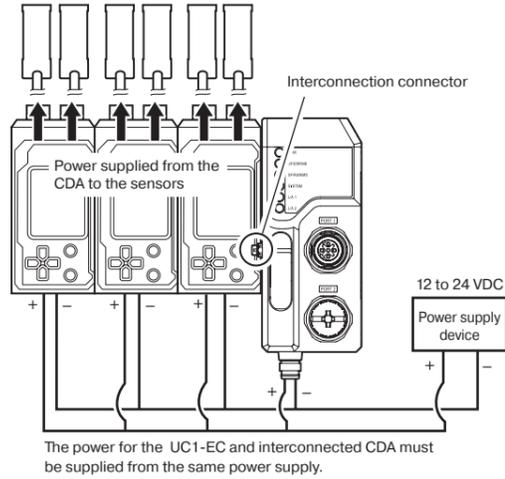
- Up to 16 fiber amplifiers or up to 8 displacement sensor amplifier units can be connected to the UC1-EC. When connecting mixed units, calculate one displacement sensor amplifier unit for two fiber amplifiers, and do not exceed a total of 16 units.
- The power supply connections vary between the devices that are connected. See **6. Connecting** for details.
- Connect the network cable from the master side to PORT 1 on this unit. To connect to another slave device, connect its network cable to PORT 2 on this unit.
- \* When not connecting to another slave device, connect the protective cap to PORT 2.

## 6. Connecting

### Connecting power cables

The UC1-EC operates with power input (12-24V DC) to the power connector. Make sure to check the wiring to the power supply device because incorrect wiring may cause a fire or damage the product

#### Combination of UC1-EC and CDA



An external power supply separate from that for the UC1-EC must be connected to the CDA. In this situation, the interconnection connector of the UC1-EC is used only for communication.

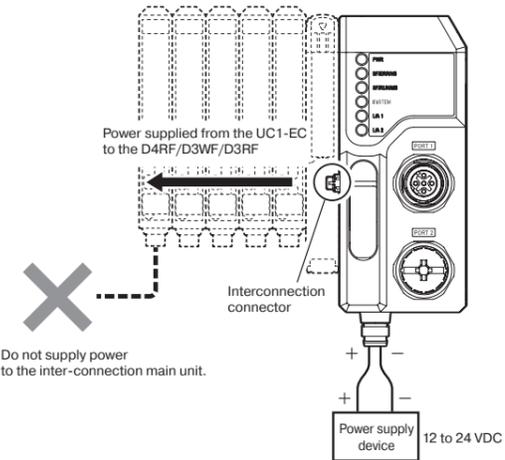
Also, power is supplied to the displacement sensors from the CDA. The UC1-EC can be connected to CDA main units and expansion units. When connecting the UC1-EC to CDA units, make sure to connect the main unit on the left end. If an expansion unit is connected on the left end, the interconnection connector will be exposed, damaging the product.

#### CAUTION

Connect all the power supply wires (brown/blue) of the connected CDA to the same power supply device. Wiring the external power supply to the UC1-EC with the factory default status (in which the wires are bundled) without wiring the external power supply to the CDA (when connected to the UC1-EC) will short-circuit the CDA.

- To prevent short-circuits, wire the external power supply in the following order: 1) CDA, 2) UC1-EC.
- The external power supply to the UC1-EC can be omitted.
  - Ensure that the length of the power cable to the UC1-EC and to the CDA series is 30 m or less.

#### Combination of UC1-EC, D4RF, D3WF and D3RF

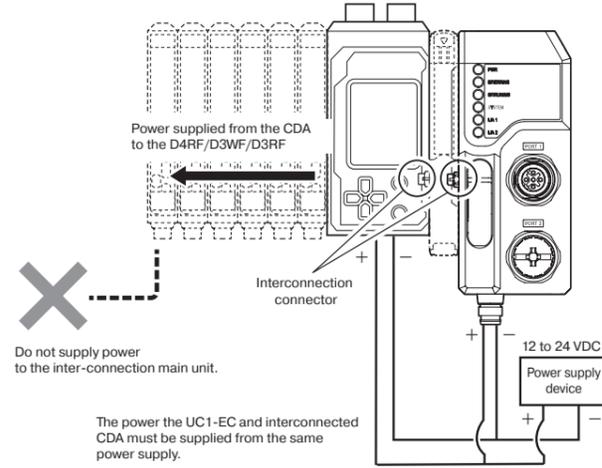


- When only one series of fiber amplifiers are to be interconnected to UC1-EC (e.g. when only D4RF series is to be interconnected), interconnect in the following order from the left end: fiber amplifier main unit → fiber amplifier expansion unit → UC1-EC.
- When the fiber amplifiers to be interconnected consists of multiple series (e.g. when D3RF, D3WF, and D4RF are mixed and interconnected), interconnect in the following order from the left end: D3RF main unit or D3WF main unit → D3RF expansion unit or D3WF expansion unit → D4RF expansion unit → UC1-EC.

#### CAUTION

- Do not supply power to D3RF, D3WF, and D4RF.
- When using cable-type fiber amplifiers, perform insulation processing to prevent the power wires (brown/blue) from short-circuiting. Short-circuits may lead to device damage. Furthermore, in the case of connector types, connect the included black cap to the M8 connector when the connector cable is not connected to prevent the pins from short-circuiting.
- Ensure that the length of the power cable to the UC1-EC is 30 m or less.

#### Combination of UC1-EC, CDA, D4RF, D3WF and D3RF

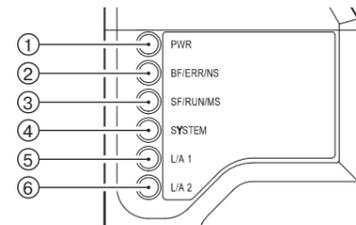
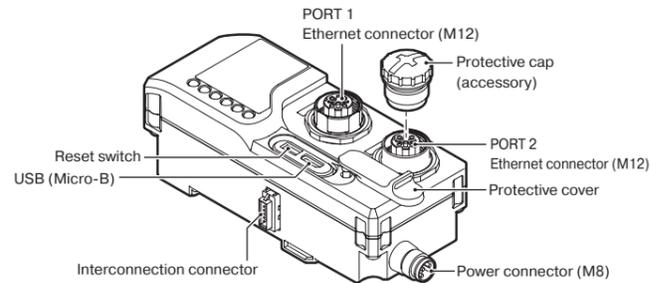


- When only one series of fiber amplifiers and CDAs are to be interconnected to UC1-EC (e.g. when only D4RF series is to be interconnected as fiber amplifiers), interconnect in the following order from the left end: fiber amplifier main unit → fiber amplifier expansion unit → CDA expansion unit → UC1-EC.
- When the fiber amplifiers to be interconnected consists of multiple series and CDAs (e.g. when fiber amplifiers D3RF, D3WF, and D4RF are mixed and interconnected), interconnect in the following order from the left end: D3RF main unit or D3WF main unit → D3RF expansion unit or D3WF expansion unit → D4RF expansion unit → CDA expansion unit → UC1-EC.
- Since the order of interconnecting D4RF expansion unit and CDA expansion unit is interchangeable, they can be interconnected in the following order from the left end: D3RF main unit or D3WF main unit → D3RF expansion unit or D3WF expansion unit → CDA expansion unit → D4RF expansion unit → UC1-EC.

#### CAUTION

- Provide the external power supply to the CDA from the same power supply device as the UC1-EC.
- Regardless of the connection configuration, it is not necessary to supply power to the D3RF, D3WF, or D4RF.
- When using cable-type fiber amplifiers, perform insulation processing to prevent the power wires (brown/blue) from short-circuiting. Short-circuits may lead to device damage. Furthermore, in the case of connector types, connect the included black cap to the M8 connector when the connector cable is not connected to prevent the pins from short-circuiting.
- Ensure that the length of the power cable to the UC1-EC and to the CDA series is 30 m or less.

## 7. Part Names



	Name	Indication	Details
①	PWR	Green ON	Voltage supply on
		Green OFF	Voltage supply off

	Name	Indication	Details
②	ERR (error)	Red OFF	No error
		Single blink	Local error in the device
		Double blink	Timeout in the device
		ON	Application controller fault
		Blinking	Invalid configuration
		Green OFF	Device initializes
③	RUN (operation)	ON	Device has OPERATIONAL status
		Blinking	Device has PRE-OPERATIONAL status
		ON	Device is running
④	SYSTEM	Green OFF	Device not configured
		ON	Device is running
⑤	L/A1 (Link/Activity 1)	Green OFF	No network connection at PORT 1
		ON	Network connection at PORT 1 available, no communication
		Blinking	Network connection, communication active
⑥	L/A2 (Link/Activity 2)	Green OFF	No network connection at PORT 2
		ON	Network connection at PORT 2 available, no communication
		Blinking	Network connection, communication active

## 8. Error Codes

All data pertaining to the device status and errors is sent to a Service Data Object.

## 9. Specifications

	Model	UC1-EC
EtherCAT specifications*1	Supported version	EtherCAT Slave
	Regulatory compliance	IEEEE802.3u
	Distance between nodes	100 m max.
	Baud rate	100 MBaud
	Cable	STP Category 5 or higher
	Supported functions	Process data communication, mailbox communication (supports CoE)
Connected devices	Connectable models	D3RF/D3WF/D4RF series inter-connection main unit and expansion unit CDA series main unit and expansion unit
	No. of connectable units	Up to 16 units*2 (One CDA unit requires two spaces)
	Connection type	5-pin connector for linking (functions as a linking end unit)
Indicators		Power indicator, green (PWR)
		Error indicator, red (ERR)
		Run indicator, green (RUN)
		Operation indicator, green (SYSTEM)
		PORT 1 indicator, green (L/A 1)
		PORT 2 indicator, green (L/A 2)
Data		PDO communication (sending: max. 120 bytes, receiving: max. 36 bytes)
		SDO communication
Ratings	Supply voltage	12 to 24 VDC, including ±10% ripple (p-p)
	Power consumption	Max. 3 W
Protection circuit		Reverse connection protection
Warm-up time		1.5 s or less
Environmental resistance	Ambient temperature/humidity	-25 to +55°C/35 to 85%RH (no freezing or condensation)
	Storage temperature/humidity	-40 to +70°C/35 to 85%RH (no freezing or condensation)
	Vibration resistance	10 to 55 Hz; double amplitude 1.5 mm; 2 hours in each of the X, Y, and Z directions
	Shock resistance	500 m/s <sup>2</sup> (approx. 50 G), 3 times in each of the X, Y, and Z directions
	Degree of protection	IP50
Applicable regulations	EMC	EMC Directive (2014/30/EU)
	Environment	RoHS Directive (2011/65/EU), China RoHS (MIIT Order No.32)
Applicable standards		EN 61000-6-2, EN 55011
Company standards		Noise resistance: Feilen Level 3 cleared
Installation		35 mm DIN rail (whose surface should be conductive)
Material		PC
Included accessories		Instruction manual, Protective cap, End plates (2)

\*1: EtherCAT is a registered trademark of Beckhoff Automation GmbH & Co. KG.

\*2: The operating ambient temperature and the maximum number of connected units for D3RF/D3WF/D4RF are as follows.

However, please check the instruction manual of the product to be connected for the operating ambient temperature and the maximum number of units that can be connected in a UL certified environment.

### D3RF/D3WF series

Ambient temperature	-25 to +55°C	-25 to +50°C	-25 to +45°C
Number of connectable D3RF/D3WF units	1 to 3	4 to 8	9 to 16

### D4RF series

Ambient temperature	-25 to +55°C	-25 to +50°C	-25 to +45°C
Number of connectable D4RF units	1 to 2	3 to 5	6 to 16

### UL Satisfaction Ratings

\*The total control output current and ambient temperature will be restricted as follows depends on the number of the sensor amplifiers and units connected to this unit.



#### Up to 3 units

Input : 12 - 24Vdc, Max. 1.02A Class 2  
Output : 12 - 24Vdc, Max. 0.45A Class 2  
Maximum Surrounding Air Temperature +55°C

#### Up to 8 units

Input : 12 - 24Vdc, Max. 1.02A Class 2  
Output : 12 - 24Vdc, Max. 0.8A Class 2  
Maximum Surrounding Air Temperature +50°C

#### Up to 16 units

Input : 12 - 24Vdc, Max. 1.02A Class 2  
Output : 12 - 24Vdc, Max. 0.8A Class 2  
Maximum Surrounding Air Temperature +45°C

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

\*This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interferences to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

- Support for the China RoHS directive
- For details on the support for the China RoHS (the Administrative Measure on the Control of Pollution Caused by Electronic Information Products), see the following website.  
[https://www.optex-fa.com/rohs\\_cn/](https://www.optex-fa.com/rohs_cn/)

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