

# TN-4500A Series Quick Installation Guide

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Moxa ToughNet Switch

Edition 2.0, April 2017

## Technical Support Contact Information [www.moxa.com/support](http://www.moxa.com/support)

### Moxa Americas:

Toll-free: 1-888-669-2872

Tel: 1-714-528-6777

Fax: 1-714-528-6778

### Moxa China (Shanghai office):

Toll-free: 800-820-5036

Tel: +86-21-5258-9955

Fax: +86-21-5258-5505

### Moxa Europe:

Tel: +49-89-3 70 03 99-0

Fax: +49-89-3 70 03 99-99

### Moxa Asia-Pacific:

Tel: +886-2-8919-1230

Fax: +886-2-8919-1231

### Moxa India:

Tel: +91-80-4172-9088

Fax: +91-80-4132-1045

# MOXA®

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P/N: 180204500011



## Overview

The ToughNet TN-4500A series M12 managed Ethernet switches are designed for industrial applications in harsh environments. The TN series switches use M12 connectors to ensure tight, robust connections, and guarantee reliable operation against environmental disturbances, such as vibration and shock. The wide 24 to 110 VDC dual power inputs increases the reliability of your communications.

The TN-4500A series includes PoE, non-PoE, and fiber switches.

- TN-4516A non-PoE series: 12 fast Ethernet M12 ports; 4 gigabit Ethernet ports.
- TN-4516A PoE series: 12 fast Ethernet M12 ports with PoE functionality; 4 gigabit Ethernet ports with PoE functionality.
- TN-4516A fiber series: 12 fast Ethernet M12 ports with PoE functionality; 2 gigabit Ethernet ports with PoE functionality; 2 gigabit Ethernet ports with a Q-ODC fiber connector.
- TN-4524A PoE series: 24 Fast Ethernet M12 ports, 16 with PoE functionality.
- TN-4528A PoE series: 24 fast Ethernet M12 ports, 16 with PoE functionality; 4 gigabit Ethernet ports with PoE functionality.
- TN-4528A fiber series: 24 fast Ethernet M12 ports, 16 with PoE functionality; 2 gigabit Ethernet ports with PoE functionality; 2 gigabit Ethernet ports with a Q-ODC fiber connector.

The -40 to 75°C operating temperature and IP42-rated waterproof enclosure allow deployment in harsh environments. The TN-4500A series Ethernet switches are compliant with mandatory sections of EN 50155, covering operating temperature, power input voltage, surge, ESD, and vibration, as well as conformal coating and power insulation, making the switches suitable for a variety of industrial applications.

## Package Checklist

Your ToughNet TN-4500A switch is shipped with the following items. If any of these items are missing or damaged, please contact your customer service representative for assistance.

- 1 Moxa ToughNet switch
- M12-to-DB9 console port cable
- 2 protective caps for console and relay output ports
- Panel-mounting kit
- CD-ROM with user's manual, Windows utility, and SNMP MIB file
- Quick installation guide (printed)
- Warranty card

## Features

### ***Anti-Vibration Circular Connectors for Robust Links***

- M12 D-coded 4-pin female connectors for Fast Ethernet 10/100BaseT(X) ports
- M12 X-coded 8-pin female connectors for gigabit Ethernet 10/100/1000BaseT(X) ports
- M12 A-coded 5-pin male connectors for console and relay outputs
- M23 6-pin male connectors for power input
- Q-ODC fiber connector for Gigabit Ethernet 1000BaseLSX with 2km multimode embedded transceiver

### ***Isolated Power Inputs***

- Supports 24 to 110 VDC (16.8 to 137.5 VDC)

### ***High Performance Network Switching Technology***

- IPv6 ready, certified by the IPv6 Logo Committee
- IEEE 1588v2 PTP (Precision Time Protocol) for the precise time synchronization of networks
- DHCP Option 82 for IP address assignment with different policies
- Turbo Ring and Turbo Chain (recovery time <20 ms @250 switches), and STP/RSTP/MSTP for network redundancy
- IGMP Snooping and GMRP for filtering multicast traffic from industrial Ethernet protocols
- Port-based VLAN, IEEE 802.1Q VLAN, and GVRP protocol to ease network planning
- QoS (IEEE 802.1p/1Q and ToS/DiffServ) allows real-time traffic classification and prioritization
- 802.3ad, LACP for optimum bandwidth utilization
- TACACS+, SNMPv3, IEEE 802.1X, HTTPS, and SSH to enhance network security
- SNMP v1/v2c/v3 for different levels of network management
- RMON for efficient network monitoring and proactive capability
- Bandwidth management prevents unpredictable network status
- Lock port allows access by only authorized MAC addresses
- Port mirroring for online debugging
- Automatic warning by exception through email, relay output
- Automatic recovery of connected devices' IP addresses
- Line-swap fast recovery
- LLDP for automatic topology discovery through network management software
- Loop protection prevents network loops
- Configurable through web browser, Telnet/serial console, CLI, and Windows utility

### ***Designed for Industry-Specific Applications***

- Four Gigabit Ethernet ports to meet high bandwidth requirements.
- Complies with all EN 50155 mandatory test items\*
- -40 to 75°C operating temperature range
- IP42 rugged high-strength case
- Panel mounting installation capability

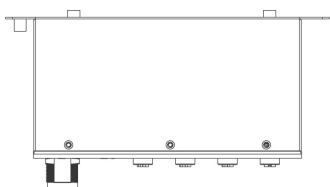
\*This product is suitable for rolling stock railway applications, as defined by the EN 50155 standard. For a more detailed statement, click here: [www.moxa.com/doc/specs/EN\\_50155\\_Compliance.pdf](http://www.moxa.com/doc/specs/EN_50155_Compliance.pdf)

### ***Recommended Optional Accessories***

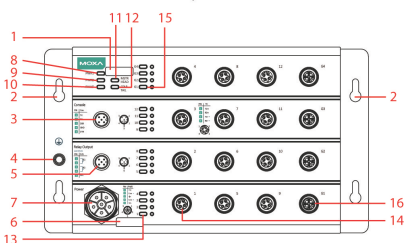
- CBL-M23(FF6P)Open-BK-100-IP67: 1-meter M23 to 6-pin power cable with IP67-rated female 6-pin M23 connector
- CBL-M12D(MM4P)/RJ45-100 IP67: 1-meter M12-to-RJ45 Cat-5E UTP Ethernet cable with IP67-rated male 4-pin M12 D-coded connector
- CBL-M12(FF5P)/OPEN-100 IP67: 1-meter M12-to-5-pin power cable with IP67-rated female 5-pin M12 A-coded connector
- CBL-M12XMM8PRJ45-Y-200-IP67: 2-meter M12-to-RJ45 Cat-5 UTP Ethernet cable with IP67-rated 8-pin male X-coded crimp type M12 connector
- CBL-M12XMM8P-Y-300-IP67: 3-meter M12-to-M12 Cat-5 UTP Ethernet cable with IP67-rated 8-pin male X-coded crimp type M12 connector

- CBL-M12XMM8P-Y-100-IP67: 1-meter M12-to-M12 Cat-5 UTP Ethernet cable with IP67-rated 8-pin male X-coded crimp type M12 connector
- M12D-4P-IP68: Field-installable M12 D-coded screw-type connector, male 4-pin, IP68-rated
- M12A-5P-IP68: Field-installable M12 A-coded screw-type connector, female 5-pin, IP68-rated
- M12X-8PMM-IP67-HTG: Field-installable M12 X-coded crimp type, slim design connector, 8-pin male, IP67-rated
- A-CAP-M12F-M: Metal cap for M12 female connector
- A-CAP-M12M-M: Metal cap for M12 male connector
- A-PLG-WPM23-01: M23 cable connector, 6-pin female, crimp type

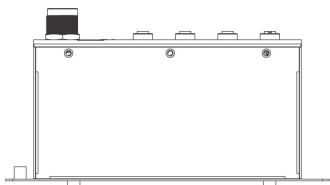
## TN-4516A non-PoE Series Panel Layouts



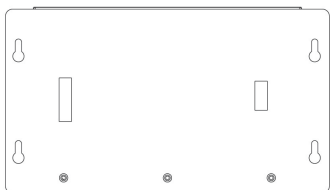
Top View



Front View



Bottom View

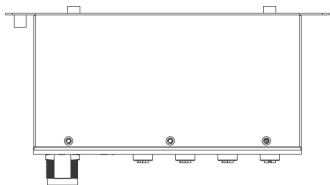


Rear View

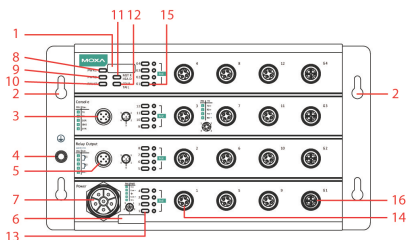
1. Model name
2. Screw holes for panel mounting kit
3. Console port
4. Grounding screw
5. Relay output port
6. Power input voltage range indicator
7. Power input port (male 5-pin shielded M23 connector)
8. PWR1 LED: for power input 1
9. PWR2 LED: for power input 2
10. FAULT LED
11. MSTR/HEAD LED: for ring master or chain head
12. CPLR/TAIL LED: for ring coupler or chain tail
13. TP port's 10/100 Mbps LED
14. 10/100BaseT(X) port (M12 D-coded 4-pin female connector)
15. Gigabit Ethernet port LED: Gigabit port's 10/100/1000 Mbps LED
16. 10/100/1000BaseT(X) port (M12 X-coded 8-pin female connector)



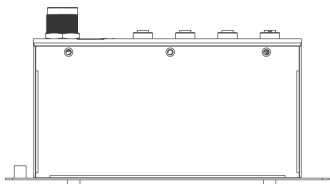
## TN-4516A PoE Series Panel Layouts



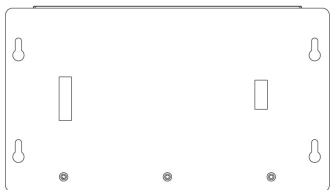
Top View



Front View



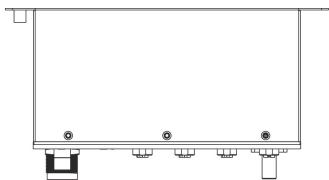
Bottom View



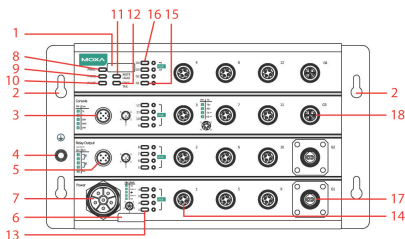
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16. 10/100/1000BaseT(X) port (M12 X-coded 8-pin female connector)

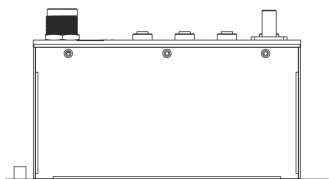
## TN-4516A Fiber Series Panel Layouts



Top View



Front View



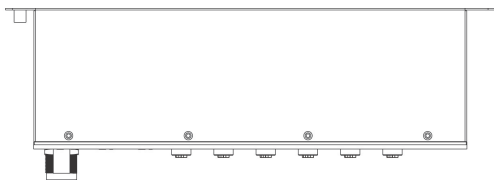
Bottom View



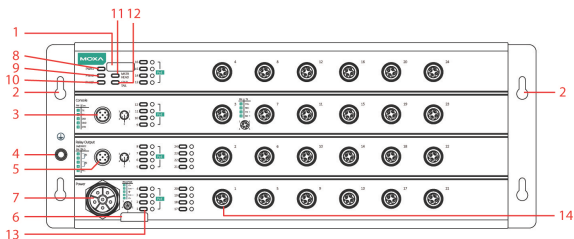
Rear View

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4. Grounding screw
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7. Power input port (male 5-pin shielded M23 connector)
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13. TP port's 10/100 Mbps LED
14. 10/100BaseT(X) port (M12 D-coded 4-pin female connector)
15. Gigabit Ethernet port LED: Gigabit port's 1000 Mbps LED
16. Gigabit Ethernet port LED: Gigabit port's 10/100/1000 Mbps LED
17. 1000BaseLSX Gigabit fiber port
18. 10/100/1000BaseT(X) port (M12 X-coded 8-pin female connector)

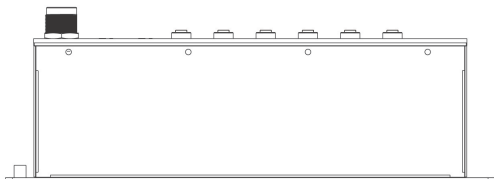
## TN-4524A PoE Series Panel Layouts



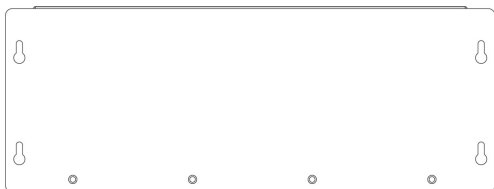
Top View



Front View



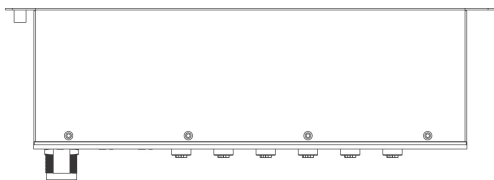
Bottom View



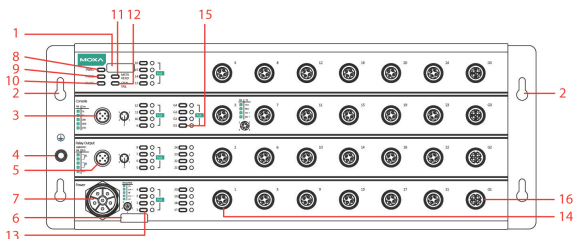
Rear View

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14. 10/100BaseT(X) port (M12 D-coded 4-pin female connector)

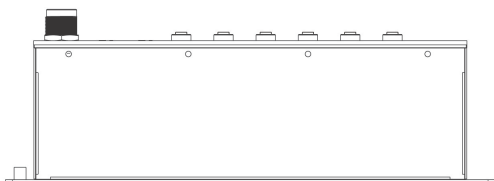
## TN-4528A PoE Series Panel Layouts



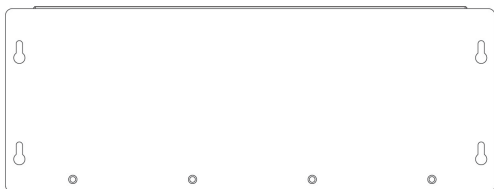
Top View



Front View



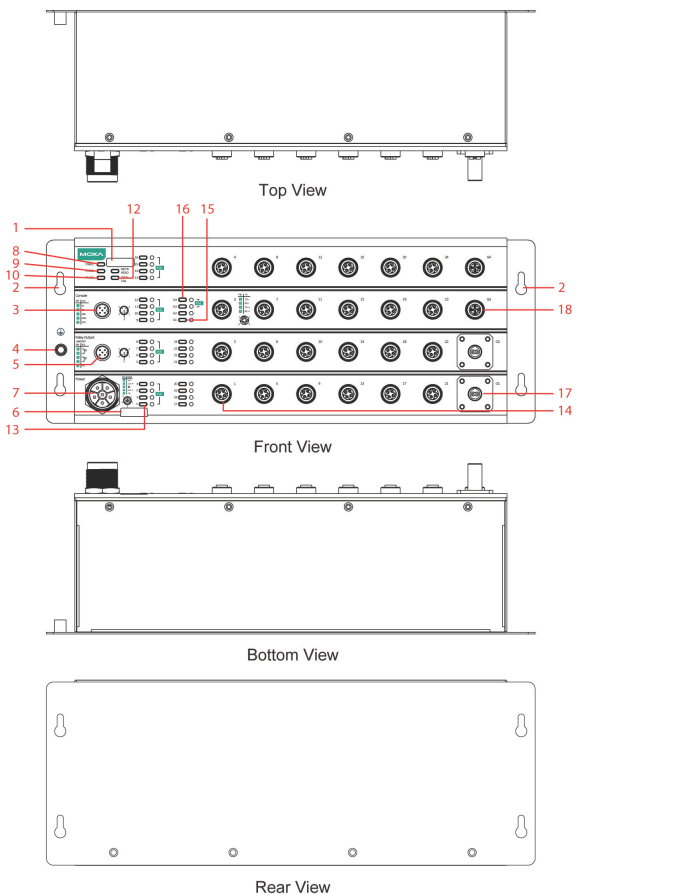
Bottom View



Rear View

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15. Gigabit Ethernet port LED: Gigabit port's 10/100/1000 Mbps LED
16. 10/100/1000BaseT(X) port (M12 X-coded 8-pin female connector)

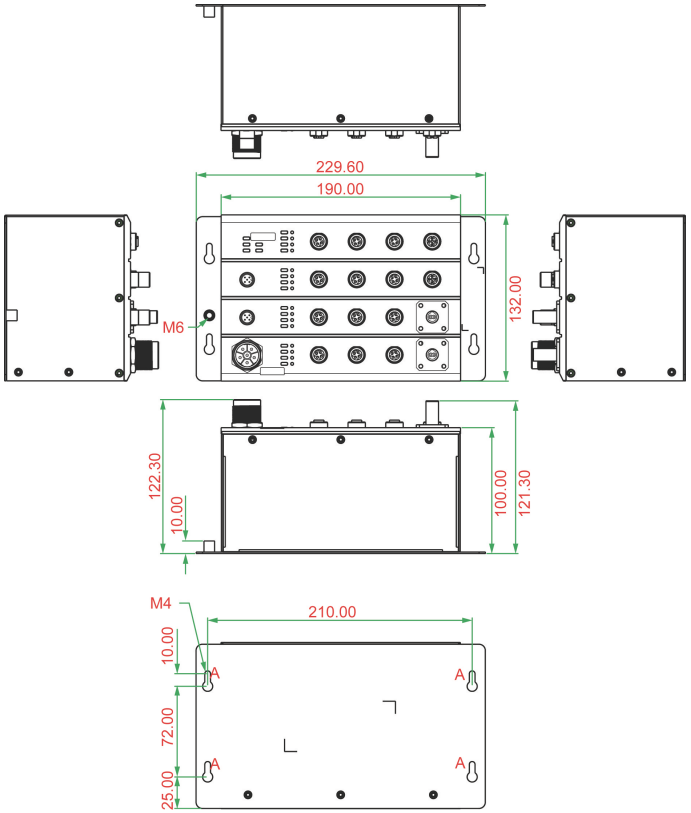
## TN-4528A Fiber Series Panel Layouts



1. Model name
2. Screw holes for panel mounting kit
3. Console port
4. Grounding screw
5. Relay output port
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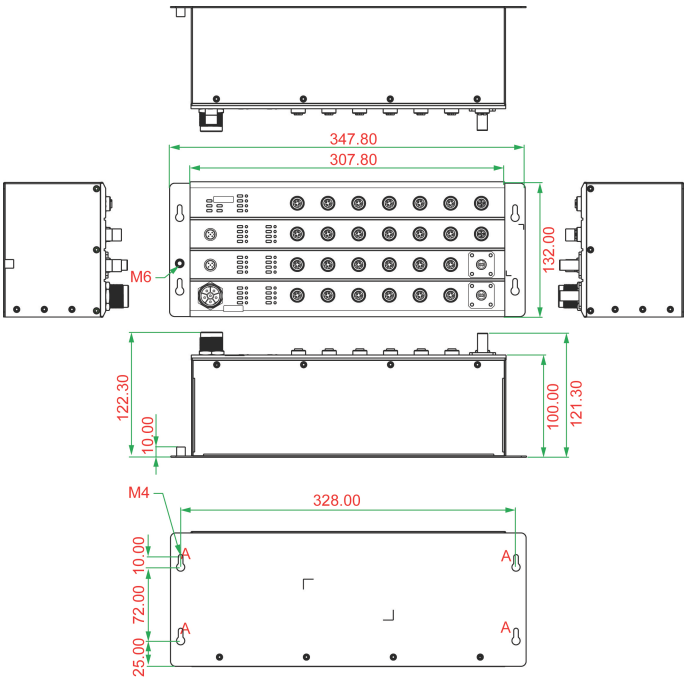
**TN-4516A Fiber Series**







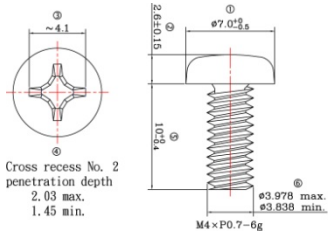
## TN-4528A Fiber Series



## Panel/Wall Mounting

**STEP 1:** Mounting the TN-4500A to a wall requires 4 screws. Use the ToughNet switch as a guide to mark the correct positions of the 4 screws.

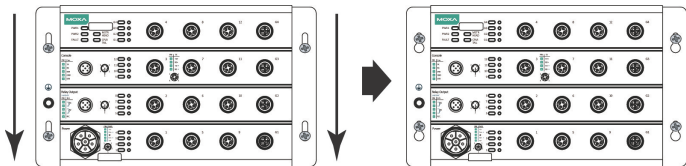
**STEP 2:** Use the 4 screws in the panel mounting kit. If you would like to use your own screws, make sure the screw head is **between 6.0 mm and 7.0 mm** in diameter and the shaft is less than **4.0 mm** in diameter, as shown at the right.



Do not screw the screws in all the way—leave a space of about 2 mm to allow room for sliding the ToughNet switch between the wall and the screws.

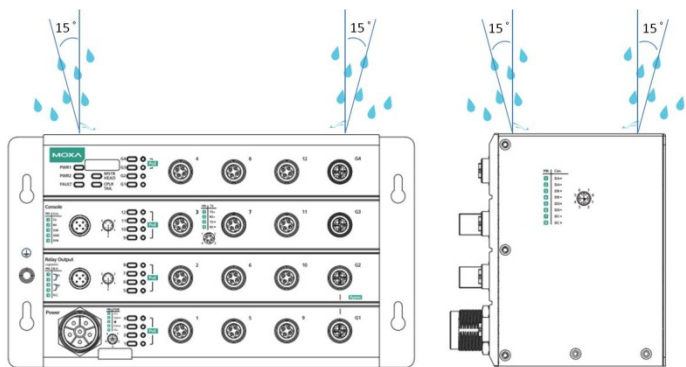
**NOTE** Before tightening the screws into the wall, make sure the screw head and shaft size are suitable by inserting the screw through one of the keyhole-shaped apertures of the ToughNet switch.

**STEP 3:** Once the screws are fixed in the wall, hang the ToughNet switch on the 4 screws through the large opening of the keyhole-shaped apertures, and then slide the switch downwards. Tighten the four screws for added stability.



**NOTE** To provide greater protection from vibration and shock, use screws with shaft diameter between 6.0 mm and 7.0 mm, and fix the ToughNet switch onto the wall directly through the large opening of the keyhole-shaped apertures.

**NOTE** TN-4500A series switches have passed IP42 certification. To achieve the IP42 protection, only use upright panel/wall mounting installation. Water sprayed at an angle of up to 15° degrees from the vertical will not damage the product (as indicated in the following illustration).



## Wiring Requirements



### WARNING

Turn the power off before disconnecting modules or wires. The correct power supply voltage is listed on the product label. Check the voltage of your power source to make sure you are using the correct voltage. Do NOT use a voltage greater than what is specified on the product label.

These devices must be supplied by a SELV source as defined in the Low Voltage Directive 2006/95/EC and 2004/108/EC.



## ATTENTION

### Safety First!

Be sure to disconnect the power cord before installing and/or wiring your Moxa switch. This device has UL 61010-2-201 approval. Use copper conductors only, 75°C, and tighten to 4.5 pound-inches. For use in pollution degree 2 environments.



## ATTENTION

### Safety First!

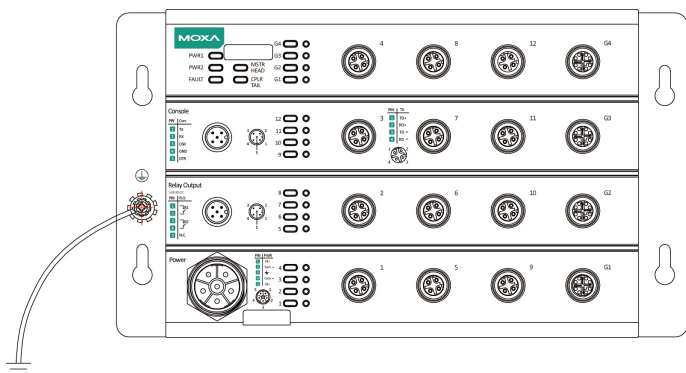
Observe all electrical codes dictating the maximum current allowable for each wire size. If the current goes above the maximum ratings, the wiring could overheat, causing serious damage to your equipment.

### Please read and follow these guidelines:

- Use separate paths to route wiring for power and devices. If power wiring and device wiring paths must cross, make sure the wires are perpendicular at the intersection point.  
**NOTE:** Do not run signal or communications wiring and power wiring through the same wire conduit. To avoid interference, wires with different signal characteristics should be routed separately.
- You can use the type of signal transmitted through a wire to determine which wires should be kept separate. The rule of thumb is that wiring that shares similar electrical characteristics can be bundled together.
- Keep input wiring and output wiring separated.
- It is strongly advised that you label wiring for all devices in the system when necessary.

## Grounding the ToughNet Switch

Grounding and wire routing help limit the effects of noise due to electromagnetic interference (EMI). Run the ground connection from the grounding screw to the grounding surface prior to connecting devices.





## ATTENTION

This product is intended to be mounted to a well-grounded mounting surface such as a metal panel.

## Connecting the Power Supplies

ToughNet TN-4500A series switches support dual power inputs—power input 1 and power input 2. The M23 6-pin male connector on the TN-4500A series switches' front panel is used for the dual power inputs.

### Pinouts for the power input port on the TN-4500A series

#### **PIN | PWR**

**1** V1+

**2** Com-

**3**  $\perp$

**4** Com-

**5** V2+



Pin	Description	Usage
1	PWR1 / DC +	Connect "PWR1 Live / DC +" to the positive (+) terminal when using a DC power source.
2	PWR1 / DC -	Connect "PWR1 Neutral / DC -" to the negative (-) terminal when using a DC power source.
3	Chassis Ground	Connect the "Chassis Ground" to the equipment ground bus for DC inputs.
4	PWR2 / DC -	Connect "PWR2 Neutral / DC -" to the negative (-) terminal when using a DC power source.
5	PWR2 / DC +	Connect "PWR2 Live / DC +" to the positive (+) terminal when using a DC power source.

**STEP 1:** Plug your power cord connector into the power input port of the TN-4500A switch.

**STEP 2:** Screw the nut on your power cord connector into the power input connector on the switch to ensure a tight connection.



## ATTENTION

Before connecting the TN-4500A series to the power input, make sure the power source voltage is stable.



## ATTENTION


Do not power on the TN-4500A series before connecting the M23 connector.

## Connecting the Relay Outputs

Each TN-4500A series switch has two sets of relay outputs—relay output 1 and relay output 2. The M12 A-coded 5-pin male connector on the TN-4500A series' front panel is used for the two relay outputs. Use a power cord with an M12 A-coded 5-pin female connector to connect the relay contacts. You can purchase an M12 power cable from Moxa; the model number is CBL-M12 (FF5P)/OPEN-100 IP67.

### Pinouts for the relay output port on the TN-4500A series

PIN	R.O.
1	R1
2	
3	R2
4	
5	N.C.



**N.C.:** Not connected

#### **FAULT:**

The two sets of relay contacts of the M12 A-coded 5-pin male connector are used to detect user-configured events. The two wires attached to the fault contacts form an open circuit when a user-configured event is triggered. If a user-configured event does not occur, the fault circuit remains closed.

## Connecting the Data Lines


### 10/100BaseT(X) Ethernet Port Connection

All TN-4500A series models have 12 or 24 10/100BaseT(X) Ethernet ports (M12 D-coded 4-pin female connector). The 10/100TX ports located on the TN-4500A series front panel are used to connect to Ethernet-enabled devices. Most users configure these ports for Auto MDI/MDI-X mode, in which case the port's pinouts are adjusted automatically depending on the type of Ethernet cable used (straight-through or cross-over), and the type of device (NIC-type or HUB/Switch-type) connected to the port.

In what follows, we give pinouts for both MDI (NIC-type) ports and MDI-X (HUB/Switch-type) ports. We also give cable wiring diagrams for straight-through and cross-over Ethernet cables.

### Pinouts for the 10/100BaseT(X) Ports on the TN-4500A series

PIN	TX
1	TD+
2	RD+
3	TD-
4	RD-



**Housing:** shield

## Pinouts for the 10/100/1000BaseT(X) M12 (8-pin) Port

PIN	Con.
1	DA +
2	DA -
3	DB +
4	DB -
5	DD +
6	DD -
7	DC -
8	DC +

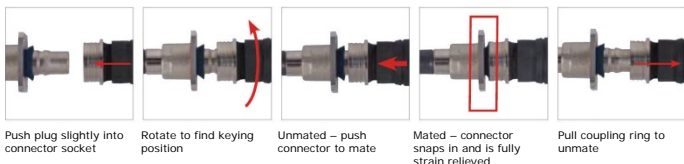


## Pinouts for the 1000BaseLSX Q-ODC® Gigabit Fiber port

PIN	FO
1	TX
2	RX



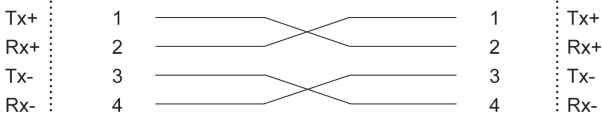
## Mating Sequence



## M12 (4-pin, M) to M12 (4-pin, M) Cross-Over Cable Wiring



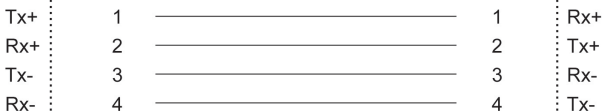
Cross-Over Cable Wiring (MDI to MDI)



## M12 (4-pin, M) to M12 (4-pin, M) Straight-Trough Cable Wiring



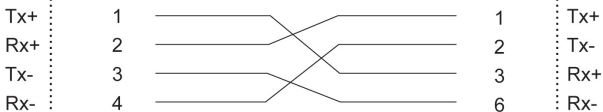
Straight-through Cable Wiring (MDI to MDI-X)



**M12 (4-pin, M) to RJ45 (8-pin) Cross-Over Cable Wiring**



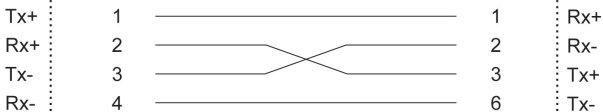
**Cross-Over Cable Wiring (MDI to MDI)**



**M12 (4-pin, M) to RJ45 (8-pin) Straight-Trough Cable Wiring**



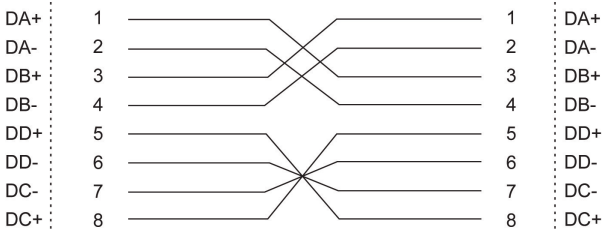
**Straight-through Cable Wiring (MDI to MDI-X)**



**M12 (8-pin, M) to M12 (8-pin, M) Cross-Over Cable Wiring**



**Cross-Over Cable Wiring (MDI to MDI)**



**M12 (8-pin, M) to M12 (8-pin, M) Straight-Trough Cable Wiring**



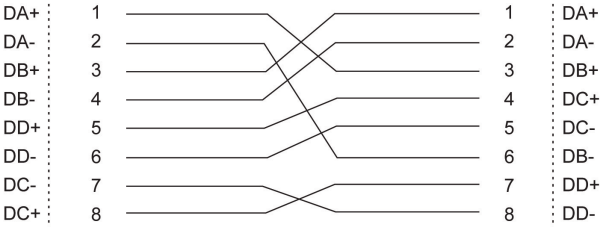
**Straight-through Cable Wiring (MDI to MDI-X)**



**M12 (8-pin, M) to RJ45 (8-pin) Cross-Over Cable Wiring**



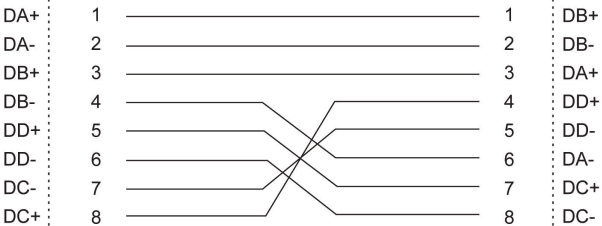
**Cross-Over Cable Wiring (MDI to MDI)**



**M12 (8-pin, M) to RJ45 (8-pin) Straight-Trough Cable Wiring**



**Straight-through Cable Wiring (MDI to MDI-X)**







## ATTENTION

The protective cover must be fixed properly to ensure IP42 protection. Use a torque wrench set to a torque of 4 kgf-m when tightening the screws. Note that applying a larger torque may damage the plastic protective cover.

## LED Indicators

Several LED indicators are located on the ToughNet switch's front panel. The function of each LED is described in the table below.

LED	Color	State	Description
<b>System LEDs</b>			
PWR1	AMBER	ON	Power is being supplied to power input PWR1.
		OFF	Power is not being supplied to power input PWR1.
PWR2	AMBER	ON	Power is being supplied to power input PWR2.
		OFF	Power is not being supplied to power input PWR2.
FAULT	RED	ON	When the corresponding PORT alarm is enabled, and a user-configured event is triggered.
		OFF	When the corresponding PORT alarm is enabled and a user-configured event is not triggered, or when the corresponding PORT alarm is disabled.
MSTR/ HEAD	GREEN	ON	When the TN switch is either the Master of this Turbo Ring, or the Head of this Turbo Chain.
		Blinking	When the TN switch is Ring Master of this Turbo Ring and the Turbo Ring is broken, or it is the Chain Head of this Turbo Chain and the Turbo Chain is broken.
		OFF	When the TN switch is neither the Master of this Turbo Ring, nor the Head of this Turbo Chain.
CPLR/ TAIL	GREEN	ON	When the TN switch enables the coupling function to form a back-up path in this Turbo Ring, or it is the Tail of this Turbo Chain.
		Blinking	When Turbo Chain is down.
		OFF	When the TN switch disables the coupling function of Turbo Ring, or it is not the Tail of the Turbo Chain.
<b>Port LEDs</b>			
TP (10/ 100M)	AMBER	ON	TP port's 10 Mbps link is active.
		Blinking	Data is being transmitted at 10 Mbps.
		OFF	TP port's 10 Mbps link is inactive.
	GREEN	ON	TP port's 100 Mbps link is active.
		Blinking	Data is being transmitted at 100 Mbps.
		OFF	TP port's 100 Mbps link is inactive.

LED	Color	State	Description
PoE Ports	AMBER	ON	Power is being supplied to a Powered Device (PD)
		OFF	Power is not being supplied to a Powered Device (PD)
G1 to G4 (10/100/ 1000M, for copper ports)	AMBER	On	TP port's 10 or 100 Mbps link is active.
		Blinking	Data is being transmitted at 10 or 100 Mbps.
		OFF	TP port's 10 or 100 Mbps link is inactive.
	GREEN	ON	TP port's 1000 Mbps link is active.
		Blinking	Data is being transmitted at 1000 Mbps.
		OFF	TP port's 1000 Mbps link is inactive.
G1/G2 (1000M, for fiber ports)	GREEN	ON	TP port's 1000 Mbps link is active.
		Blinking	Data is being transmitted at 1000 Mbps.
		OFF	TP port's 1000 Mbps link is inactive.

## Specifications

Technology	
Standards	IEEE 802.3 for 10BaseT IEEE 802.3u for 100BaseT(X) IEEE 802.3ab for 1000BaseT(X) IEEE 802.3x for Flow Control IEEE 802.1D for Spanning Tree Protocol IEEE 802.1w for Rapid STP IEEE 802.1Q for VLAN Tagging IEEE 802.1s for Multiple Spanning Tree Protocol IEEE 802.1p for Class of Service IEEE 802.1X for Authentication IEEE 802.3ad for Port Trunk with LACP
Software Features	
Management	IPv4/IPv6, SNMP v1/v2c/v3, Telnet, LLDP, Port Mirror, Syslog, RMON, BootP, DHCP Server/Client, DHCP Option 66/67/82, TFTP, SNTP, SMTP, RARP, HTTP, HTTPS, SNMP inform, Flow Control, Back pressure flow control
Filter	802.1Q VLAN, Port-Based VLAN, GVRP, IGMPv1/v2, GMRP, Static Multicast
Redundancy Protocols	STP/RSTP, MSTP, Turbo Ring v1/v2, Turbo Ring v2 with DRC, Turbo Chain, Link Aggregation
Security	RADIUS, TACACS+, SSL, SSH, Port Lock, Broadcast Storm Protection, Rate Limit
Time Management	SNTP, NTP Server/Client, IEEE 1588v2 PTP(SW-based)
MIB	MIB-II, Ethernet-like MIB, P-BRIDGE MIB, Q-BRIDGE MIB, Bridge MIB, RSTP MIB, RMON MIB Group 1, 2, 3, 9
Switch Properties	
Priority Queues	4
Max. Number of Available VLANs	64
VLAN ID Range	VID 1 to 4094
IGMP Groups	256

<b>Interface</b>	
Fast Ethernet	Front cabling, M12 D-coded 4-pin female connector, 10/100BaseT(X) auto negotiation speed, F/H duplex mode, and auto MDI/MDI-X connection
Gigabit Ethernet	Copper ports: M12 X-coded 8-pin female connector, 10/100/1000BaseT(X) and bypass relay option Fiber ports: M12 connector, 1000BaseLSX
Console Port	M12 A-coding 5-pin male connector
System LED Indicators	PWR1, PWR2, FAULT, MSTR/HEAD, CPLR/TAIL
Port LED Indicators	10/100M (Fast Ethernet port), 10/100/1000M (Gigabit Ethernet port), PoE
Alarm Contact	Two relay outputs in one M12 A-coding 5-pin male connector with current carrying capacity of 1 A @ 30 VDC
<b>Power Requirements</b>	
Input Voltage	24/36/48/72/96/110 VDC
Operating Voltage	16.8 to 137.5 VDC
Input Current	TN-4516A non-PoE series: Max. 0.7 A @ 24 VDC TN-4516A PoE series: Max. 7.0 A @ 24 VDC TN-4516A fiber series: Max. 7.0 A @ 24 VDC TN-4524A PoE series: Max. 6.5 A @ 24 VDC TN-4528A PoE series: Max. 7.2 A @ 24 VDC TN-4528A fiber series: Max. 7.2 A @ 24 VDC
Connection	M23 6-pin male connector
Overload Current Protection	Present
Reverse Polarity Protection	Present
<b>Physical Characteristics</b>	
Housing	Metal
IP Rating	IP42 protection (optional protective caps available for unused ports)
Dimensions (W × H × D)	TN-4516A non-PoE series: 229.8 x 132 x 122.3 mm (9.05 x 5.20 x 4.81 in) TN-4516A PoE series: 229.8 x 132 x 122.3 mm (9.05 x 5.20 x 4.81 in) TN-4516A fiber series: 229.8 x 132 x 122.3 mm (9.05 x 5.20 x 4.81 in) TN-4524A PoE series: 347.8 x 132 x 122.3 mm (13.70 x 5.20 x 4.81 in) TN-4528A PoE series: 347.8 x 132 x 122.3 mm (13.70 x 5.20 x 4.81 in) TN-4528A fiber series: 347.8 x 132 x 122.3 mm (13.70 x 5.20 x 4.81 in)
Weight	TN-4516A non-PoE series: 1965 g (4.32 lb) TN-4516A PoE series: 2607 g (5.74 lb) TN-4516A fiber series: 2705 g (5.96 lb) TN-4524A PoE series: 3063 g (6.74 lb) TN-4528A PoE series: 3304 g (7.27 lb) TN-4528A fiber series: 3375 g (7.44 lb)
Installation	Panel mounting

<b>Environmental Limits</b>	
Operating Temperature	-40 to 75°C (-40 to 167°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Operating Humidity	5 to 95% (non-condensing)
<b>Regulatory Approvals</b>	
Safety	UL 61010-2-201 (Pending), EN 60950-1 (LVD)
EMC	EN 55022, EN 55024
EMI	CISPR 22, FCC Part 15B Class A
EMS	IEC 61000-4-2 ESD: Contact: 6 kV; Air: 8 kV IEC 61000-4-3 RS: 80 MHz to 1 GHz: 20 V/m IEC 61000-4-4 EFT: Power: 2 kV; Signal: 2 kV IEC 61000-4-5 Surge: Power: 2 kV; Signal: 2 kV IEC 61000-4-6 CS: 10 V IEC 61000-4-8
Rail Traffic (for panel mounting installations)	EN 50155*, EN 50121-4, EN 50121-3-2, EN 45545-2
*This product is suitable for rolling stock railway applications, as defined by the EN 50155 standard. For a more detailed statement, click here: <a href="http://www.moxa.com/doc/specs/EN_50155_Compliance.pdf">www.moxa.com/doc/specs/EN_50155_Compliance.pdf</a>	
Shock	EN 50155, IEC 61373
Freefall	IEC60068-2-31
Vibration	EN 50155, IEC 61373
Please check Moxa's website for the most up-to-date certification status.	
<b>MTBF (mean time between failures)</b>	
Time	TN-4516A-4GTX-WV-T: 599,164 hrs. TN-4516A-4GTXBP-WV-T: 589,421 hrs. TN-4516A-12PoE-4GPoE-WV-T: 428,680 hrs. TN-4516A-12PoE-2GPoE-2GTXBP-WV-T: 427,322 hrs. TN-4516A-12PoE-2GPoE-2GODC-WV-T: 421,432 hrs. TN-4524A-16PoE-WV-T: 429,402 hrs. TN-4528A-16PoE-4GPoE-WV-T: 393,894 hrs. TN-4528A-16PoE-2GPoE-2GTXBP-WV-T: 392,746 hrs. TN-4528A-16PoE-2GPoE-2GODC-WV-T: 387,767 hrs.
Standard	Telcordia SR332
<b>Regulatory Approvals</b>	
Warranty Period	5 years
Details	See <a href="http://www.moxa.com/warranty">www.moxa.com/warranty</a>