TN-G6512 Series
Quick Installation Guide

Moxa ToughNet Switch

Version 2.2, October 2021

MOXA®

Overview

The ToughNet TN-G6512 Series of M12 managed Ethernet switches are designed for railway applications, including rolling stock and wayside installations. The switches use M12 and other circular connectors to ensure tight, robust connections, and guarantee reliable operation in industrial environments where vibration and shock are commonplace. The TN-G6512 Series of Ethernet switches provide 12 Gigabit Ethernet M12 ports; 8 ports support IEEE 802.3at/af compliant PoE functionality. These PoE switches are classified as power source equipment (PSE); they provide up to 30 watts of power per port, and can be used to power IEEE 802.3at/af compliant powered devices (PDs), such as IP cameras, wireless access points, and IP phones.

The TN-G6512 Series has push-pull M12 connectors that are tailor-made for push-pull cables in order to facilitate quick installation, and also allow M12 rotary cables to be utilized. The 24 to 110 VDC wide power input range and isolated dual power inputs not only allow the same type of power source at different sites around the globe, but also increase the reliability of communications systems. Furthermore, the -40 to 70°C operating temperature capability and IP67-rated enclosure make the switches suitable for deployment in harsh environments. The TN-G6512 Series of Ethernet switches are compliant with the essential sections of EN 50155, covering operating temperature, power input voltage, surge, ESD, and vibration, as well as conformal coating and power insulation, which makes the switches suitable for a variety of industrial applications.

Package Checklist

Your ToughNet TN-G6512 switch is shipped with the following items. If any of these items are missing or damaged, please contact your customer service representative for assistance.

- TN-G6512 switch
- 15 protective caps for the power connector, all Ethernet ports, console port, and USB storage port (already fixed on switch)
- Panel mounting kit
- Quick installation guide (printed)
- Warranty card

Features

Anti-vibration Push-pull/Circular Connectors for Robust Links
- M12 X-coded 8-pin female connectors for Gigabit Ethernet 10/100/1000BaseT(X) ports
- M12 B-coded 5-pin female connector for serial console port
- M12 A-coded 5-pin female connector for USB storage port
- M12 K-coded 5-pin male connector for power input

Isolated Power Inputs
- Supports 24 to 110 VDC (16.8 to 137.5 VDC)

High-performance Network Switching Technology
- Provides up to 30 watts per PoE port with a total power budget of 96 watts per switch
- IPv6 Ready logo awarded (IPv6 Logo Committee certified)
- DHCP Option 82 for IP address assignment with different policies

- Turbo Ring and Turbo Chain (recovery time < 50 ms @ 250 switches), and STP/RSTP/MSTP for network redundancy
- IGMP snooping and GMRP for filtering multicast traffic
- EtherNet/IP and Modbus/TCP industrial Ethernet protocols supported
- Port-based VLAN, IEEE 802.1Q VLAN, and GVRP to ease network planning
- QoS (IEEE 802.1p/1Q and ToS/DiffServ) allows real-time traffic classification and prioritization
- IEEE 802.3ad, LACP for optimum bandwidth utilization
- SNMPv1/v2c/v3 for different levels of network management
- TACACS+, SNMPv3, IEEE 802.1X, HTTPS, and SSH to enhance network security
- 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 and relay output
- Line-swap fast recovery
- LLDP for automatic topology discovery in network management software
- Configurable by web browser, Telnet/serial console, CLI, and Windows utility
- Loop protection prevents network loops

### *Designed for Industry-specific Applications*
- Twelve Gigabit Ethernet ports to meet high bandwidth requirements.
- Complies with all EN 50155 mandatory test items*
- -40 to 70°C operating temperature range
- IP67-rated rugged 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

Recommended Optional Accessories

- 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
- M12X-8PMM-IP67-HTG: Field-installable M12 X-coded crimp type, slim design connector, 8-pin male, IP67-rated
- A-CAP-M12F-M-PP: Metal Cap for M12 female push-pull connector

Panel Layouts
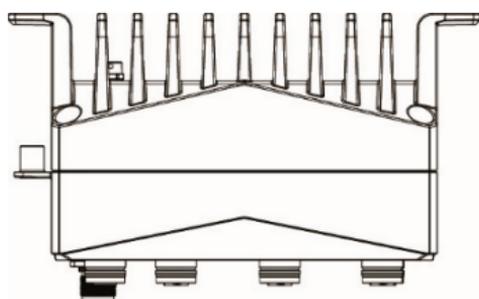
Top View
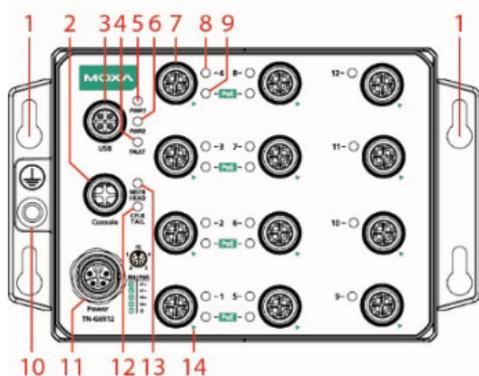
Front View
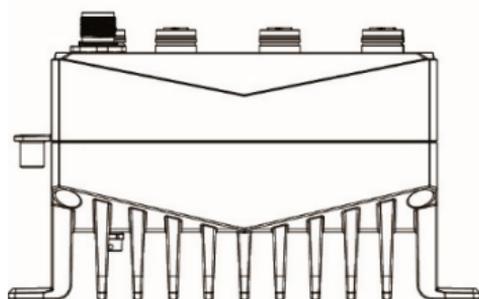
Bottom View
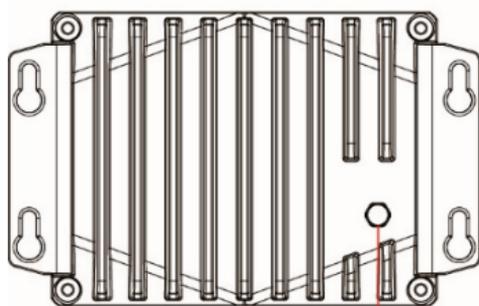
Rear View

1. Screw holes for panel mounting kit
2. Console port
3. USB port
4. FAULT LED
5. PWR1 LED:
   for power input 1
6. PWR2 LED:
   for power input 2
7. 10/100/1000BaseT(X) port (M12 X-coded 8-pin female connector)
8. 10/100/1000BaseT(X) port LED
9. PoE LED
10. Grounding screw
11. Power input port (M12 K-coded 5-pin male connector)
12. CPLR/TAIL LED: for ring coupler or chain tail
13. MSTR/HEAD LED: for ring master or chain head
14. Alignment mark for X-coded connector
15. Waterproof vent

⚠️ **ATTENTION**

Exposed connectors when not in use must be tightly covered with protective caps (an optional accessory) to ensure IP67-rated protection.

Mounting Dimensions (unit = mm)

Panel/Wall Mounting

**STEP 1:** Mounting the TN-G6512 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.
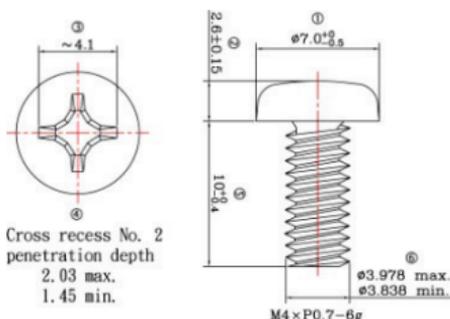
Do not screw the screws in all the way—leave a space of about 2 mm to allow room for sliding the ToughNet switch between the wall and the screws.

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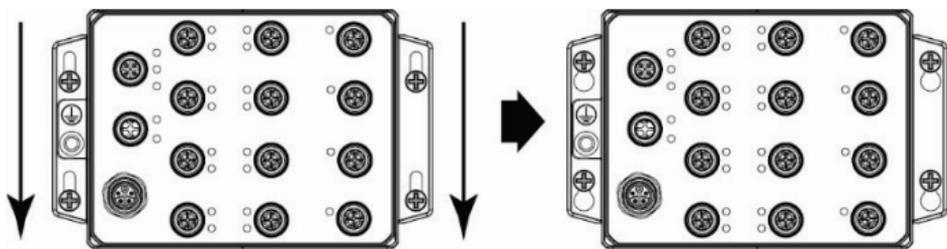
NOTE To provide greater protection from vibration and shock, use screws with shaft diameter between 6.0 mm and 7.0 mm, and fix the ToughNet switch onto the wall directly through the large opening of the keyhole-shaped apertures.

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, 70°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.
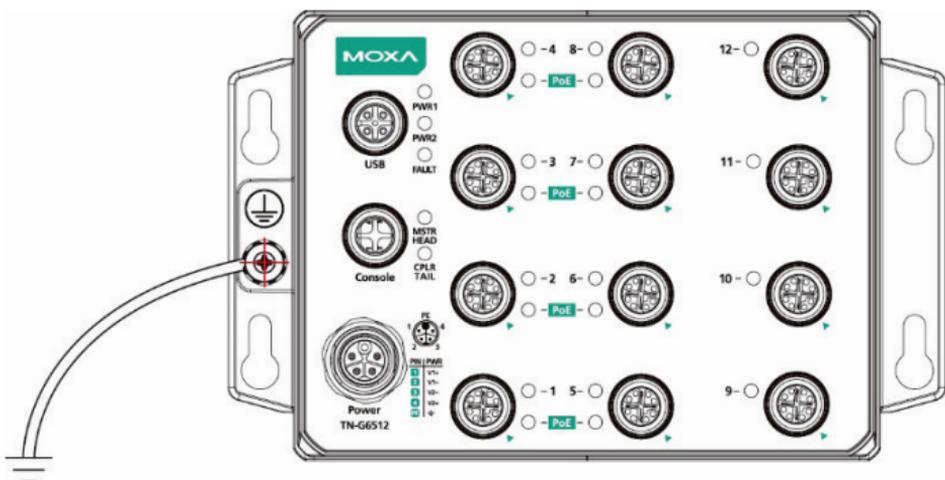
⚠ ATTENTION

To ground this product to earth, use a green and yellow AWG 18 or higher grounding cable.

⚠ ATTENTION

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

Connecting the Power Supplies

The ToughNet TN-G6512 Series switches support dual power inputs—power input 1 and power input 2. The M12 K-coded 5-pin male connector on the TN-G6512 Series switches' front panel is used for the dual power inputs.

Pinouts for the power input port

PIN	PWR
1	V1+
2	V1−
3	V2−
4	V2+
PE	GND
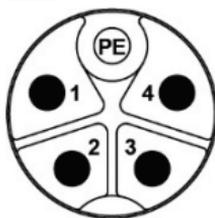
Pin	Description	Usage
1	PWR1 / DC +	Connect "PWR1 Live / DC +" to the positive (+) terminal when using a DC power source.
2	PWR1 / DC −	Connect "PWR1 Neutral / DC −" to the negative (−) terminal when using a DC power source.
3	PWR2 / DC −	Connect "PWR2 Neutral / DC −" to the negative (−) terminal when using a DC power source.
4	PWR2 / DC +	Connect "PWR2 Live / DC +" to the positive (+) terminal when using a DC power source.
PE	Chassis Ground	Connect the "Chassis Ground" to the equipment ground bus for DC inputs.

STEP 1: Plug your power cord connector into the power input port of the TN-G6512 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-G6512 Series to the power input, make sure the power source voltage is stable.

⚠ ATTENTION

Do not power on the TN-G6512 Series before connecting the M12 power connector.

Connecting the Serial Port

The TN-G6512 Series has a M12 B-coded 5-pin female connector. Users can use an adapter to connect a management PC and control the device using commands through the CLI (Command-Line Interface).

Pinouts for the M12-B (5-pin) Port

PIN	CON
1	TX
2	RX
3	DSR
4	GND
5	DTR
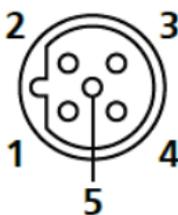
Connecting the USB Storage Port

The TN-G6512 Series has a M12 A-coded 5-pin female connector. Users can either use an adapter or the ABC-02-P-USB-M12 to connect to a PC or to import configuration files to the device.

PIN	CON
1	D-
2	5V
3	NC
4	D+
5	GND
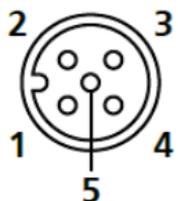
Connecting the Data Lines

10/100/1000BaseT(X) Ethernet Port Connection

The TN-G6512 Series has 12 10/100/1000BaseT(X) Ethernet ports (M12 X-coded 8-pin female connector). The 10/100/1000TX ports located on the front panel of the TN-G6512 Series 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 10/100/1000BaseT(X) M12 (8-pin) Port

PIN	Con.
1	DA +
2	DA −
3	DB +
4	DB −
5	DD +
6	DD −
7	DC −
8	DC +
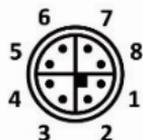
M12 (8-pin, M) to M12 (8-pin, M) Cross-Over Cable Wiring

Cross-Over Cable Wiring (MDI to MDI)

DA+	1		1	DA+
DA-	2		2	DA-
DB+	3		3	DB+
DB-	4		4	DB-
DD+	5		5	DD+
DD-	6		6	DD-
DC-	7		7	DC-
DC+	8		8	DC+
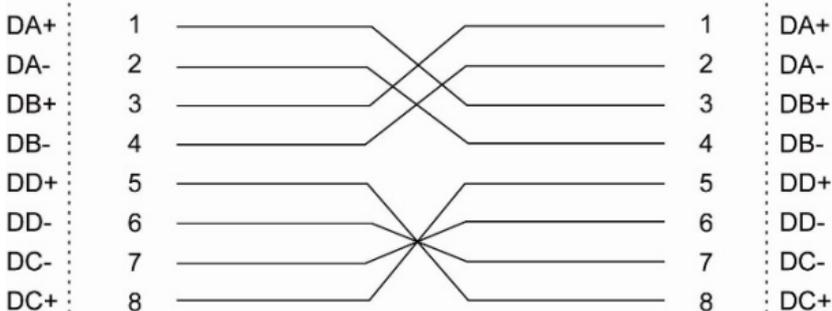
M12 (8-pin, M) to M12 (8-pin, M) Straight-Trough Cable Wiring

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

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

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

Cross-Over Cable Wiring (MDI to MDI)

DA+	1		1	DA+
DA-	2		2	DA-
DB+	3		3	DB+
DB-	4		4	DC+
DD+	5		5	DC-
DD-	6		6	DB-
DC-	7		7	DD+
DC+	8		8	DD-
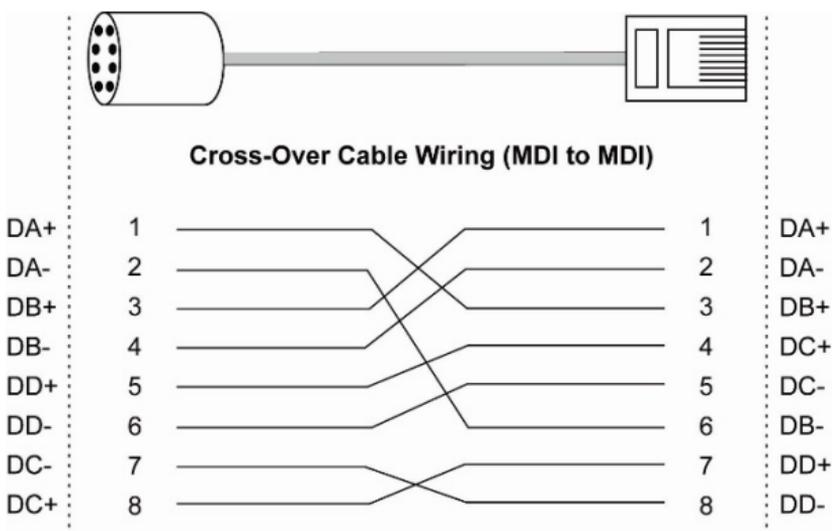
M12 (8-pin, M) to RJ45 (8-pin) Straight-Trough Cable Wiring

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

DA+	1		1	DB+
DA-	2		2	DB-
DB+	3		3	DA+
DB-	4		4	DD+
DD+	5		5	DD-
DD-	6		6	DA-
DC-	7		7	DC+
DC+	8		8	DC-
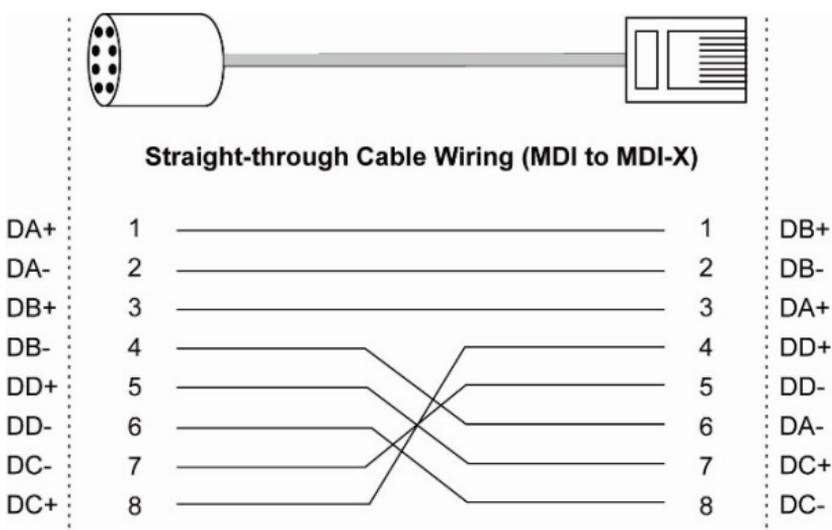
> ⚠️ **ATTENTION**
>
> The protective cover must be fixed properly to ensure IP67 protection. Use a torque wrench set to a torque of 12.5 kgf-m when
> tightening the screws. Note that applying a larger torque may damage the protective cover.

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
System LEDs			
PWR1	AMBER	ON	Power is being supplied to power input PWR1.
		OFF	Power is not being supplied to power input PWR1

LED	Color	State	Description
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.
FAULT + MSTR/HEAD + CPLR/TAIL	Rotate Blinking Sequentially		When ABC-02 is importing or exporting files.

LED	Color	State	Description
Port LEDs			
TP Ports (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.
PoE Ports	AMBER	ON	Power is being supplied to a Powered Device (PD)
		OFF	Power is not being supplied to a Powered Device (PD)

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, 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
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	256
VLAN ID Range	VID 1 to 4094
IGMP Groups	256

Interface	
Gigabit Ethernet	Front cabling, M12 X-coded 8-pin connector, 10/100/1000BaseT(X) auto negotiation speed, F/H duplex mode, auto MDI/MDI-X connection
Console Port	M12 B-coded 5-pin female connector
USB Storage Port	M12 A-coded 5-pin female connector
System LED Indicators	PWR1, PWR2, FAULT, MSTR/HEAD, CPLR/TAIL
Port LED Indicators	10/100/1000M (Gigabit Ethernet port), PoE

Power Requirements	
Input Voltage	24/36/48/72/96/110 VDC
Operating Voltage	16.8 to 137.5 VDC
Input Current	Max. 5.8 A @ 24 VDC
Connection	M12 K-coded 5-pin male connector

Overload Current Protection	Present
Reverse Polarity Protection	Present
Physical Characteristics	
Housing	Metal
IP Rating	IP67 protection (protective caps available for unused ports)
Dimensions (W × H × D)	159 x 97 x 100 mm (6.26 x 3.82 x 3.94 in)
Weight	1,750 g (3.86 lb)
Installation	Panel mounting
Environmental Limits	
Operating Temperature	-40 to 70°C (-40 to 158°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Operating Humidity	5 to 95% (non-condensing)
Regulatory Approvals	
Safety	IEC 62368-1, UL 62368-1
EMC	EN 55032, EN 55024
EMI	CISPR 32, 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 6 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: www.moxa.com/doc/specs/EN_50155_Compliance.pdf	
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.	
MTBF (mean time between failures)	
Time	471,356 hrs
Standard	Telcordia SR332
Regulatory Approvals	
Warranty Period	5 years
Details	See www.moxa.com/warranty