N-Tron® Series

300 Series

Media Converter & Industrial Ethernet Switches

Installation Guide | December 2015

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CONTACT INFORMATION :

AMERICAS

York, PA: +1 (717) 767-6511
Mobile, AL: +1 (251) 342-2164
Ballston Lake, NY: +1 (518) 877-5173
Hours: 8am-6pm Eastern Standard Time
(UTC/GMT -5 hours)

ASIA-PACIFIC

Shanghai, P.R. China: +86 21-6113-3688 x767
Hours: 10am-6pm China Standard Time
(UTC/GMT +8 hours)

EUROPE

The Netherlands: +31 33-4723-225
Hours: 9am-6pm Central European Time
(UTC/GMT +1 hour)

Website: www.redlion.net

Email: customer.service@redlion.net

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Preface

Disclaimer

Portions of this document are intended solely as an outline of methodologies to be followed during the maintenance and operation of N-Tron® 300 series Industrial Ethernet Switch equipment. It is not intended as a step-by-step guide or a complete set of all procedures necessary and sufficient to complete all operations.

While every effort has been made to ensure that this document is complete and accurate at the time of release, the information that it contains is subject to change. Red Lion Controls is not responsible for any additions to or alterations of the original document. Industrial networks vary widely in their configurations, topologies, and traffic conditions. This document is intended as a general guide only. It has not been tested for all possible applications, and it may not be complete or accurate for some situations.

Users of this document are urged to heed warnings and cautions summarized at the front of the document, such as electrical hazard warnings.

Compliance Information

It is recommended that the owner of this equipment determine and ensure conformance with any specific and applicable local regulations.

Part 15 of the Federal Communications Commission (FCC) - A Rules: Interference

Every effort has been made to ensure that this equipment is designed to comply with the limits for a Class A digital device, as described in the FCC Rules.

This product complies with Part 15 of the FCC-A Rules.

Operation is subject to the following conditions:

1. This device may not cause harmful Interference
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 in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this device in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

Industry Canada

This Class A digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. 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.

Cet appareillage numérique de la classe A répond à toutes les exigences de l'interférence canadienne causant des règlements d'équipement. L'opération est sujette aux deux conditions suivantes: (1) ce dispositif peut ne pas causer l'interférence nocive, et (2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer l'opération peu désirée.

Environmental Impact Statement

Red Lion equipment contains no hazardous materials as defined by the United States Environmental Protection Agency (USEPA). Red Lion recommends that all failed product be returned to Red Lion for failure analysis and proper disposal.

Toxic Emissions

Red Lion equipment releases no toxic emissions.

Trademark Acknowledgments

Ethernet is a registered trademark of Xerox Corporation.

All other product names, company names, logos or other designations mentioned herein are trademarks of their respective owners.

Applicable 300 Series Industrial Ethernet Switches

This Hardware Installation Guide applies to the following 300 series devices:

302MC-XX	302MCE-XX-YY	304TX
305FX-XX	305FXE-XX-YY	
306TX	306FX2-XX	306FXE2-XX-YY
308TX	*Where: XX=ST or SC and YY= -15, -40, or -80*	

Release Notes and Document Updates

The hard copy and electronic media versions of this document are revised only at major releases and therefore, may not always contain the latest product information. As needed, Documentation Notes and/or Product Bulletins will be provided between major releases to describe any new information or document changes.

The latest online version of this document and all product updates can be accessed through the Red Lion web site at http://www.redlion.net

Publication History

The following information lists the release history of this document.

Issue/Revision	Content Description
Revised 2011-11-29	Document Updates
Revised 2015-11-06	Document reformatted and safety information added.

Related Documents

Visit the Technical Resources page on the Red Lion website at the following link to view available documents related to this product.

www.redlion.net/n-tron_documentation

Document Comments

Red Lion appreciates all comments that will help us to improve our documentation quality. The user can submit comments through the Red Lion Customer Service. Simply email us at customer.service@redlion.net.

Additional Product Information

Additional product information can be obtained by contacting the local sales representative or Red Lion through the contact numbers and/or e-mail addresses listed on the inside of the front cover.

Warnings and Cautions / Avertissements et mises en garde

Warnings apply to situations where personal injury or death may result.

Mises en garde s'appliquent aux situations où des blessures corporelles ou la mort peuvent en résulter.

Cautions apply to where reduced function or damage to equipment may result.

Avertissements s'appliquent à où fonction réduite ou d'endommagement de l'équipement peut entraîner.

General Safety Cautions and Warnings / Précautions et avertissements de sécurité générale

	**CAUTION:** Do not perform any services on the unit unless qualified to do so. Do not substitute unauthorized parts or make unauthorized modifications to the unit. **ATTENTION:** Ne pas effectuer de services sur l'appareil s'il n'est pas qualifié pour le faire. Ne pas substituer pièces non autorisées ou de modifications non autorisées de l'appareil.
	**WARNING:** Do not operate the unit with the top cover removed, as this could create a shock or fire hazard. **AVERTISSEMENT -** Ne pas faire fonctionner l'unité avec le couvercle retiré, ceci pourrait créer une décharge électrique ou un incendie.
	**CAUTION:** Do not block any air vents on the unit. **ATTENTION:** N'obstruez pas les fentes d'aération de l'unité.

Electrical Safety Warnings / Avertissements de sécurité électrique

	**WARNING:** Do not work on equipment or cables during periods of lightning activity. **AVERTISSEMENT:** Ne pas travailler sur le matériel ou les câbles pendant les périodes d'activité de la foudre.
	**WARNING:** Properly ground the unit before connecting anything else to the unit. Units not properly grounded may result in a safety risk and could be hazardous and may void the warranty. See the grounding technique section of this Hardware Guide for proper ways to ground the unit. **AVERTISSEMENT:** Correctement à la terre de l'unité avant tout raccordement à l'unité. Unités pas correctement mise à la terre peut entraîner un risque de sécurité et pourraient être dangereux et peut annuler la garantie. Voir la section technique de mise à la terre de ce mode d'emploi des moyens appropriés à la masse de l'appareil.
	**WARNING:** Do not operate the unit with the top cover removed, as this could create a shock or fire hazard. **AVERTISSEMENT:** Ne pas faire fonctionner l'unité avec le couvercle retiré, ceci pourrait créer une décharge électrique ou un incendie.
	**WARNING:** Power must be supplied by an isolating source, and a 3.3A max. rated UL recognized fuse must be installed immediately before the unit. **AVERTISSEMENT:** Celui-ci doit être alimenté par une source à isolation et un 3.3A fusible homologué UL nominale max. doit être installé immédiatement avant l'unité.
	**CAUTION:** Observe proper DC Voltage polarity when installing power input cables. Reversing voltage polarity can cause permanent damage to the unit and voids the warranty. **ATTENTION:** Respecter la polarité correcte de tension DC lors de l'installation des câbles d'alimentation d'entrée. Inversion de polarité de tension peut causer des dommages permanents à l'appareil et annule la garantie.

Environmental Safety Cautions and Warnings / Sécurité environnementale mises en garde et avertissements

	**CAUTION:** This equipment is suitable for use in Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only. **ATTENTION:** Cet équipement est adapté pour une utilisation dans la classe I, Division 2, Groupes A, B, C et D ou non dangereux endroits seulement.
	**WARNING:** Do not operate the equipment in the presence of flammable gases or fumes. Operating electrical equipment in such an environment constitutes a definite safety hazard. **AVERTISSEMENT:** Ne pas utiliser le matériel en présence de gaz ou de vapeurs inflammables. L'utilisation de matériel électrique dans un tel environnement constitue un danger certain.

WARNING: Disconnect the power cable before removing the enclosure top.
AVERTISSEMENT: Débranchez le câble d'alimentation avant de retirer le boîtier supérieur.

Hazardous Location Warnings / Les avertissements d'emplacement dangereux

WARNING: Install only in accordance with Local and National Codes of authorities having jurisdiction.
AVERTISSEMENT: Installer uniquement, conformément aux codes locaux et nationaux des autorités ayant compétence.

WARNING – Explosion Hazard: Do not connect or disconnect any connections while circuit is live unless area is known to be non-hazardous.
AVERTISSEMENT - Risque d'explosion: Ne pas brancher ou débrancher les connexions lorsque le circuit est sous tension sauf si la zone est connue pour être non dangereux.

WARNING: Class I, Div 2 installations require that all devices connected to this product must be UL approved for the area in which it is installed.
AVERTISSEMENT: Classe I, Div 2 installations nécessitent que tous les périphériques connectés à ce produit doit être certifié UL pour la zone dans laquelle il est installé.

WARNING: Only UL approved wiring with temperature ratings greater than 90°C permitted for Class I, Div 2 installations operating at temperatures up to70°C ambient.
AVERTISSEMENT: Seul le câblage homologué UL avec cotes de température supérieure à 90 °C Permis de classe I, Div 2 installations opérant à des températures allant jusqu'à70°C de température ambiante.

WARNING: Limited Operating Voltage: 12-30V for Class I, Div 2 installations.
AVERTISSEMENT: Tension de fonctionnement limité: 12-30 V pour la classe I, Div 2 installations.

CAUTION: This equipment is suitable for use in Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only.
ATTENTION: Cet équipement est adapté pour une utilisation dans la classe I, Division 2, Groupes A, B, C et D ou non dangereux endroits seulement.

Laser Safety Warning / Consignes de sécurité relatives au laser

	**CAUTION (Only for FXE products):** CLASS 1 LASER PRODUCT. Do not stare into the laser. **ATTENTION (Uniquement pour les produits FXE):** PRODUIT LASER CLASSE 1. Ne pas regarder dans le laser.

Section 1 Introduction and Specifications

Introduction

The Red Lion N-Tron® 300 series Unmanaged Industrial Ethernet Switches support high speed layer 2 switching between ports. All 300 series switches are housed in a ruggedized steel enclosure, and provide Category-5 compliant 10/100-BaseT connections for high performance network design, and hub/repeater upgrades.

The 300 series provides Fast Ethernet connectivity from 4 to 17 ports. These unmanaged switches are available in copper and fiber port combinations for maximum deployment flexibility.They are also optionally available with N-View™ monitoring technology, which can be found in the Red Lion monitored family of products.

302MC/MCE

The 302MC/MCE is a 2 port unmanaged media converter that converts 10/100BaseTX copper to 100BaseFX full duplex fiber.

304TX, 306TX, and 308TX

The 304TX, 306TX, and 308TX are affordable and share a small footprint. Each switch is capable of auto negotiating 10/100 Mb and half/full duplex communications.

305FX and 306FX2

The 305FX and 306FX2 switches are unmanaged and have 4 ports similar to the 304TX, plus an additional multimode fiber optic up-link port(s), capable of 2 Kilometers of 100 Mb communications without the use of repeaters.

305FXE and 306FXE2

The 305FXE and 306FXE2 switches are unmanaged and similar to the 305FX and 306FX2, respectively. However, these models use singlemode transceivers with extended range capability. The N-Tron FXE products utilize singlemode fiber transceiver(s) that are capable of 15, 40, and up to 80 Kilometers of 100 Mb full duplex communications.

All fiber products utilize the IEEE compliant SC or ST duplex connectors for fiber optic communications. All 10/100Base-TX ports utilize the RJ45 shielded connectors.

Key Features

- Full IEEE 802.3 & 100Base-FX Compliance
- Full IEEE 1613 Compliance (Communications Networking Devices in Electric Power Stations)
- NEMA TS1/TS2 Compliance (Traffic Control Systems)
- American Bureau of Shipping (ABS) Type Approval (Maritime and Offshore Applications)
- Extended Environmental Specifications
- Support for Full/Half Duplex Operation
- LED Link/Activity Status Indication
- Autonegotiation, Autosensing Speed, Duplex, and Flow Control

- Up to 1.8 Gb/s Maximum Throughput
- Industry Standard 35mm DIN-Rail Mounted Enclosure

300 Series Specifications

Table 1. 300 Series Key Specifications

Physical Specifications				
Model	**Height**	**Width**	**Depth**	**Weight**
302MC	2.97 in (75.56mm)	2.01 in (50.99mm)	3.17 in (80.56mm)	0.75 lbs (0.3 kg)
304TX	3.06 in (77.64mm)	2.01 in (50.99mm)	3.38 in (85.87mm)	0.75 lbs (0.3 kg)
305FX	3.46 in (87.96mm)	2.01 in (50.99mm)	3.38 in (85.87mm)	0.75 lbs (0.3 kg)
306FX2	3.46 in (87.96mm)	2.01 in (50.99mm)	3.38 in (85.87mm)	0.75 lbs (0.3 kg)
306TX	3.06 in (77.64mm)	2.01 in (50.99mm)	3.39 in (86.08mm)	0.75 lbs (0.3 kg)
308TX	3.46 in (87.96mm)	2.01 in (50.99mm)	3.38 in (85.87mm)	0.75 lbs (0.3 kg)
Electrical Specifications				
Input Voltage	**Input Current**		**Input Ripple**	**Input Wire Size**
10-30 VDC (Regulated)	230mA max. @ 24VDC (Steady State)		Less than 100 mV	16-28 AWG
Inrush Current	8.0A /0.6 ms @ 24VDC (302MC/304TX/306TX)	9.0A /0.5 ms @ 24VDC (308TX)	10A /0.9 ms @ 24VDC (305FX / 306FX2)	
Environmental Specifications				
Operating Temperature		**Storage Temperature**	**Operating Humidity**	**Operating Altitude**
-40°C to 70°C		-40°C to 85°C	10% to 90% (non condensing)	0 to 10,000 ft.
Network		**Media**		
10BaseT		> Cat-3 Cable		
100BaseT		> Cat-5 Cable		
100BaseFX		Multimode:50-62.5/125µm Fiber		
100BaseFX		Singlemode:7-10/125µm Fiber		
Connectors				
10/100BaseT		RJ45 UTP Ports		
100BaseFX		SC or ST Duplex Port(s) (if equipped)		
Recommended Minimum Wiring Clearance				
Front	2" (5.08 cm) for 304TX, 306TX, & 308TX models 4” (10.16 cm) for 302MC, 305FX, & 306FX2 models			
Side	1" (2.54 cm)			

Table 2. [Fiber Transceiver Characteristics

Fiber Length	2km*	15km**	40km**	80km**
TX Power Minimum	-19dBm	-15dBm	-5dBm	-5dBm
RX Sensitivity Maximum	-31dBm	-31dBm	-34dBm	-34dBm
Wavelength	1310nm	1310nm	1310nm	1550nm

* = Multimode **= Singlemode

Regulatory Approvals

Safety

Suitable for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations, or Nonhazardous Locations only.

EMI

- EN61000-6-4, EN55011 - Class A
- FCC Title 47, Part 15, Subpart B - Class A

EMS

- EN61000-6-2
- EN61000-4-2 (ESD)
- EN61000-4-3 (RS)
- EN61000-4-4 (EFT)
- EN61000-4-5 (Surge)
- EN61000-4-6 (Conducted Disturbances)

Conducted Low Frequency: IEC60533

Shock: IEEE 1613 (250 mm)

Vibration

- IEEE 1613 (V.S.4 150mm/s)
- IEC60068-2-6 (Test Fc)

Cold: IEC60068-2-1

Dry Heat: IEC60068-2-2

Damp Heat: IEC60068-2-30 (Test Db)

Certifications

GOST-R Certified

Section 2 Installation

Introduction

This section contains the information and procedures necessary to unpack, inspect, install and connect the N-Tron 300 series models.

Unpacking

Remove all the equipment from the packaging, and store the packaging in a safe place or dispose according to your standard operating procedure.

Inspection

Please ensure the shipping package contains the following items in undamaged condition:

1. 300 series unit
2. N-Tron product CD

If the package contents are damaged:

1. Contact your carrier.
2. File any damage claims with the carrier.

Installing/Mounting

Read the following warning before beginning the installation:

Lire l'avertissement suivant avant de commencer l'installation:

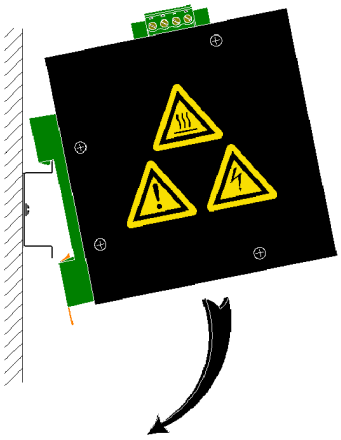
	**WARNING:** Never install or work on electrical equipment or cabling during periods of lightning activity. Never connect or disconnect power when hazardous gases are present. **AVERTISSEMENT:** Ne jamais installer ou de travailler sur un équipement électrique ou de câblage pendant les périodes d'activité de la foudre. Ne jamais brancher ou débrancher l'alimentation en gaz dangereux sont présents.
	**CAUTION (Only for FXE products):** CLASS 1 LASER PRODUCT. Do not stare into the laser. **ATTENTION (Uniquement pour les produits FXE):** PRODUIT LASER CLASSE 1. Ne pas regarder dans le laser.

	**WARNING:** Disconnect the power cable before removing the enclosure top. **AVERTISSEMENT:** Débranchez le câble d'alimentation avant de retirer le boîtier supérieur.

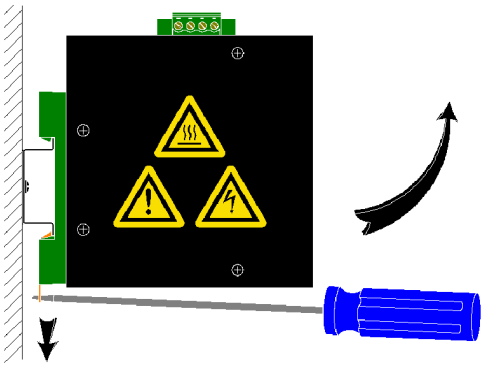
	**WARNING:** Do not operate the unit with the top cover removed, as this could create a shock or fire hazard. **AVERTISSEMENT:** Ne pas faire fonctionner l'unité avec le couvercle retiré, ceci pourrait créer une décharge électrique ou un incendie.

DIN-Rail Mounting

Install the unit in a standard DIN-Rail. Recess the unit to allow at least 5” of horizontal clearance for fiber optic cable bend radius (2” for TX models).

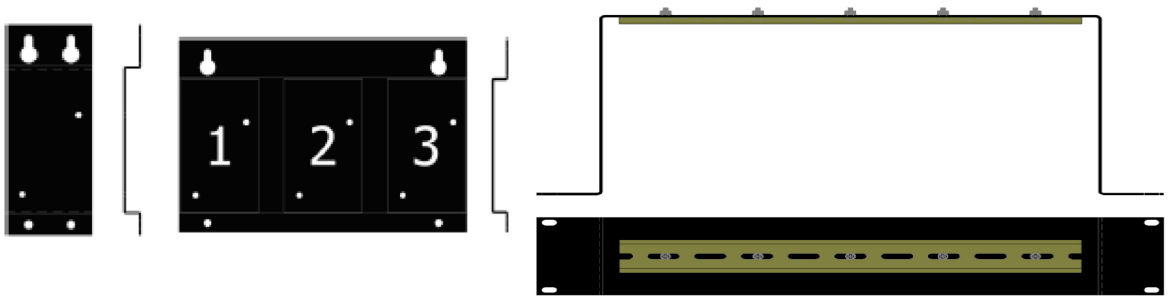


To install the unit to 35mm industrial DIN-Rail, place the top edge of the included mounting bracket on the back of the unit against the DIN-Rail at a 15° angle as shown. Rotate the bottom of the unit to the back (away from you) until it snaps into place.



To remove the unit from the 35mm industrial DIN-Rail, place a flat head screwdriver into the orange release clip found at the bottom of the unit, and apply downward force on the clip until it disengages from the bottom of the unit from the DIN-Rail. Rotate the bottom of the unit towards you and up at an approximate 15° upward angle to completely remove the unit.

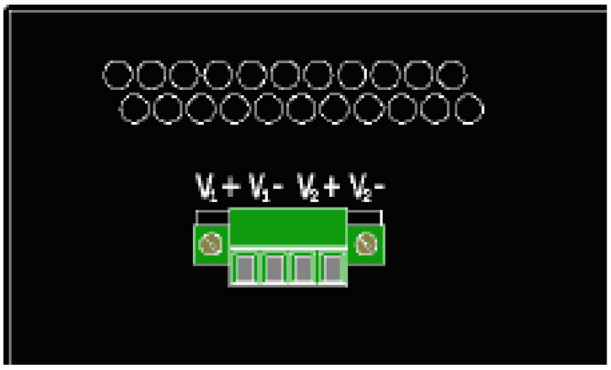
All N-Tron 300 series products are designed to be mounted on industry standard 35mm DIN-Rail. However, DIN-Rail mounting may not be suitable for all applications. We offer three alternative mounting solutions: the 300 Panel Mount Assembly (P/N: 300-PM), the 900 Panel Mount Assembly (P/N: 900-PM), and the Universal Rack Mount Kit (P/N: URMK). These may be used to securely mount 302MC, 304TX, 305FX, 306FX2, 306TX, and 308TX units to a panel or standard 19" rack.



300-PM **900-PM** **URMK**

Connections

Power Connection



1. Unscrew & Remove the DC Voltage Input Plug from the top header.
2. Install the DC Power Cables into the Plug (observing polarity on unit).
3. Plug the Voltage Input Plug back into the top header.
4. Tightening torque for the terminal block power plug is **0.22 Nm/0.162 Pound Foot**.
5. All LED's will flash ON Momentarily.
6. Verify the Power LED stays ON (GREEN).

> **Note:** Either V1 or V2 can be connected to power for minimal operation. For redundant power operation, V1 and V2 plugs must be connected to separate DC Voltage sources. Use wire sizes of 16-28 gauge. The power cord should be limited to less than 10 meters in order to ensure optimum performance.

Recommended 24V DC Power Supplies, similar to:

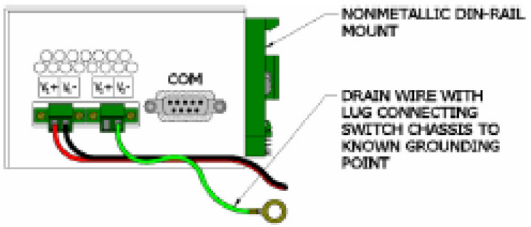
100VAC/240VAC:

N-Tron series NTPS-24-1.3, DC 24V/1.3A

Ground Connection

300 Series Grounding Techniques

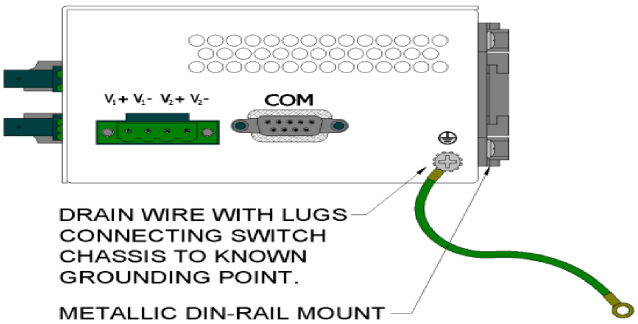
The grounding philosophy of any control system is an integral part of the design. N-Tron 300 series switches are designed to be grounded, but the user has been given the flexibility to float the switch when required. The best noise immunity and emissions (i.e. CE) are obtained when the N-Tron switch chassis is connected to earth ground via a drain wire. Some N-Tron switches have metal DIN-Rail brackets that can ground the switch if the DIN-Rail is grounded. In some cases, N-Tron switches with metal brackets can be supplied with optional plastic brackets if isolation is required.



Both V- legs of the power input connector are connected to chassis internally on the PCB. Connecting a drain wire to earth ground from one of the V- terminal plugs as shown here will ground the switch and the chassis. The power leads from the power source should be limited to 3 meters or less in length.

As an alternate, users can run a drain wire & lug from any of the DIN-Rail screws or empty PEM nuts on the enclosure. When using an unused PEM nut to connect a ground lug via a machine screw, care should be taken to limit the penetration of the outer skin by less than 1/4 in. Failure to do so may cause irreversible damage to the internal components of the switch.

Note: Before applying power to the grounded switch, you must use a volt meter to verify there is no voltage difference between the power supply's negative output terminal and the switch chassis grounding point.

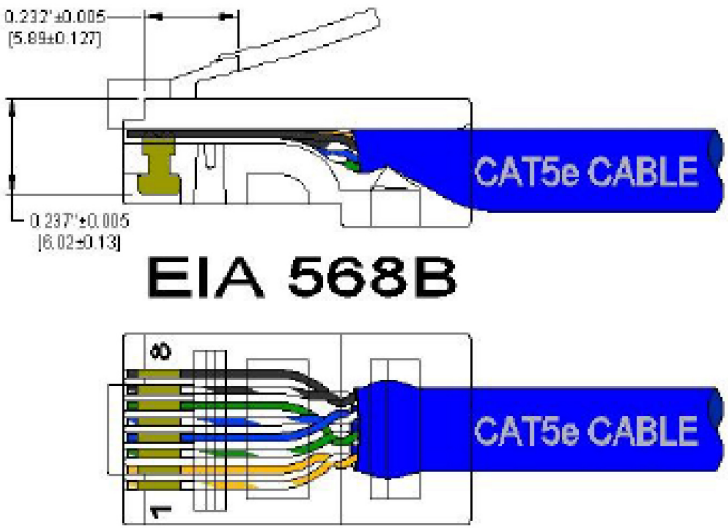


If the use of shielded cables is required, it is generally recommended to only connect the shield at one end to prevent ground loops and interfere with low level signals (i.e. thermocouples, RTD, etc.). Cat5e cables manufactured to EIA-568A or 568B specifications are required for use with N-Tron Switches.

In the event all Cat5e patch cable distances are small (i.e. All Ethernet devices are located the same local cabinet and/or referenced to the same earth ground), it is permissible to use fully shielded cables terminated to chassis ground at both ends in systems void of low level analog signals.

RJ45 Connector Crimp Specifications

Please reference the illustration below for the Cat5 cable specifications:



Connecting the Unit

For 300 series fiber units, remove the dust cap from the fiber optic connectors and connect the fiber optic cables. For Fiber Optic ports, the TX port on the near station should be connected to the RX port of the far end station, and the RX port should be connected to the TX port of the far end station.

For 10Base-T ports, plug a Category 3 (or greater) twisted pair cable into the RJ45 connector. For 100Base-T ports, plug a Category 5 (or greater) twisted pair cable into the RJ45 connector. Connect the other end to the far end station. Verify that the LNK LED's are ON once the connection has been completed. To connect any other port to another Switch or Repeater, use a standard Cat5 straight through or crossover cable.

	**CAUTION:** Creating a port to port connection on the same switch (i.e. loop) is an illegal operation and will create a broadcast storm which will crash the network! **ATTENTION:** La création d'un port à l'autre connexion sur le même commutateur (c'est-à-dire boucle) est une opération illégale et créera une tempête de diffusion qui va planter le réseau!

Note: For units which have the **N-View Option**, you can validate that all ports are working correctly by installing the N-View OPC Server software. The software is freely distributed on the Product CD and our website (http://www.redlion.net/support/software-firmware). Once the software is installed, you should view the Ports Counter page to remotely monitor each connected port. You may find it helpful to copy [Alt]+[Print Screen] the Port Counter information for each port and paste [Control]+[V] into a Windows document for further review. Please consult your N-View OPC Server Manual for additional information.

Section 3 Operation and Maintenance

Introduction

This section provides information on the N-Tron 300 series device ports and LED indicators function as well as basic troubleshooting guidelines.

300 Series Ports and Indicators

The 300 series ports and LED indicators, and a description of their functions, are identified in the following figure and Table 3.

Table 3. 300 Series Front Panel

Port/LED	Description
LNK	Link LED for Fiber Optic Ports
TX	Fiber Optic Transmit Ports
RX	Fiber Optic Receive Ports
ACT	Activity LED for Fiber Optic Ports
RJ45 Ports	Ports 1-4 Auto sensing 10/100BaseT Connections
⏻	Green LED lights when Power is connected

NOTE: Each RJ45 data port has two LED's for each connector. The lower LED indicates LINK status, and the upper LED indicates ACTIVITY.

300 Series LED's and Operating Modes

The 300 series LED's and a description of the associated operating mode is presented in Table 4.

Table 4. Unit LED's

LED	Color	Description
⏻	Green	Power is applied
	OFF	Power is off
LNK	Green	Link between ports established
	OFF	No link between ports
ACT	Green	Data is active between ports
	OFF	Data is inactive between ports

Maintenance

There are no field serviceable parts to the N-Tron 300 series switches.

Verify/Troubleshoot

The following procedure provides some guidelines to assist in identifying hardware issues that might be affecting unit performance.

1. Make sure the (Power LED) is ON.
2. Verify that Link LED's are ON for connected ports.
3. Verify cabling used between stations.
4. Verify that cabling is Category 5 (or greater) for 100Mbit Operation.
5. Verify TX is connected to far end RX and vise versa (fiber optic units only).

N-Tron® 300 Series Limited Warranty

(a) Red Lion Controls Inc., Sixnet Inc., N-Tron Corporation, or Blue Tree Wireless Data, Inc. (the “Company”) warrants that all Products shall be free from defects in material and workmanship under normal use for the period of time provided in “Statement of Warranty Periods” (available at www.redlion.net) current at the time of shipment of the Products (the “Warranty Period”). **EXCEPT FOR THE ABOVE-STATED WARRANTY, COMPANY MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE PRODUCTS, INCLUDING ANY (A) WARRANTY OF MERCHANTABILITY; (B) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; OR (C) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Customer shall be responsible for determining that a Product is suitable for Customer’s use and that such use complies with any applicable local, state or federal law.

(b) The Company shall not be liable for a breach of the warranty set forth in paragraph (a) if (i) the defect is a result of Customer’s failure to store, install, commission or maintain the Product according to specifications; (ii) Customer alters or repairs such Product without the prior written consent of Company.

(c) Subject to paragraph (b), with respect to any such Product during the Warranty Period, Company shall, in its sole discretion, either (i) repair or replace the Product; or (ii) credit or refund the price of Product provided that, if Company so requests, Customer shall, at Company's expense, return such Product to Company.

(d) **THE REMEDIES SET FORTH IN PARAGRAPH (c) SHALL BE THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDY AND COMPANY'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN PARAGRAPH (a)**.