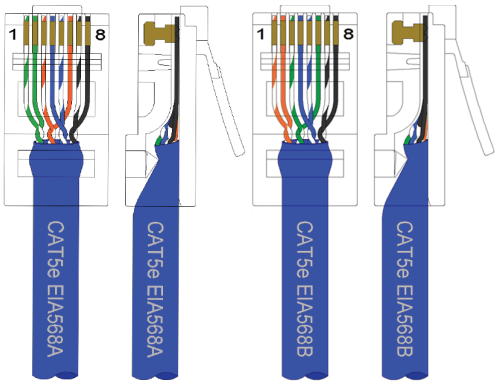
N-TRON
THE INDUSTRIAL NETWORK COMPANY

White Paper Series

Cat5e Cable Wiring Schemes

This document provides basic background information regarding the 568A and 568B wiring standards. It will also define the differences between these standards. Instructions for creating standard and crossover cables are included in this document.

The two color code schemes used to correctly wire the RJ-45 eight-position modular plugs are 568A and 568B. These two color codes are approved by the American National Standard Institute/Telephone Industry Association/Electronics Industry Association (ANSI/TIA/EIA) wiring standards. There is no difference between the two wiring schemes, in connectivity or performance, when connecting Ethernet devices provided the devices are wired for the same scheme. The only instance one scheme has an advantage over the other is when one end of a segment is connected to a modular device and the other end to a punch block. In this case, the 568A has the advantage of having a more natural progression of pairs at the punch block side.



Cables are generally made up of 8 wires twisted together in 4 pairs. Each pair is easily identified by one of four primary colors and is intended to carry a signal and its return. There are three popular wiring patterns for Cat5e and RJ-45 cables: 568A, 568B, and a crossover cable with 568A on one end and 568B on the opposite end. Functionally there is no difference between a straight through 568A to 568A cable and a straight through 568B to 568B cable. U.S. Government regulations require the use of 568A standard wiring installed under federal contracts. N-Tron adopted the 568B standard since it is the most widely used in Industrial Ethernet installations. It also meets the ANSI/TIA/EIA standard. This scheme provides one pair for backward compatibility to the USOC wiring scheme. It is always advisable to check the specification for any given project and make sure that If a wiring scheme is specified, it is adhered to. This illustration shows the differences between the 568A and 568B color schemes: The orange and green pairs are interchanged as shown here. These standards specify a maximum segment length of 100 meters (328 feet) between two devices. This length includes patch panels and cables. When longer distances are desired, the use of switches, repeaters, or fiber optic media may be required.

A cable can sometimes be incorrectly wired with correct continuity, but not with correct pairing. This often happens when the cable is terminated consistently at both ends but in the wrong order. A dynamic or AC test is required to detect this type of error. If the cable has correct continuity but a paring error, crosstalk will likely occur. Crosstalk is the bleeding of signals carried by one pair of conductors onto another pair through the electrical process of induction. The conductors do not need to make contact with each other as the crosstalk is transferred magnetically. This is an unwanted effect that can cause slow transfer or completely inhibit the transfer of data signals over a long cable segment. The wire twists found in Cat5e cable significantly reduce crosstalk and its side effects.

Electro Magnetic Interference (EMI) is an unwanted signal that is induced into the cable. Unlike crosstalk, EMI is typically induced from a source that is external to the cable. This could be an electrical power cable or device, or in some cases adjacent Cat5e cables that do not adhere to the 568A and 568B standards. Attenuation is the loss of signal in a cable segment due to the resistance of the wire plus other electrical factors that cause additional resistance. Longer cable length, poor connections, bad insulation, high levels of crosstalk, and EMI will all increase the total level of attenuation. The 568A and 568B standards were developed to provide more effective communications for longer distances in a Cat5e cable segment than using non-standard schemes. Fiber optic cable is the only medium that is completely immune to crosstalk and EMI since it uses light to transfer data instead of electrical current.

Creating Cat5e Standard and Crossover Cables

Before attempting to construct standard Cat5e patch cables, make sure you have all the necessary tools and materials before you begin. Materials required include a length of Cat5e certified cable and several RJ-45 connectors. For best results, use a quality ratcheting tool such as the popular IDEAL Telemaster™ Tool for cutting and terminating RJ-45 plugs.

1. Most crimp tools have two blades: one designed to cut through a cable completely and the other designed to help remove the cable's outer jacket. Use the first blade to cut the cable to length. Then use the second blade to strip about an inch of the cable's outer jacket so that all the wires inside are exposed. Be careful not to cut the inside wires when stripping the cable's jacket insulation.

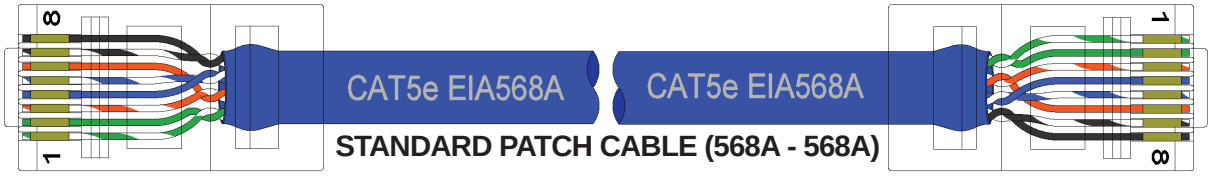
2. With the jacket removed, the eight wires within the Cat5e cable are exposed. If a string is present remove it, and untwist the wires to within one-eighth inch of the jacket.

3. Fan the wires out from left to right in the order they are to be crimped. Using the same color scheme (568A or 568B) at both ends will create a standard patch cable as shown in the 568A-568A and 568B-568B illustrations on the following page.

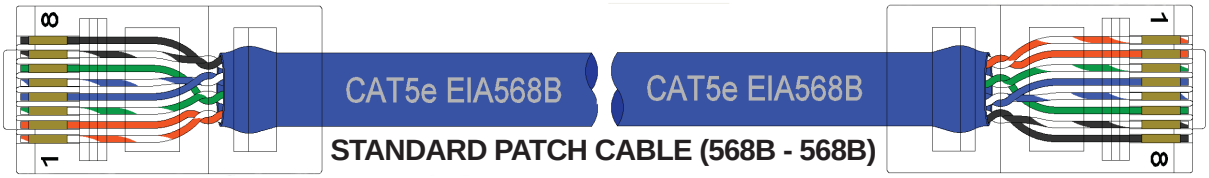
4. With the wires aligned and flattened out, use the cutting blade to evenly trim the wires while leaving approximately one half inch exposed.

5. With the clip facing away, carefully insert the wires into the RJ-45 connector as shown below.

6. Once two RJ-45 connectors have been installed at both ends, the quality of all connections must be tested to ensure the pinouts have been terminated properly. This is a very important step that is often overlooked due to the expense of the testing equipment. The LanRover Pro TP600 will identify shorts, opens, miswires, reversals, and split pairs. In addition, this professional tester will help determine the final length of the cable.

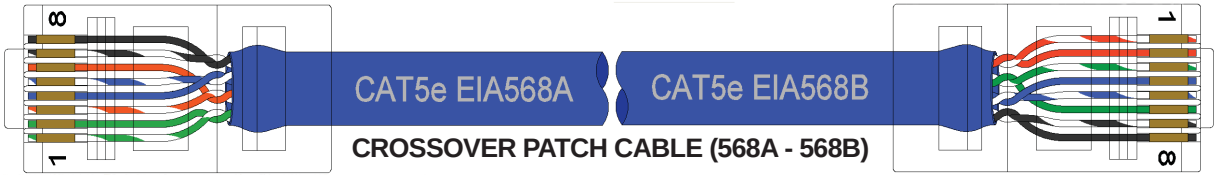


STANDARD PATCH CABLE (568A - 568A)



STANDARD PATCH CABLE (568B - 568B)

Two Ethernet switches may be connected together with a standard patch cable as long as both devices are compliant with the MDIX standard. N-Tron Ethernet switches use this technology on all 10/100 RJ-45 ports. The MDIX standard automatically performs the crossover functions without user configuration. It allows the switch to properly align the conductors internally. In some situations, connection of similar devices such as legacy hubs or network interface cards (NIC's) may be accomplished by the use of a crossover cable. In this case, the cable will physically perform the crossover function. A crossover cable can be easily created by using the 568A scheme at one end and the 568B scheme at the other end as shown in the 568A-568B illustration below.



CROSSOVER PATCH CABLE (568A - 568B)

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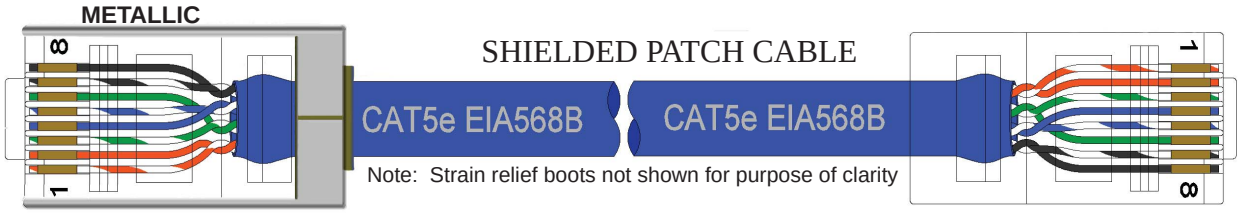
Shielded Cat5e Cable Detail

The use of shielded cables between devices is not required for most N-Tron devices (please consult the user manuals for specific details). 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.

EIA 568A

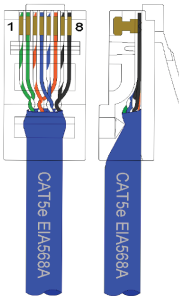
Pin #	Wire Color Legend	Signal
1	White/Green	TX+
2	Green	TX-
3	White/Orange	RX+
4	Blue	TRD2+
5	White/Blue	TRD2-
6	Orange	RX-
7	White/Brown	TRD3+
8	Brown	TRD3-

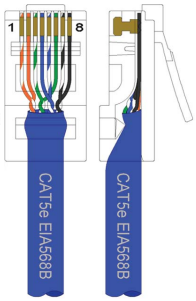
EIA 568B

Pin #	Wire Color Legend	Signal
1	White/Orange	TX+
2	Orange	TX-
3	White/Green	RX+
4	Blue	TRD2+
5	White/Blue	TRD2-
6	Green	RX-
7	White/Brown	TRD3+
8	Brown	TRD3-

M12

Pin #	Wire Color Legend	Signal
1	White/Orange	TX+
2	White/Green	RX+
3	Orange	TX-
4	Green	RX-





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