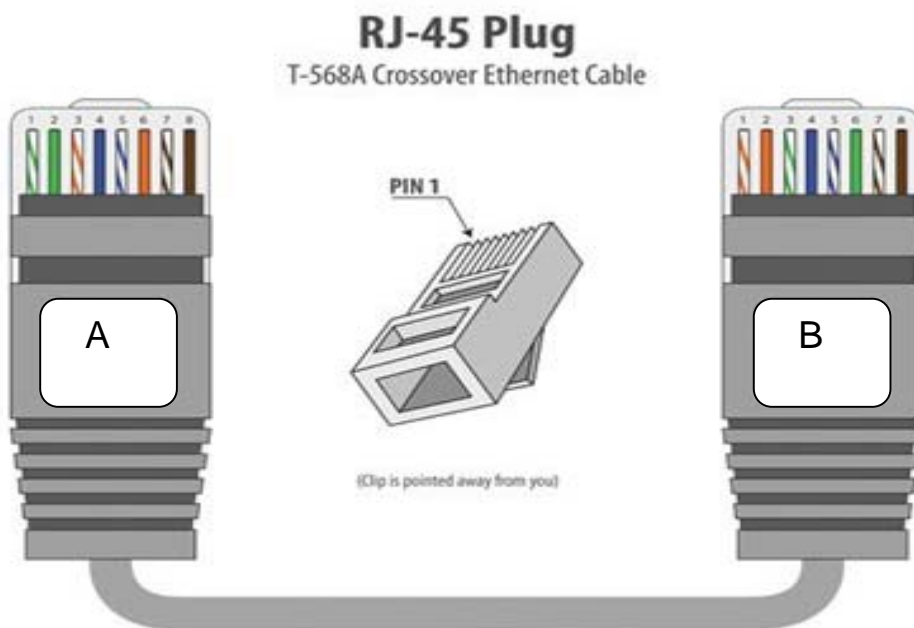
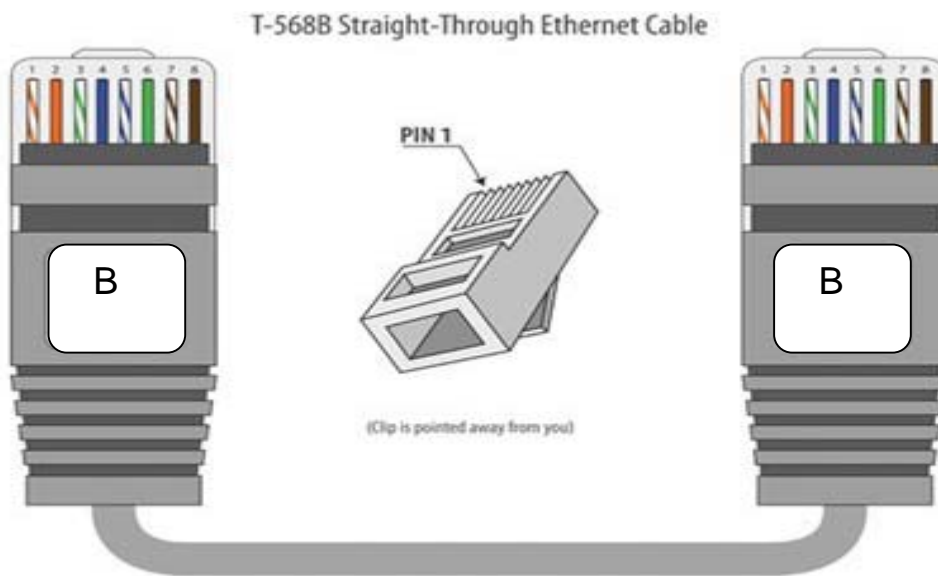


## APPLICATION NOTE: Ethernet Wiring Primer

AN023

There are two standards of the Ethernet leads, using the RJ-45 plugs. The TIA/EIA 568-A was adopted in 1995, but then TIA/EIA 568-B standard was adopted in 2002. It is best to stick to one, these days –B is generally used, and shown below.

To connect from, for instance, a PC to a Switch, use a straight-through “Patch” lead. To connect two Ethernet devices directly, without a hub or switch, you need a Crossover cable, in the second picture.



A good way of remembering how to wire a Crossover Ethernet cable is to wire one end using the T-568A standard and the other end using the T-568B standard.

Another way of remembering the color coding is to simply switch the Green set of wires in place with the Orange set of wires. Specifically, switch the solid Green (G) with the solid Orange (O), and switch the green/white with the orange/white.

## Ethernet Cable Instructions

1. Pull the cable off the reel to the desired length and cut. If you are pulling cables through holes, it is easier to attach the RJ-45 plugs after the cable is pulled.
2. If using hoods, don't forget to put them on now.
3. The total length of wire segments between a PC and a hub or between two PCs cannot exceed 100 Metres (328 feet) for 100BASE-TX and 300 Metres for 10BASE-T.
4. Start on one end and strip the cable jacket off (about 1") using a stripper or a knife. Be very careful not to nick the wires, otherwise you will need to start over.
5. Spread, untwist the pairs, and arrange the wires in the order of the desired cable end. Flatten the end between your thumb and forefinger. Trim the ends of the wires so they are even with one another, leaving only 1/2" in wire length. If it is longer than 1/2" it will be out-of-spec and susceptible to crosstalk. Flatten and insure there are no spaces between wires.
6. Hold the RJ-45 plug with the clip facing down or away from you. Push the wires firmly into the plug. Inspect each wire is flat even at the front of the plug. Check the order of the wires. Double check again. Check that the jacket is fitted right against the stop of the plug. Carefully hold the wire and firmly crimp the RJ-45 with the crimper.

## Ethernet Cable Tips

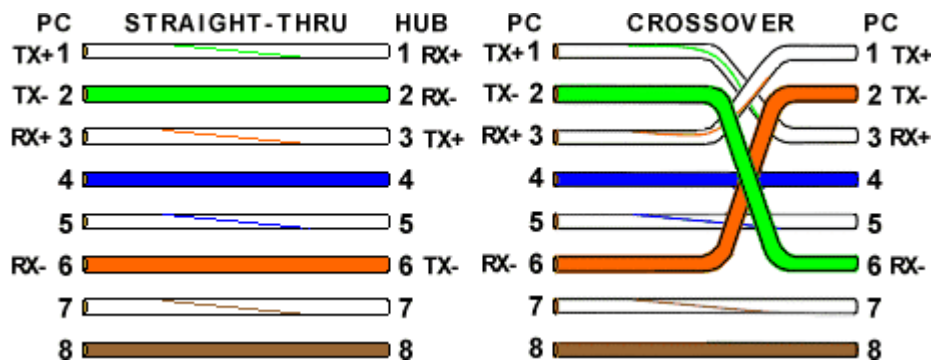
- A Crossover has one end with the Orange set of wires switched with the Green set.
- Odd numbered pins are always striped, even numbered pins are always solid colored.
- Looking at the RJ-45 with the clip facing away from you, Brown is always on the right, and pin 1 is on the left.
- No more than 1/2" of the Ethernet cable should be untwisted otherwise it will be susceptible to Crosstalk, and may reduce the bandwidth.
- Do not deform
  - do not bend
  - do not stretch
  - do not staple
  - do not run parallel with power cables
  - do not run Ethernet cables near noise inducing components.
  - In industrial situations you may need to use screened CAT-5 cable

## Basic Theory

The picture here shows an 'A' straight through ('B' swaps the O and G, and the W/O and W/G pairs). The Crossover shows an 'A' to a 'B'.

Ethernet data travels via the 4 Tx and Rx wires.

Notice that the Blue and Brown wires are not actually used for the Ethernet Data wires, but may be used for Power over Ethernet.



## Power over Ethernet (PoE)

Power over Ethernet allows a device (the Powered Device) to be powered from its own Ethernet cable from suitable Power Sourcing Equipment (PSE).

There are two types of PSEs – Endspans and Midspans. Endspans (commonly called PoE switches) are Ethernet switches or routers that include the power over Ethernet transmission circuitry. Midspans are power injectors that stand between a regular Ethernet switch and the Powered Device, injecting power without affecting the data.

- As defined by the IEEE 802.3af committee and ratified in June of 2003, PoE provides 48v DC over the unused pairs of Category 5 or the better UTP LAN Data Cables.
- Ethernet Data signals continue to travel on wires 1,2,3 and 6 (Orange and Green pairs).
- Power is either :-
  - Superimposed on the data wires 1 & 2 and 3 & 6 – Mode A or
  - Routed through the unused wires 4 & 5 and 7 & 8 – Mode B.
- The Powered Device must accept power in either polarity to allow for the use of crossover cables – ie there are no dedicated +ve and -ve wires.
- The Powered Device picks the power off of its RJ45 connector and routes it into its power circuit. This eliminates the need for the device to be powered locally from an AC outlet. The Powered Device must be able to operate in either Mode A or Mode B.
- Up to 12 Watts is provided to the End device per the 802.3af PoE Standard.
- The updated IEEE 802.3at-2009 PoE standard also known as PoE+ or PoE plus, provides up to 25.5W of power. The 2009 standard prohibits a powered device from using all four pairs for power, but the later IEEE 802.3-2012 standard allows up to 51W of power over a single cable by utilizing all four pairs in the Category 5 cable.

With thanks from [www.incentre.net](http://www.incentre.net)