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| **Applies To:** | Ethernet Crossover Cable | **Article ID:** | AD-KB-000035 |
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# Ethernet Gigabit Crossover Cable

**The following article explains the proper wiring layout for connectors on this cable.**

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# Ethernet crossover cable

From Wikipedia, the free encyclopedia

An **Ethernet crossover cable** is a type of Ethernet cable used to connect computing devices together directly where they would normally be connected via a network switch, hub or router, such as directly connecting two personal computers via their network interface controllers.

Owing to the inclusion of automatic MDI/MDI-X configuration capability in most modern Ethernet equipment, use of crossover cables is typically only necessary in older network installations.


Gigabit T568B crossover cable ends

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## Overview

The 10BASE-T and 100BASE-TX Ethernet standards use one wire pair for transmission in each direction. The Tx+ line from each device connects to the tip conductor, and the Tx- line is connected to the ring. This requires that the transmit pair of each device be connected to the receive pair of the device on the other end. When a terminal device is connected to a switch or hub, this crossover is done internally in the switch or hub. A standard *straight through* cable is used for this purpose where each pin of the connector on one end is connected to the corresponding pin on the other connector.

One terminal device may be connected directly to another without the use of a switch or hub, but in that case the crossover must be done


8P8C modular crossover adapter

externally in the cable or modular crossover adapter. Since 10BASE-T and 100BASE-TX use pairs 2 and 3, these two pairs must be swapped in the cable. This is a *crossover cable*. A crossover cable must also be used to connect two internally crossed devices (e.g., two hubs) as the internal crossovers cancel each other out.

Because the only difference between the T568A and T568B pin/pair assignments are that pairs 2 and 3 are swapped, a crossover cable may be envisioned as a cable with one modular connector following T568A and the other T568B (see Jack crossover wiring). Such a cable will work for 10BASE-T or 100BASE-TX. Gigabit Ethernet (and an early Fast Ethernet variant, 100BASE-T4) use all four pairs and also requires the other two pairs (1 and 4) to be swapped.
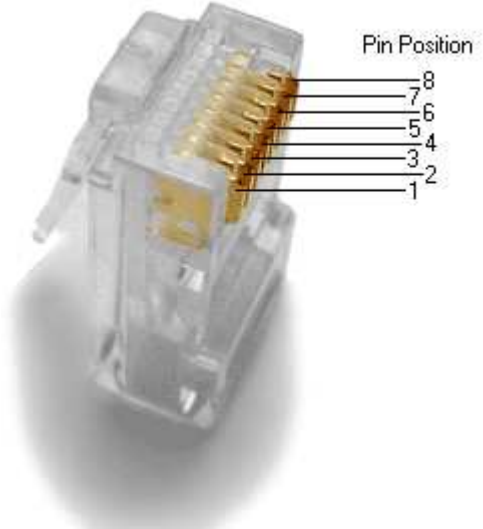
# Crossover cable pinouts

In practice, it does not matter if non-crossover Ethernet cables are wired as T568A or T568B, just so long as both ends follow the same wiring format. Typical commercially available "pre-wired" cables can follow either format depending the manufacturer. What this means is that one manufacturer's cables are wired one way and another's the other way, yet both are correct and will work. In either case, T568A or T568B, a normal (un-crossed) cable will have **both** ends wired according to the layout in the *Connection 1* column.



Crossover cable connecting two MDI ports
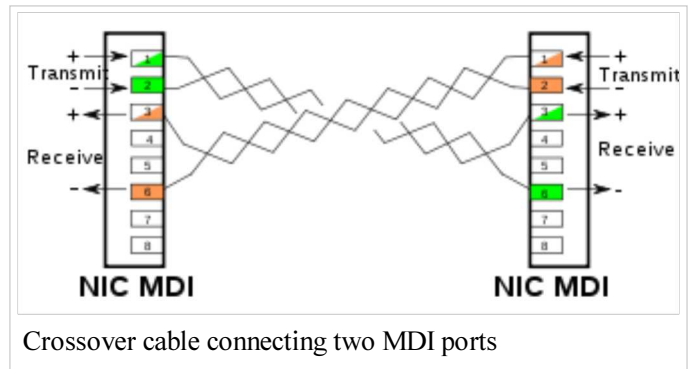
Although the Gigabit crossover is defined in the Gigabit Ethernet standard[1], all Gigabit PHYs feature an auto-MDIX capability and are designed for compatibility with the existing 100BASE-TX crossovers. The IEEE-specified Gigabit crossover is generally seen as unnecessary.

Certain equipment or installations, including those in which phone and/or power are mixed with data in the same cable, may require that the "non-data" pairs 1 and 4 (pins 4, 5, 7 and 8) remain un-crossed.
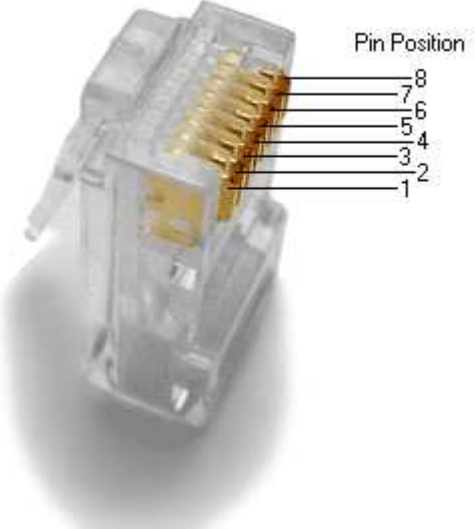
**Two pairs crossed, two pairs uncrossed**
**10BASE-T or 100BASE-TX crossover**

| Pin | Connection 1: T568A | | | Connection 2: T568B | | | Pins on plug face |
|---|---|---|---|---|---|---|---|
| | signal | pair | color | signal | pair | color | |
| 1 | BI_DA+ | 3 | white/green stripe | BI_DB+ | 2 | white/orange stripe | |
| 2 | BI_DA- | 3 | green solid | BI_DB- | 2 | orange solid | |
| 3 | BI_DB+ | 2 | white/orange stripe | BI_DA+ | 3 | white/green stripe | |
| 4 | | 1 | blue solid | | 1 | blue solid | |
| 5 | | 1 | white/blue stripe | | 1 | white/blue stripe | |
| 6 | BI_DB- | 2 | orange solid | BI_DA- | 3 | green solid | |
| 7 | | 4 | white/brown stripe | | 4 | white/brown stripe | |
| 8 | | 4 | brown solid | | 4 | brown solid | |

## Gigabit T568A crossover
### All four pairs crossed
### 10BASE-T, 100BASE-TX, 100BASE-T4 or 1000BASE-T crossover (shown as T568A)
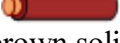
| Pin | Connection 1: T568A | | | Connection 2: T568A Crossed | | | Pins on plug face |
|---|---|---|---|---|---|---|---|
| | signal | pair | color | signal | pair | color | |
| 1 | BI_DA+ | 3 | white/green stripe | BI_DB+ | 2 | white/orange stripe | |
| 2 | BI_DA- | 3 | green solid | BI_DB- | 2 | orange solid | |
| 3 | BI_DB+ | 2 | white/orange stripe | BI_DA+ | 3 | white/green stripe | |
| 4 | BI_DC+ | 1 | blue solid | BI_DD- | 4 | brown solid | |
| 5 | BI_DC- | 1 | white/blue stripe | BI_DD+ | 4 | white/brown stripe | |
| 6 | BI_DB- | 2 | orange solid | BI_DA- | 3 | green solid | |
| 7 | BI_DD+ | 4 | white/brown stripe | BI_DC- | 1 | white/blue stripe | |
| 8 | BI_DD- | 4 | brown solid | BI_DC+ | 1 | blue solid | |

## Gigabit T568B crossover
### All four pairs crossed
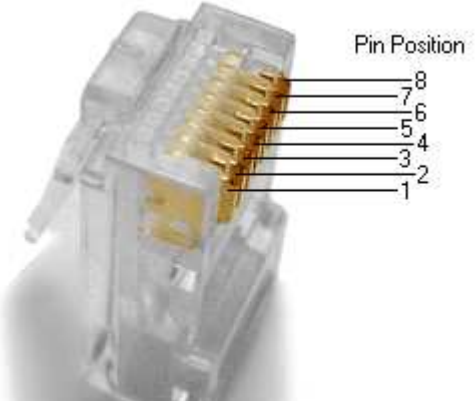### 10BASE-T, 100BASE-TX, 100BASE-T4 or 1000BASE-T crossover (shown as T568B)

| Pin | Connection 1: T568B | | | Connection 2: T568B Crossed | | | Pins on plug face |
|---|---|---|---|---|---|---|---|
| | signal | pair | color | signal | pair | color | |
| 1 | BI_DA+ | 2 | white/orange stripe | BI_DB+ | 3 | white/green stripe | |

| 2 | BI_DA- | 2 | orange solid | BI_DB- | 3 | green solid |
| 3 | BI_DB+ | 3 | white/green stripe | BI_DA+ | 2 | white/orange stripe |
| 4 | BI_DC+ | 1 | blue solid | BI_DD- | 4 | brown solid |
| 5 | BI_DC- | 1 | white/blue stripe | BI_DD+ | 4 | white/brown stripe |
| 6 | BI_DB- | 3 | green solid | BI_DA- | 2 | orange solid |
| 7 | BI_DD+ | 4 | white/brown stripe | BI_DC- | 1 | white/blue stripe |
| 8 | BI_DD- | 4 | brown solid | BI_DC+ | 1 | blue solid |

## Automatic crossover

If one of two connected devices has the automatic MDI/MDI-X configuration feature there is no need for crossover cables. Introduced in 1998, this made the distinction between uplink and normal ports and manual selector switches on older hubs and switches obsolete.[2]

Although Auto-MDIX was specified as an optional feature in the 1000BASE-T standard[1], in practice it is implemented on widely on most interfaces. It has been available for example on Apple Inc. computers since about the Power Mac G5.[3]

Besides the eventually agreed upon *Automatic MDI/MDI-X*, this feature may also be referred to by various vendor-specific terms including: *Auto uplink and trade*, *Universal Cable Recognition* and *Auto Sensing*.

## See also

- Crossover cable
- Jack crossover wiring
- Registered jack, which expands on the introduction and evolution of these connectors.

## References

1. ^ *a b* Clause "40.4.4 Automatic MDI/MDI-X Configuration" in IEEE 802.3-2008: ("IEEE 802.3-2008, Part 3" (http://standards.ieee.org/getieee802/download/802.3-2008_section3.pdf) . 2010-06-22. p. 192. http://standards.ieee.org/getieee802/download/802.3-2008_section3.pdf. Retrieved 2011-02-07. "Implementation of an automatic MDI/MDI-X configuration is optional for 1000BASE-T devices.")
2. ^ Daniel Dove (February 1998). 802.3 "1000BASE-T Automatic Crossover Algorithm" (http://www.ieee802.org /3/ab/public/feb98/ddmdix1.pdf) . *Presentation to IEEE 802.3ab working group*. http://www.ieee802.org

/3/ab/public/feb98/ddmdix1.pdf 802.3. Retrieved June 17, 2011.

3. **^** "Apple products that require and Ethernet cable" (http://support.apple.com/kb/HT2274/) . *Apple support web site*. October 22, 2008. http://support.apple.com/kb/HT2274/. Retrieved June 17, 2011.

# External links

- Creating a crossover network (http://www.jamus.co.nz/technology/technology.php)

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Categories: Ethernet cables | Signal cables