

Making an Ethernet Patch Cable

This information is presented to assist you in the creation of Ethernet patch cables. Be aware that making or modifying Ethernet patch cables improperly will cause loss of network connectivity. To make a patch cable, you'll need 2 RJ-45 connectors, a crimper and 4-pair cable.

1. Use the correct type of cable:

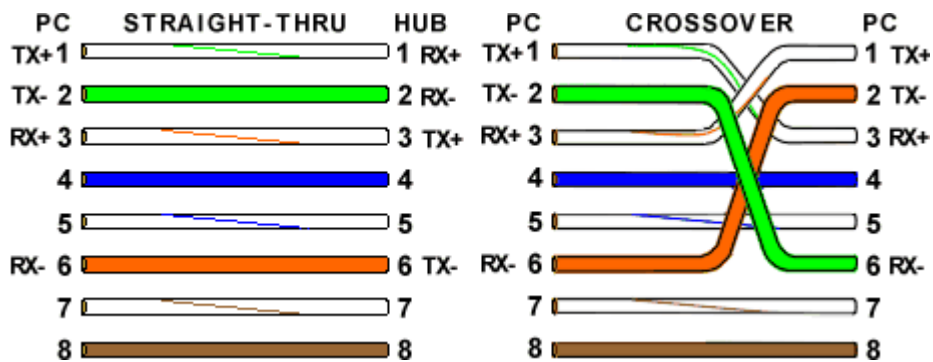
In order for your network to work, you must use the correct category of 4-pair cable and terminate the RJ-45 connectors correctly. Today's high-speed networks use Cat 5, Cat 5e or Cat 6. Use of incorrect cable will degrade the speed of, or cause the network to not work at all. The chart below details the various categories of cable available.

Cable Category	Rated Frequency Bandwidth (MHz)	Uses
1	None	
2	1	Telephone Wiring
3	16	Telephone Wiring, 10Base-T
4	20	Token-Ring, 10Base-T
5	100	100Base-TX, 10Base-T
5e	100	1000Base-T, 100Base-TX, 10Base-T
6	250	1000Base-T, 100Base-TX, 10Base-T

Increasing category levels are backward compatible. In other words, Cat 5 may be used in place of Cat 3 but not visa versa. Manufacturers will often test and certify their cable well beyond the standards.

2. Basic Rules:

Two types of Ethernet cables are used when connecting network components: Straight-Through and Crossover. Straight-Through cables are used most often as patch cords for normal connections. If you require a cable to connect two PC's directly together or if you connect two older hubs together, you will need to use a Crossover cable.

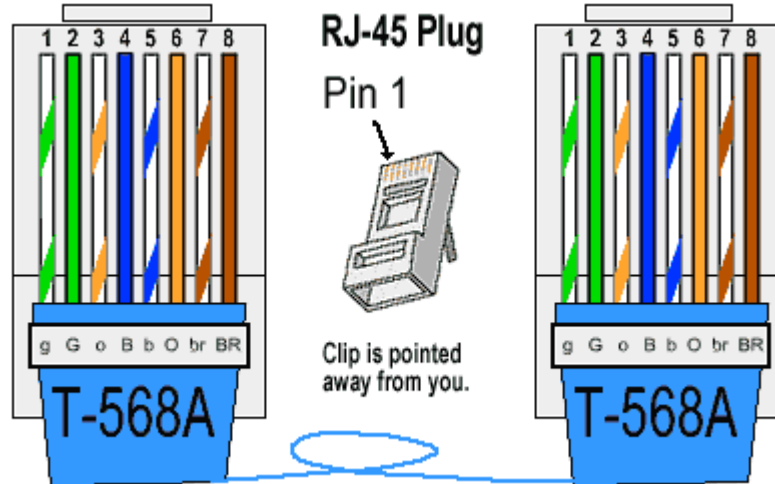


By looking at a Straight-through cable and a Crossover cable, you'll see that the TX (transmitter) pins are connected to the corresponding RX (receiver) pins, plus to plus and minus to minus. You can also see that both the blue and brown pairs on pins 4, 5, 7, and 8 are not used in either standard. So why bother using these wires? Well, for one thing it's easier to install a connector with all the wires grouped together. Otherwise you'll be spending time trying to fit those tiny little wires into each of the corresponding holes in the RJ-45. Also, those wires *are* used for PoE (Power over Ethernet.) So it's a good idea to stick to the standard. (See the last page of this document for an explanation of PoE.)

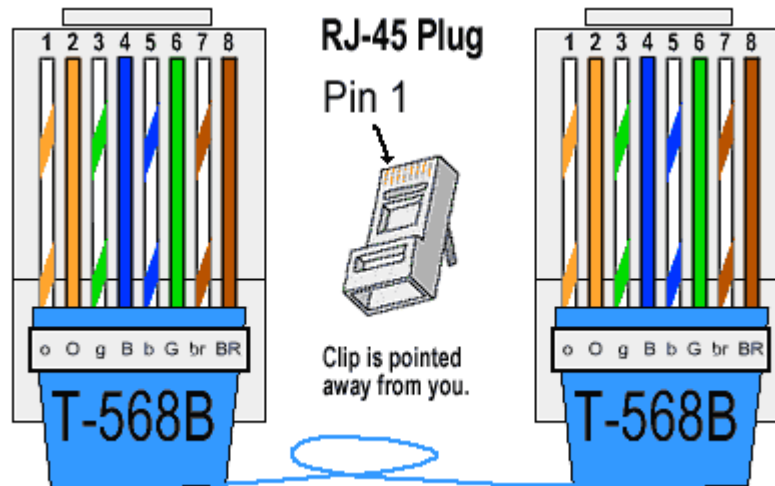
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3. Color Code Standards:

T-568A Straight-Through Ethernet Cable



T-568B Straight-Through Ethernet Cable

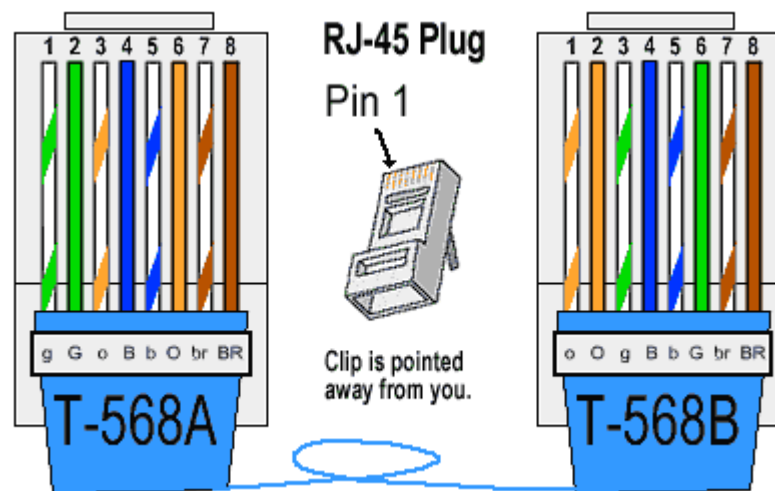


Either the T-568A or T-568B standard may be used in network installations. However most off-the-shelf Ethernet cables are the T-568B standard. Functionally, it makes no difference in which you choose.

Straight-Through cables are used most often as patch cords for connecting a router or hub, modem and computer. If you're connecting two PC's directly together, or if you connect two older hubs together, you will need to use a Crossover cable. See the diagram on the next page.

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RJ-45 Crossover Ethernet Cable



A good way of remembering how to make a Crossover 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 with the solid orange, and switch the green/white with the orange/white.

4. Making an Ethernet Patch Cable:

1. Pull cable off the reel to the desired length and cut. If you are pulling cables through holes, it's easier to attach the RJ-45 plugs after the cable is pulled. The total length of wire segments between a PC and a hub or between two PC's cannot exceed 100 Meters (328 feet) for 100BASE-TX and 300 Meters for 10BASE-T.
2. Start on one end and strip the cable jacket off (about 1") using a stripper or a knife. Be extra careful not to nick the wires, otherwise you will need to start over.
3. 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.
4. Hold the RJ-45 plug with the clip facing down or away from you. Push the wires firmly into the plug. Inspect that 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.
5. Check the color orientation, check that the crimped connection is not about to come apart, and check to see if the wires are flat against the front of the plug. If even one of these is incorrect, you will have to start over. Test the Ethernet cable. Cable testers are available for purchase at most computer or electronic supply stores.

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5. Ethernet Cable Tips:

- A straight-thru cable has identical ends.
- A crossover cable has different ends.
- A straight thru is used as a patch cord in most Ethernet connections.
- A crossover is used to connect two PC's without a hub or for connecting two older hubs.
- 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.
- Do not deform, do not bend, do not stretch, do not staple, do not run parallel with power cables, and do not run Ethernet cables near noise inducing components. Here's a short list: neon signs, electric heaters, speakers, printers, TV sets, fluorescent lights, copiers, microwave ovens, telephones, fans, electric motors, electric ovens, dryers, washing machines, and shop equipment.

6. Power over Ethernet (PoE):

Power over Ethernet has been implemented in many variations before IEEE standardized 802.3af. 802.3af specifies the ability to supply an endpoint with 48V DC at up 350mA or 16.8W. The endpoint must be capable of receiving power on either the data pairs (often called phantom power) or the unused pairs in 100Base-TX. PoE can be used with any Ethernet configuration, including 10Base-T, 100Base-TX and 1000Base-T. Power is only supplied when a valid PoE endpoint is detected by using a low voltage probe to look for the PoE signature on the endpoint. PoE power is typically supplied in one of two ways, either the host Ethernet switch provides the power, or a "mid-span" device is plugged in between the switch and endpoints which supplies the power.

RJ45 Pin #	Wire Color (T568A)	Wire Diagram (T568A)	10Base-T Signal 100Base-TX Signal	PoE
1	White/Green		Transmit+ (Tip)	Mode A +
2	Green		Transmit - (Ring)	Mode A +
3	White/Orange		Receive+ (Tip)	Mode A -
4	Blue		Unused (Ring)	Mode B +
5	White/Blue		Unused (Tip)	Mode B +
6	Orange		Receive- (Ring)	Mode A -
7	White/Brown		Unused (Tip)	Mode B -
8	Brown		Unused (Ring)	Mode B -

Power over Ethernet Pin out