Appendix

6A

Making a Category 5e Cable

In this chapter, we will learn the following to World Class standards:

- **Studying the Electrical Design**
- **Making a Straight Through Category 5e Network Patch Cable**

Studying the Electrical Design

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As in every project a mechanical or electrical designer starts, they need to have a complete understanding of what needs to be accomplished. In this chapter, that means we want to be able to create a standard computer network patch cable. Now, although most designers have assignments given to them and they have never before completed a similar task, so begins the path to discovery. For the majority of designers in the world, although they have drawn floor plans, created part details and purchased components from catalogs, they have not designed a printed circuit board. We will tell any designer that like most disciplinary tasks, there is a process, the electrical and mechanical parts are very much smaller and once we construct our first design; we will want to continue learning about other network cables.
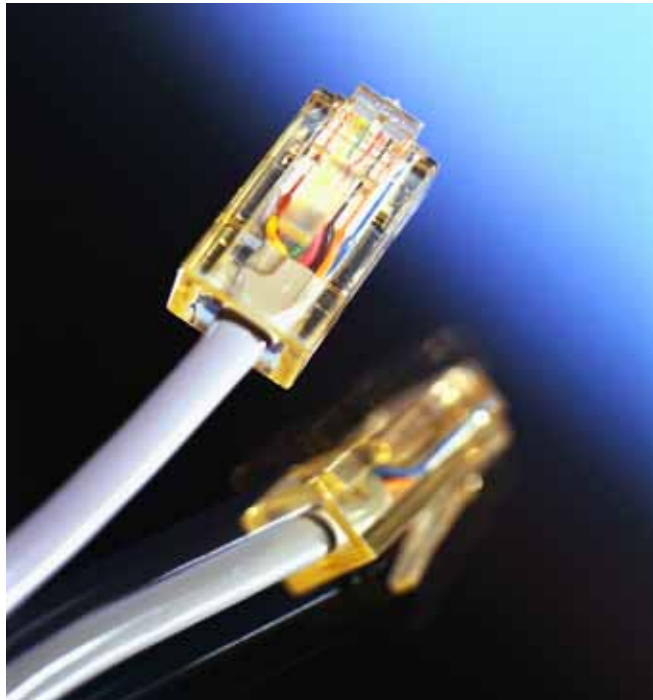
Figure 6a.1 – Network Cable

The first item on our list to invention is to examine a network cable. In the computer network industry there are multiple ways of connecting a computer to a network such a company's Local Area Network (LAN) or our computer to a high-speed modem at a residential setting to connect to the Internet. A popular method is to use a wireless network card in our computer and to connect through radio waves to a wireless router. Another method is to connect to the corporate server through a fiber optic cable. The design we will work on in this chapter is where there is a network card in the computer and we use a Category 5e or 6 patch cable to connect to a switch. A category 5e cable supports 100 Megabits per second (Mbps) communication speed and the Category 6 cable is for 1000 Mbps or one Gigabit per second.

A network patch cable (also known as a straight through cable) meets the Electronic Industry Standard TIA/EIA 568-B wiring standard. The cable assembly is comprised of two RJ-45 cable connectors and a cable that is a minimum of 1 meter long and does not exceed 100 meters in length. If we have a straight run that exceeds the 100 meter (328 feet) distance, we can use a network switch in the middle and add another patch cable to make the balance of the distance.

Network Patch Cable Bill of Material		
Item No.	Description	Qty
1	RJ-45 connector	2
2	Category 5e cable	10 ft.

The RJ45 connector has small spikes that spear through the wire's insulation to create an electrical path when we crimp the connector to the end of the cable. The Category 5e and 6 cable has eight

26 AWG conductors, where each pair is twisted, so there are four twisted pairs. We can purchase the cable without shielding for applications that do not involve Electromagnetic Interference (EMI) or we can use the cable with shielding for environments where we anticipate EMI problems.

Making a Straight Through Category 5e Network Patch Cable

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In order to make a network patch cable, we need tools to do the work. This includes a wire cutter, cable strippers, RJ- 45 cable crimpers, a pair of scissors.

Category 5e or 6 cable typically comes in 1000 foot boxes. When we receive the box of cable, we want to inspect the cable for damage that may have occurred during shipping. Another concern technicians have is that the individual conductor insulation is not properly color coded which means we will have a difficult time determining the order of the wires when aligning them before crimping.

Before cutting the cable, we should have done a site inspection to determine the length that we require. We need to add another 10% to 50% to the cable length, so we can move computers or other network devices around in the room without having to make another cable. Extra cable can be coiled and tied up with a plastic cable ties, so we do not have a trip hazard in the office. Now that we have determined the cable length, use the wire cutter to slice the cable.

The next step is to employ a wire stripper to remove approximately 2 inches of the exterior insulation surrounding the four twisted pairs of wires. Now we would like to separate all four pairs of wires into a star pattern with the white orange - orange pair in the north, the white blue - blue pair in the east, the white brown - brown pair in the south and the white green - green pair in the west.

At this moment, we need to untwist each pair and straighten the individual conductors between our thumb and index finger.
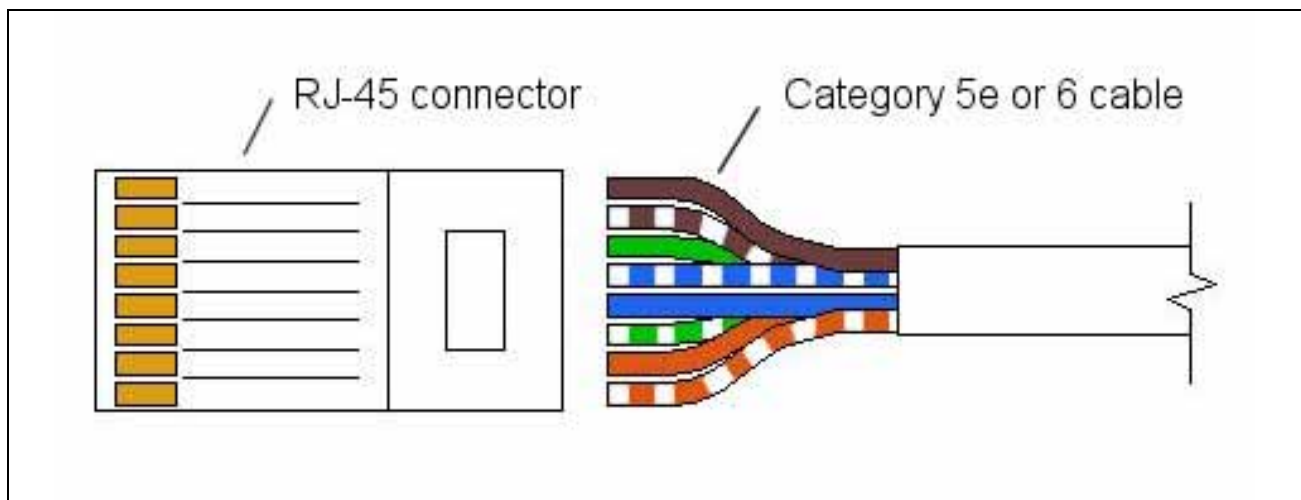

Figure 6a.2 – 568-B Wiring

Align the wires from left to right as shown in figure 6a.2. The 2 inch long wires will appear as a flat ribbon. Use a sharp wire cutter on the RJ-45 wire crimper to cut the ribbon down to just over a half an inch from the end of the outer insulation. With the tab on the RJ-45 facing away, insert the flat ribbon into the connector as shown in figure 6a.2. We can see the copper wire when looking into the clear end of the connector and by checking each side. A crooked cut of the ribbon will cause the wire to be engaged on one side of the connector and not on the opposite side. Also, the exterior cable insulation will be under the stress relief bar on the connector. Cutting the ribbon too long and there will not be a stress relief in the cable assembly and the constant wiggling during the cable's lifetime will cause an early failure. Insert the RJ-45 connector and cable into the crimping head and squeeze tightly. Some cable crimpers have a ratchet mechanism that will not release the connector until the prescribed squeeze has been achieved.

Repeat the process on the other side of the cable and our assembly is complete. Now, we need to test the cable with a RJ-45 cable tester. Once the cable passes the test, label both ends of the cable with the cable identifying number from the network-wiring diagram.

* World Class CAD Challenge 30-6 * - The project engineer wants to you to make a 10 foot long Category 5e Network Patch Cable in 15 minutes.

Continue this drill four times each time completing the patch cable under 15 minutes to maintain your World Class ranking.