

LAB 2: LAN CABLING

Required Component:

1. LAN Cable
2. RJ 45
3. Crimping Tool
4. Tester

Theory:

LAN Cable:

A LAN (Local Area Network) cable is a type of network cable used to connect devices such as computers, printers, routers, and switches within a limited area like a home, office, or school. It enables fast and reliable data transfer between these devices, allowing them to share files, internet access, and other network resources.

The most common type of LAN cable is the Ethernet cable, which typically features RJ-45 connectors on both ends. These cables are user-friendly, provide stable connections, and support high-speed communication, making them essential for creating an efficient and dependable local network.

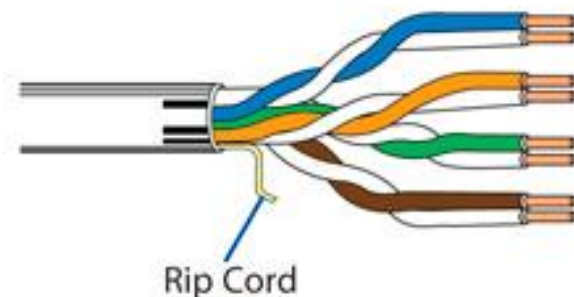


Fig 1: LAN Cable

Cabling Standard:

Cabling standards are guidelines that define how network cables should be connected, arranged, and used. These standards ensure that cables function correctly and are compatible with various devices around the world. By following cabling standards, we can reduce connection issues and maintain reliable communication between devices in a network.

One of the most widely used cabling standards in networking is the TIA/EIA-568 standard, which specifies how to wire Ethernet cables and connectors for consistent and efficient performance.

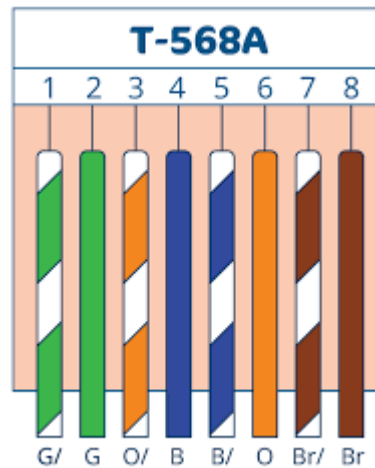
568A Standard

The 568A wiring standard is one of the two main arrangements used for Ethernet cables. It is commonly used in residential networks and is often preferred for government and federal projects. In this standard, the green-colored wires come before the orange ones.

The color order from pin 1 to pin 8 is:

1. Green White
2. Green
3. Orange White
4. Blue
5. Blue White
6. Orange
7. Brown White
8. Brown

Following this specific order ensures proper signal transmission and compatibility. The 568A standard is used when creating both straight-through and crossover Ethernet cables, depending on how it is paired with the other end.



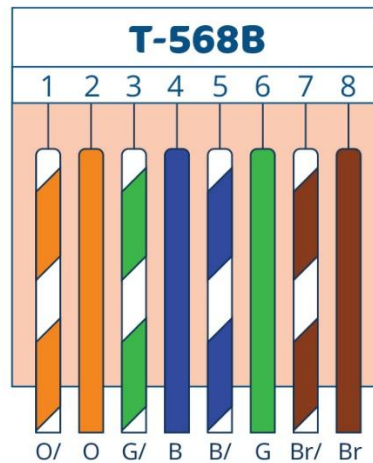
568B Standard

The 568B wiring standard is more commonly used in commercial settings and older network installations. It differs from the 568A standard by switching the positions of the green and orange wire pairs. In this standard, the orange-colored wires come before the green ones.

The color order from pin 1 to pin 8 is:

1. Orange White
2. Orange
3. Green White
4. Blue
5. Blue White
6. Green
7. Brown White
8. Brown

568B became the more popular standard over time, especially in offices and larger network environments. Like 568A, it ensures proper signal transmission and reliable communication between network devices.

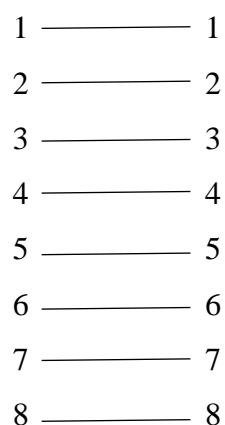


Straight Cable

A straight cable is a type of Ethernet cable where both ends follow the same wiring standard—either 568A to 568A or 568B to 568B. This means the wire colors are arranged in the same order on both connectors.

Straight cables are used to connect different types of devices, such as a computer to a switch, a router to a switch, or a PC to a hub. They are very common and are typically used in most home and office networks.

For example, when connecting your computer to your internet router, a straight cable is usually the one you would use.



Crossover Cable

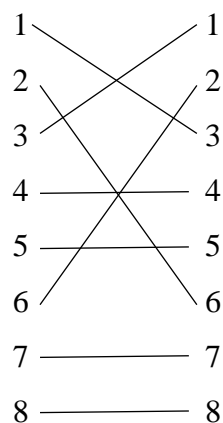
A crossover cable is an Ethernet cable where one end uses the 568A wiring standard and the other end uses the 568B standard. This means the wire colors are arranged differently on each connector, causing the transmit and receive signals to "cross over."

Crossover cables are used to connect similar types of devices, such as:

- PC to PC
- Switch to switch
- Router to router
- Hub to hub

There are also cases where devices that appear different are treated as similar in function. For example, connecting a PC to a router or a switch to a hub typically required a crossover cable in older network setups.

These connections rely on the crossing of transmit and receive signals for proper communication. However, most modern network devices now support **Auto-MDI/MDIX**, a feature that allows them to automatically detect the connection type and adjust accordingly. Despite this advancement, understanding and identifying the correct cable type is still important, especially in lab environments or when working with legacy hardware.



Cable Category Table

There are different types of LAN cables, called categories, which are designed to support different speeds and applications. The table below shows the common LAN cable categories from Category 1 to the latest Category 8, including their maximum data speeds, and typical uses:

Category	Maximum Speed	Max. Length	Frequency	SHIELDING	Application
CAT 1	Up to 1Mbps(Carry only Voice)	--	1MHz	Unshielded	Old telephone cabling
CAT 2	Up to 4Mbps	--	4MHz	Unshielded	Token Ring Network
CAT 3	Up to 10Mbps	100m	16MHz	Unshielded	Token Ring & 10BASE-T Network
CAT 4	Up to 16Mbps	100m	20MHz	Unshielded	Token Ring Network
CAT 5	Up to 100Mbps	100m	100MHz	Unshielded	Ethernet, Fast ethernet and Token Ring
CAT 5e	Up to 1Gbps	100m	100MHz	Unshielded or Shielded	Ethernet, Fast ethernet & Gigabit ethernet
CAT 6	Up to 10Gbps	100m	250MHz	Unshielded or Shielded	Ethernet, Fast ethernet, Gigabit ethernet & 10G Ethernet(37 - 55 meter)
CAT 6a	Up to 10Gbps	100m	500MHz	Shielded	Ethernet, Fast ethernet, Gigabit ethernet & 10G Ethernet(37 - 55 meter)
CAT 7	Up to 10Gbps	100m	600MHz	Shielded	Ethernet, Fast ethernet, Gigabit ethernet & 10G Ethernet(100 meter)
CAT 8	Up to 40Gbps	100m	2000MHz	Shielded	Ethernet, Fast ethernet, Gigabit ethernet & 25G-40G Ethernet(30 meter)

Procedure:

- Take a Cat6 LAN cable and use a crimping tool to carefully remove the outer jacket without damaging the inner wires.
- Untwist the twisted pairs of wires inside and straighten each wire individually.
- Remove the plastic cross-shaped separator (also called the cross skeleton) found in Cat6 cables to make handling easier.
- Arrange the wires according to the chosen wiring standard — either for a straight cable (same standard on both ends) or a crossover cable (different standards on each end), following the 568A or 568B wiring schemes.
- Trim the wires evenly so they are all the same length, ensuring a neat fit into the connector.
- Insert the wires carefully into the RJ45 connector, making sure all wires stay in the correct order and reach the front of the connector.

- Use the crimping tool to firmly clamp the RJ45 connector, locking the wires securely in place.
- Repeat the same process for the other end of the cable.
- Use a cable tester to verify the cable's connectivity and confirm that it is wired correctly.

Result:

A Cat6 straight-through Ethernet cable was successfully created using the 568B wiring standard on both ends. After crimping and assembling the cable, a LAN cable tester was used to verify the connections. The tester confirmed that all 8 pins were correctly connected in the same order on both ends (1 to 1, 2 to 2, 3 to 3, 4 to 4, 5 to 5, 6 to 6, 7 to 7, 8 to 8), confirming the cable is properly made and suitable for network communication between different devices.

Discussion:

LAN cabling is a fundamental aspect of networking that ensures reliable communication between devices. This lab covered key topics such as different cable types (straight-through and crossover), wiring standards (568A and 568B), and the proper use of tools like crimping tools and cable testers. Understanding the distinction between straight and crossover cables is essential because each serves a specific purpose depending on the devices being connected. Proper cable preparation—including stripping the outer jacket, untwisting and arranging wire pairs, and securely attaching RJ45 connectors—is crucial to create a functional and durable cable. Testing the cable after assembly confirms both the accuracy of wiring and the quality of the crimping process. This hands-on experience reinforces theoretical knowledge related to physical network setup and troubleshooting.

Conclusion:

The LAN cabling lab provided valuable hands-on experience in preparing and assembling Ethernet cables following correct standards and procedures. It emphasized the importance of understanding cable types, wiring schemes, and the correct use of networking tools. By completing the creation and testing of both straight-through and crossover cables, essential skills were developed for building and maintaining functional local area networks. This foundational knowledge is critical for anyone involved in network installation or technical support.