Index

Sl. no.	Name of experiment	Date of experiment	Date of submission	Teacher's sign
1	Overview of networks			
2	Overview of cables			
3	Cable configurations			

Experiment: 1

What is computer networks?

A network consists of two or more computer that are linked in order to share resources (such as printers and scanners), exchange files, or allow electronic communication. The computers on a network may be linked through cables, telephones lines, radio waves, satellite or infrared light waves or even visible light (in case of LiFi).

Why do we need networking?

Resource sharing

- Hardware (computing resources, disks, printers)
- Software (application software)

Information sharing

- Easy accessibility from anywhere (files, databases)
- Fetching any available information on internet using search engine

Communication

- Email
- Sending messages between two or more computers in a LAN

Remote computing

- Accessing any computer over a network from another computer by logging into that computer via some VNC system.

Cloud computing

- A huge network of hosted servers to do tasks like storage, management and processing of data

Distributed computing

- Uses a system whose components are located on different networked computers, which communicate and coordinate their actions by passing messages to one another. Torrent uses peer-to-peer network which is the epitome of distributed computing

How many kinds of networking?

Depending on one's perspective, we can classify networks in different ways:-

- Based on network size: LAN, MAN, WAN
- Based on topology (connectivity): Bus, Star, Ring
- Based on management method: Peer to peer and client/server

- Based on transmission media: wired (UTP, coaxial cable, fiber-optic cable) and wireless

Based on Network size:

LAN (Local area network)

- Typically connects computer in a single building or a campus
- Developed in 1980s
- Medium: optical fibre, coaxial cables, twisted pair, wireless
- High speed networks
- Speed adequate for most distributed systems
- Typically buses or rings
- ethernet , token ring

MAN(Metropolitan area network)

- Generally covers town and cities (50 kms)
- Developed in 1980s
- Medium: optical fibres, cables
- Data rates adequate for distributed computing applications
- Message routing is fast

WAN(Wide area network)

- Developed in 1960s.
- Generally covers large distances (states, countries, continents).
- Medium: communication circuits connected by routers.
- Routers forwards packets from one to another following a route from the sender to the receiver. Store-and-Forward.
- Hosts are typically connected (or close to) the routers.
- Problems with delays if using satellites.

Based on topology

What is a Physical Topology?

The physical topology of a network refers to the configuration of cables, computers, and other peripherals. Physical topology should not be confused with logical topology which is the method used to pass information between workstations.

Linear Bus

A linear bus topology consists of a main run of cable with a terminator at each end. All nodes (file server, workstations, and peripherals) are connected to the linear cable. Ethernet and Local Talk networks use a linear bus topology.

Advantages

- Easy to connect a computer or peripheral to a linear bus.
- Requires less cable length than a star topology.

Disadvantages

- Entire network shuts down if there is a break in the main cable.
- Terminators are required at both ends of the backbone cable.
- Difficult to identify the problem if the entire network shuts down.
- Not meant to be used as a stand-alone solution in a large building.

Star

A star topology is designed with each node (file server, workstations, and peripherals) connected directly to a central network hub. Data on a star network passes through the hub or concentrator before continuing to its destination. The hub or concentrator manages and controls all functions of the network. It also acts as a repeater for the data flow. This configuration is common with twisted pair cable however; it can also be used with coaxial cable.

Advantages

- Easy to install.
- No disruptions to the network then connecting or removing devices.
- Easy to detect faults and to remove parts.

Disadvantages

- Requires more cable length than a linear topology.
- If the hub or concentrator fails, nodes attached are disabled.
- More expensive than linear bus topologies because of the cost of the concentrators.

Ring

In Ring Topology, all the nodes are connected to each-other in such a way that they make a closed loop. Each workstation is connected to two other components on either side, and it communicates with these two adjacent neighbors. Data travels around the network, in one direction. Sending and receiving of data takes place by the help of TOKEN.

Mesh

In a mesh network topology, each of the network node, computer and other devices, are interconnected with one another. Every node not only sends its own signals but also relays data from other nodes. In fact a true mesh topology is the one where every node is connected to every other node in the network. This type of topology is very expensive as there are many redundant connections, thus it is not mostly used in computer networks. It is commonly used in wireless networks. Flooding or routing technique is used in mesh topology.

Tree

A tree topology combines characteristics of linear bus and star topologies. It consists of groups of star-configured workstations connected to a linear bus backbone cable. Tree topologies allow for the expansion of an existing network.

Advantages

- Point-to-point wiring for individual segments.
- Supported by several hardware and software venders.

Disadvantages

- Overall length of each segment is limited by the type of cabling used.
- If the backbone line breaks, the entire segment goes down.
- More difficult to configure and wire than other topologies.

Experiment: 2

What is Network Cabling?

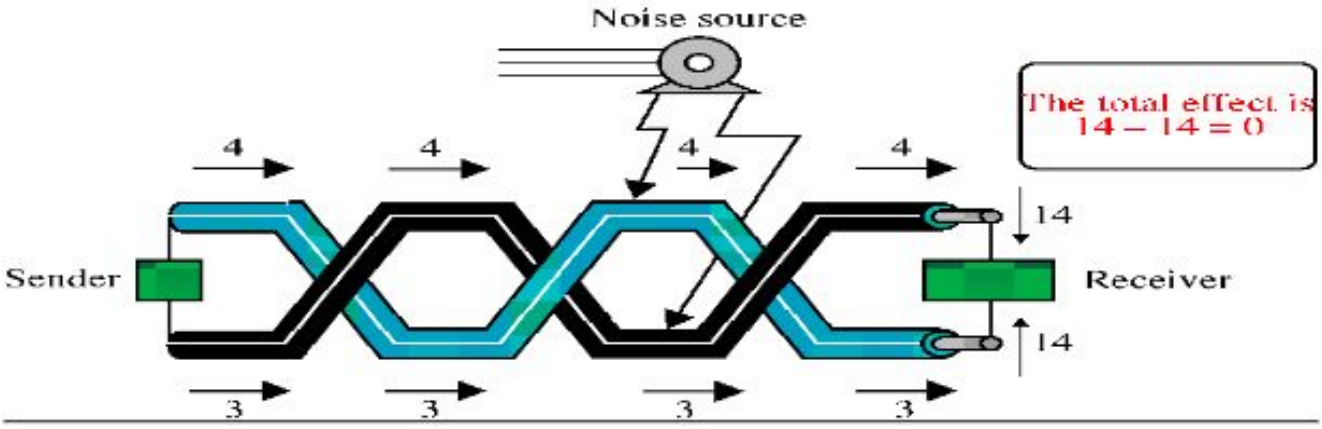
Cable is the medium through which information usually moves from one network device to another. There are several types of cable which are commonly used with LANs. In some cases, a network will utilize only one type of cable, other networks will use a variety of cable types. The type of cable chosen for a network is related to the network's topology, protocol, and size.

Guided media:

- Twisted-Pair cables:
  - Unshielded Twisted-Pair (UTP) cables
  - Shielded Twisted-Pair (STP) cables
- Coaxial cables
- Fiber-optic cables

Twisted-Pair Cables

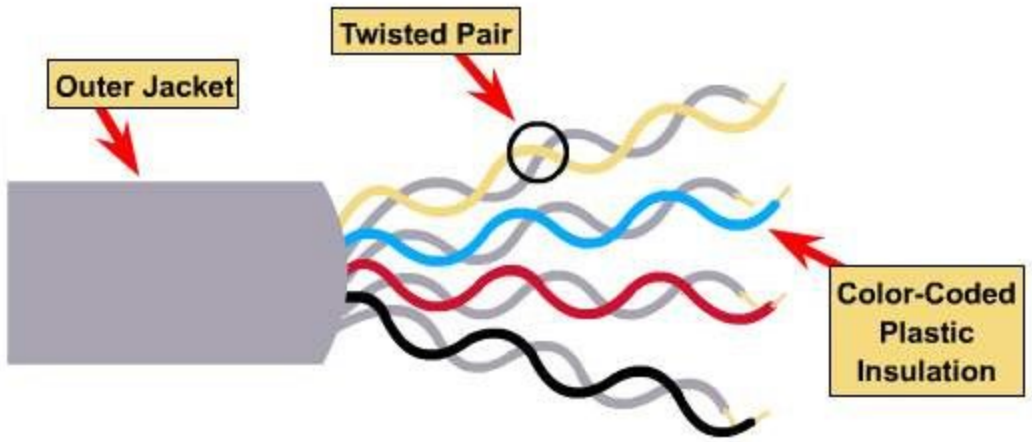
If the pair of wires are not twisted, electromagnetic noises from, e.g., motors, will affect the closer wire more than the further one, thereby causing errors.



Unshielded Twisted Pair (UTP) Cable

The quality of UTP may vary from telephone-grade wire to extremely high-speed cable. The cable has normally four pairs of wires inside the jacket. Each pair is twisted with a different number of twists per inch to help eliminate interference from adjacent pairs and other electrical devices. The EIA/TIA (Electronic Industry Association/Telecommunication Industry Association) has established standards of UTP and rated some categories of wire.

- Typically wrapped inside a plastic cover (for mechanical protection)
- A sample UTP cable with 5 unshielded twisted pairs of wires



Types of UTP cable:

Cat 1: Currently unrecognized by TIA/EIA. Previously used for Pots telephone communications, ISDN and doorbell wiring.

Cat 2: Currently unrecognized by TIA/EIA. Previously was frequently used on 4 M bit/s networks.

Cat 3: Currently defined in TIA/EIA-568-B, used for data networks utilizing frequencies up to 16 MHz Historically popular for 10 Mbit/s Ethernet networks.

Cat 4: Currently unrecognized by TIA/EIA. Provided performance of up to 20 MHz, and was frequently used on 16 Mbit/s token ring networks.

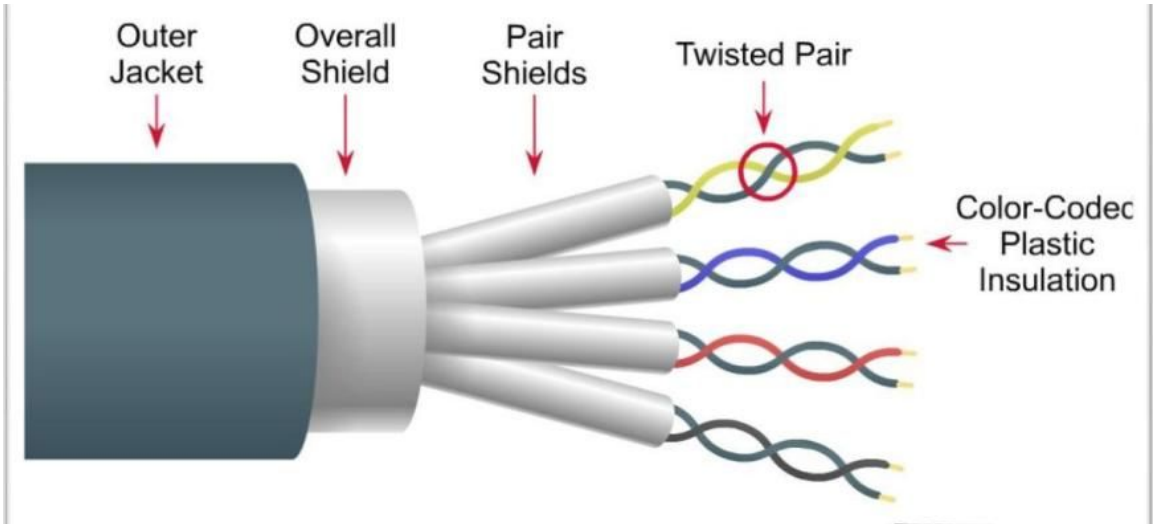
Cat 5: Currently unrecognized by TIA/EIA. Provided performance of up to 100 MHz, and was frequently used on 100 Mbit/s Ethernet networks. May be unsuitable for 1000BASE-T gigabyte Ethernet.

Cat 5e: Currently defined in TIA/EIA-568-B. Provides performance of up to 100 MHz, and is frequently used for both 100 Mbit/s and gigabyte Ethernet networks.

Cat 6: Currently defined in TIA/EIA-568-B. It provides performance of up to 250 MHz, more than double category 5 and 5e.

Shielded Twisted Pair (STP) Cable

Shielded twisted pair (STP) is suitable for environments with electrical interference; however, the extra shielding can make the cables quite bulky. Shielded twisted pair is often used on networks using Token Ring topology.
STP cables are similar to UTP cables, except there is a metal foil or braided-metal-mesh cover that encases each pair of insulated wires.

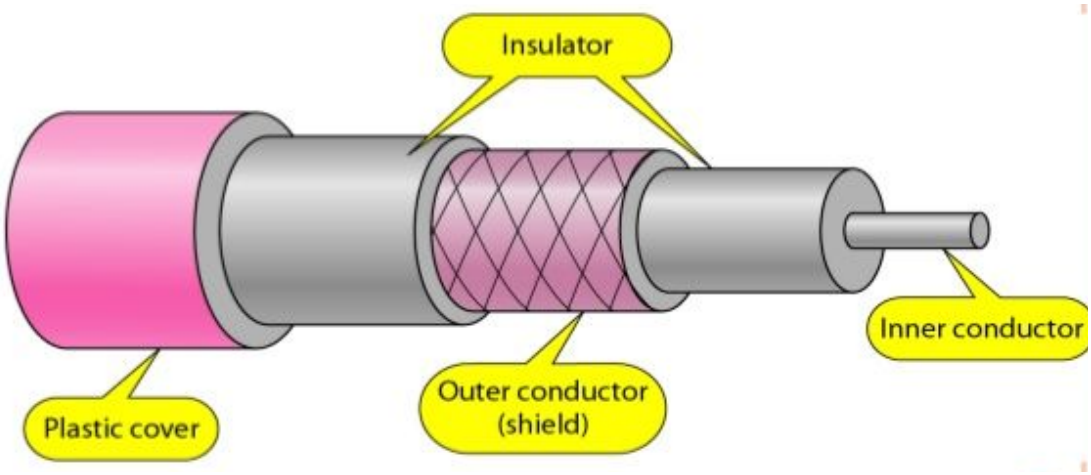


Coaxial Cable

Coaxial cabling has a single copper conductor at its center. A plastic layer provides insulation between the center conductor and a braided metal shield. The metal shield helps to block any outside interference from fluorescent lights, motors, and other computers.

Although coaxial cabling is difficult to install, it is highly resistant to signal interference. In addition, it can support greater cable lengths between network devices than twisted pair cable. The two types of coaxial cabling are thick coaxial and thin coaxial.

- In general, coaxial cables, or coax, carry signals of higher freq (100 KHz–500 MHz) than UTP cables
- Outer metallic wrapping serves both as a shield against noise and as the second conductor that completes the circuit

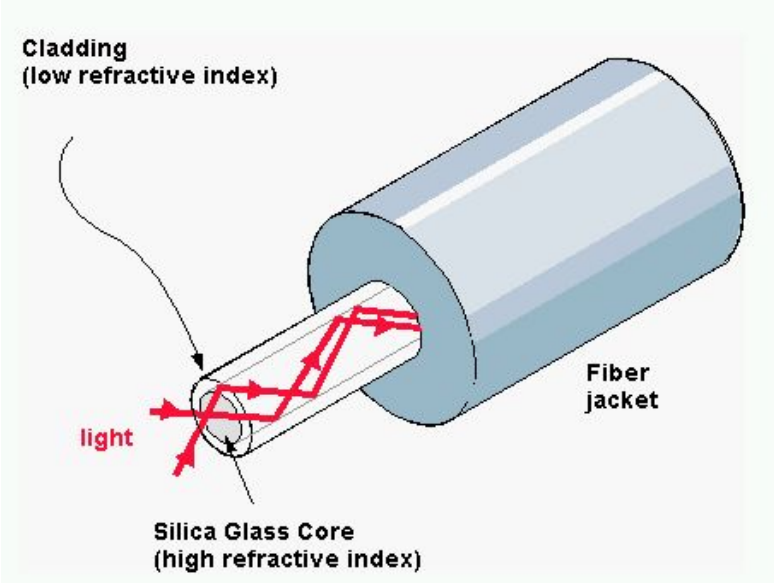


Fiber Optic Cable

Fiber optic cabling consists of a center glass core surrounded by several layers of protective materials. It transmits light rather than electronic signals eliminating the problem of electrical interference. Fiber optic cable has the ability to transmit signals over much longer distances than coaxial and twisted pair. It also has the capability to carry information at vastly greater speeds.

- Light travels at $3 * 10^8$ m/s in free space and is the fastest possible speed in the Universe
- Light slows down in denser media, e.g. glass
- Refraction occurs at interface, with light bending away from the normal when it enters a less dense medium
- Beyond the critical angle Þ total internal reflection
- Light bounces back and forth along the core

- Common light sources: LEDs and lasers



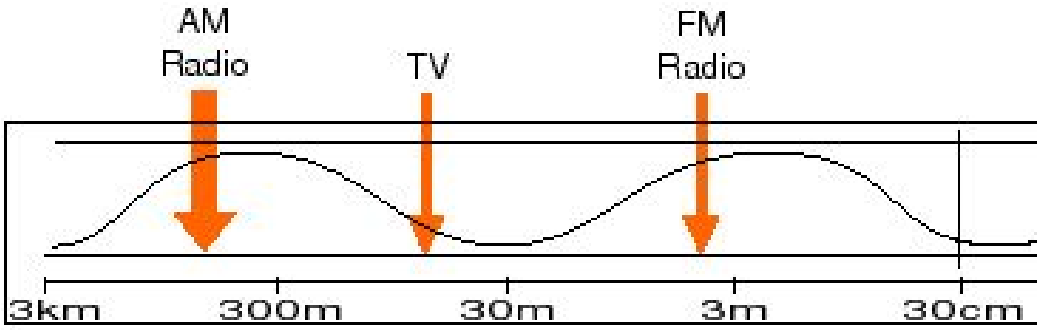
Unguided media: Wireless

Wireless transmission:

- Radio wave
- Microwave
- Infrared

Radio waves

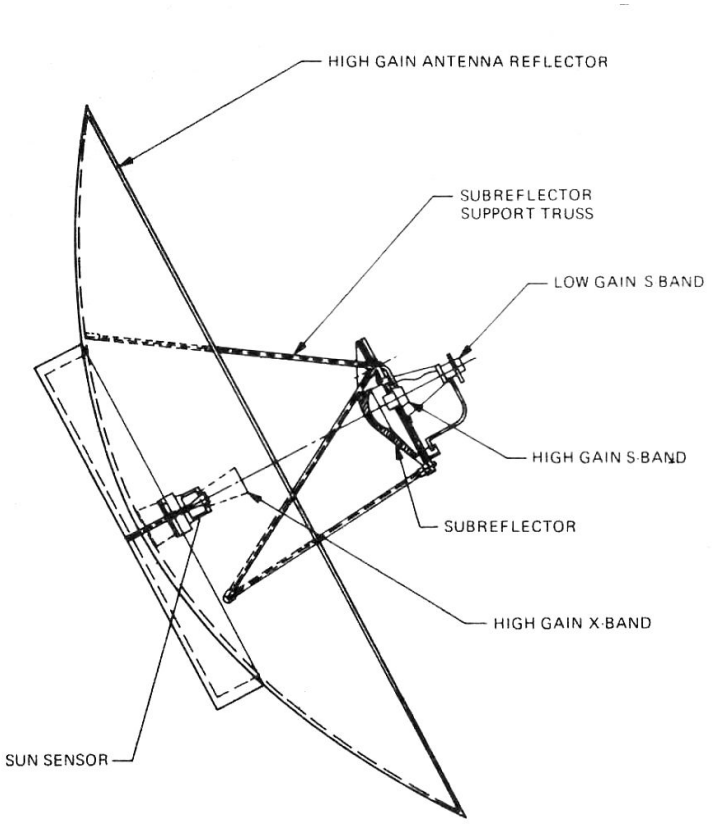
- Radio waves are used for multicast communications, such as radio and television, and paging systems. They can penetrate through walls.
- Highly regulated. Use omni directional antennas



Radio Wave Region of the Electromagnetic Spectrum

Microwaves

Microwaves are used for unicast communication such as cellular telephones, satellite networks, and wireless LANs. Higher frequency ranges cannot penetrate walls. Use directional antennas - point to point line of sight communications.



Infrared signals

Infrared signals can be used for short-range communication in a closed area using line-of-sight propagation.

Experiment: 3

Unshielded twisted pair (UTP) cable

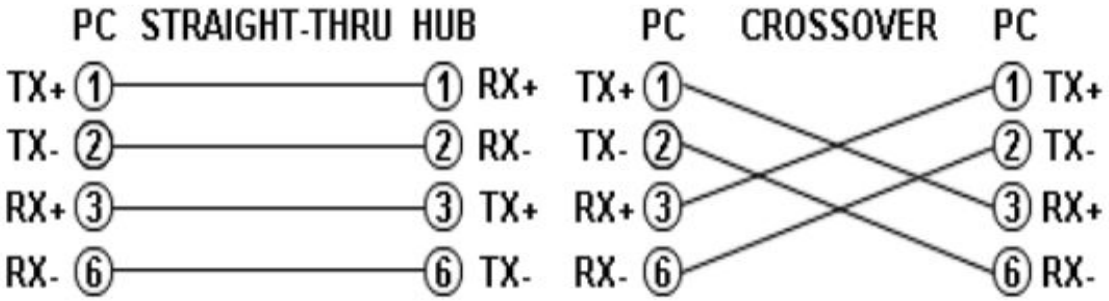
Connector 1	Connector 2
WHT-GRN	WHT-GRN
GRN	GRN
WHT-ORG	WHT-ORG
BLU	BLU
WHT-BLU	WHT-BLU
ORG	ORG
WHT-BRN	WHT-BRN
BRN	BRN

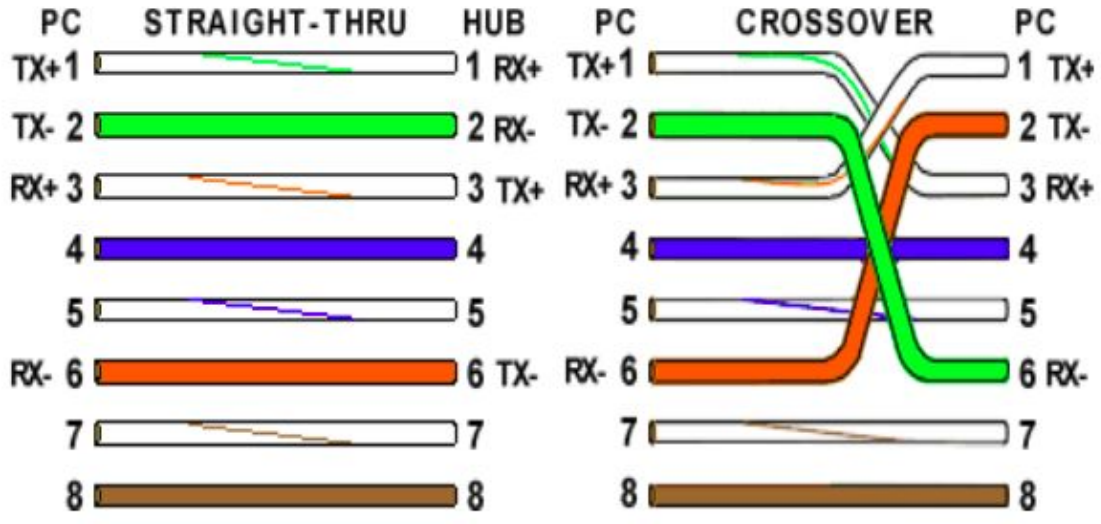
UTP (EIA 568-B) Cable (Straight through)

Connector 1	Connector 2
WHT-ORG	WHT-ORG
ORG	ORG
WHT-ORG	WHT-GRN
BLU	BLU
WHT-BLU	WHT-BLU
GRN	GRN
WHT-BRN	WHT-BRN
BRN	BRN

UTP (EIA 568-A/EIQ 568-B) Cable (Crossover)

Connector 1	Connector 2
WHT-GRN	WHT-ORG
GRN	ORG
WHT-ORG	WHT-GRN
BLU	BLU
WHT-BLU	WHT-BLU
ORG	GRN
WHT-BRN	WHT-BRN
BRN	BRN





Installing Cable - Some Guidelines

When running cable, it is best to follow a few simple rules:

Always use more cable than you need. Leave plenty of slack.
Test every part of a network as you install it. Even if it is brand new, it may have problems
that will be difficult to isolate later.
Stay at least 3 feet away from fluorescent light boxes and other sources of electrical interference.
If it is necessary to run cable across the floor, cover the cable with cable protectors.
Label both ends of each cable.
Use cable ties (not tape) to keep cables in the same location together.
Cable Assembly Instructions
1. Skin off the cable jacket approximately 1" or slightly more.
2. Un-twist each pair, and straighten each wire between the fingers.
3. Place the wires in the order of one of the two diagrams shown above (568B or 568A).
4. Bring all of the wires together, until they touch.
5. At this point, recheck the wiring sequence with the diagram.
6. Optional: Make a mark on the wires at 1/2" from the end of the cable jacket
7. Hold the grouped (and sorted) wires together tightly, between the thumb, and the forefinger.
8. Cut all of the wires at a perfect 90 degree angle from the cable at 1/2" from the end of the cable jacket. This is a very critical step. If the wires are not cut straight, they may
not all make contact. We suggest using a pair of scissors for this purpose.
9. Conductors should be at a straight 90 degree angle, and be 1/2" long, prior to insertion into the connector.
10. Insert the wires into the connector (pins facing up).
11. Push moderately hard to assure that all of the wires have reached the end of the connector. Be sure that the cable jacket goes into the back of the connector by about 3/16".
12. Place the connector into a crimp tool, and squeeze hard so that the handle reaches its full swing.
13. Repeat the process on the other end. For a straight through cable, use the same wiring.
14. For a "crossover" cable, wire one end 568A, and the other end 568B.
15. Use a cable tester to test for proper continuity.