

Network

By:

Engr. Joseph Ronald Cañedo

Introduction

- We'll look at connecting your embedded computer to the real world by adding a **Local Area Network (LAN)** interface.
- There is a wide variety of networks employed:
 1. Controller Area Network (CAN)
 - is a network for industrial applications, where a conventional network just won't do. CAN is suited to electrically noisy and harsh conditions and is the network of choice in electrically severe environments.
 2. Ethernet
 - is the intranet network that connects the world's desktop computers, as well as a host of other devices such as routers, gateways, printers, and other peripherals.

Controller Area Network (CAN)

- Through the late 70s and 80s, the complexity of automotive electronics grew considerably, with engine-management systems, ABS braking, active suspension, electronic transmissions, automated lighting, air-conditioning, security, and central locking. Each of these systems does not exist in isolation but is part of an integrated whole.
- A considerable amount of information exchange is required, and, therefore, some means of system interconnection must be provided. The conventional method was point-to-point wiring, which provided discrete interconnection between each subsystem.
- This methodology was a natural evolution from the simple electrics of earlier cars, but as automotive complexity grew, such a scheme proved vastly inadequate. Each car could have several kilometers worth of wiring and dozens of connectors. Such complex wiring systems added greatly to the cost of producing a car, added unnecessary weight, reduced reliability, and made servicing a nightmare.

Controller Area Network (CAN)

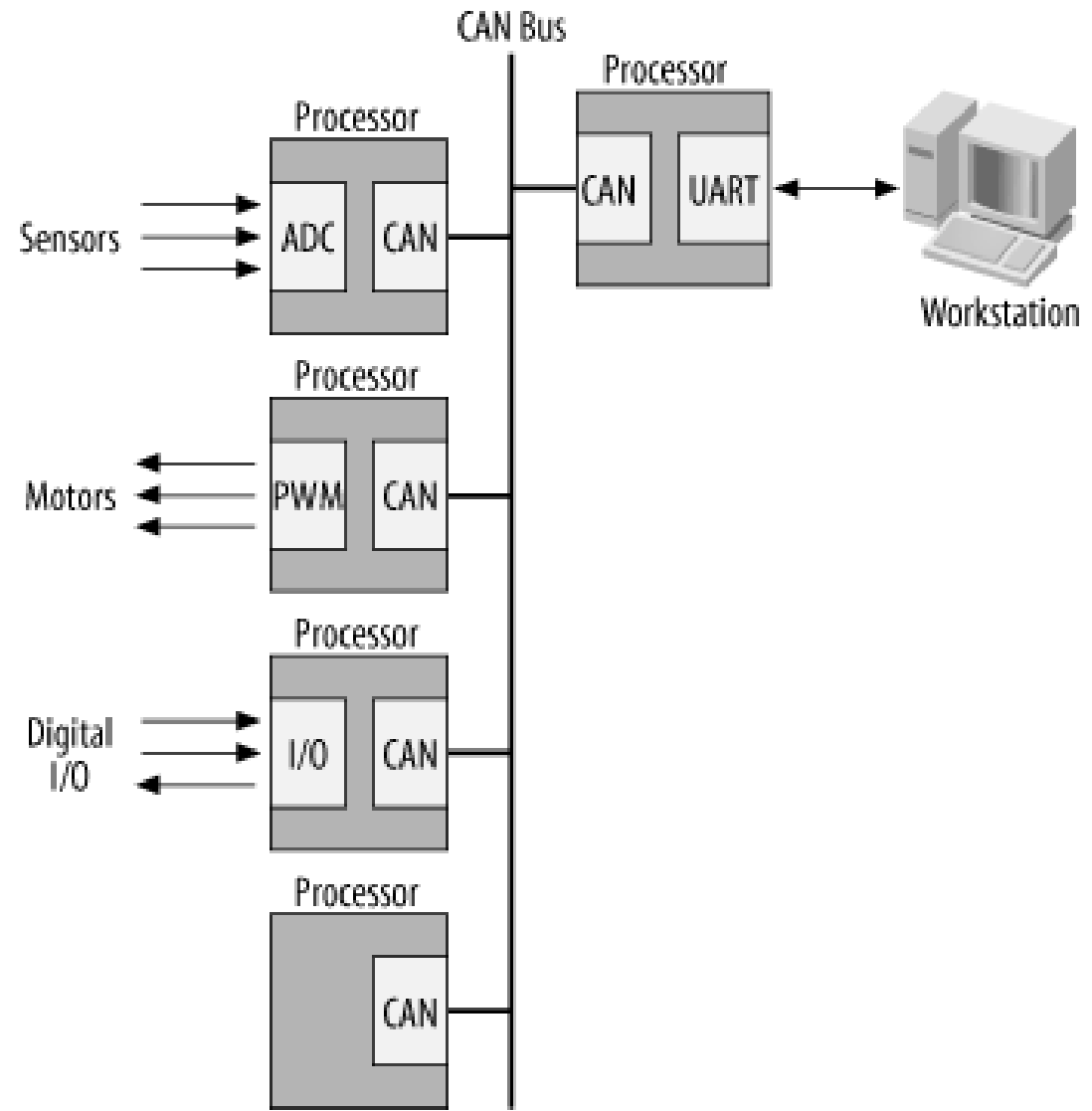
- The obvious solution was to replace complexity with simplicity and implement intersystem communication using a low-cost digital network. The automotive electrical environment is very noisy. With electric motors, ignition systems, RF emissions, and so on, the 12 V supply to automotive electronics can have ± 400 V transients.
- The required communication network must therefore be able to cope with this noise and work reliably.
- The network must provide high-noise immunity and error detection and handling, with retransmission of failed packets.
- Thus was born the Controller Area Network, more commonly known as CAN, implementing real-time communication at up to 1 Mbps, over a 2-wire serial network.
- CAN specifies only the physical and data-link layers of the ISO-OSI model, with higher layers left to the specific implementation.

Controller Area Network (CAN)

- Bosch developed CAN in Europe in the late 1980s, originally for use in cars.
- Because of its robustness, CAN has expanded beyond its automotive origins and can now be found in industrial automation, trains, ship navigation and control systems, medical systems, photocopiers, agricultural machinery, household appliances, office automation, and elevators.
- CAN is now an international standard under ISO11898 and ISO11519-2.

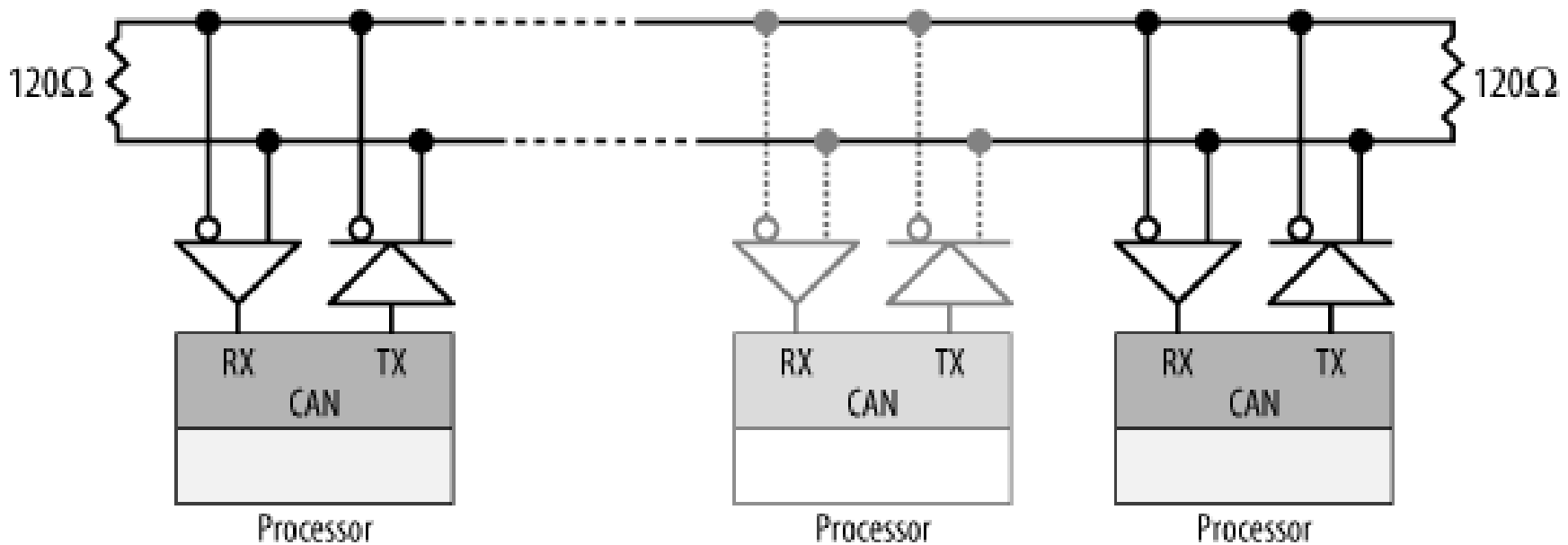
Controller Area Network (CAN)

- CAN supports multiple masters on the network, with each master responsible for local sensing and control within the distributed system.



Controller Area Network (CAN)

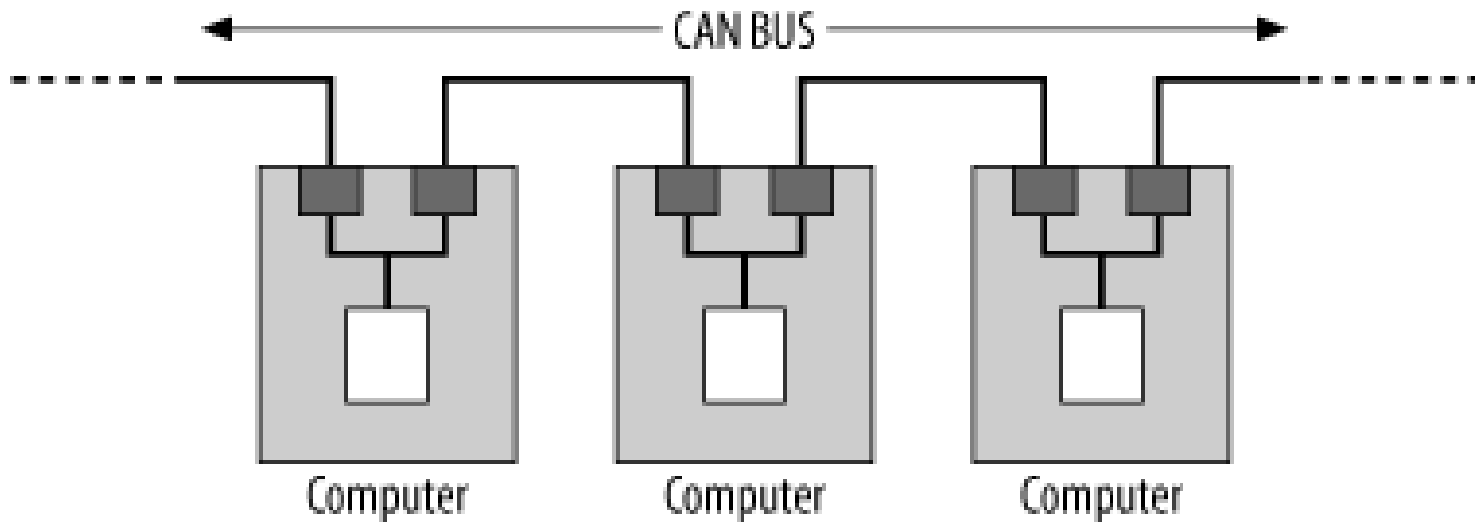
- CAN network uses wired-AND logic, with a maximum bus length of 1,000 meters (3,300 feet), and a bus length of 40 meters (133 feet) at maximum data rate over twisted-pair wiring.



CAN Bus

Controller Area Network (CAN)

- The embedded computer must also have some way of physically attaching to the bus. The simplest method is simply to bring the bus into the computer system on one connector, tap off it, and then route it out through another connector



Tapping into a CAN bus by using two connectors on a PCB

Controller Area Network (CAN)

- Many implementations of CAN just use standard IDC-type headers for the connectors. However, the actual CAN standard specifies that the connector should be a 9-pin Sub-D connector.

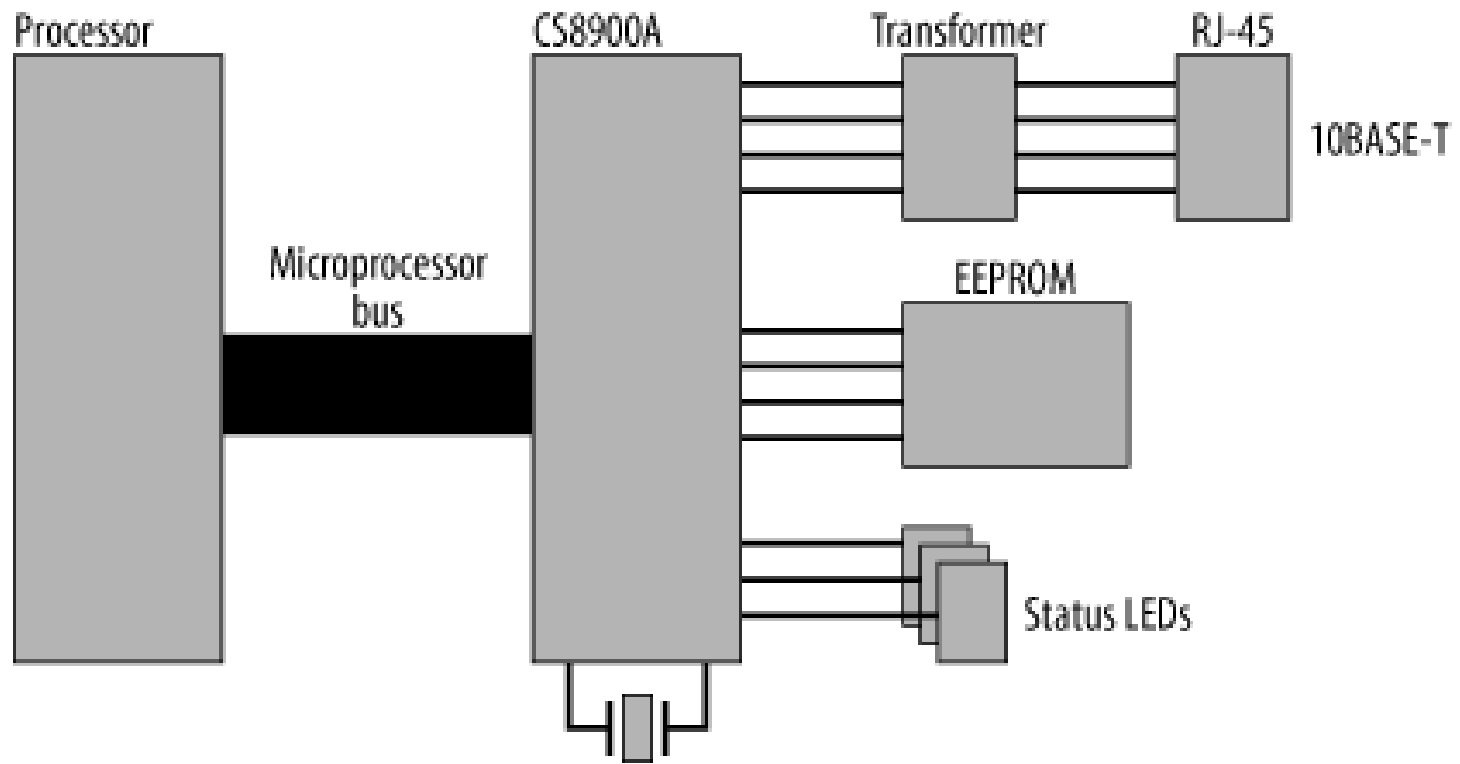
CAN pinouts

Pin	Signal/use
1	Reserved
2	CAN_L
3	Ground
4	Reserved
5	Reserved
6	Ground
7	CAN_H
8	Reserved
9	V+ (optional power source)

Ethernet

- Developed at Xerox PARC in the early 1970s, this local-area networking standard has found its way into every possible application and has evolved over time to encompass a number of standards ranging from wireless networks (802.11) to gigabit Ethernet.

Ethernet



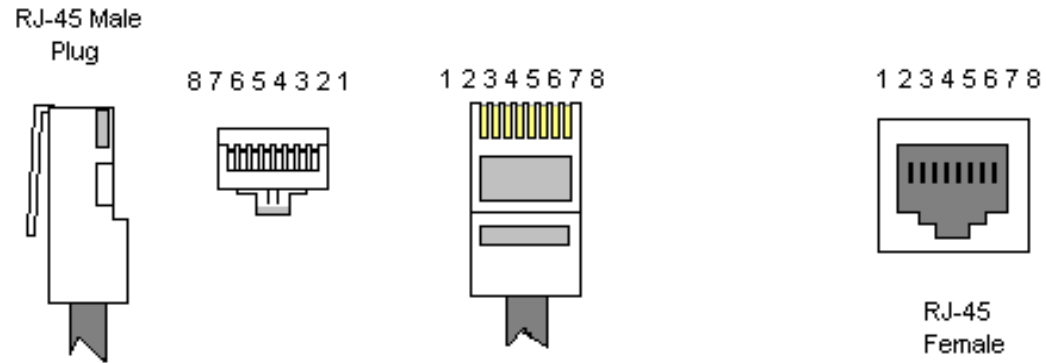
Block diagram showing a CS8900A implementation

Ethernet

RJ-45 connector signals

Pin	Signal name	Purpose	Wire color
1	TD+	Transmitted data	White/orange
2	TD-	Transmitted data	Orange
3	RD+	Received data	White/green
4	NC	No connection	Blue
5	NC	No connection	White/blue
6	RD-	Received data	Green
7	NC	No connection	White/brown
8	NC	No connection	Brown

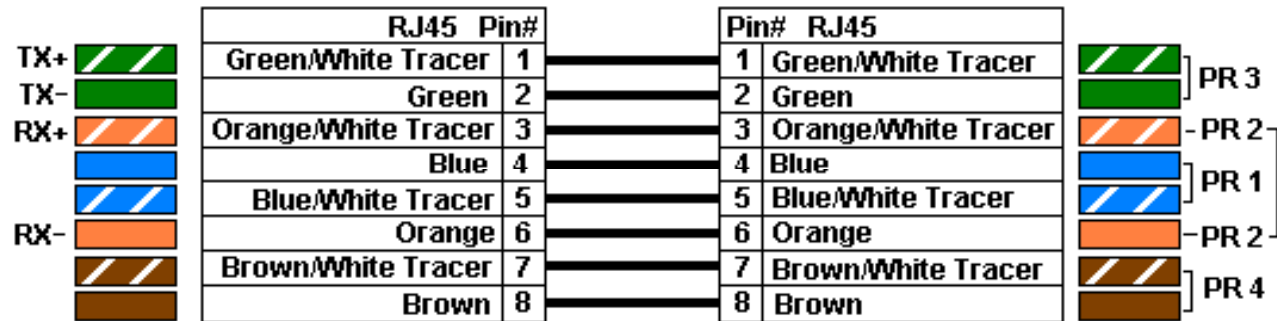
Ethernet



RJ-45

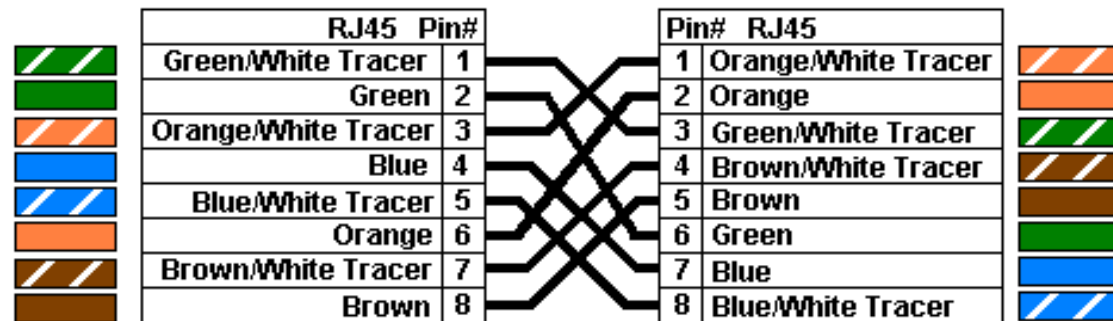
Color Standard
EIA/TIA T568A

Ethernet Patch Cable



Color Standard
EIA/TIA T568A

Ethernet Crossover Cable



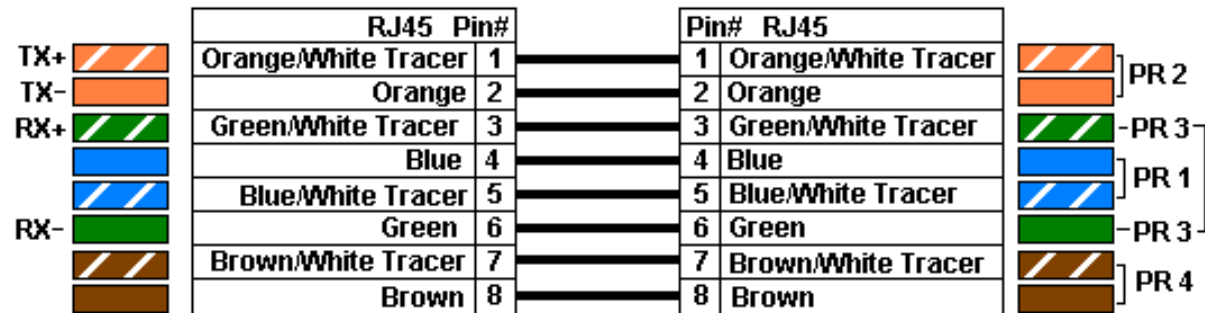
"A" is earlier

Ethernet

Color Standard
EIA/TIA T568B

Ethernet Patch Cable

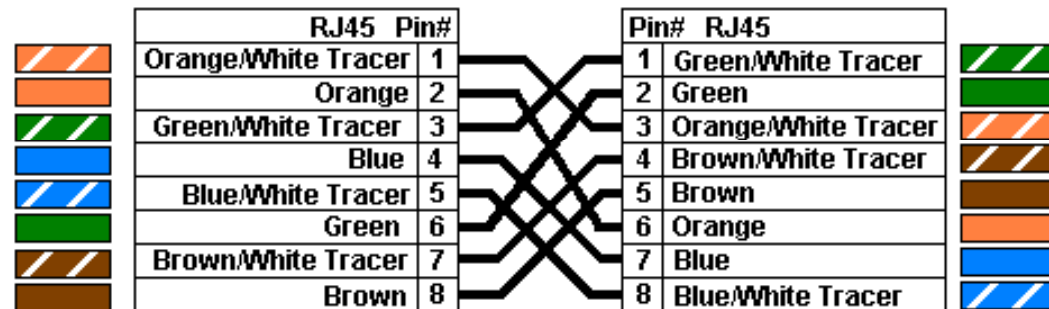
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Color Standard
EIA/TIA T568B

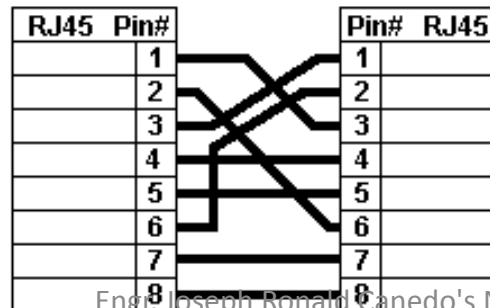
Ethernet Crossover Cable

RJ-45



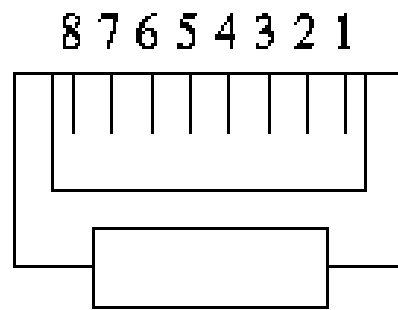
"B" is most recent

Common Ethernet Crossover Cables may only cross connect the Orange & Green pairs



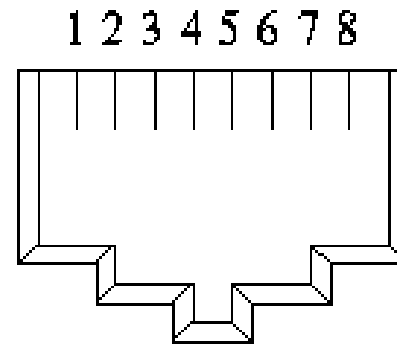
B&B MODELS:
C5UMB3FOR-CROSS
C5UMB7FOR-CROSS

Pins #4 & #5 and #7 & #8 connect without crossing for PoE devices using these for Power Over Ethernet

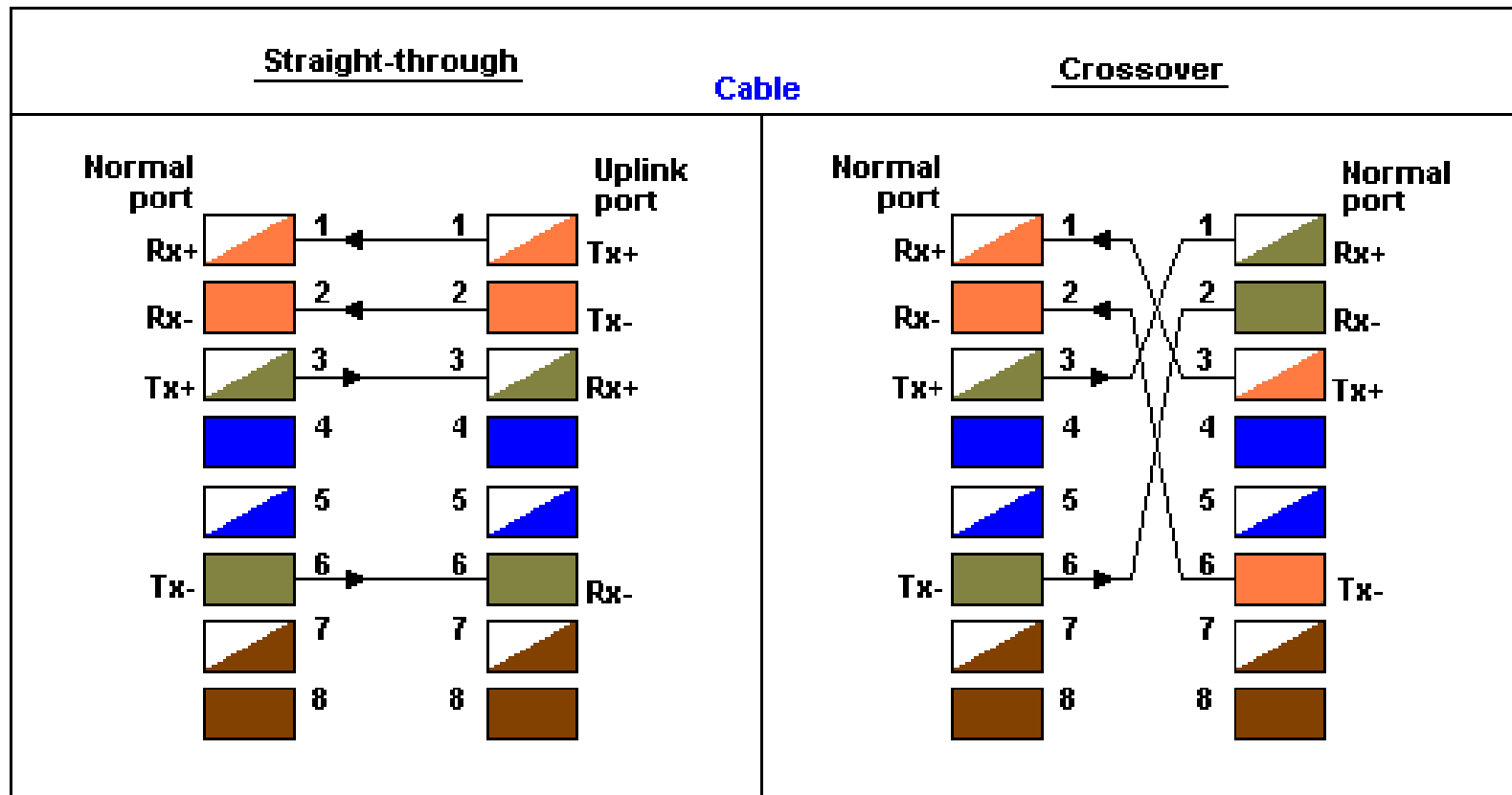


End view

RJ45



Looking into an RJ45 jack

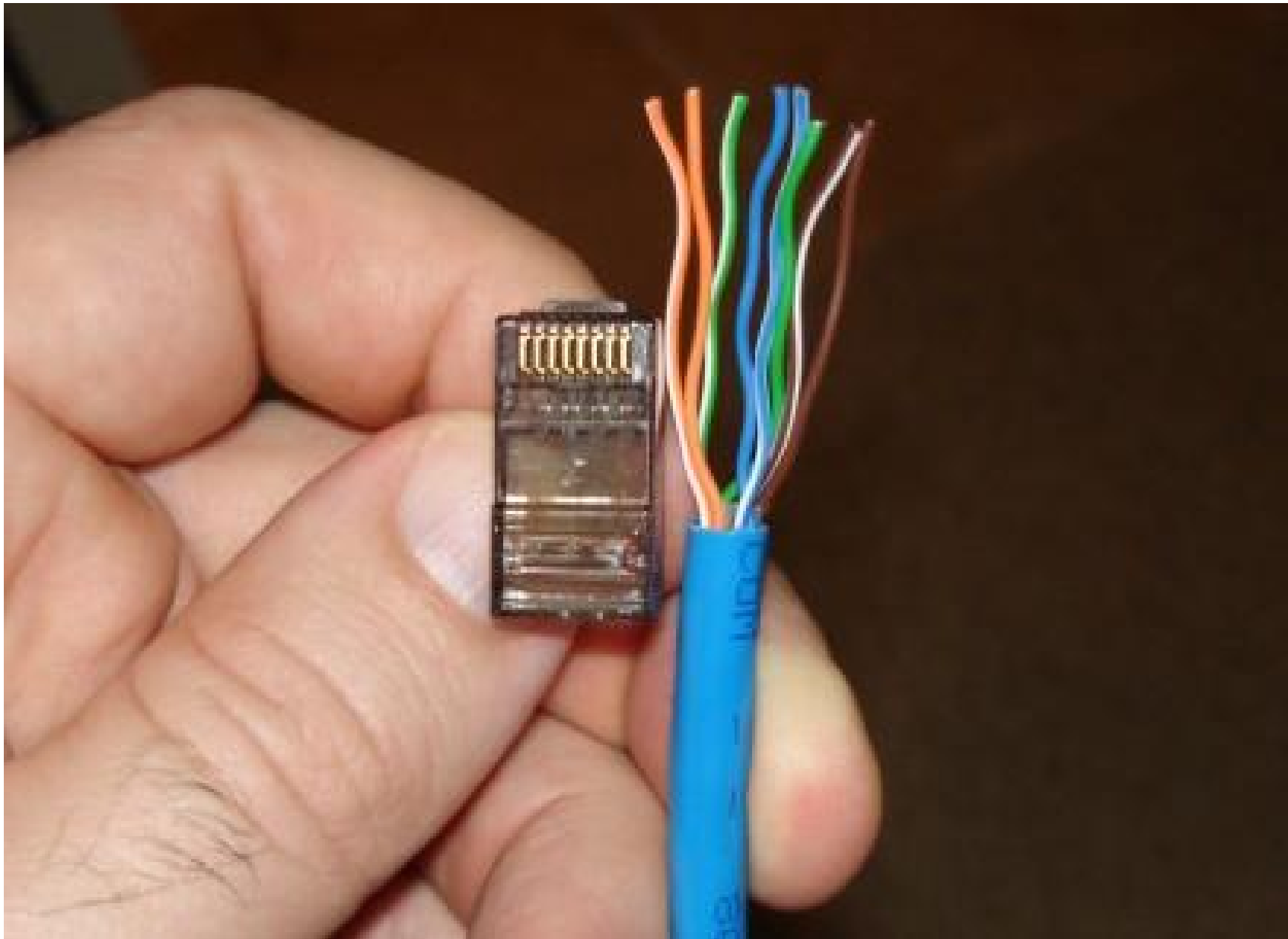




Booted **RJ45** Patch Lead

Cat5e **RJ45** Jack







LAN Card

