

*An Electrical  
Contractor's Guide to:*

# Communications Wiring for Today's Homes

*Simple  
Low Cost  
Comprehensive*

**COPPER FOR  
TELECOMMUNICATIONS**

**P**hone wiring isn't just for phones anymore. Ordinary telephone wiring can't handle today's rapidly expanding communications needs.

Today's homeowners expect their homes to accommodate:

- ◆ Multiple phone lines
- ◆ Internet service
- ◆ Video distribution, and other entertainment services
- ◆ Data and security services
- ◆ Fax machines
- ◆ And the list goes on.

Faster and more reliable than ordinary phone wiring, low-cost, high-tech copper wiring (Category 5 or better) should be installed to *every room* in the modern home. It's what is needed to carry voice, data and other services from where they enter the house to every room, *and* from any one room to any other.

This guide gives the basics on wiring homes for the rapidly evolving information age—and today's homeowners demand it. If you don't offer this service, rest assured, your competitors will.

## **WHY NOW?**

Unshielded twisted pair (UTP) copper information wiring—often called structured wiring—is used today for offices, schools and factories to provide local area networks (LANs), which allow computers to talk to one another and to receive and send Internet and high-speed computer data outside the facility. Category 5 ("Cat 5") is the current standard, but will soon be supplanted by even higher-speed versions, known as Category 5E (E for enhanced) and Category 6. (Category 6 has at

least twice the bandwidth, or information-carrying capacity, of Cat 5 at a small cost premium.)<sup>1</sup>

Right now, the typical home doesn't require the capacity to move computer signals around as fast as the typical office. *However, offices get extensively remodeled—and rewired—every few years. Homes do not.* The wiring you install must serve indefinitely.

The phone wiring of the past, often referred to as "quad" wiring because it has four copper wires, is now obsolete. Cat 5 or higher speed wiring has four twisted wire *pairs*, or eight wires. All are needed to provide the multiple services discussed in this brochure.

In fact, an FCC ruling, effective in July 2000, now *requires* that homes, as well as businesses, be wired for the information age.



**Copper Development Association Inc.**

## COPPER UTP WIRING

### What is it?

Copper UTP wiring contains eight color-coded conductors (four twisted pairs of copper wires). It offers greatly increased bandwidth compared with old-fashioned quad wiring.

The cable is small (roughly 3/16 inch in diameter), inexpensive and easy to pull, although it must be handled with care.

### Advantages.

Modern copper UTP wiring offers the following advantages:

#### Diversity

The Internet and computer communications, as well as ordinary phone signals, can be carried throughout the home on modern, inexpensive, high-speed, UTP cables. (To service a large number of TV channels, it is recommended to also run high-quality coaxial cable, such as quad-shielded RG-6.)

#### More phone numbers

Several phone numbers can be made available throughout

the house. Actually, voice service requires very little bandwidth, and the addition of separate numbers is almost trivial.

#### Bandwidth

Cat 5 has an approved bandwidth of 100 MHz (megahertz), while Category 6, when finally approved as a standard, will likely accommodate at least 200 MHz when tested under stringent conditions. Bandwidth correlates with speed, and these bandwidths are *many orders of magnitude greater* than the bandwidth required for a "modern" 56 kbps (kilobits per second) modem. Category 6 wiring, with encoding, will be able to carry at least 1 gigabit (billion bits) per second. If you're counting, that's about *50,000 pages* of text per second.

#### New Services

The Internet is now available at high speed to many homes, but homeowners won't be able

to take full advantage of it if their wiring is inadequate. One high-capacity technology now being offered by local phone companies is DSL (digital subscriber line). And cable modems are being offered by cable TV companies that bring in the Internet on the same coaxial cable carrying the TV signals. Will these signals reach a dead end in the homes you wire? Will the information highway end in a cow path?

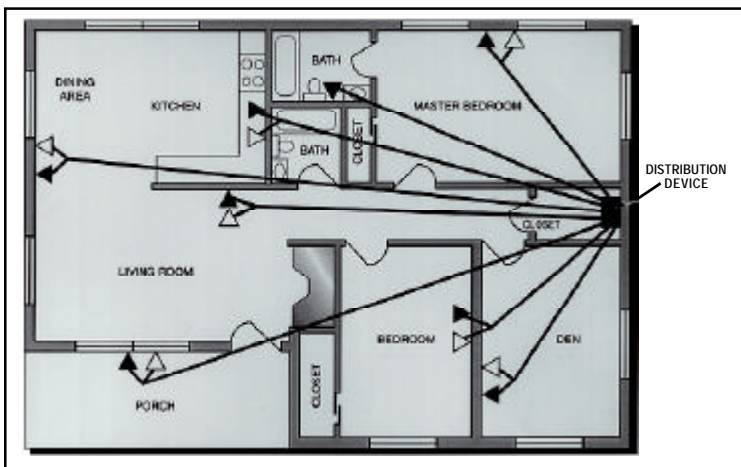
#### Reliability

Interference on telecommunications lines can result in scrambled faxes, interrupted on-line sessions and distorted video and audio signals. High-tech twisted-pair copper wiring is designed to resist interference from sources in the home, such as microwave ovens, vacuum cleaners, fluorescent lights, power tools, other appliances and external communications signals. The tight, accurate twist of the wire pairs and their balanced mode of transmission are the reasons.

#### Approved

Performance of these cables is verified by Underwriters Laboratories (UL), the international product testing agency, and similar groups.

Figure 1



## LET'S GET SPECIFIC

When installing telecommunications wiring in residences, follow these four simple principles to provide homeowners with the most modern, flexible voice and data services:

- ◆ Use Cat 5 (or Better) UTP Copper Wiring
- ◆ Wire Every Room
- ◆ Use a Star Wiring Pattern
- ◆ Use 8-Pin Modular Jacks

Here's why:

### Use Cat 5 (or Better) UTP Wiring.

Most of the reasons have been mentioned: ability to move large quantities of data around the house; ability to move a limited number of TV signals from the point of entrance to anywhere and everywhere else in the house (using a readily available adapter); ability to move other signal-level entertainment to as many locations as desired; and of course phone, fax and computer/printer connections wherever desired.

### Wire Every Room.

Since the electrical contractor can only guess at the future uses of the various rooms of a house when he wires it, it's best to provide outlets virtually everywhere. For instance, the kitchen is often the business center of a household and thus needs multiple jacks.

### Use a Star Wiring Pattern.

With star wiring, each outlet (jack) has its own individual "home run" of cabling extending back to a central distribution device. There are three major advantages to this:

**1) flexibility**— all changes in distribution of services can be quickly and easily made at the central distribution device. Each outlet can be treated independently from all others. (In loop, also known as "daisy chain," wiring—that is, where a number of outlets are tied together in series—outlets cannot be treated independently.);

**2) isolation of problems**— when an interruption takes place (nail through a wall and into a cable, etc.) only one outlet is affected; and

**3) quality of signal**— each additional connection point is a potential source of interference and other problems which can cause a loss of signal quality.

Having an extra outlet or two in some rooms, particularly home offices, is a wise move, since you can't anticipate future room use or furniture arrangements. This should be accomplished with home runs to the additional outlets.

Most seasoned professionals strongly recommend running "extra wire" to any location where it might be needed later. For example, two 4-pair cables might be run to each outlet, rather than one, to enable expansion and flexibility.

To further future-proof your homes for only a small additional cost, consider running Category 5E or 6 all the way, but particularly for an area that might be used as a home office.<sup>1</sup>

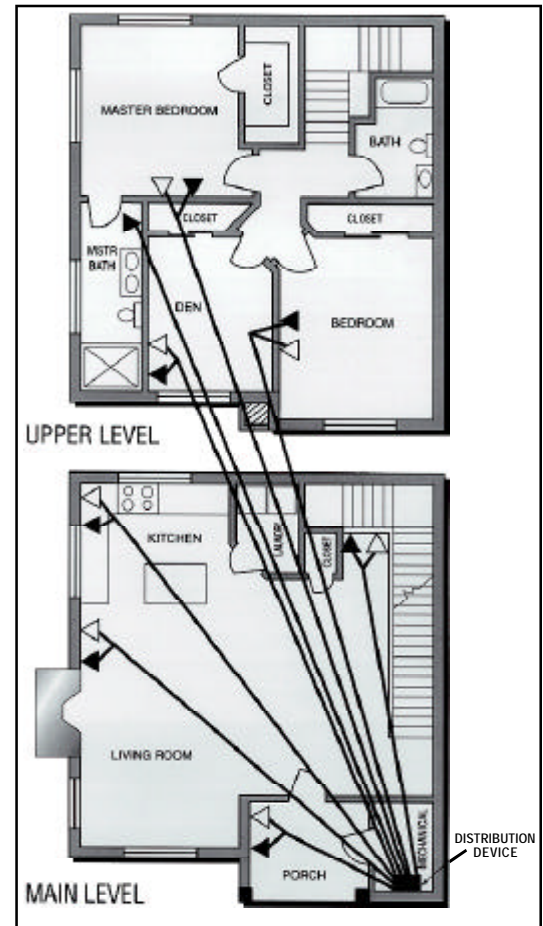


Figure 2

Figure 1 (on page 2) is a simplified plan of a small, two-bedroom, single-story house. Note that all the wiring radiates from a single distribution device—the star pattern—and there are multiple outlets in each major room, including the kitchen and the porch.

Figure 2 (above) is a larger, two-story house, with a den that could well serve as a home office, again showing the star wiring pattern.

### Use 8-Pin Modular (RJ-45) Jacks.

These devices provide connection points for all eight of the wires contained in the four twisted pairs. Figure 3 (on page 4) shows a wall outlet with two such jacks.

## Proper Installation is Crucial.

A contractor needs to know communications wiring and how to install it according to strict guidelines, such as the following:

- ◆ how much pull can be applied to a cable (usually 25 pounds);
- ◆ how much separation is needed between data and power cables (6 inches at least, crossing, if necessary, at 90 degrees);
- ◆ what fixtures to avoid (fluorescent lights in particular);
- ◆ how far back the cable sheathing can be stripped (no further than necessary, typically 1-1/4 inches);
- ◆ how much untwisting of the pairs can be done when making connections (1/2 inch is usually the maximum recommended, 3/8 inch is better);
- ◆ how tight a bend radius can be tolerated (usually about 1 inch, although some designs are less sensitive than others); and
- ◆ how long a cable run can be (about 300 feet).



Figure 3

More details on installation practices will soon be available in a separate CDA publication.

### Important:

All connecting devices—central distribution device, plugs on the ends of cables, outlets, etc.—should be rated for the cable used. For

instance, if Cat 5 cable is used, all devices must be at least Cat 5 rated. If Category 5E or 6 cable is used, all devices should be similarly rated.

Finally, the finished installation should be thoroughly tested.

### Video Cables.

Although the industry is working toward an all-UTP solution for wiring residences, at this time it is prudent to also include conventional coaxial cable for video distribution, particularly cable TV. This is because it is difficult to predict whether many channels—well over 100, for example—may become a reality in the near future, some channels of which will be the more bandwidth-consuming high-definition television (HDTV).

If coax is installed, quad-shielded RG-6 coax, with an all-copper center conductor, should be used for superior performance. (Copper-plated steel center conductors are also available, providing additional

stiffness, but are unable to handle low-frequency currents used to power some devices.) A lesser grade, RG-59, should not be used.

## IN CONCLUSION

Now is the time to start differentiating the homes you wire from those of your competitors by wiring them for the Information Age. High-level UTP wiring to every room is a clear sales advantage at minimum cost to the homeowner.

### Note:

<sup>1</sup> In the telecommunications and electronics industries standards are important. However, because of the fast moving nature of these industries the marketplace usually runs well ahead of the standards-setting process.

Cables meeting the expected performance standards of both Category 5E and 6 are commercially available from multiple vendors at this printing. The standard for Cat 5E is now official, but for Cat 6 it is still pending. Use the best cable available.

## FOR MORE INFORMATION

To obtain a copy of either or both of CDA's videos, "Infrastructure Wiring for New Homes" and "Infrastructure Wiring for Existing Homes," and for more details on high-tech residential wiring, contact:

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