

INDIA'S LARGEST MAGAZINE EXCLUSIVELY FOR SATELLITE & CABLE TV

News

Editorial

Mailbox

Indian News

International News

Convergence News

Business News

Financial News

Articles

Focus: HBO Shifts

Home To One Alliance

Channels Go Zee

Blockbuster Way

Star News Channel

Taking Shape

ESS Hike

Subscription Rate

TV AD Rates To

Compete With Cable

Eutelsat's W5

Satellite Launched

NDS-Pirate or Police?

DD Commences

Narrow Casting

FCC Reject Echostar-

Merger

Gemex 2003

TEN Sports -6

Months Old Walking

Middle East TV

Channel Launched

Technical

Understanding CAT-5

Cables

Past Tech Archives

Columns

Dish Doctor

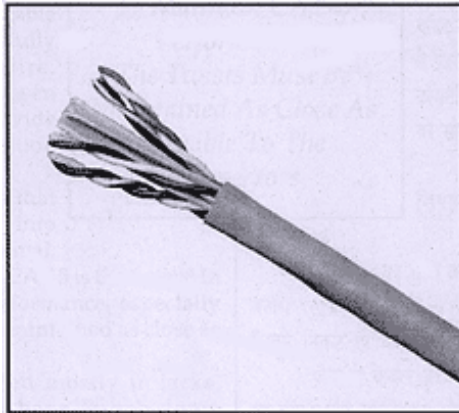
UNDERSTANDING CAT - 5 CABLES

THE BASICS

Today's technology continues to promote convergence. Here in India, cable TV networks now often offer broadband internet connectivity through an extended LAN network more accurately, a Metropolitan Area Network (MAN). These networks must utilise CAT 5 cables as drop cables from the distribution outlet to the subscriber's computer. As a result, CAT 5 cables are now widely sold through CATV hardware retailers and purchased and deployed by Indian cable TV networks.

Lets take a closer look at the CAT 5 cable....

UTP CABLE



UTP stands for "unshielded twisted pair." It is a cable type with one or more pairs of twisted insulated copper conductors contained in a single sheath. UTP cables are the most common type of cabling used in desktop computer applications. Unlike coaxial cables, the UTP cable has no shielding. The cable is not Coaxial, and simply consists of a bunch of twisted pairs of unshielded Cable, giving it its name. The twist in the cable plays a crucial role in the overall performance, as we shall see later.

To begin with, what is this cabling called ? Some call it "data/voice," some call it "low voltage," but most call it "Structured Cabling." It's the infrastructure for telephone and LAN connections in most commercial installations.

CAT 5 - The TWIST

UTP cable is manufactured in various different categories. Each category indicates the performance capability of that cable. The word "Category" is abbreviated to "CAT". Hence Category 3 cable is CAT 3 cable and Category 5 cable is CAT 5 cable.

CAT 5 refers to cables consisting of 4 Unshielded Twisted Pairs (UTP) of 24 AWG bare copper. The performance for these cables & connectors is specified up to 100 MHz and data rates of 100 Mbps.

The Color code shall be as follows

Pair 1	Blue-White	Extruded Blue stripe on White
Pair 2	Orange-White	Extruded Orange stripe on White
Pair 3	Green-White	Extruded Green stripe on White
Pair 4	Brown-White	Extruded Brown stripe on White

Table 1 : CAT - 5 Color Codes

The heart of CAT5 UTP cable comprises of four pairs of carefully twisted pairs of copper wire, insulated with carefully chosen themoplastic insulation to provide high bandwidth,

SCaT Seconds
Sat Updates
Channel Changes
Channel Guide
Channel Reach

Sat Updates

Channel Changes

Channel Guide

Channel Reach

low attenuation and low crosstalk. Low crosstalk ensures that signal leakage from one wire into the neighbouring ones, is minimal.

The secret ingredient of CAT 5 is the twists! In order to maintain CAT 5 performance, especially crosstalk, the twists must be maintained as close as possible to the connectors! The cable is terminated mostly in jacks, connector receptacles that have Punch-down terminations on the rear, and "tricks" inside to prevent crosstalk. As computer networks got faster, a need was felt for improved or enhanced CAT 5 cables. From this, emerged the CAT 5e specification.

CAT 5E

Often referred to as addendum 5, Category 5 Enhanced (CAT-5e) was developed for simultaneous bi-directional transmission over 4-pairs. Both Category 5 and Category 5e consist of unshielded twisted pair with 100 ohm impedance. The bandwidth specifications of CAT 5 & CAT 5e are the same, 100 MHz. Improvements to Category 5 were made and additional electrical requirements such as power sum NEXT, equal level far-end crosstalk, power sum equal level far-end crosstalk, and return loss were added to create the 5e specification. Typical applications include those of Category 5 and full duplex encoding schemes such as gigabit Ethernet (1000 Base T).

*To Maintain CAT - 5
Performance, The Twists Must
Be Maintained As Close As
Possible To The Connectors*

5 & 5E DIFFERENCE

The differences between Category 5 and Category 5e are in their transmission performance. Category 5e components are most suitable for a high-speed Gigabit Ethernet. While Category 5 components may function to some degree in a Gigabit Ethernet, they perform below standard during high-data transfer scenarios. To support Gigabit Ethernet, a higher performance version of CAT 5, enhanced CAT-5 or CAT-5e has been added to the standards. CAT 5e adds new performance requirements to permit higher speed network operation.

Parameter	CAT 5 100 MHz	CAT 5E 100 MHz
Attenuation	24.0dB	24.0dB
Next	27.1dB	30.1dB
Psnext	N/A	27.1dB
Elfext	17.0dB	17.4dB
Pselelnext	14. dB	14.4dB
ACR (derived)	3.1dB	6.1dB
PSACR(derived)	N/A	3.1dB
Return Loss	8.0dB	10.0dB

Table : 2 Performance Characteristics

**OTHER CATS !
BEWARE OF CAT-3**

Right now, you can get hardware and cable rated for CAT 3 or CAT 5. With cable, it's easy to see the difference; it's in the twists. But jacks are harder to tell the differences, but they are different. If you terminate CAT 5 cable with CAT 3 jacks, you will get CAT 3 performance - no better!

NON STANDARD CAT-7

And today, vendors are hyping CAT 6 and a ton of higher performance cable options. CAT 6 standards have been established, but CAT 7 is not yet standardised, and investing in them today could be a total waste of money, depending on how the standards committees go. You are probably better off saving your money and investing time in installing CAT 5 properly.

Even better, consider optical fiber if higher performance is your goal. However, for LAN delivery of Internet, as used in India, it is economically unviable to offer huge Internet bandwidth at less than Rs 1000 per month per subscriber. Hence CAT 5 cable is more than adequate for the task. Even CAT 5e is quite unnecessary.

10BASE-T

Let's take a quick look at the network speeds standards that are typically employed in LAN / MAN networks. 10BASE-T is the standard defined by the Institution of Electrical & Electronics Engineers (IEEE) for sending information at 10 Mbps on Unshielded Twisted Pair (UTP) cabling, and defines various aspects of running Ethernet on this cabling.

Frequency (MHz)	Attenuation (db/100 m)
.772	1.8
1.0	2.0
4.0	4.0
8.0	5.8
10.0	6.5
16.0	8.2
20.0	9.2
25.0	10.4
31.25	11.7
62.5	17.0
100.0	22

Table 3 : Attenuation for CAT5 cables

100BASE-T

100BASE-T is the IEEE standard for sending information at 100 Mbps on Unshielded Twisted Pair (UTP) cabling, and defines various aspects of running baseband Ethernet on UTP cables. 1000BASE-T is the IEEE standard that defines the requirement for sending information at 1000 Mbps on unshielded twisted-pair cabling, and defines various aspects of running baseband Ethernet on this cabling.

THE RJ45 CONNECTOR

The RJ 45 connector are the standard plug and jack connectors used with CAT 5 cable. It is a Registered Jack (RJ) in accordance with the Universal Service Ordering Codes (USOC). The RJ-45 connector is a 8 conductor modular plug and can also be called a "modular 8 pin" Jack: The receptacle for a RJ-45 Plug. Plug: The connector put on the end of UTP cable.

CAT CABLE JARGON

Let us take a brief look at some of the common CAT 5 jargon.

WIREFMAP

As the name suggests, this test maps or verifies which wire is connected to which pin. Each wire is to be connected to a specific pin in the RJ 45 connector, for proper

interconnectivity. All eight wires must be connected to the correct pins, and the test is called a wiremap test.

ATTENUATION

The reduction in signal strength due to loss in the cable.

NEXT

Near End Cross Talk, or the signal coupled from one pair to another in UTP cable.

ACR

Attenuation to crosstalk ratio, a measure of how much "headroom" the signal should have at the receiver. This parameter is typically calculated, not measured.

MECH SPECS

Insulated Conductor

The diameter of the insulated conductor shall be 0.90 mm (0.0355 in) maximum. The insulated conductor used as the white single shall have a coextruded colored stripe as defined in "Color Codes". The stripe shall be of the same material as the insulation.

DIELECTRIC BRAKDOWN

The dielectric breakdown of the cable shall be at least 2000 volts AC conductor to conductor.

PAIR ASSEMBLY

The cable shall be restricted to four-pair size to support a broad range of applications. The pair twist lengths shall be selected to ensure compliance with all requirements listed in the Transmission section. Bonding conductors together or other assembly methods requiring special tools or instructions for pair termination is not allowed.

Cable Diameter (Non-Plenum) The nominal jacket outside diameter : 5.08mm MAX The nominal jacket thickness : 0.56 mm MAX

CABLE JACKET PRINT

The cable jacket shall be printed with a minimum of the following information: Manufacturer, Manufacturer's part number, cable type, listing file number, number of pairs, listing type (i.e. CMP), and sequential footage markings.

BREAKING STRENGTH

The ultimate breaking strength of the completed cable shall be 400 N (90 lbf) minimum.

BENDING RADIUS

The cable shall withstand a bend radius of 20.3mm (0.80 in) at a temperature of -200 C ? 1? C without jacket or insulation cracking.

ELECTRICAL PERFORMANCE

Frequency (MHz)	NEXT (dB)
.772	64
1.0	62
4.0	53
8.0	48
10.0	47
16.0	44
20.0	42

25.0	41
31.25	39
62.5	35
100.0	32

Table 4 : Next Specifications

DC RESISTANCE

The resistance of any conductor shall not exceed 28.6 Ohms per 1000 ft at or corrected to a temperature of 200 C.

DC RESISTANCE UNBALANCE

The resistance unbalance between the two conductors of any pair shall not exceed 5% when measured at or corrected to a temperature of 200 C.

MUTAL CAPACITANCE

The mutual capacitance of any pair at 1 kHz, measured in accordance with ASTM D 4566 is not to exceed 5.6 nf per 100 m at or corrected to a temperature of 200 C.

CHARACTERISTIC IMPEDANCE

The cable shall have a characteristic impedance of 100 Ohms? 15% for frequencies from 1 MHz to 100 MHz.

NEAR END CROSSTALK (NEXT)

Maximum values permitted for NEXT (rounded to the nearest dB) are listed in table 4 :

CONCLUSION

Compared to coaxial cable which needs to operate upto 1000 MHz, CAT 5 cable operates to a "mere" 100 MHz. However, given the simple structure of the cable and the absence of shielding, the construction of CAT 5 cable is critical. It is almost impossible for the buyer to verify the CAT 5 cable's technical performance. Hence purchasing cable manufactured by a reputed company (preferably ISO 9000 approved) is a quick way of ensuring reliable and consistent performance. Fortunately, the CAT 5 cable also uses simple crimp connectors which do not need soldering or elaborate pre-connector "dressing". In affect, the cable TV technician should be able to quickly adapt to the use of CAT 5 cables and connectors.

[Contact us](#)