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Decoding the Rainbow: Color-coding standards for fiber optic cables

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While watching David Attenborough's new series "Life in Color"—which I highly recommend—it's easy to see how important color is in nature. Plants and animals use color for camouflage, warning, mating and plenty more. It's essential to the survival of most species. Color is equally important in fiber optics; without color codes, building and operating networks would be very difficult.

Color has long been used to identify technology components. In the heyday of copper phone cables, a cable could have hundreds of pairs of wires. Each wire pair had a specified color, with one wire a solid color and the other white with a stripe of the first wire's color. Wires were in bundles of a dozen, with colors assigned to each number (1–12). Bundles of 12 wires were wrapped in colored binder tape. After 12 bundles, a color stripe was added to the binder tape. That sequence could carry on to large numbers of wires.

That system formed the basis of the color codes now used in fiber optics to identify numbers 1–12. In a loose tube cable, the tubes of 12 fibers are also color-coded in the same sequence. When the cables get bigger than 144 fibers, color stripes on the tubes identify those of higher numbers. Fibers in ribbon cable are arranged in a row using the 12 colors to identify fibers.

Since color-coding is all systematic, one can uniquely identify an individual fiber even in the new high-density cables that include 864, 1,728, 3,456 or 6,912 fibers.

Color codes are especially important to the fiber splicer who must sort out the correct fibers to connect when splicing cables. Splicing two identical cables in a long-distance link is easy since you just need to match fibers in the two cables. Splicing becomes more complex when splitting one cable into two or more, for example in a fiber to a home network that branches out after splitters or drops cables to subscribers.

Without color-coding, keeping track of all those fibers would be impossible. But with proper design and documentation, it's relatively easy to match colored buffer tubes to the proper splice trays and match fibers to splice and place in the tray.

Color-coding is also used for other purposes. Color codes for premises cables identify the types of fibers in the cables, which is especially handy in a facility with racks and patch panels with several types of fibers.

Like a box of crayons

If you see a yellow cable, it's single-mode. Orange is multimode, generally 62.5/125-micron OM1, but it could be 50/125 OM2, making it necessary to check the connector color or the printing on the cable jacket to be certain. Aqua cables are laser-optimized 50/125 fiber, either OM3 or OM4, so again you need to check the cable jacket labeling.

The latest addition is lime green for OM5, but it's so rare you will probably never see it. It is also unlikely that you will see dark blue, which indicates polarization maintaining single-mode fiber.

Connectors also have their own color codes. Multimode connectors are beige for OM1, black for OM2 and aqua for OM3 and OM4. Single-mode has only two colors, but they are very important. Blue single-mode connectors are physical-contact finished ferrules, while green connectors are angled physical-contact, and you want to be sure not to mix these up as mating two different types can damage the ferrules on both.

The ultimate use of color-coding is needed for cables with MPO multifiber array connectors. These connectors have 12 or 16 fibers in a row, with options for 2 rows, making them 24 or 32 fiber connectors. These connectors are mostly used in factory-made prefabricated cable plants where you get your cable in a box and just have to install it, no termination required. They are also used to connect to equipment that transmits at high speeds over parallel fibers, e.g., 100 gigabits/second using 4 channels of 25-gigabit data simultaneously.

Color-coding diagrams for MPO cable plants are incredibly complex. In the Telecommunications Industry Association's (TIA) 568 standard that covers fiber optic cable polarity, almost 40 pages are devoted to MPO polarity. Honestly, I don't know how anybody figures it out!

A final note on color-coding: it's an industry standard—TIA 598—which means it's voluntary. Don't be surprised if you find pink, olive or any other hued cable. The customer can specify any colors they want.

Tags: **Fiber Optics (/tags/fiber-optics)**, **Cable (/tags/cable)**, **Color-Coding (/tags/color-coding)**

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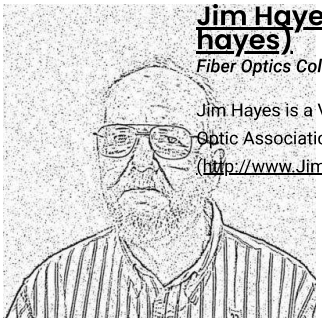

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