

### Fiber Optics: The Switch from Copper. WHERE, WHY, HOW?

So, you have come to the conclusion it is time to begin implementing fiber optic cable for usage now or in the very near future. Change is happening at an ever-increasing pace. Look at the systems you are installing now, and consider that only a few years ago smart phones and tablets were not ubiquitous. Networks and devices are constantly making their way through the alphabet, and today's typical homeowner considers internet access and speed of service to be as important—if not more important—than water and electrical utilities. Things are definitely changing.

It is also clear that what water and power services were in the 1930s, Internet access is today. Google is currently working to provide faster plans, offering 1 GB per second at a test project community in California. That is 100 to 1,000 times faster than the current “high speed” Internet packages of 1 to 10 MB per second. IP traffic growth alone has grown four times over the past five years, and global IP traffic is expected to grow three times over the next five years. Every device you install wants to grab a piece of this speed, and fiber will represent the backbone of all your systems and connectivity moving forward. Choosing to not install fiber today is not an option anymore for you, or for your clients.

Now that you're embracing the transition to fiber optics, how do you go about planning and implementing fiber optic cable on your projects? Cleerline Technology Group has been working to answer these questions for you. We saw this change coming, and now we're right in the middle of it. Cleerline SSF™ fiber is as easy to install as any CAT5/6 cabling you or your company might encounter. SSF™ is Stronger, Safer, and Faster terminating than any other fiber cable, allowing you to continue almost all the same practices you currently use when installing standard copper UTP cabling.

The following list addresses some of the most common questions you might encounter when making the switch from copper to fiber:

- 1) **Where should I run fiber optic cable?** Any device currently using copper UTP, or in some cases, coaxial cable will be able to utilize fiber at some point in the near future. Devices include:
  - a. Network devices: computer locations; WAPs; switches; feed from any DMARC-supplying service to an office or home.
  - b. Video displays and devices: TV's, projectors, cameras, etc. 4k Ultra is coming, and hybrid fiber cables have already begun to appear. The writing is on the wall. The electronics portion of the equation is beginning to move to fiber. With a send/receive HDMI balun set that transmits an HDMI signal up to 20km now available at \$170 dealer cost—with no distance or interference issues--the switch to fiber is well underway.

- c. Any device involving increased distance. Longer runs on copper UTP will be the first to become incompatible with the increasing data transmission required for any signal type. Many copper balun send-and-receive devices have issues above 100ft with current signal types, which is very telling.
  - d. Satellite dishes: we are at the most two, if not one, generation out from the switch to fiber for this type of connection. Every provider is currently working on some form of deployment, as it will allow the expansion of their current offerings through increased in speed and bandwidth.
- 2) **Where should I not bother running fiber?** This is a difficult question to answer. Again, consider that fiber usage will soon be in the same vein as your current copper CAT5/6 usage. As you implement fiber, just as you would pair CAT5/6 with an HDMI cable to a TV display, you are simply adding the fiber to the equation, It will take the place of one of these cables now, or within a short period of time.
- 3) **How much will it cost me to run fiber as I'm pulling CAT6?** A single strand of fiber called "Simplex" will typically cost around 30% more than what you might be paying for CAT6. This single strand has the ability to transmit more data than a bundle of CAT6 cables at a much higher rate of speed. In fact, it typically works out to the same expense as pulling a 2-conductor speaker wire to each desired location. If you look at the cost/benefit equation and take into account that the most expensive cable run is one you decide to do after the fact, installing fiber now is very inexpensive. If you are wiring for the future, which is right around the corner, and it is a cost issue, present it to your client as a separate add-on. Your client has heard of fiber, and in most cases he or she will want to ensure that they avoid ripping up their walls in the near future by adding a small additional installation expense.
- 4) **What type of fiber do I install, singlemode or multimode?** This is a topic that can seem confusing initially, but becomes clear rather quickly. Always keep in mind to check the specs of the equipment you will be installing. If you are leaving it "dark" and the runs are under 1,000ft/308m multimode is a safe bet. A few notes to clarify this:
  - a. Multimode – typically referred to as 50/125, in that the core is 50um in diameter and the cladding is 125um overall. Multimode fiber is typically installed in applications 1200ft / 360m. Just like installing a copper balun sending device, one should verify with the equipment specs for fiber type, connector style, and distance, but again in most cases multimode devices are intended to reach a minimum of 1000ft / 308m. Also, just like CAT5/5E/6/6E, there are grades of multimode fiber referred to as OM2, OM3, and OM4. In most cases the current OM3 fiber is the equivalent "CAT7"

and is the most widely used type. Multimode fibers utilize colors to distinguish type of fiber and color identifiers:

- i. Jacket colors typically are
    1. OM2 = Orange
    2. OM3 = Aqua
    3. OM4 = Violet
  - ii. For individual fibers located within a jacket the colors follow the same EIA/TIA standards as CAT5/6, being blue, orange, green, brown and continuing down the color chart.
- b. Singlemode Fiber– typically referred to as 9/125 in that the core is 9um in diameter and the cladding is 125um overall. Singlemode fiber is typically installed in applications from 1 meter to multiple kilometers. Just like a copper balun device, one should verify with the equipment specs for fiber type, connector type, and distance. For singlemode things are a bit simpler. Two grades: typically OS1 and OS2. Cleerline only manufactures the OS2 higher grade. Singlemode color identifiers:
- i. Jacket colors typically are
    1. Singlemode = Yellow

- 5) **Do I terminate the ends of leave the cable “dark”?** A: This depends on the installation. Again, much like CAT5/6, if you are landing the fiber cable in a structured panel it can always be terminated and left ready for use, just like you would do with copper. For direct connection purposes to certain devices (i.e. to a video display), for future use it may be best not to terminate the cable so the right connector type can be chosen and installed for the display or balun receiver that will ultimately be installed. With HDMI baluns over fiber that can send to distances up to 20km at under \$200, and Ethernet 10/100/1000 send devices for multimode fiber at under \$100 dealer cost, fiber devices are flooding the market and should be the go-to choice in any installation.
- 6) **I am terminating the fiber. What type of connectors do I install?** A: At first the question of fiber and connector type can seem very confusing. Think of it this way: When working with RG6 coax you can terminate with a F connect, RCA, or BNC, for example, based on what type of connectors the electronics you are working with offer. When terminating fiber, the two most common styles of connectors are SC or LC. The equipment you are hooking up to will determine the type of connector. Adapters are available, but it is always easiest to check ahead and determine both fiber type and connector style ahead of time.
- a. SC type – The SC or “Snap” type connector has a snap-in mechanism and contains a 2.5mm ferrule. Available in singlemode (blue cover) and in multimode (typically beige or aqua).

- b. LC type – The LC or “Push-and-Latch” type connector resembles an RJ45 telephone type tab/jack. LC connectors use a 1.25mm ferrule and are licensed by Lucent. They are highly favored for singlemode applications and on components where space is at a premium as they are half the size of the SC type. Available in singlemode (blue) and in multimode (typically beige or aqua)
  
- 7) **How do I make provisions for the future connection of fiber in the distribution panel?** As with any panel or rack, leaving just a bit of extra space always helps down the road. Looking at this again from the copper perspective, fiber takes just a bit less space than copper and can be trimmed out in patch panels or widely available panel boxes. The network switches you currently install are already showing up with SFP (small form plug) ports, being a slot allowing for fiber connections to be hooked up. As the use of coax eroded and was replaced by copper RJ45 connections, so will Category cable move toward fiber.
  
- 8) **Any recommendation on installation?** It is always recommended to follow “best installation practices.” With Cleerline SSF™ fiber having 10,000 times more bend and up to 400 times more pull strength than typical glass fibers, the use of SSF™ simplifies your installs. The fiber is much more durable than the Copper CAT6 you might be installing. SSF™ is some of the lowest loss cable under bend conditions, but it is always a good practice when installing cable to make sure the fiber is not left with any kinks and to utilize sweeping bends during the install. Since fiber is immune to interference, you avoid some of the issues you have with copper.
  - a. Note: Just like copper CAT5/6, you would not spend the time to make short jumpers for your installation/panels. Fiber jumpers are readily available in both fiber types and all connection styles in the most common lengths of 1, 2, 3, 5, and 10 meters. Cleerline XD patch cords are a perfect solution.
  
- 9) **How much of a service loop is recommended at the distribution panel?** As you know, items can always have the need at the final install to be moved around, and it is always a best practice to have the cable left too long and never too short. That being said, for outlets at a WAP or other location a 1-meter loop can suffice. For the data cabinet, being a bit more generous never hurts.