

Testing residential cabling systems

Application Note

Networking, verifying and certifying today's "smart homes" is a growing business

It wasn't that long ago that wiring a home meant electricity and a single phone line. Today, consumers expect homes to be wired with multiple phone outlets, cable TV, and a computer network available in every room. Installers and contractors are now "home networking professionals" that are expected to not only install this new generation of residential networks, but verify and, in some case, certify them as well.

Data cabling installation is similar to, but markedly different than, the practices used to

install telephone wiring, requiring installers to learn new skills. Even telephony wiring is changing with many newer systems employing the same four-pair UTP cabling used in data networks. Much work is already being done to standardize requirements for home cabling, often called SOHO (Small Office Home Office) cabling. In the U.S., this is covered in TIA 570A, the Residential and Light Commercial Telecommunications Wiring Standard.

These changes also require installers and contractors to have the latest generation of test tools, like the MicroScanner™ Pro from Fluke Networks, which tests both coaxial (RG6, RG59, etc. for CAT V/CCT V), all twisted pair cable (UTP/STP/SSTP), and even troubleshoots other wiring for speakers, security networks or telephone cabling.

Data communications

Residential data communications cabling is typically four-pair 100-ohm twisted pair cabling rated at CAT V or VE. It runs from the Network Interface Device (or NID, a wiring distribution panel located near the outside data access connection) to outlets positioned in rooms throughout the home. The homeowner may choose to connect a hub at the NID or simply connect directly to an outside Internet access service, depending upon the desired complexity of the home network.

When installing residential cabling, care must be taken to preserve proper twist ratios in the cable when attaching data jacks, in order to minimize crosstalk concerns. To avoid deformation, the cable should

not be stretched or pulled around sharp corners, which could lead to performance degradation. When possible, data cabling should be routed away from cables carrying ac power to avoid noise coupling.

Certification and verification

In commercial cabling, standards are well in place for the testing and certification of structured wiring systems. Business systems are expected to place high demands on installed cabling and a myriad of standards define installation and test requirements. Such networks are certified to meet standards.

Certification refers to the process of making measurements and then comparing the results obtained to pre-defined standards, so that a pass/fail determination can be made. In the case of a CAT VE link for example, tools like the Fluke Networks OMNIScanner®2 or DSP-4300, make thousands of measurements across a bandwidth of 100 MHz and compares them to complicated formulae from agreed-upon standards.

In contrast, most home wiring systems are "verified." Verification ensures that basic continuity and correct terminations have been applied, but does not attempt to measure the information-carrying capacity of the link. This is a reasonable simplification to make, because home networking links are considerably shorter than commercial wiring links.

Because the links are shorter, they do not suffer nearly as much from attenuation losses. Since the signal is typically much stronger,



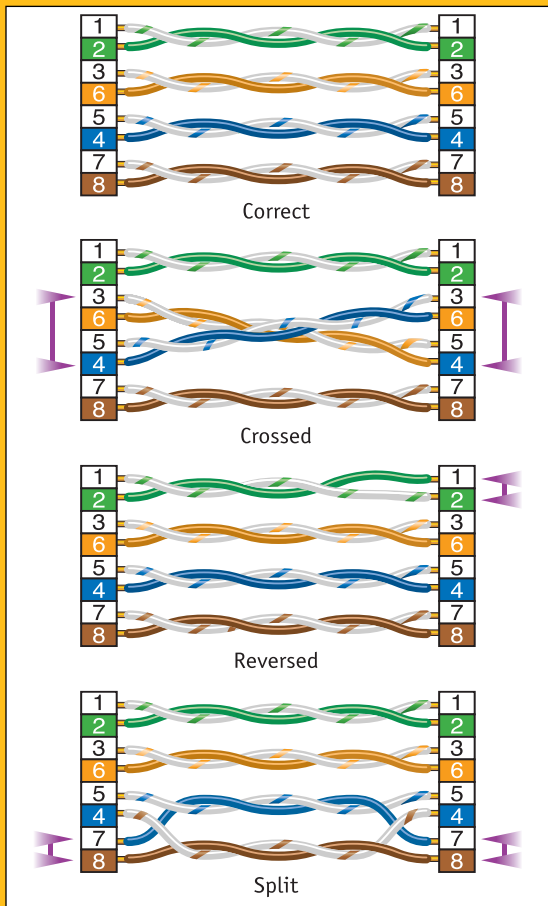


Figure 1: Common wiring errors

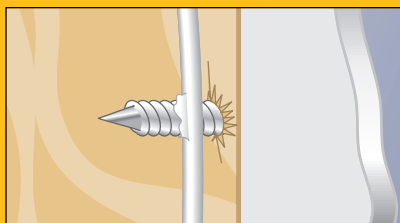
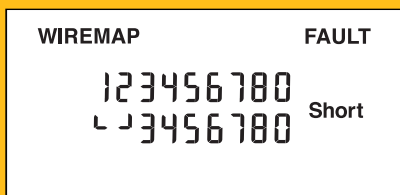


Figure 2: Wiring fault and field tester wire map display

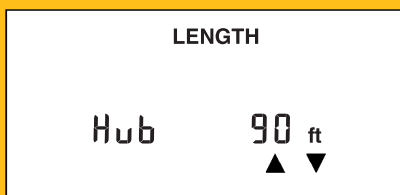


Figure 3: Field tester identifying length and termination of an unknown cable. The connection is to an inactive network hub. If the hub was active, the speed (10/100) of the connection would be indicated.

impairments such as near end crosstalk (NEXT), far end crosstalk (FEXT), or return loss are much less of a concern.

Wiremap

In verifying residential wiring, the most important measurement or diagnostic is wiremap. Wiremap ensures proper pin-to-pin connectivity between both ends of the link. In the home, a cable could be cut or shorted by a nail or staple, incorrectly terminated or miswired, or damaged by other construction processes. A good wiremap tester will quickly find any breaks, shorts, or miswires.

Diagnostics

When a fault is detected, it needs to be correctly identified and fixed quickly. For example, if the wiremap tester indicates pin 2 is open or missing, a lot of time can be wasted trying to visually determine the location of the problem – assuming the cable isn't hidden in the wall. This is why the TDR (Time Domain Reflectometry) functions in the MicroScanner Pro are extremely useful. TDR is like "cable radar" allowing you to see how far away an open or shorted event is. In the preceding example, a TDR function (usually called length measurement) might tell you pin 2 is open at 33 feet on a 58-foot cable.

The MicroScanner Pro can also identify what's happening at the far end of the cable (e.g. It is open? Shorted? Connected to a hub?), which saves time when troubleshooting.

UTP and coax

In residential applications, the MicroScanner Pro's length function with support for both twisted pair and coaxial copper cable means you can troubleshoot telephone, data, and CAT V cabling problems with a single tester. Length is also useful because it allows you to measure and record the total length of installed cabling for documentation and billing purposes.

Another popular troubleshooting tool is the toner/probe. This is actually a pair of tools used together. The toner generates a special signal on an attached cable while the probe listens for the signal. When its tip is in close proximity to the cable, it sounds a telltale musical tone. The closer the tip is to the cable, the louder the sound.

The MicroScanner Pro has four unique toners for finding hidden cabling with a standard probe. This is useful to identify one cable from a group clustered together or find a cable that might be hidden behind a wall. You attach the toner to the known end and set it to generate the signal. Then you sweep the probe across all the potential far ends or cabled areas and listen for the distinctive tone.

Home networks are increasingly commonplace and represent a great opportunity for residential cabling installers to provide a useful service with excellent profit margins. But data cabling requires more than the old "install and forget" methodology. Simple tests and the right test tools to verify and certify that the residential cabling is installed correctly will increase customer satisfaction and help grow new business.

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