New Directions for Interconnect Testing

by Mike Mathews, Cabletest International

Technology is moving at a rapid pace to eliminate and simplify as many interconnects as possible. For example, a major car builder is working on a way to use flex circuits instead of a wiring harness in an automobile because the harness is a large contributor to the labor content and manufacturing defects in a car.

This thinking also is being pursued in aircraft and other commercial products where wiring is a large component. Even the interconnects in PCs are being designed out using universal serial bus (USB) technology.

Designers are turning to high frequency buses and light (fiber optics) to move data and control signals to eliminate the labor and weight associated with traditional wiring methods. This would seem to bode bad times for the interconnect test industry.

Interconnects still must be tested, but the method and economics of testing are changing. The push is to downsize tester size and cost and increase speed and capability.

Sadly enough, testing does not add value to a product. It is a pure cost. This is an old, very tired argument. However, technologies that combine testing with production control, operator instructions, manufacturing, QC reporting, and error analysis are being developed. Fast PCs with Windows 95 attached to networks are just now being marketed.

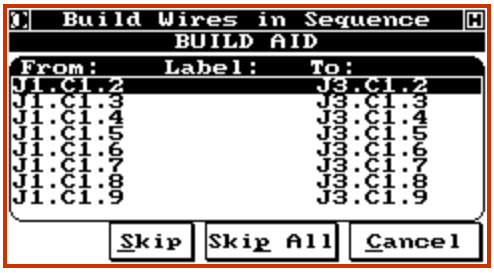
In the past, the test process has consumed the CPU. Now it is possible to have the test process take only a portion of the computing power. It will take a while, but the test platform of the future will do much more than simply sort good from bad. It will provide a computing environment to the production floor.

Build-Aid

One new feature provided on many new test systems is the “build aid” or guided manufacturing. Simply put, this is the capability to direct you in exactly how to build the wiring harness. For facilities that are building many different complex cables in a just-in-time environment, this capability can speed production and improve quality. One user has achieved a 50% improvement in throughput using a build-aid feature. The build-aid uses the following steps:

The wire list or CAD data is automatically processed to identify all the wire segments and develop a test program. The order for each wire and the routing are identified to keep from developing rats' nests in the wiring process. This is a manual step performed off-line.

Data Preparation

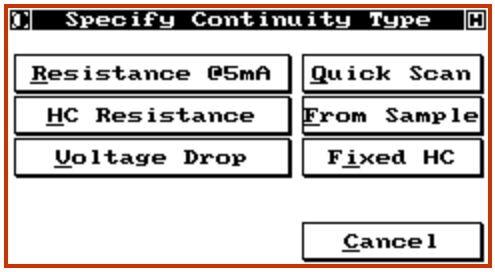


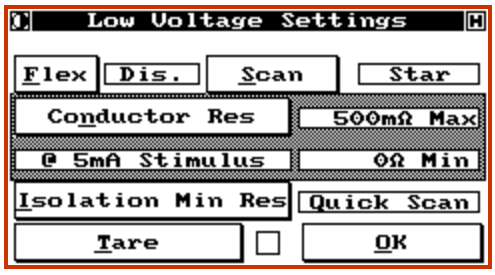
- Wire list data is captured from the existing database. This can be a simple wire list, a CAD/CAM data file, or an existing test program. The test program can be a self learn of a known good cable being built.
- The data is converted automatically to an internal operational format.
- A special off-line process allows engineering to add a sequence number to each wire segment. This also can be accomplished directly using a self- learn from the tester. This step eliminates the rat's nest of wires that can occur from random wiring.
- The test and manufacturing data is converted automatically to a database for use directly by the build-aid tester.
- All data can be stored in the network server and access-restricted using password control.

Operator Sequence

- The operator selects the part number from a product list.
- The wires are put into one of the connectors in any order.
- The system then shows each wire in sequence and directs the operator where to terminate that wire. The operator selects the next wire and touches it to a ground. If the correct wire is selected, then the tester shows where that wire is to be terminated.

As each wire is terminated, it is tested automatically using a low-voltage stimulus. The system will not proceed to the next wire until the current wire is terminated correctly.





- When all wires in the product are correctly terminated, the operator engages the palm switches, and the

product is tested using up to a 1-A continuity stimulus and voltage up to 1,500VDC or 1,000VAC per the test specification.

- When the product is correctly built and tested completed test record is issued into the network database.

- The system will not allow the operator to continue unless the previous product was built and tested correctly.

This kind of build-aid sequence:

- Reduces operator training.
- Reduces paper and confusion on the manufacturing floor.
- Reduces manufacturing time and errors.
- Reduces handling of the product because the product is completely tested when the manufacturing step is completed – no second step.
- Improves quality and quality reporting, an important step is ISO certification.

Networking

Another trend is to connect multiple testers to the existing corporate network. The rationale for this capability is to share data between multiple testers, allows a central collection for the error data, and provide production statistics. Networking is a key to test-error data analysis, and most systems today allow for this kind of connection.

Error Processing

Every company wants to get more information from their testers, such as yield, frequency of errors, operator efficiency, and parametric statistics. However, the actual form and substance of these reports vary by each user and application.

Many testers provide simple yield analysis and data storage, but the most rational solution has the tester provide the error reports in a Comma Delimited ASCII format. These files then can be pulled into almost any spreadsheet or database program and manipulated. Charts can be produced, reports generated, and control instituted.

The test supplier is relieved of the custom engineering required for each company, and the customer gets what he really wants. A plant-wide network with testers attached is required for this to really work.

Test Program Generation

Another breakthrough is test-program generation. Even in highly computerized environments most test programs in the wire/interconnect test area are generated by self learn of a known-good product. However, it is getting more difficult to determine exactly what known-good is without prior testing.

Some products are hand-programmed by a technician transcribing schematics to a test list. More and

more, companies are demanding that the testers, even the small ones, create programs from CAD/CAM data that already exists in magnetic form spreadsheets. They want an off-line test-generation process. Just providing the wire path is not enough. The software also must have the capability to automatically process test instructions for components such as resistors, diodes and capacitors that may exist in the product. Many current products being tested have relays built into the assembly. These must be programmed automatically as well, so that both the normally open and normally closed sides of the relay can be tested.

The key here is automation of the engineering function, especially those where someone is reentering data that is essentially is already entered somewhere else. Today, engineering time is expensive and more valuable than the manufacturing and tester time.

New Test Features

Several new hardware capabilities are in the marketplace. Most wire and interconnect testing is performed at either a constant stimulus or very low frequency. In today's marketplace, higher frequency testing is required more often. For example, the USB cables must to be tested at least 5 MHz.

Most switching systems in the wire test business are limited to 400 kHz. New coax switching developments are required to test high-frequency products. In addition, new test functions must be developed for crosstalk and other frequency- related problems.

Discontinuity testing is becoming a requirement for wiring on critical military and aerospace products. It is necessary to simultaneously monitor all test points while a product is being physically stressed to find momentary open or short failures. The time requirement for a discontinuity can be 10us or less.

Summary

This is an odd time to be selling interconnect testers. The market is shrinking from the heydays of the early 1980s, but actually there are more competitors offering more options and capabilities. It is now a buyer's market that is driven by innovation and problem solving rather than catalogs and price lists.

About the Author

Mike Mathews has been associated with the interconnect test market for over 20 years and has worked in engineering, marketing, product development and sales. Mr. Mathews graduated from the University of Texas and Virginia Tech with degrees in industrial and systems engineering.

For additional information, please contact:

CableTest Systems Inc.
400 Alden Road
Markham, Ontario
L3R 4C1 Canada

T: (905) 475-2607
F: (905) 475-2609

sales@CableTest.com

www.CableTest.com