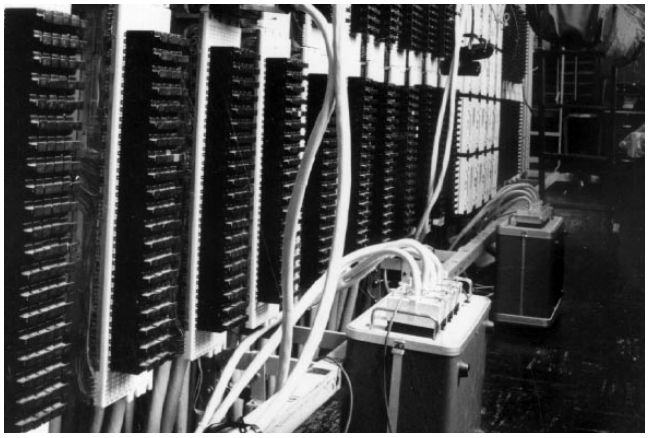
Communications Cable Testing

Application Note 1270-7



Applications

Wire and Cable Manufacturing
Communications Equipment Manufacturing
PBX Manufacturers

Departments

Test Engineering Production

Description

The performance of a manufactured communications cable must be verified before it is actually used. Performance parameters are measured while subjecting cables and their connectors to the limits of their environmental specifications. The cables can contain either fiberoptics or metallic wires and can be thousands of meters long.

Problem

Hundreds of temperature points must be measured and correlated with performance test results. Tests may run for days, weeks or even months under a wide range of environmental conditions. In some cases, loads, test chamber temperatures, and other test conditions must be varied to fully exercises the cables and connectors. In most cases the amount of switching required is significant. Oscilloscopes, power meters, spectrum analyzers, and other test equipment may be switched in and out as various parameters of cable performance are measured. Though this is a production application, cables such as these tend to be custom built, requiring a flexible and easy to reconfigure test system.

Solution

The ideal solution combines a data acquisition system with a programmable switch controller. The data acquisition system measures hundreds of temperature and other relevant environmental parameters such as pressure and humidity. It also performs functions such as environmental chamber control, load switching and high power source switching. The electronic switches connect test equipment to the cable to verify performance parameters. The data acquisition system, the switches and the test equipment are under the control of a high-performance control computer. Usually the speed requirements, calculations and comparisons, and the large amounts of data generated require the use of a high-speed UNIX computer.

HEWLETT® PACKARD

The results of automated testing can be remarkable. Large communications cables cost many dollars per foot. In some cases, once a cable is installed, it is more expensive to pull it for repair than it is to build and install a new one. Imagine the cost of retrieving a transoceanic cable. Because of the costs involved and the one-chance-only situation, a cable test system can easily pay for itself on the first cable it tests.

Implementation

Cable Temperature

Thermocouples are generally used because of their low cost and high reliability. Temperature is monitored at various points along the cable including at mechanical stress points and connectors as well as at various points in the environmental chamber. RTDs are sometimes used where high accuracy is needed and temperatures are extreme.

Instrumentation: Integrating DVM, Relay Multiplexer with Thermocouple Compensation, FET Multiplexer with Thermocouple Compensation

Cable Resistance

Resistance measurements in metal wire cables are made not only to verify continuity but to accurately characterize conductor purity, uniformity, and connector contact quality.

Instrumentation: Integrating DVM, Relay Multiplexer

Power Loss

Signal power loss through a cable and its connectors is an important measure of cable performance. To test for power loss, the system programs and injects a known current (or laser power in a fiber optic cable) at one end of the cable and compares the known input level to the measured output level to determine the power loss.

Instrumentation: Voltage D/A Converter, Current D/A Converter, Digital Output

Transducer Voltage

Some transducers output voltage to indicate measured parameters, such as humidity, pressure and optical power. More commonly, many transducers have current loop outputs which can be monitored by using current-sense resistors.

Instrumentation: Integrating DVM, Relay Multiplexer

Signal Switching

Data communications measurements require specialized equipment, such as spectrum analyzers, digital oscilloscopes, and impedance meters. A programmable electronic switch is the best method of connecting these devices to the cable under test. Proper channel impedances can be maintained and complex switch configurations can be stored and recalled as required.

Instrumentation: Programmable Switch, VHF Matrix Card, UHF Matrix Card

Key System Features

- Easy to reconfigure
- Real-time Clock and Pacing
- Easy to Program
- Downloadable Subroutines
- Large Channel Capacity
- Thermocouple/RTD Linearization

Typical System Configuration

Data Acquisition System	Qty
13 Slot Mainframe	1-3
Integrating DVM	1
Relay Multiplexer Channels	40-800
FET Multiplexer Channels	20-100
Digital Outputs	4-32
Actuators	1-16

Computer/Software

- HP Series 700 Computer Workstation
- VXI MXI Module
- Keyboard, Monitor and Mouse
- Disc Drive and Printer
- MXI Interface
- Software - HP-UX and C Language Development Environment

Other Equipment

- Programmable Switch
- VHF Matrix Cards
- UHF Matrix Card
- RF Impedance Analyzer
- Network or Signal Analyzer
- Optical Source and Receiver

Printed in USA 6/95
5964-0153E