

Vitrek Cable & Connector Test System Facilitates Multi-Point High Voltage/Current Testing

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INTRODUCTION

Hipot testing is critical in assuring compliance with a host of electrical safety standards and in confirming the assembled product is free from electrical or mechanical defects. Hipot testers are used to measure leakage current and insulation resistance between all components and connections, confirm solid ground connections and test ground bonds. All of these tests require the sequential application of precise and controlled high voltages or currents between pairs of elements then accurately measuring and recording the results. Products like the Vitrek 95x and V7x Series are excellent examples of the industry's best electrical safety testers.

Many hipot tests require making multiple measurements. For example, a three-conductor power cord connected to an electronic device would require a voltage withstand test between the conductors as well as a ground bond test between the ground wire and the chassis.

A connector assembly with multiple pins would require a unique test for each pair of contacts as well as between each contact and adjacent wires and then the connector body. A simple four-conductor cable might require 20 separate tests:

1. Continuity on each conductor - 2 or 4 conductors
2. Insulation resistance between each conductor and ground or shell - 4 more tests
3. Insulation resistance from each conductor to all the other conductor - 12 additional tests

For a 24-conductor cable, the total number of individual tests could be as high as 578.

Doing this manually is not only labor intensive, it is also highly susceptible to errors:

- ▶ Were all of the combinations tested?
- ▶ Were some inadvertently duplicated?
- ▶ Have all the test conditions been implemented?
- ▶ Did the operator properly record the data?

In many cases, a programmable, multi-point switching system is an essential tool to quickly and accurately implement the entire series of electrical safety tests. Using a fixture to quickly connect the entire assembly, a multi-point switching unit serves as an interface with the hipot tester and automatically sequences the testing through all the combinations. As "simple" as this sounds, a great deal of engineering and innovation goes into these devices.

CABLE AND CONNECTOR TEST SYSTEM COMPONENTS

To conduct the sheer number of tests that are often necessary in a safe and accurate way, the recommended multi-point test system would include the following:

- ▶ A Vitrek V7x Series or 95x Series Hipot Tester (a white paper titled "Fundamentals of Electrical Safety Testing" provides details of the important features and functions of the Vitrek hipot tester products, visit www.Vitrek.com for details.)

- ▶ A Vitrek 964i programmable high voltage switching system.
- ▶ QT Enterprise Software for controlling the test sequences (optional) (an overview of the features of QT enterprise software is provided at the end of this white paper.)

INTRODUCTION TO THE VITREK 964i HIGH VOLTAGE SWITCHING SYSTEM

Whether it's an 8-pin connector, a 64-conductor cable or an entire tray of SMD capacitors, the 964i has the capability to automatically route test points to the tester without manual intervention. With voltage switching capability up to 15,000 volts or current switching as high as 70 amperes, the 964i Automated Switching System (Figure 1) routes test signals for whatever is connected to it. For example, the 964i can be utilized in applications where users need to:

- ▶ Perform hipot/continuity/ground bond tests at various points, etc.
- ▶ Apply high voltage or current to multiple points.
- ▶ Measure circuit L/C/R at various points, etc.
- ▶ Measure or apply other signals at various points (500 Hz maximum frequency,) etc.



Figure 1. Open view of the Vitrek 964i highlights the unit's modular construction.

FEATURES OF THE VITREK 964i

A valuable benefit of the Vitrek 964i is its unique ability to provide a number of different tests, thanks to its modular design:

- ▶ **COMPLETE FLEXIBILITY** — Combinations of relay cards, terminals and wiring can be customized. Up to 64 relays and 66 terminals can be installed in a single chassis.
- ▶ **FRONT PANEL INPUT CONNECTIONS** — The front panel terminals are designed to allow direct connection to the output terminals of a Vitrek Hipot Safety Analyzer.
- ▶ **EASY DEBUGGING WHEN PROGRAMMING** — The presently commanded relay states are available on the front panel display, making debugging a safety test procedure easy. The user is also able to manually control the relays.
- ▶ **RELIABLE HIGH-SPEED OPERATION** — Relay states can be changed in as little as 5ms; the 964i automatically provides all of the required timing.
- ▶ **AUTOMATIC MAINTENANCE ALERTS** — Accumulates counts of relay operations for each relay on a given bank and warns the user if any relay is approaching (or beyond) its life expectancy.
- ▶ **HIGH VOLTAGE AND CURRENT CAPABILITY** — Relay cards up to 15kV are available. Relay cards up to 70Arms are available. Both high voltage and high current relay cards can be in the same 964i.

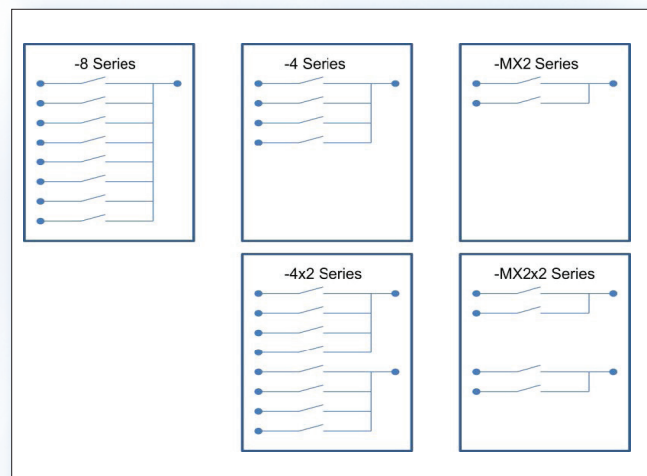


Figure 2. Standard 964i relay cards include 8:1, 4:1 and 2:1 and dual 4:1 and 2:1 multiplexing cards.

FEATURES OF THE VITREK 964I

- ▶ **DIRECT CONTROL BY VITREK HIPOT TESTER** — Can be controlled directly by a Vitrek 95x or V7x series safety tester.
- ▶ **QT ENTERPRISE SOFTWARE** — available for the PC for total system control; 95x, V7X or V series Hipot tester and up to 16 964i switching systems.
- ▶ **CHOICE OF INTERFACES** — The standard 964i comes with RS232 and VICL interfaces, the user can add an optional GPIB interface.

Each 964i is custom configured to user requirements utilizing a selection of relay cards (Figure 2) that are installed in any of eight banks in the chassis. The operation of each relay is individually controlled via commands from the tester or directly programmed into the 964i. Unlike typical cable testers which are restricted to a fixed pattern, test points can also be connected to other equipment such as an impedance (LCR) meter or digital multi-meter (DMM).

The 964i also has a full published command set so it can be programmed for use with other testers if it is needed for a different application.

Two versions of the multiplexer (MUX) cards shown in Figure 2 are available based on the specific requirements of the device-under-test (DUT). The low-voltage LV series cards can handle medium currents at voltages up to 3KVdc or 2KVrms. The high-voltage HV series cards are designed to handle low currents at voltages up to 7, 10 or 15kVdc or 5, 7 or 10KVrms.

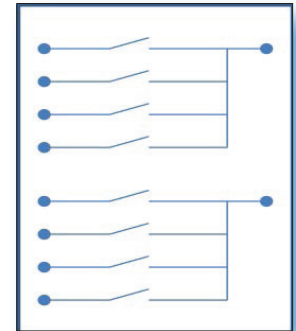


Figure 3. A special multiplexer card (HC-4) is designed to facilitate AC ground bond tests.

One additional MUX card - the HC-4 cards are designed to multiplex Ground Bond tests. The HC-4 is a dual 4:1 multiplexing card; one set of 4 relays carries current up to 40Arms and the other handles voltage sense. Figure 3 shows the configuration.

964I CONFIGURATION AND ACCESSORIES

The 964i is easily configured to a wide range of specific test and measurement requirements.

- ▶ Select from 4 different voltage ratings - 3KV, 7KV, 10KV and 15KV.
- ▶ Determine the number of and type of cards needed based on the number of test pairs. For each card, define if it will be used as the + (HV bus) or - (return bus).
- ▶ Select any desired accessories.
- ▶ Draw the desired wiring diagram and email it to Vitrek's application team. (This can be a hand drawing photographed and texted to us. We will create a custom configuration for you based on the drawing.)
- ▶ Order or create custom fixtures as required.

Standard front inputs connect directly to the hipot tester outputs and up to 60 rear panel terminals connect to the DUT - typically utilizing test fixtures to speed setup and reduce chances of incorrect connections.

Figures 4 and 5 are examples of test accessories available from Vitrek. (see www.vitrekt.com for a complete list of available accessories.)

Up to four 964i units can be controlled directly by a single Vitrek 95x or V7X series hipot tester or up to sixteen via PC/GPIB interface. The 964i's LCD display confirms system status and switch activation at a glance. The result is a highly repeatable, rapid switching test system with no operator intervention and fully automated data acquisition.



Figure 4. The K2-R lead set is used with the HC-4 card when conducting ground bond tests.



Figure 5. The TI-115-2 is one of several test fixtures available to simplify connection to instrument power cords.

QT ENTERPRISE SOFTWARE

Vitrek's QT Enterprise software is the ideal solution for integrating Vitrek's V7x and 95x Series Hipot & Ground Bond Testers with the 964i High Voltage Switching System. For complex setups, QT Enterprise can display detailed instructions and images to the operator to ensure proper connections prior to testing.

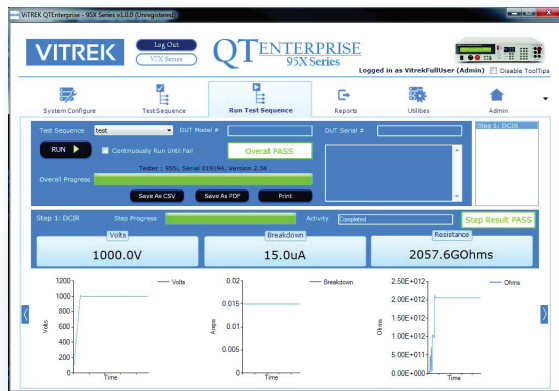


Figure 6. QT Enterprise software provides the perfect answer for the setup and operation of complex test sequences.

QT Enterprise provides a clean and intuitive means for creating and modifying a virtually unlimited number of electrical safety testing procedures. Each test sequence can have as many as 999 steps to perform a comprehensive range of electrical safety tests including AC and/or DC voltage withstand, insulation resistance, ground bond testing and others. Barcode reading of DUT model and serial number assures proper application of required tests.

QT Enterprise only communicates with the tester (and optionally, the switch units) when required to do so. This means that work with QT Enterprise on any computer can be performed to define users, system configurations and/or test sequences without requiring specific interface hardware or the units themselves.

A complete description of the features and capabilities of QT Enterprise Software is available at www.vitrek.com.

CONCLUSION

Multi-point high-voltage and current testing of power connections and cable assemblies can involve dozens and even hundreds of individual point-to-point tests. Performing these test manually is not only a daunting task, but one fraught with the potential for errors. The Vitrek 964i Programmable High Voltage Switching System in combination with Vitrek's high performance Hipot & Ground Bond Testers provide the answer to efficient setup and execution of these tests. Utilizing QT Enterprise software to program the testing sequences further facilitates the testing and documentation of test results.

For more information on Vitrek's line of High Voltage & Electrical Safety & Test Equipment visit us online at www.Vitrek.com.

