Automatic Cable Tester

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Because of problems encountered and the time required to test multiconductor cables, the Automatic Cable Tester was designed and built by JPL Quality Assurance. This instrument has significantly reduced test time and increased the reliability of the hardware.

I. Introduction

Due to the increased number of cables and the time required to test them, it was necessary for Quality Assurance to find improved methods of performing the tests. A review was conducted of all commercially available equipment that would meet our requirements. The constraints were:

(1) The need for test flexibility at low volume.

(2) Compatibility with existing equipment.

(3) The need to be more cost effective.

No equipment was available that would meet our requirements. Therefore, it was necessary for JPL Quality Assurance to design and build the Automatic Cable Tester (ACT). The use of this instrument has increased the accuracy and reliability of test results, while reducing the man-hours required to perform necessary tests.

II. Description of Equipment

The JPL Automatic Cable Test Set (Fig. 1) consists of one commercial piece of test equipment plus three JPL-designed panels. These units are:

(1) 0–1000-volt commercial power supply and 100-circuit relay scanning unit. The scanning unit accepts only pin-to-pin circuits.

(2) Multicircuit patch panel. The patch panel provides the capability to test cables that are not wired in the normal pin-to-pin configuration, thus eliminating the need for additional testing in a manual mode.

(3) Connector adapter panel. The connector adapter panel provides a full selection of connector adapters without the operator having to stop and locate specific adapters for the particular cable under test.

(4) Branch circuit switching panel. The branch circuit switching panel is designed to pre-program the test set to accept multi-pin circuits on a cable under test. Without the branch circuit panel, the unit would reject the cable as being shorted.

The test set automatically tests each circuit for proper terminal-to-terminal resistance (continuity) and simultaneously checks each circuit against all other circuits for shorts and high-resistance leakage. Cables can also be checked separately for shorts or continuity. In the "shorts only" condition, only one end of the cable needs to be connected to the tester. The operator can select high voltage for dielectric breakdown tests, or use very low voltage for testing circuitry that cannot withstand high voltage. All test parameters, such as test time, type of test, reject levels, etc., can be selected on the control unit.

III. Implementation Results of Automatic Test Equipment

The previously used method of testing multiconductor cables was limited to a continuity test with an ohmmeter or a battery/buzzer (this method is incapable of determining poor terminations such as cold solder and uncrimped pins) and a Hi-Pot and/or megohm test by hand between each pin and all adjacent pins (individually). The manual method is subject to human error (i.e., failure to test a pin) and at best was incomplete. A true dielectric strength (Hi-Pot) and insulation resistance test (Meg) should be performed between each pin (circuit) and all other pins, shields, and connector shells tied together in common.

Operation of the tester (Fig. 2) is simple and can be performed with minimum operator training. Once the cable under test is connected and test parameters have been set, it is necessary only for the operator to push the start button. The test is completely automatic with the tester stopping and identifying all faults.

A significant benefit of the new equipment is the savings in test time. For example, in testing a 100-wire, 2-connector cable, excluding setup time, the old method took two persons 30 minutes each, while the new method only required one person approximately 1 minute to perform the same task.

An additional advantage of the test equipment is safety of operation. Previous methods of testing using high voltages were hazardous in their actual use, plus the side effect of "charging" the unit under test, where electrical shock and possible injury could result. The Automatic Test Unit self-shorts all circuits after test, thus eliminating such hazards.

The significant increase in reliability was a contributing factor in the DSN Engineering decision to discontinue procurement of spare cabling for the Deep Space Network.

IV. Future Plans

All multiconductor cables are electrically inspected using the new JPL Automatic Cable Tester. Cables not meeting the required electrical parameters are separated and identified to prevent their being put into service. A program has already been initiated to identify the exact cause of failures, and steps are being taken to prevent further occurrences.

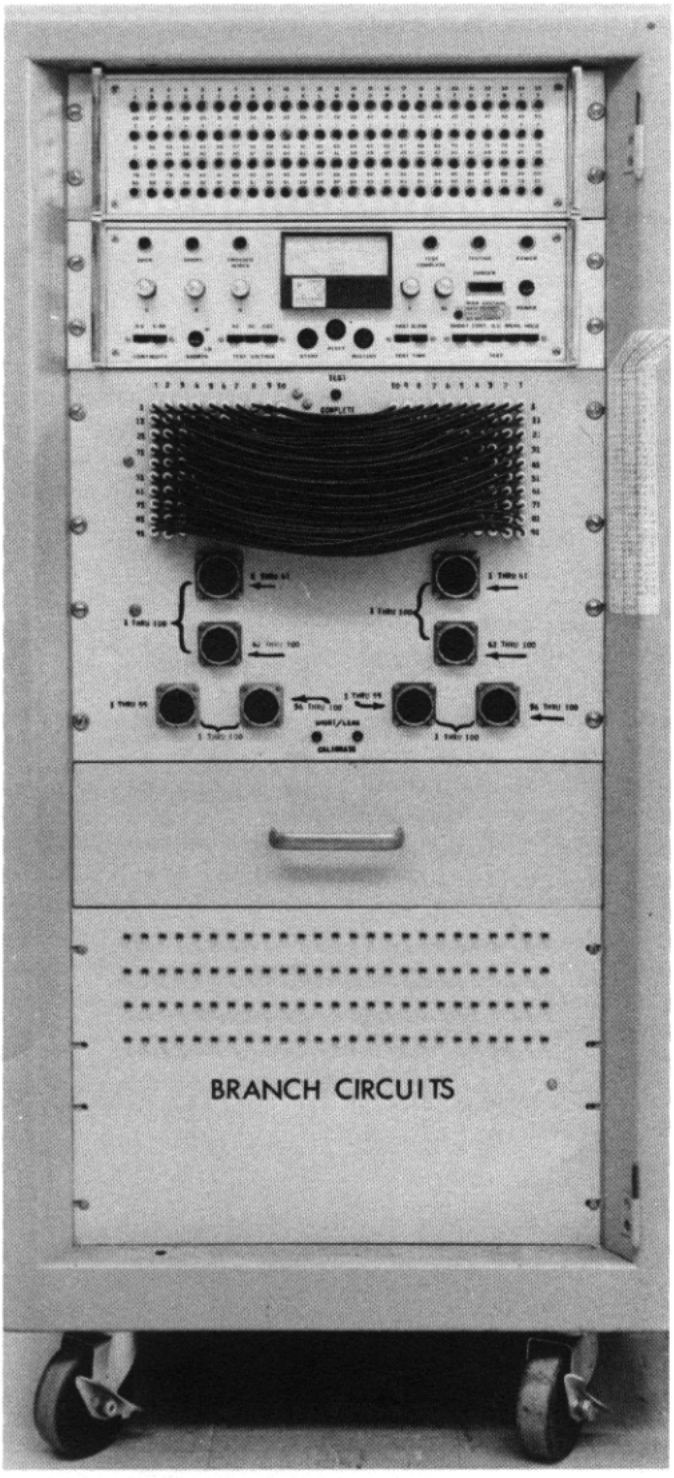

Fig. 1. JPL Automatic Cable Tester

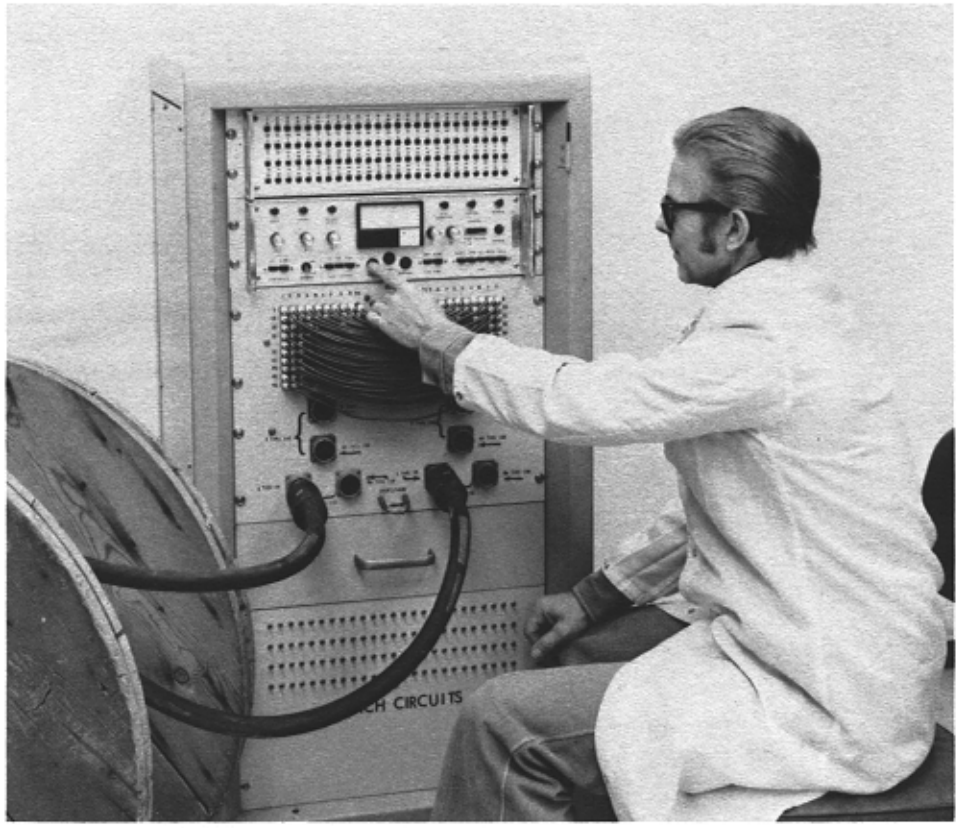

Fig. 2. Operator using Automatic Cable Tester

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