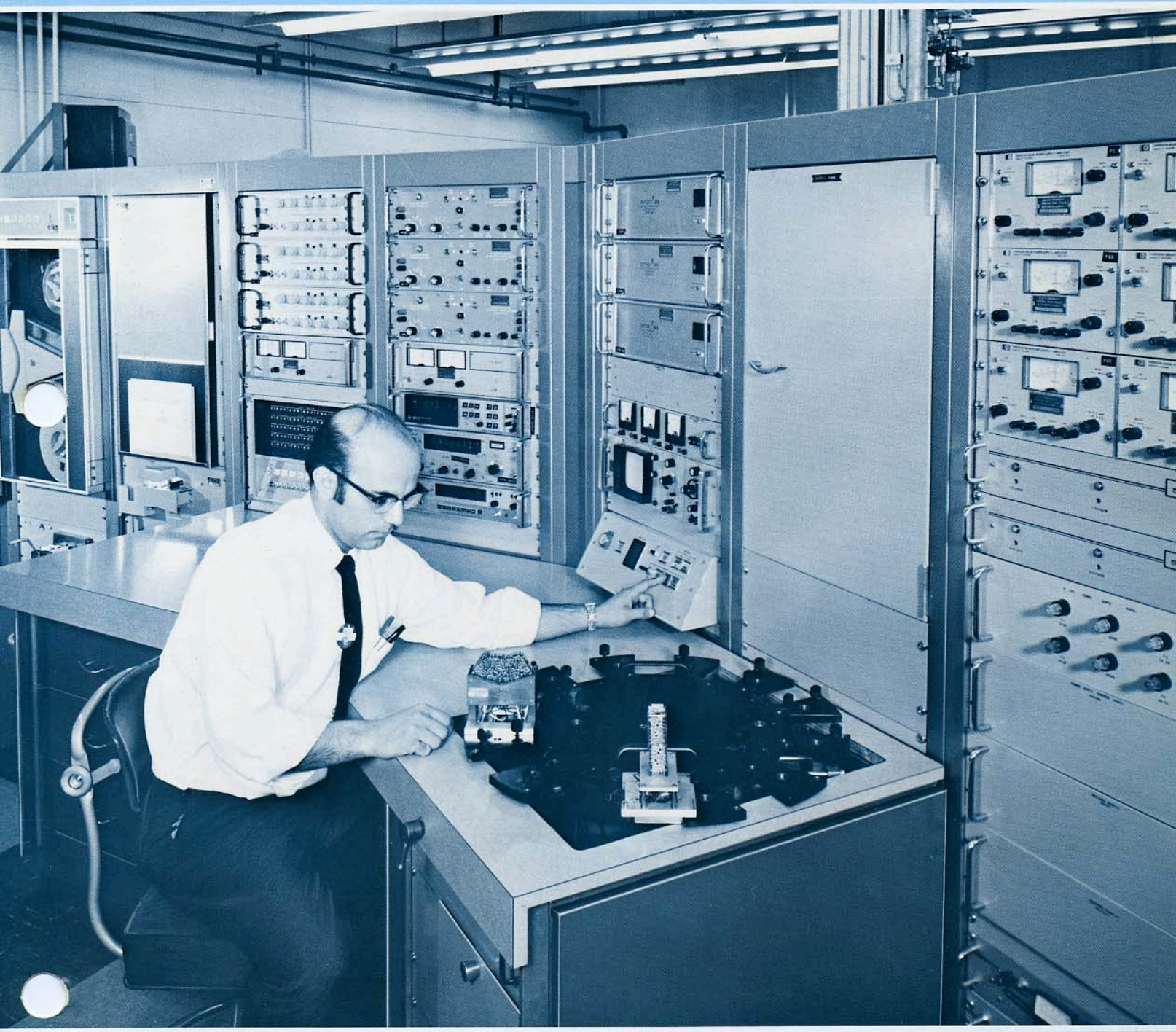
HEWLETT hp PACKARD

APPLICATIONS OF COMPUTERIZED DIGITAL DATA ACQUISITION SYSTEMS

High-Volume Production Testing

A Solution to a Measurement Problem for: RAYTHEON COMPANY
Lowell, Massachusetts



THE APPLICATION

Two basic test systems have been developed at Raytheon for production testing of electronic modules and subassemblies used in a military weapon system. The first type tests modules and trays (modules in combination) in the frequency range from dc to 1 MHz. The second type tests subsystem elements consisting of flight control and target seeker sections, which are comprised of trays in combination. These tests are conducted in the frequency range extending to the microwave region. All systems follow the same modular hardware and software concept.

THE MEASUREMENT PROBLEM

Raytheon needed a system which could perform many different tests on a variety of electronic modules and subassemblies, on a high-volume basis and in reasonable time.

THE SOLUTION

To accomplish the measurement task, Raytheon selected the test system shown in the block diagram. It consists of versatile instrumentation, thus allowing Raytheon to reconfigure the system as necessary for different testing requirements. Major elements include an HP computer and associated I/O devices, programmable stimuli and measuring instruments, system interconnection and switching matrix, special circuits panel, and operator control panel. A carousel mounted on the front of the system holds up to 12 modules which are tested one at a time.

Switching for distribution of stimuli and signal input to the measuring devices is performed primarily by the crossbar switch. Since the crossbar is limited to currents below 100 mA, power supplies are controlled via relays in the power control panel.

Special switching that cannot be performed in the matrix or power control panel, such as switching a load in or out, is accomplished by a card plugged into the special circuits panel. (Plug-in cards on the special circuits panel provide signal conditioning peculiar to each module.)

The large number of output lines needed by the computer to control all the variables in a system of this complexity are obtained, in the I/O expander panel, by means of a relay tree controlled by two 16-bit duplex registers.

The measurement system initially installed has been highly successful and, as a result, three additional systems, utilizing the same modular hardware and software approach, have been installed to handle the entire production testing needs for this program and another new program.

COVER:
Computer-Controlled Module/Tray Test Station at Raytheon Performs Stimulus Response Testing on Complex Electronic Devices.

SYSTEM OPERATION

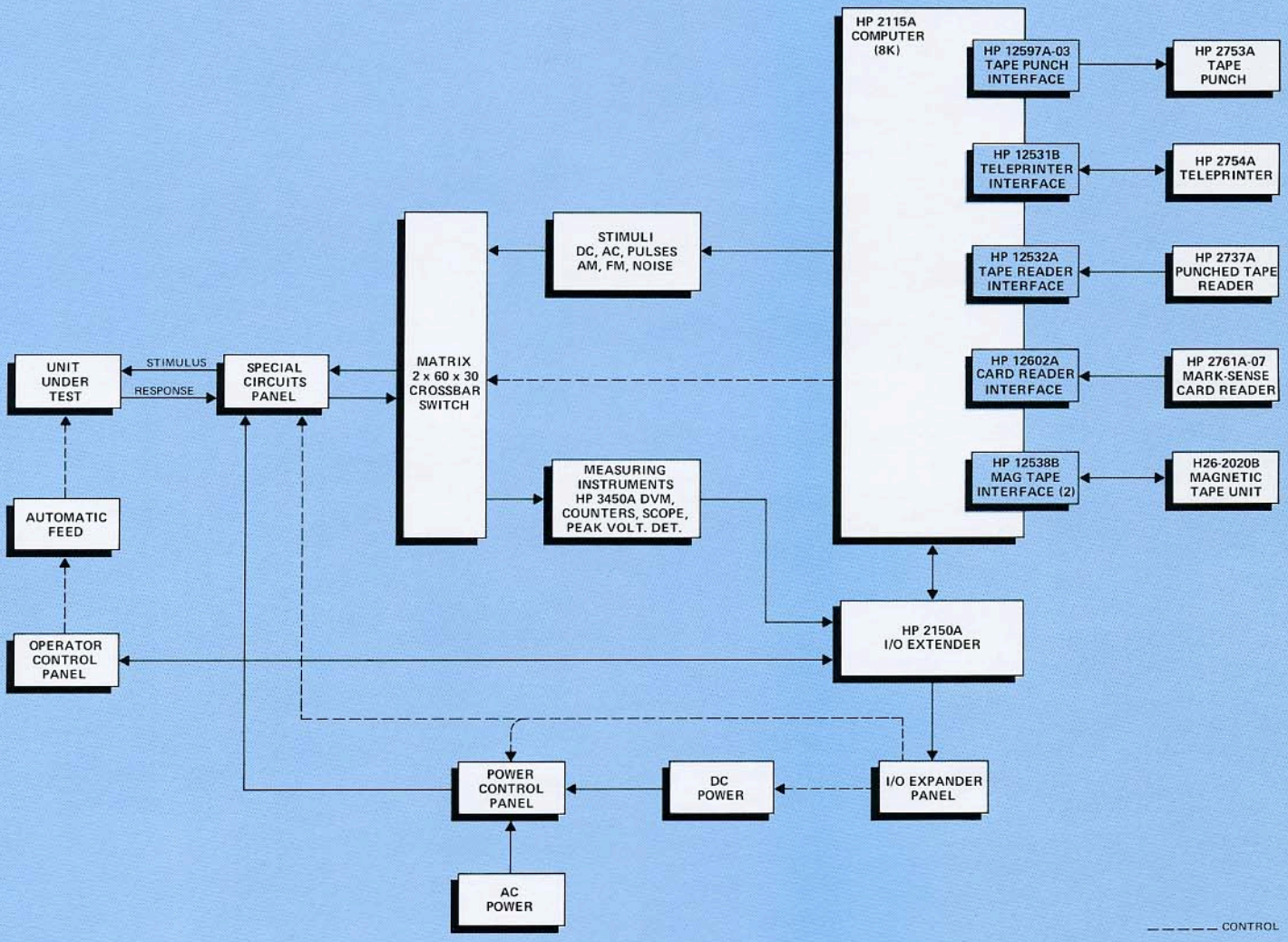
A module test typically involves ten different combinations of stimuli with five measurements each. A complete test may take from 40 to 90 seconds, depending on the module complexity. Systems measurement functions include dc and ac voltages, resistance, ratio, frequency, and time interval.

A monitor program, normally resident in memory, provides basic control of the system. Mark-sense cards containing identification of the operator, test station, and module under test, call the unit-under-test program from magnetic tape storage into core. After all tests are performed on a module, the carousel is automatically stepped, under program control, to the next module, and so on until all have been tested. Upon completion of all tests on a module, the teleprinter lists the module identification, whether it passed all tests, or the test at which it failed, together with the required and actual result. (Failed units are also signalled at the control panel.) The test technician uses this information to troubleshoot faulty units later on (using a separate test station). Besides the printout, all test result information is logged on magnetic tape for subsequent analysis.

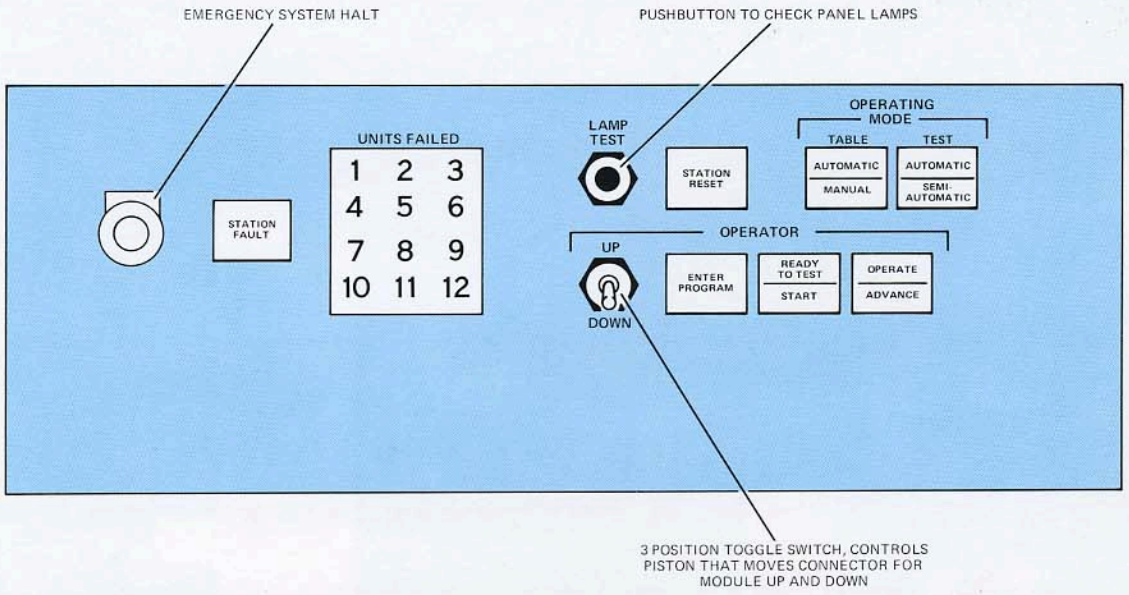
Test programs are normally written in HP FORTRAN, using predefined drivers to control the various peripherals. Use of standard drivers for the stimuli and measuring instruments minimizes the incremental effort required to write a new test program. The system is designed to be operated by nontechnical people, using only controls on the operator control panel; all other instrument (and computer) controls are normally covered.

BENEFIT OF COMPUTERIZED DATA ACQUISITION

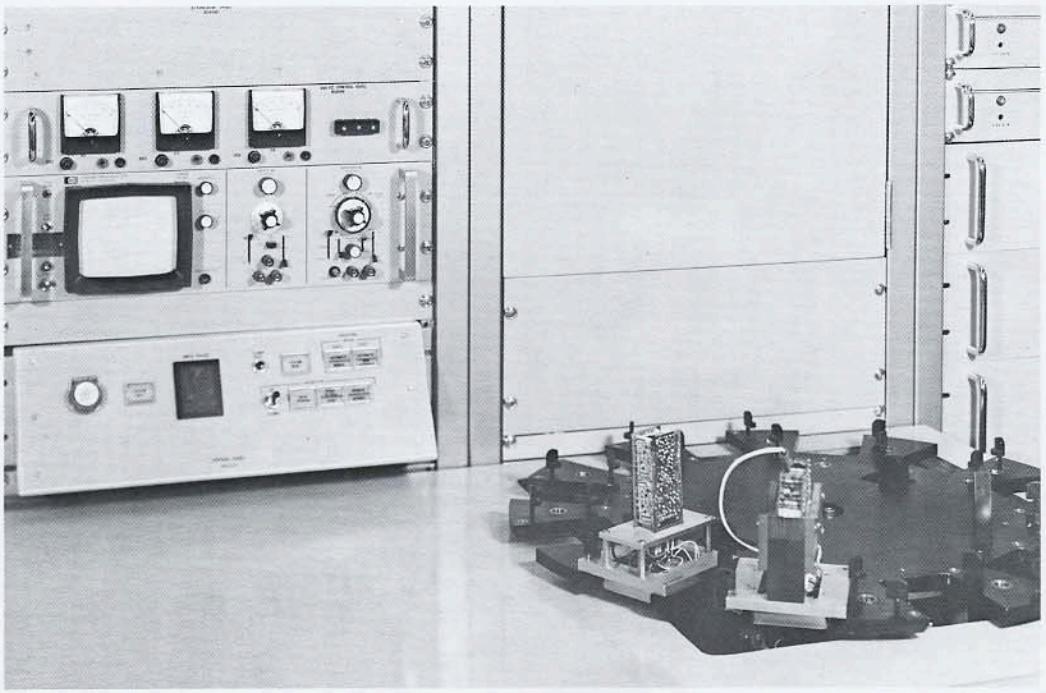
The HP computer-controlled system permits large quantities of complex electronic equipment to be tested within a reasonably short time. Further convenience plus cost and time savings are realized by: (1) Maximum use of commercially available and flexible instrumentation for ease of reconfiguring systems for different tasks, (2) Modular I/O structure of HP computers for easy interface of HP instruments plus available general-purpose interfaces for interfacing other equipment, and (3) Modular software allowing drivers to be written easily for all devices for which drivers do not already exist.



Automatic Test Station Block Diagram



Operator Control Panel Allows Non-Technical People to Operate System



Close-up of Test Station Showing Control Panel and Carousel with Two Modules in Place

For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181
West (213) 877-1282. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94303. In Europe, 1217 Meyrin-Geneva, Switzerland

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