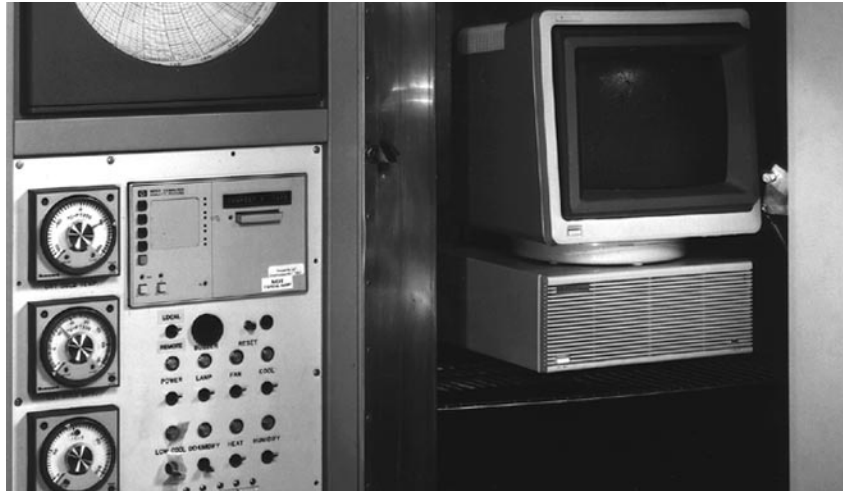# Environmental/Autoclave Testing

**HP Data Acquisition
Application Note**

Description

Environmental chambers and auto-claves are used during testing of electronic equipment, electronic subassemblies, military equipment, aerospace equipment, and many man-made materials. Research engi-neers use these chambers to see how their design is affected by dif-ferent temperatures, pressures, and humidities. Production test engi-neers use an environmental cham-ber to test products for final accep-tance. Autoclaves are usually used to control the environment of a pro-duction process such as the curing of a man-made material like plastic.

Problem

An environmental chamber (or an autoclave) can be set to specific temperatures, pressures, and humidities. It is important to moni-tor all these characteristics to learn their effect on a product in the chamber. In some cases it is also necessary to control the chamber so that it cycles through various temperatures and pressures as part of the test or curing process.

Solution

A VXIbus data acquisition and con-trol system from Hewlett-Packard is an ideal solution for monitoring parameters in an environmental chamber. Temperature, pressure, and humidity transducers can be monitored with a data acquisition system and the information stored in the instrument or sent to the computer for analysis and archiv-ing. For new products, parameters of the product can be measured by the system and the results can be compared to the temperature, pres-sure, and humidity of the chamber.

The environmental chamber or autoclave can also be controlled by the data acquisition and control sys-tem. Using digital outputs connect-ed to external relay switches, the data acquisition system can turn heaters, air conditioners, pumps, vacuums, and valves on and off to control all parameters of the cham-ber. The data acquisition system ensures that each product is cycled through exactly the same condi-tions. This guarantees precise test-ing, uniform product quality, and accurate product characterization.

Temperature
Humidity
Pressure
Product measurements
Chamber control
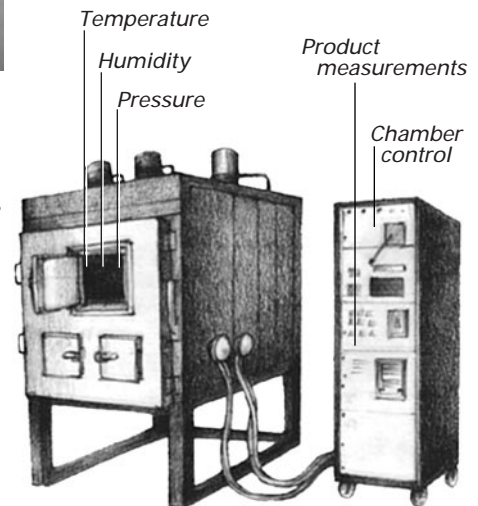
Applications

Electronics
Automotive
Aerospace
Transducer manufacturers
Fiberglass manufacturers
Plastics manufacturers

Departments

Research & development
Environmental test
Test engineering
Production test
Quality assurance

Implementation

Temperature

Thermocouples and thermistors are commonly used to measure the temperature of the chamber or autoclave. Sometimes temperature transducers are also mounted inside the product to see how chamber air temperature affects temperatures in the product. Accuracy is very important in these tests.

Pressure

Pressure inside the chamber is often used to simulate the effects of altitude on the operation of the product. In autoclaves, the pressure is used in conjunction with temperature to effect a specific curing process on materials such as plastics or fiberglass. Pressure transducers generally output small voltages (0-100 mV), current (4-20 mA), or larger voltages (0-10 Vdc).

Humidity

In some cases, products are tested by varying the humidity of the chamber. This is often done when the product is intended for use in either high humidity climates like the tropics or low humidity climates like the desert. Some humidity transducers utilize wet and dry thermocouples (mV outputs) and others use an LVDT-like device that outputs a 0 to 10 Vdc signal.

Chamber control

The most common type of chamber control is on/off. Chamber temperature can be changed by turning a heater or cooler on or off. Chamber pressure can be changed with a pressure or vacuum pump and one or more valves. Humidity in the chamber is also controlled by opening or closing valves.

Product measurements

A variety of measurements can be made on the electronic assemblies or products in the chamber. Voltages, currents, resistances, capacitance, strain, temperature, and frequency are but a few of the possible measurements that could be made by the data acquisition system on the device-under-test (DUT). DUT performance measurements are correlated with environmental conditions inside the chamber to predict DUT performance under the extreme operating conditions of its intended application environment.

Key System Features

- VXIbus open architecture
- Data Acquisition and Control on a single programmable VXIbus card (E1419A)
- Graphical programming language (HP VEE)
- Flexibility with deterministic control
- Wide choice of inputs/outputs
- Built-in control algorithms
- Up to 32 user-written "C" code algorithms
- 65,000 reading FIFO buffer
- 500 reading Current Value Table (CVT)
- All algorithms can write to FIFO/CVT
- Data can be time-stamped

Typical Configuration

Data Acquisition System	Qty
HP E1421B VXI 6-Slot Card Cage	1
HP E1406B VXI Slot 0 Command Module	1
HPE1419A Multifunction Measurement & Control Card	1-2
Analog input channels	10-30
Digital output channels	12-44
Computer and Software	
HP Vectra Series PC with HP 82341C HP-IB Interface Card	
HP VEE for Windows 95	
HP LaserJet or InkJet printer	