

**Agilent**  
Power, Temperature, and Vibration  
Monitoring for Air Conditioners  
Application Note



## Introduction

Air conditioners are getting more common as more families are installing them in their homes.

Therefore, testing of air conditioners is becoming important as well. Test parameters taken into consideration by air conditioner manufacturers to ensure home users' comfort include voltage, current, power, temperature, pressure, and vibration.

This application note explains how to make the necessary measurements for an air-conditioner test, with the above test parameters in mind.

## Testing Requirements

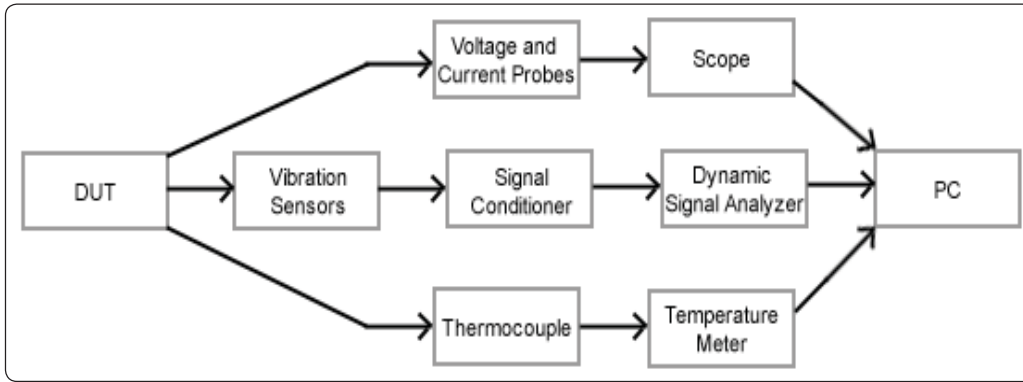
One of the crucial requirements for air conditioners is that they have to meet their specified energy efficiency. To ensure this, the voltage and current consumed by the air conditioner need to be measured.

Other specifications include the cooling and heating temperatures of the air conditioner, and the noise generated by imbalanced blades of rotating fans in the system. These would require

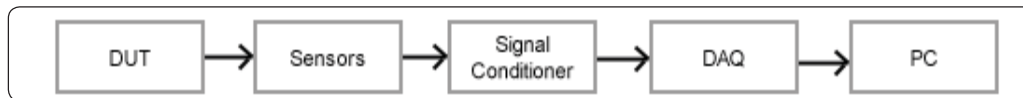
temperature, vibration, and pressure measurements.

## Test Setup

The device under test (DUT) in this application is the air conditioner. A generic setup would utilize an oscilloscope to measure the voltage and current, leading to power measurement. Temperature measurements can be done using a thermocouple or thermistor that is connected to a temperature meter. Vibration can be measured using a dynamic signal analyzer with the necessary transducers. All the information obtained will be processed by each instrument or device before it is transferred to a computer (PC) for post analysis.



**Figure 1** Generic test setup for power, temperature and vibration measurement



**Figure 2** Typical test setup utilizing DAQ device for measurement

Figure 1 depicts the generic test setup explained earlier. In this setup, three instruments are required: scope, dynamic signal analyzer, and temperature meter. Therefore, it is essential to study and understand all three instruments in order to successfully obtain the voltage, current, vibration, and temperature measurements.

Figure 2 shows how Agilent’s USB data acquisition (DAQ) device can replace the three individual instruments in the previous generic setup. A typical DAQ measurement system consists of the DUT, sensors, signal conditioner, DAQ device, and PC. In each testing requirement, only the corresponding transducer, sensor, or signal conditioner is needed.

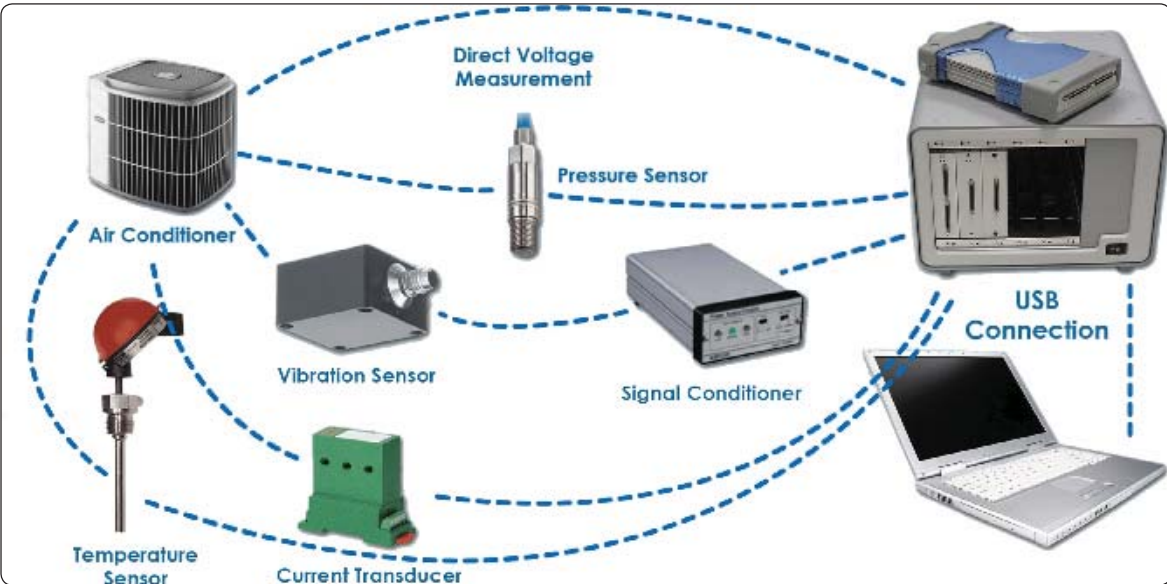
This means that only one instrument will be needed to interface to the PC, eliminating the need to learn more instrumentation in order to make the necessary measurements.

### Test Methodology

The DAQ device is able to read direct voltage measurement as shown in Figure 3. Other parameters such as pressure, vibration, current, and temperature measurements are measured by using different types of sensors or transducers before they are sent to the DAQ device. Once these measurements are captured, the DAQ will perform an analog-to-digital conversion (ADC) on the analog signals before sending the signals to the PC for analysis.

### Advantages of Agilent’s USB DAQ Solution

- Universal Serial Bus (USB) is a connectivity specification that offers ease of use and plug-and-play capabilities.
  - USB is a common standard interface for PC and no additional hardware is required to act as an interface.
  - Interfacing to the PC is performed only via the DAQ device, greatly simplifying control and programming and eliminating the need to learn more instrumentation.
- Oscilloscopes typically have a resolution of 8 bits, but the Agilent USB DAQ device offers up to 16 bits of resolution, making measurements more accurate.



**Figure 3** Data acquisition implementation for air conditioner test and analysis

•Oscilloscopes typically have a maximum of four channels, while the Agilent USB DAQ device offers a maximum of 64 single-ended (SE) channels per module. If more channels are needed, they can be fitted into multiple chassis.

### Conclusion

With Agilent's DAQ solution, a PC needs to be connected to only one instrument for test and analysis, rather than to multiple instruments as in a traditional setup. This makes control much easier and more straightforward.

The sensors and transducers can be chosen based on test requirements. With dedicated sensors and transducers, measurements can be done at the required test points with greater accuracy and simpler setup.

Visit [www.agilent.com/find/U2300A](http://www.agilent.com/find/U2300A) for additional information or contact your nearest Agilent sales office or sales representative.

### Related Agilent Literature

- ANSI/ASHRAE Standard 87.3-2001 (RA 2006), *Method of Testing Propeller Fan Vibration-Diagnostic Test Methods*
- System Developer Guide - Using USB in the Test and Measurement Environment Application Note*, literature number 1465-12



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