HVAC Energy Efficiency Testing
using the LogBook/360™

Energy Conservation

Application Note #61

Application Summary

Manufacturers of heating, ventilating, air conditioning, and refrigeration appliances are under intense pressure, now more than ever before, to design and produce the most energy efficient equipment that they can. Often, potential customers, particularly US government facilities that must meet the Energy Policy Act of 1992, demand that the manufacturer have proof or evidence from qualified testing labs that the equipment does indeed meet the advertised or claimed efficiency ratings. One such widely used testing lab has been characterizing appliances and HVAC equipment for many years and has an impeccable reputation for its work.

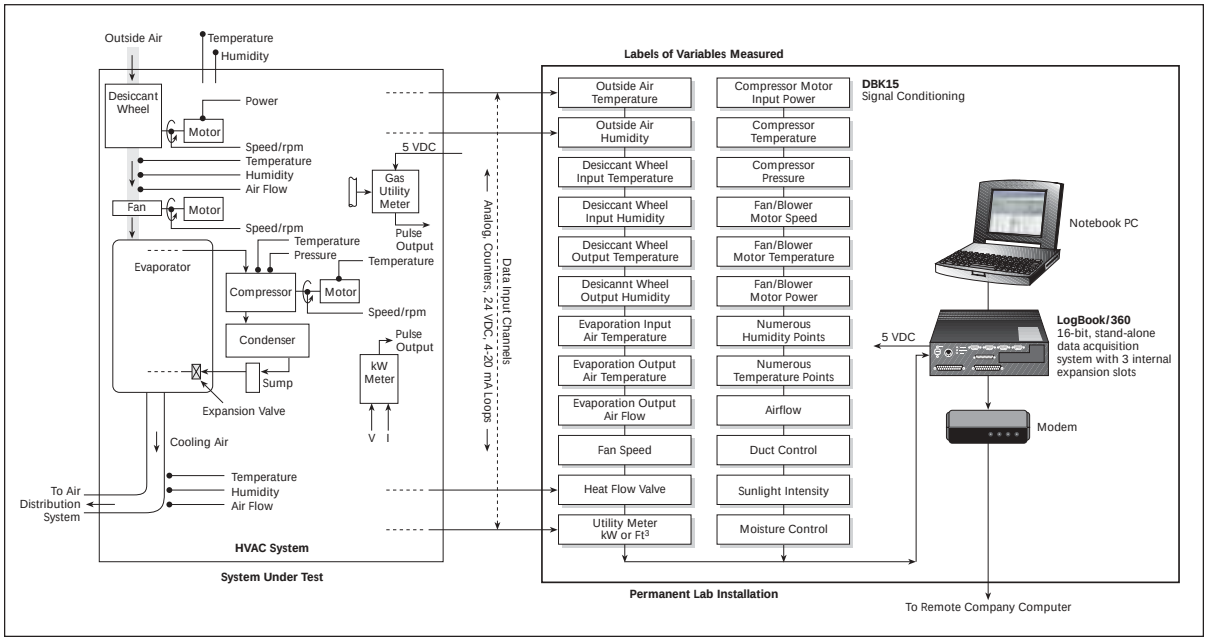
The lab currently instruments such appliances to measure and collect data on a variety of electrical signals, input power, relative humidity, temperature, pressure, gas volume, and airflow — variables that are used to compute the energy efficiency. Major measurement issues hinge around the prevailing outdoor air temperature and humidity as well as the indoor values. Often, reducing the temperature of a large facility to improve comfort without considering the humidity can consume more electrical energy than dropping the humidity while ignoring the higher temperature. For example, reducing humidity to 25% at a temperature of 70˚F can feel just as comfortable as a facility with a lower temperature but higher humidity.

Potential Solution

The data acquisition system intended to monitor these variables must be able to resolve a temperature measurement to better than one degree and contain sufficient input channels to accurately map the entire temperature and humidity space. A supervisor recently purchased equipment for his test lab that had no previous data acquisition equipment. He evaluated several systems, all based on a personal computer for measurement and control, but decided he needed equipment that could be left unattended, remotely located, and connected to a modem to download data to a company computer at regular intervals. Moreover, two additional critical factors were its price-to-performance ratio and construction. It had to be rugged enough to withstand some vibration and wide temperature variations.

IOtech's Solution

Of all the systems he evaluated, only the IOtech LogBook/360™ system was able to meet every requirement. The LogBook was a perfect fit because it



IOtech LogBook data acquisition systems permanently located in test laboratories record the critical operating variables in HVAC systems and appliances. The captured data let engineers calculate energy efficiency to ensure the hardware complies with local and federal energy conservation requirements. The variables that the LogBooks continuously measure include dry bulb temperature, relative humidity, airflow, power input, and gas flow, and all are downloaded to a main company computer through modems during evening hours.

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uses an internal memory card and does not depend on the media of a separate PC to store data. As a result, the supervisor purchased five systems; four are currently in service and the fifth is a spare. Another feature he likes is LogView™. The bundled software is easy to program and communicate with through a modem from the central office. Each evening, about midnight, the office computer interrogates the various bases and downloads the day's data. Some sites use an analog instrument, such as a utility meter, that feeds pulses to the LogBook. The moving contacts of a switch generate the pulses that correspond to some known quantity such as one cubic foot of gas or one kW of electrical power. The LogBook supplies 5 VDC power directly to the switch contacts to provide its own signal without ancillary signal conditioning.

The LogBooks are permanently installed in the vertical back plane of an electrical enclosure, and the sensors connect to the terminal blocks on the LogBook through DBK15™ signal conditioners. Each collection site measures between 18 and 20 channels of analog input, two to four counters, 24 VDC, and 4 to 20 mA loops. The 24 VDC power supply feeds up to 16 instrumentation loops and simultaneously powers the LogBook. The sensors measure dry bulb temperature and relative humidity from numerous points in systems under test. For example, airflow sensors, relative humidity sensors, and temperature sensors are placed in groups to measure outdoor air temperature, supply air temperature and flow, and a desiccant wheel's input and output relative humidity. Air passes through the slowly revolving desiccant wheel containing silica gel to remove the moisture regardless of the air temperature, a method that is more efficient than controlling just the air temperature in both small and large auditorium-size facilities.

In addition to the simplified hardware connections, the lab supervisor found the LogView software package straightforward and easy to use. Within about only two days, he was able to set up the system and begin acquiring data. And the LogBook has not required calibration since its initial calibration at the factory.

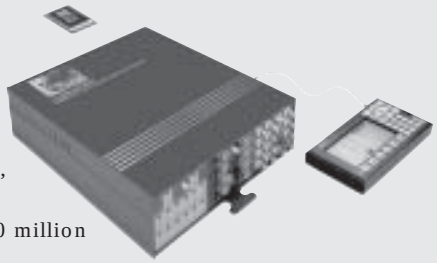
Conclusion

HVAC manufacturers are required to meet both locally and federally regulated efficiency ratings relative to energy conservation. In order to comply with the rules, many systems are tested in a lab environment under procedures that let engineers collect data for calculating the energy efficiency. One lab depends on IOtech LogBook/360 data acquisition systems to measure temperatures to better than one degree F, as well as relative humidity, airflow, speed or rpm, and compressor pressure. The system is remotely located and connects to modems that download one day's data to the company's main computer during low-usage times.

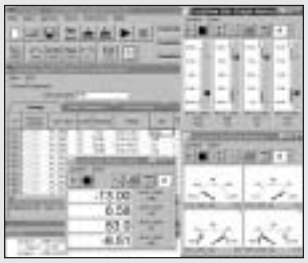
LogBook

The LogBook™ combines on-board intelligence and a large capacity PC-Card removable memory, with the industry's easiest and most powerful data logging software. Its 16-bit, 100-kHz A/D and triggering capabilities make it ideal for collecting high *and* low speed phenomena. A comprehensive array of signal conditioning expansion cards and modules are offered that allow the LogBook to take measurements from virtually any transducer, from thermocouples to accelerometers.

Features



- Operates without a PC at the test site
- 16-bit, 100-kHz analog and digital sampling
- Compact yet expandable architecture can accommodate over 400 channels of analog, digital, and frequency I/O
- Stand-alone nonvolatile storage of over 250 million samples via removable PC-Card memory
- Card swapping and uploading during acquisition allows continuous data acquisition
- Communication with PC via RS-232, parallel port, modem, or by transporting a PC-Card; optional RS-422 interface
- Built-in analog inputs support 14 programmable ranges up to 20V
- Synchronous, mixed signal acquisition of analog, digital, and counter inputs
- Optional modem support provides remote communication
- Optional GPS support (LogBook/360 only) logs location information
- Optional control terminal provides channel inspection, and acquisition queries
- AC or DC powerable



LogView requires no programming or block diagram configuration

Software

- Includes LogView™ *Out-of-the-Box*™ software for easy setup, calibration, & more; no programming required
- Simple spreadsheet-style interface provides powerful setup features for immediate startup
- Acquisition configurations can be transported to the LogBook via PC-Card, serial port, parallel port, or modem connection
- Provides direct support for a wide variety of transducers
- Includes eZ-PostView™ for post-acquisition data viewing

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