

In-Vehicle Temperature Testing

using the LogBook/300™

Automotive

Application Note #40

Automobile owners expect their vehicles to operate reliably wherever they are driven, whether in the desert or in the arctic. Therefore it is imperative that automobile manufacturers verify the temperature operating ranges of components in a prototypical automobile in its final stage before production.

Application Summary

An automobile manufacturer needed to road test a new model of vehicle in extreme temperatures and collect engine performance data. Researchers planned road tests in Arizona and Alaska, in ambient temperatures ranging from -30°C (-22°F) to $+55^{\circ}\text{C}$ ($+131^{\circ}\text{F}$). To measure the prototype's performance, test engineers needed to instrument six automobiles for more than 40 temperature measurements of each engine and its components including oil, coolant, engine-control unit, alternator, and other OEM parts.

Potential Solution

Previously, the automobile manufacturer utilized a DAT recorder that required a time-consuming effort to convert a digital tape to a workable computer file

for data evaluation. In addition to being difficult to work with, the DAT recorder was bulky and prohibitively expensive for outfitting six cars.

IOtech's Solution

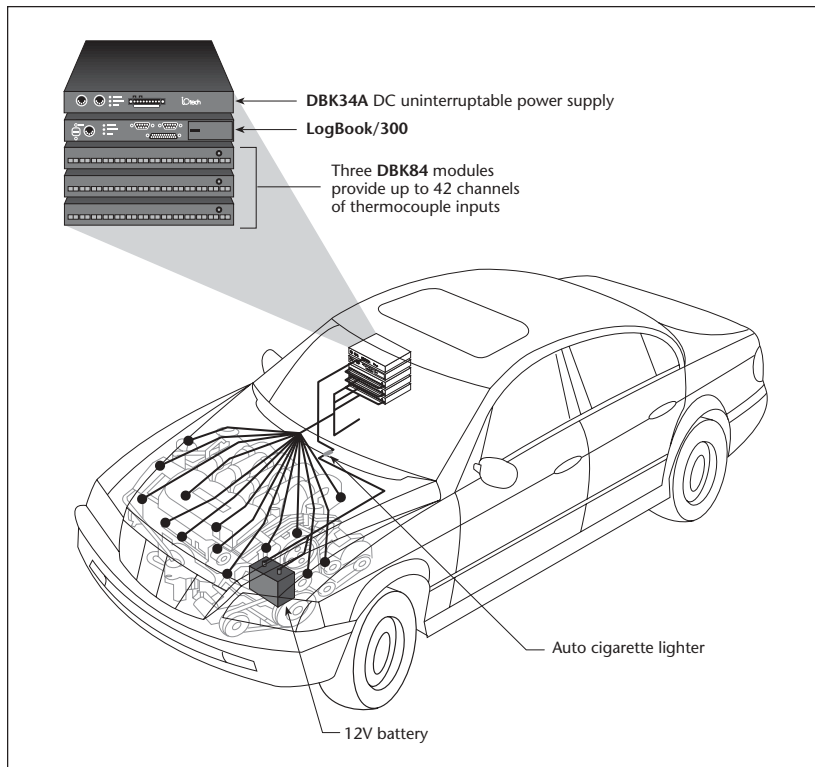
To conduct the on-the-road tests, the manufacturer needed a data acquisition system able to meet a demanding set of performance criteria. These criteria included portability, operability from a battery, ability to accommodate and filter thermocouple signals, and a high-channel count. The system needed to run unattended by way of a simple setup process, followed by an easy download of the data to a laptop PC.

IOtech's LogBook/300™ stand-alone data acquisition system was chosen for the thermocouple application because it was cost effective, equipped to measure many thermocouples, fit easily in the car's front seat, and provided quick download via a memory PC-Card (PCMCIA) and included LogView™ *Out-of-the-Box*™ software.

Technicians glued or taped thermocouples to engine components, or sealed them into engine pipes, and ran

the thermocouples to a single position in the front seat where they were screwed into the terminals of the LogBook/300 data acquisition system. The LogBook/300 was powered via a DBK34A™ DC uninterruptible power supply attached to the cigarette lighter. The DBK34A supplied necessary power to the LogBook/300 during power sags caused primarily by engine cranking. The LogBook/300 measured more than 40 channels at the rate of 1K sample/s.

To accommodate the thermocouple signals, the manufacturer used the DBK84™ signal conditioning option. Three DBK84 modules expanded the system to up to 42 channels of thermocouple inputs. Noise reduction averaging was employed in the software setup to eliminate the noise induced by the automobile into the thermocouples. After



The LogBook/300 stand-alone data acquisition system, DBK34A power supply, and DBK84 thermocouple modules logged measurements from more than 40 thermocouples attached to engine components



averaging channels, stability was within 0.05°C even in the electrically noisy engine compartment.

The researchers were also pleased with the LogBook/300's optional LBK1™ handheld terminal that allowed remote monitoring and control of the LogBook/300 while the car was on the road.

After each test, technicians removed the 20-Mbyte memory PC-Card (PCMCIA) from the LogBook/300 and quickly and easily transferred the data to a laptop PC. LogView *Out-of-the-Box*™ software, included with the LogBook/300, served as a simple method to graphically view the data and save it to disk, for later analysis using any post-acquisition analysis package including Microsoft Excel.

Conclusion

With nonvolatile storage of up to 250 million samples and a removable PC-Card memory, the LogBook/300 data acquisition system provided a low-cost-per-channel and easy-to-use solution. The system's extensive signal conditioning options for many signal types including thermocouples, combined with an optional control terminal for triggering and reviewing required data, made it an effective tool for researchers measuring temperatures in the field.

The LogBook/300 collected on-the-road data that verified that the engine and its components operate according to expectations at extreme temperatures and that there are no unexpected problems: a mission critical to ensuring that the car will operate under all driving conditions satisfactorily.

LogBook/300



IOtech's LogBook/300™ data acquisition system provides high speed, low cost, and ease-of-use, without requiring a PC at your test site. The intelligent LogBook/300 executes your data acquisition applications and saves acquired data using low-cost PC-Card memory. And since you don't need a PC at the test site, you save cost, space, and avoid the threat of damage or theft to your PC.

Features

- 16-bit, 100-kHz A/D converter with digital calibration
- 16-channel analog inputs — expandable up to 256 channels
- Digital I/O, frequency I/O, and analog output expandable to over 200 channels
- Non-volatile storage of up to 250 million samples via low-cost and removable PC-Card memory
- Infinite acquisition duration by swapping PC-Cards
- Direct communication with PC via serial, parallel port, or modem if desired
- Optional control terminal for triggering & reviewing acquired data
- Signal conditioning options for strain gages, thermocouples, accelerometers, and nearly every other signal type
- AC or DC powerable
- Vehicle network interface option
- GPS option

Signal Conditioning Options

- Expansion cards and modules for high-voltage/current, strain gages, thermo-couples, isolation, relays, accelerometers, filtering, simultaneous sample & hold, vehicle network measurements, and more



LogView requires no programming or block diagram configuration

Software

- Includes LogView™ *Out-of-the-Box*™ software for easy setup, calibration, and 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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