



Forklift Truck Testing

using the LogBook/360

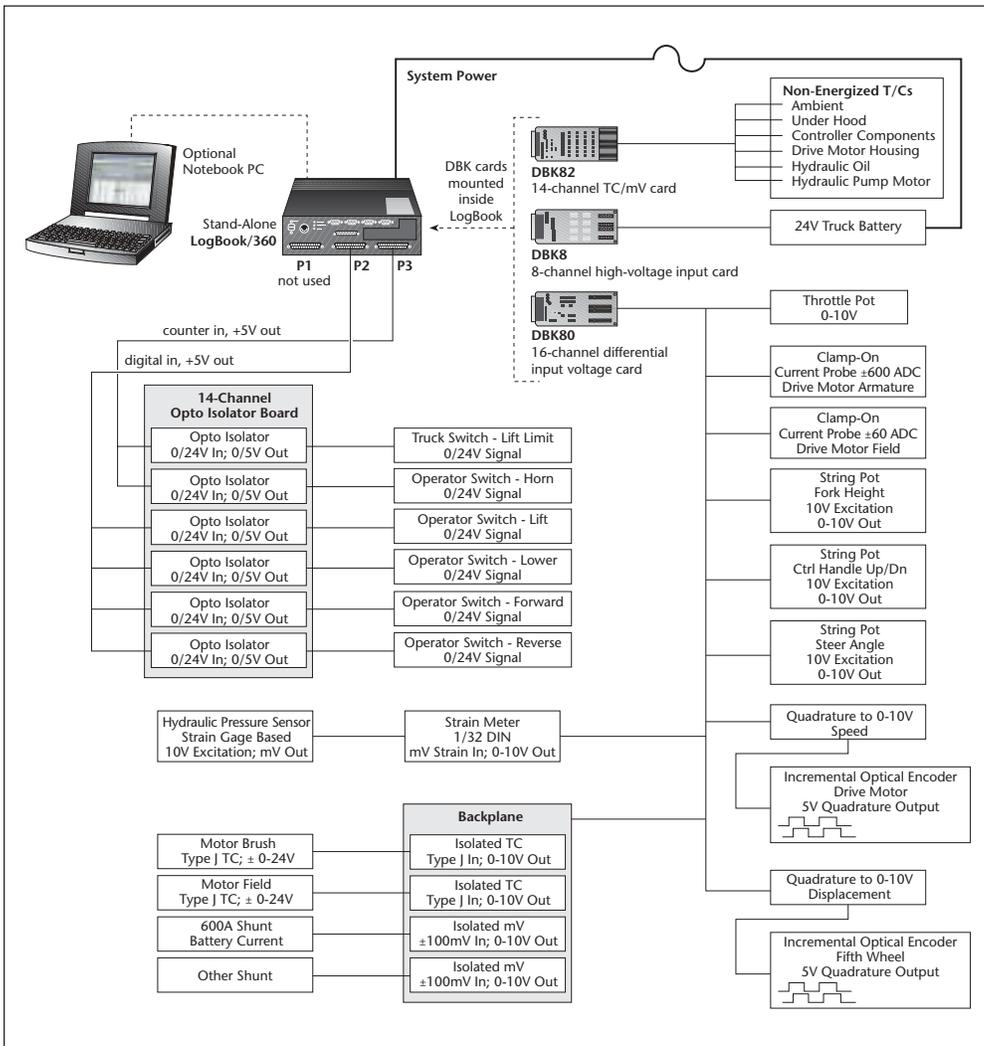
Application Note #62

Application Summary

Forklift trucks may be one of the most curious-looking vehicles around the warehouse or on the factory floor, probably because they are designed for utility and hard work, not for appearance. And to make them most useful and reliable, technical specialists spend a lot of up-front design engineering time characterizing how operators treat them.

For example, a major forklift manufacturer records critical data on both production and new prototype forklifts to get a reading on how well the truck's

components stand up to the rigors of every day use. Sometimes, this is done at a customer's site. Tests are set up to measure braking distance, speed, and acceleration under a specific duty-cycle pattern. The tests also include measuring battery consumption, a range of voltages and currents, thermocouples, hydraulic pressures, and optical rotary encoders. From the data collected, test engineers determine life expectancies for numerous components such as horns, switches, batteries, relays, and accessories, and they recommend design changes where needed.



The block functional diagram illustrates the basic setup used at the forklift manufacturer's test labs for conducting numerous daily tests. The configuration lets technicians move through different arrangements without rewiring. The LogBook can be used in stand-alone mode where no PC is present, or it can be linked to a PC via a serial port or modem for interactive data collection.

Possible Solution

During the early 1990s, the forklift manufacturer had purchased a stand-alone logger comprising some extremely robust data acquisition system modules that served well enough over the years. But recently, it was time to upgrade. The company investigated new systems that were available and assessed the cost versus the benefits of upgrading the old system. The company determined that it would cost at least 80% that of a new system to upgrade the one it was using. The company further realized that it would still be faced with the old system's limitations, such as relatively expensive training. For instance, company personnel would need to attend a two-day, off-site session to learn the new upgrade. Moreover, the old system used proprietary software that was particularly difficult to learn.

IOtech's Solution

When the forklift manufacturer investigated the new data acquisition systems that were available, it chose an IOtech LogBook/360™. Its engineers determined that when compared to the old system, the LogView™ software that comes with the LogBook is much easier to understand and use. The lab supervisor trained two technicians in just four hours, compared to the two-day training session previously needed.



The company now uses a stand-alone **LogBook/360** connected to a **DBK82™** thermocouple card, a **DBK8™** 8-channel high-voltage card, and a **DBK80™** 16-channel low-voltage card. The digital signals connect directly to the P2 and P3 ports on the LogBook. Various thermocouples interface the **DBK82** thermocouple card, including 8 type J and 6 type K. The **DBK80**, 16-channel differential input card handles all other signals, except the 24V battery that connects to the **DBK8** high-voltage card.

The encoders are incremental types. They generate a 1,000-step/revolution signal and output two clock trains, A and B, 90° out of phase with each other. Both outputs connect to two channels of the **LogBook** and provide both speed and directional information. For example, currently the technicians are performing brake testing using encoders and a 5th wheel. One encoder on the 5th wheel measures the truck position within 1/16th of an inch. The other encoder connects to the drive motor to measure its speed, and by comparing drive motor speed to ground speed, they can determine when the tires may be slipping.

The engineers find **LogBooks** easy to configure and set up to accept any kind of input. Thermocouples, low-voltage inputs, and most other sensors in the system are conditioned to provide a 0 to 10V output. In addition, the IOtech equipment has been reliable and rugged. Engineers performed a "steel test" that was conducted in and out of freezers, and the **LogBook** was strapped down to a forklift truck with no particular suspension, just solid rubber tires. Although the **LogBook** took quite a beating, the data it recorded through all the tests were more than satisfactory.

Conclusion

A major forklift manufacturer's test labs use a relatively inexpensive but complete IOtech data acquisition system to log real-time, operational variables on their trucks. The data help engineers verify current designs or determine engineering design changes that will ultimately produce a more robust vehicle. Technicians can measure up to 14 thermocouple channels

with a **LogBook/360** connected to a **DBK82** module, 8 high-voltage channels through a **DBK8** module, and 16 channels of ±10 VDC signals with a **DBK80** module. Opto-isolators interface with on/off switch signals, optical

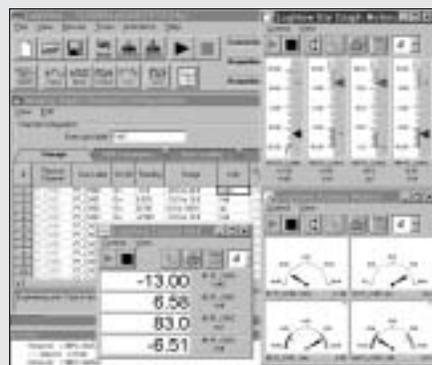
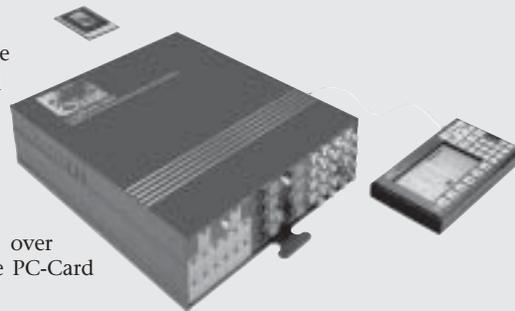
encoders provide motor and ground speed, clamp-on ammeters provide current inputs, string potentiometers provide fork height signals, and special strain-gage sensors measure hydraulic pressures.

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, 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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