

# Battery Cycle Monitors: Proving How Hard the UPS Batteries *Really* Work

A White Paper by Liebert

## SUMMARY

*Many battery vendors provide "cycle service" warranties. They rate their products to provide rated output for a certain number of discharge cycles of a specified depth. Without a means of recording the frequency and depth of power outages and discharge cycles, the user (and battery vendor) have no way to verify if the batteries have done their job per specification. Liebert supplies an internal battery cycle monitor that provides much of the functionality of external monitors provided by battery vendors.*

## Picking the right battery

The wise facilities manager is not afraid to ask, "How often do I really *need* an Uninterruptible Power System (UPS) at my site?" A few companies perform power quality surveys before purchasing a UPS, so they have a rough idea of the number of power outages and disturbances to expect in a year. But once the UPS is up and running, does anybody keep score anymore? How many 10-second brownouts has the UPS saved you from? How many 10-minute outages?

Even after deciding to purchase a UPS, the facilities manager should ask, "Have I bought the correct batteries, the correct warranty and the level of preventive maintenance appropriate for my actual battery cycling needs?" These are tougher questions. The initial power quality survey won't help you here. You need data on the actual events that cause the UPS to draw power from the batteries.

One way to collect this data is to purchase an external recording device. For example, various battery vendors sell these devices as accessories. Each brand has its unique strengths and weaknesses, with features that might not be applicable for all situations. A different way to gather the information is to have a universal monitoring system integrated into the UPS itself. So Liebert has done that.

## The Liebert Battery Cycle Monitor

The Series 600 Battery Cycle Monitor (BCM) is in the current firmware, Versions 2.2 and later, as a set of menus and screens integrated into the familiar user interface. All the information in the BCM can be recalled at the front panel of the UPS module or collected remotely through an optional modem and communications card. This feature is standard on all Series 600 UPS products shipped after October 1, 1995. It can be enhanced with the optional Temperature Sensor Kit, available factory-installed or retrofitted in the field.

## What'll it do for me?

The service life of your battery depends on the number and depth of discharge cycles it experiences. Some manufacturers have cycle service warranties which explicitly state the capabilities of each battery model. For example, a specific battery model might be warranted to provide 5,000 discharge cycles lasting 0-30 seconds but only 150 of the longer discharge cycles lasting between 4 and 15 minutes. Warranty adjustments will be based on the number and duration of discharge cycles, instead of just pro-rated over time.

The Series 600 Battery Cycle Monitor documents the cycle service of the battery. It collects and retains information on last 132 events that involved discharging the UPS battery. Each battery discharge cycle is put into one of four categories, depending on the duration of the event:

- 0-30 Seconds Discharge
- 31-90 Seconds Discharge
- 91-240 Seconds Discharge
- Over 240 Seconds Discharge.

The BCM collects and retains this information for each discharge cycle:

- System time and date
- Event Number
- Duration of cycle (seconds)
- Lowest DC Bus Voltage
- Highest DC Bus Current
- KW carried by the batteries at the start of cycle, and
- Battery Environment Ambient Temperature.

In addition, the BCM retains summary information on the total number of events, the cumulative ampere hours and the total discharge time since a given date.

Up to 132 discharge cycle events can be stored at any given time. When the buffer approaches its capacity, a warning message is broadcast via terminal and modem communication channels and a complete listing of all records (in order of occurrence) is sent to the terminal port. If a serial printer is attached to the terminal port, the operator can print a hard copy of the report. If a printer is not available, a terminal emulation program can capture the report to disk for later review or printing. Once the buffer is filled, new data will replace the old on a First In, First Out basis as new cycles occur.

To view the BCM information, go to the System Status screen. On Version 2.2 and later firmware, the bottom line on the screen will be the Battery Cycle Monitor selection. Choosing the BCM option brings you to the next screen, shown in Figure 1. Now you can select either the Battery Cycle Monitoring Summary screen or one of four screens showing detailed information on any one of the four categories of discharge (0-30 seconds, 31-90 seconds, 91-240 seconds and Over 240 seconds).

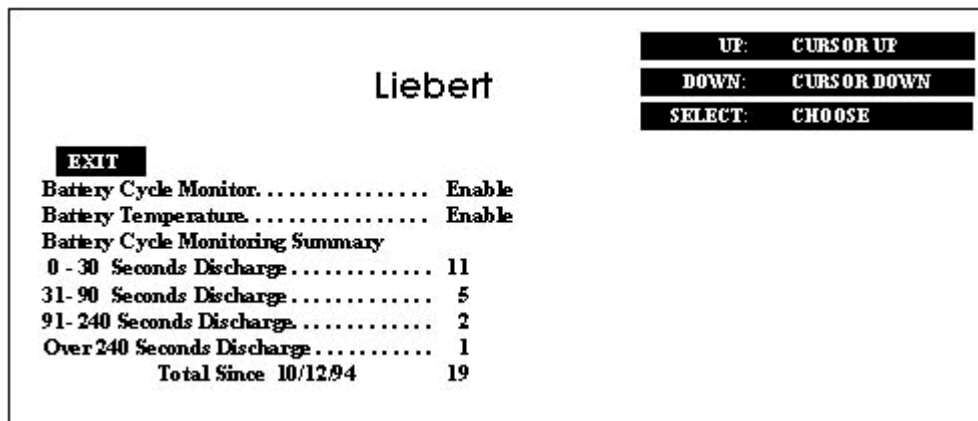


Figure 1. Battery Cycle Monitor screen

The Summary screen (Figure 2) ordinarily shows Total Number of Discharge Cycles, Accumulated Battery Time, Accumulated Battery Amp Hours, Accumulated Battery Kilowatt Hours and the current temperature at the spot where you have positioned the optional Battery Temperature Sensor. During a battery discharge event, the screen changes to show information about the current discharge cycle. The screen displays Active Cycle Time in place of Accumulated Battery Time and substitutes Active Battery AH and Active Battery KWH for their accumulated counterparts.

**NOTE:**

The optional Temperature Sensor Kit includes one thermistor, which can be mounted at any location you choose -- inside a battery cabinet, alongside a battery rack, even on the wall or ceiling of the battery room. For applications which need to monitor more than a single spot temperature, the Liebert *SiteScan* product provides an additional dimension of functionality. See *SiteScan* brochures for details.

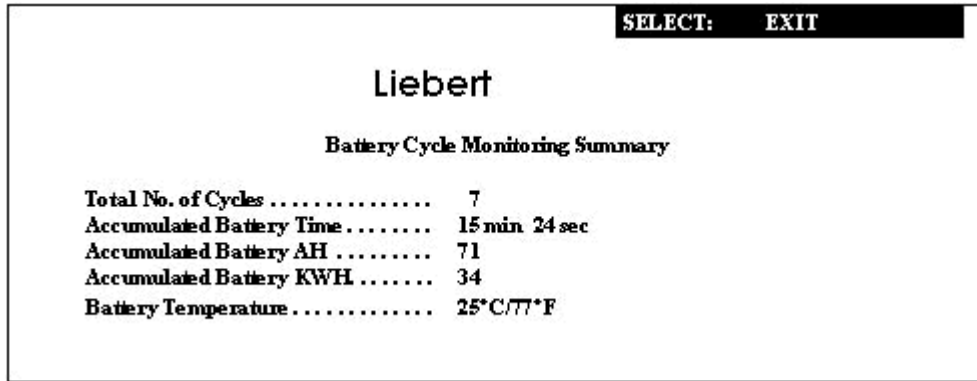


Figure 2. Battery Cycle Monitoring Summary screen

Figure 3 shows a typical detail screen for the 91-240 Seconds Discharge category. This information can also be collected remotely, through the optional communications board and modem, by a remote terminal or a personal computer equipped with a modem and communications program. See our Operations and Maintenance Manual for information on polling the Series 600 remotely.

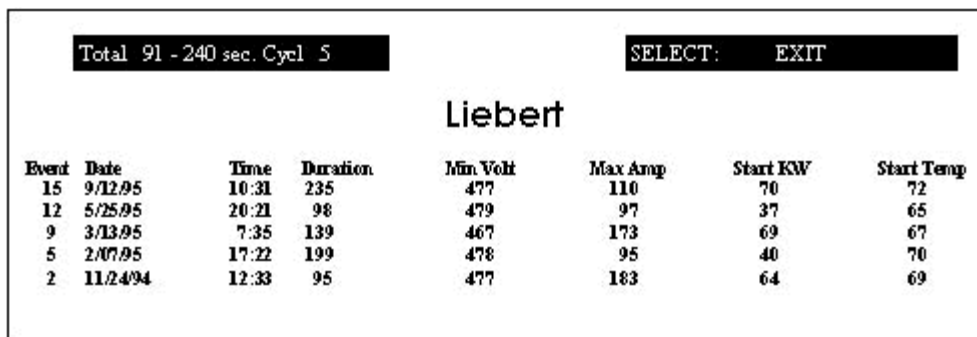


Figure 3. Typical data on discharge cycles of 91 to 240 seconds duration during the recording period. Battery temperature readings require the Battery Temperature Sensor kit.

### How do I use the information?

The whole point of this data is to show how hard your batteries are working. If your batteries are experiencing more (or deeper) discharge cycles than anticipated, your cycle service warranty may not last as long as planned. True, it isn't good news, but this knowledge makes it easier to justify getting beefier cells when it's time to replace or expand the system. Conversely, if discharge activity is less than or about the same as forecasted, you can prove it to the battery manufacturer's satisfaction.

We recommend checking information on the screen of the UPS every few weeks, to see if there's been any change in the pattern of discharge cycles. We also recommend calling the UPS monthly (or at least quarterly) and downloading the historical information. This data can then be imported into any of the major spreadsheet programs and analyzed for trends. The downloaded information will be required to support the battery vendors' cycle service warranties.

### How does the Liebert BCM compare to external units?

The external battery cycle monitors sold by battery vendors are designed to provide the specific information needed to evaluate warranty eligibility. They typically plug into a standard 120 VAC wall outlet and have an internal battery to protect the memory during power outages. They sense battery voltage, current flow and the presence of the 120 VAC input power. They take note of any excursion outside of the preset float voltage range, whether due to a discharge event or faulty battery charge voltage regulation. They also sense ambient temperature at the monitor. By contrast, the Liebert BCM primarily concerns itself with discharge events and not the efficacy of the charging circuit. And the Liebert BCM, when equipped with the optional Temperature Sensor Kit, records temperature at the batteries.

Now the peculiarities. For starters, some vendors' sensor cables must be a specific length, limiting the unit to a location within 25 feet of the battery. This is fine for a battery cabinet attached to the side of the UPS, but less convenient when the cells are on racks in the next room. Second, some vendors recommend plugging their BCM into a power source that is *not* protected by the UPS; otherwise their BCM has no way of telling when there's a power outage. Third, if you do as they recommend and there's an outage, their monitors go into the minimalist mode. The battery keeps the historical data intact, but the unit is dead to the outside world; you cannot access any of the information until power is restored to its 120 VAC outlet. Fourth, the information collected by their devices tends to be more summarized and less detailed than the Liebert version. Fifth, the display screen on the external units are tiny by comparison to the monitor screen on the Liebert Series 600 UPS.

The Series 600 BCM, by comparison, has the advantage of being designed into our specific UPS. You can walk right up to the front of the UPS and use its 80-character by 25-line LCD screen and pushbutton controls. Our BCM works normally during power outages, backed up by the same internal battery that supports the other Series 600 microprocessor controls. And since it's built in, it can use the UPS's modem and phone jack.

### **Is the Liebert BCM acceptable to the battery vendors?**

Most major battery manufacturers accept the Liebert BCM as providing sufficient documentation to validate their cycle service warranties. We have received approval from Johnson Controls, Yuasa/Exide and C&D. However, this approval is generally conditional upon having the optional temperature sensor kit. For this reason, we recommend ordering the sensor kit interface to be factory installed for all systems with rack-mounted batteries. Furthermore, the customer needs to periodically record or download the information from the Liebert BCM onto a permanent paper report, as explained earlier. *Note: The temperature-sensor interface PWA can be installed at the factory. However, the actual sensor unit will need to be installed in the battery room at the site, with 2-conductor wire supplied by the installing contractor.*

### **How do I buy it?**

If you purchased a Series 600 UPS after January 1996, you already have the BCM in firmware. Walk up to your Series 600 and select the SYSTEM CONFIGURATION screen. On the right side of the screen, just above the copyright notice, you will see VERSION XX. The BCM is part of Version 2.2 and higher. Now check out your SYSTEM STATUS screen. If you have Version 2.2 or later, the Battery Cycle Monitor should be one of your choices at the bottom of this screen. If not, don't despair. Early shipments of Version 2.2 did not have the BCM activated, since it was an extra-cost feature at that time. Ask your Liebert sales representative or applications engineer for instructions on activating the BCM. The procedure isn't complicated, but requires opening the front door of the UPS for access to the interlock button.

If you have Version 2.1, upgrading to Version 2.2 is a matter of changing out the ROM chips -- not difficult, but your Liebert Global Services Customer Engineer will need to put the UPS to bypass to make the swap. If you have version 2.0 or below, you need a new micro monitor board. The earlier micro board is part number 02-790870-00. The current micro board is 02-790870-10, often referred to as the "dash ten" board. You might also need to change out the display driver PWA, which plugs into the micro board. The part number for the Temperature Sensor Kit is 83-791212-00.

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