

Battery Testing



Battery-Powered Medical Devices Workshop: Challenges and Opportunities



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Foreword

“Battery maintenance is one of the top ten problems faced by today’s Biomedical Engineers” according to



March/Apr. 2011 issue of Biomedical Instrumentation and Technology



Picture Source: Ottawa Heart Institute., T. Zakutney & M. Cleland, Batteries & Medical Devices, 2005

Centralized Battery Testing & Management

- Battery gets treated like a medical device
 - Tagging & tracking battery data/serial number, supplier information
- Hospital does not use mandatory replacement based on date-stamp alone
 - *Batteries can last longer*
- Routine testing at preventative maintenance keeps all batteries at acceptable state-of-health



Picture Source: Ottawa Heart Institute., T. Zakutney & M. Cleland, Batteries & Medical Devices, 2005

Battery Testing for Quality Assurance

Not All New Batteries Perform

6V 4Ah (C/20) VRLA gel used in a portable infusion pump – minimum pump runtime battery must be at least **85% of design capacity**.



12 New Batteries – Battery Capacity

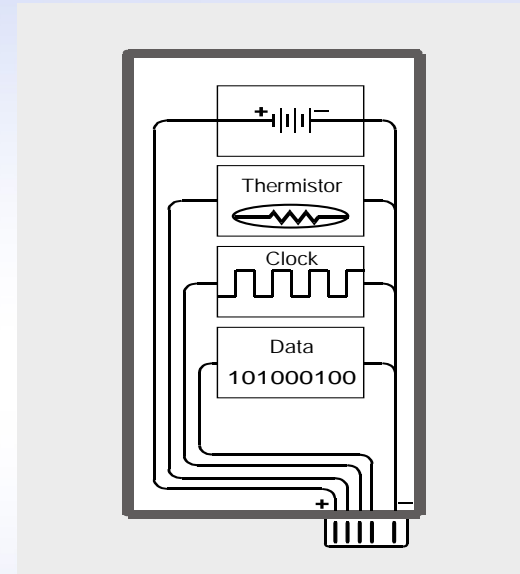
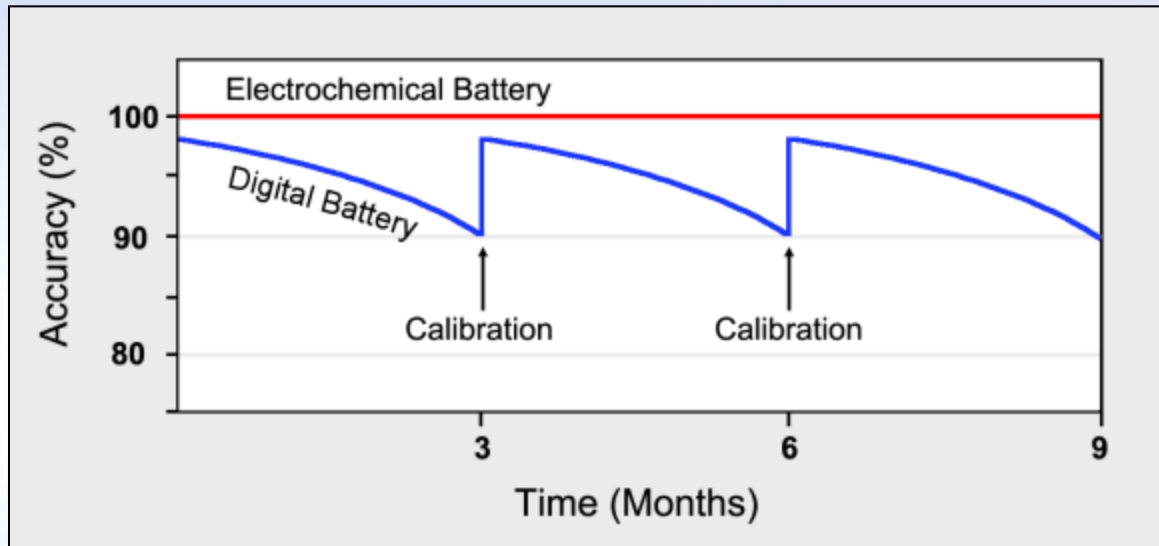
| ID# | Cap % | Fault Code | ID# | Cap % | Fault Code |
|---------|-------|------------|---------|-------|------------|
| A041152 | 119% | N/A | FL#40 | 117% | N/A |
| A041327 | 117% | N/A | A040597 | 105% | N/A |
| A040517 | 126% | N/A | A040537 | 90% | N/A |
| A040543 | 117% | N/A | A040530 | 95% | N/A |
| FL#18 | 114% | N/A | A040541 | 106% | N/A |
| A040518 | 76% | 116 | A040965 | 110% | N/A |



Low Capacity

Battery Testing for Smart Batteries

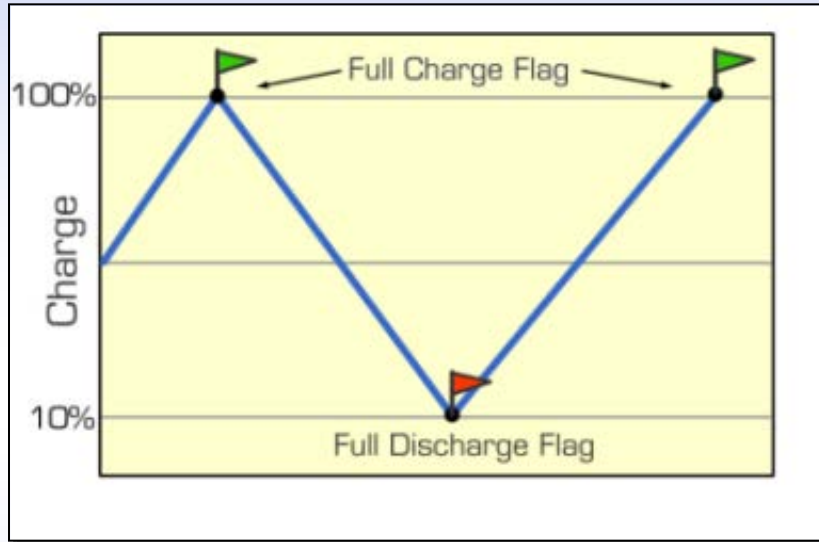
Compliance & Calibration



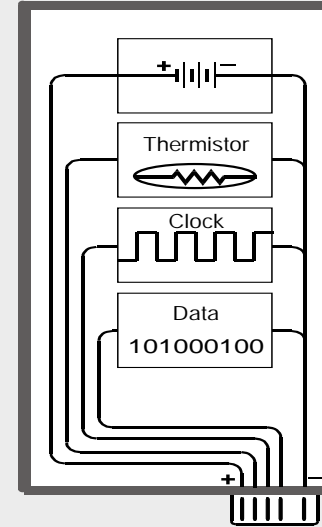
- With time the electrochemical and digital battery drift apart. Calibration or learning corrects the error
- Assessing the digital battery is relatively simple, but the truth lies in the electrochemical battery

Battery Testing for Smart Batteries

Compliance & Calibration



Calibration sets electronic flags



- Apply a full charge/discharge/charge cycle in the equipment or on a battery analyzer. Repeat every 3 months or after 40 partial cycles
- Impedance tracking may reduce the need for calibration. Non-calibrated smart battery will still work but provide false SoC readings

Battery Testing for Smart Batteries

Compliance & Calibration

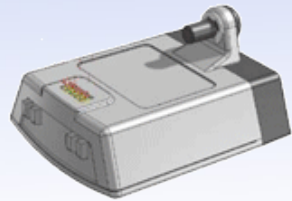
- Apple smartphones show 100% charge when the battery is only 90% charged. Aging will add 20-30% to the error
- Engineers at a SAE meeting remarked: “SoC readings on new EV battery modules can be off by 15%”
- EV owners have run out of battery power with the fuel gauge still reading at 25%
- “Impedance Tracking” provides improvements, but no method is perfect



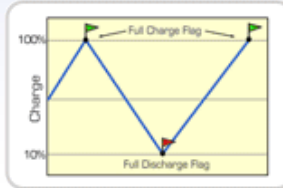
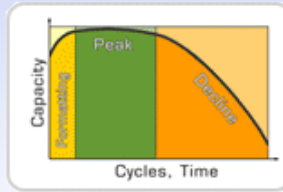
Battery SoC and SoH estimations are complex.

Battery Testing for Smart Batteries

Calibration & Asset Tracking



Medical Device Battery

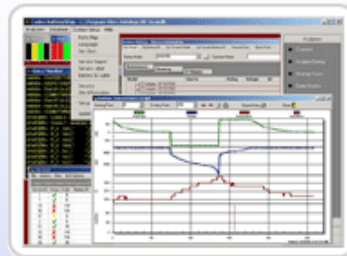


- Battery capacity fades over time

- Even the latest battery fuel gauges require calibration



C7400ER-D



Wired/Wireless Network

Send/Receive Data

Hospital



Software Cloud
Operational
Management System

Battery tester calibrates the battery,
captures SMBus data and adds a
measured battery capacity =
Performance Validation

Battery = Asset

- Device Usage
- Preventative Maintenance

Medical Device Battery Testing

The Bottom line

- **Compliance**
Equipment state-of-readiness & reliability including the battery
- **Continuity of Care**
Removes risk related to untested batteries
- **Cost**
Battery testing saves money



Battery Tester

Thank you!



www.BatteryUniversity.com
Educational website