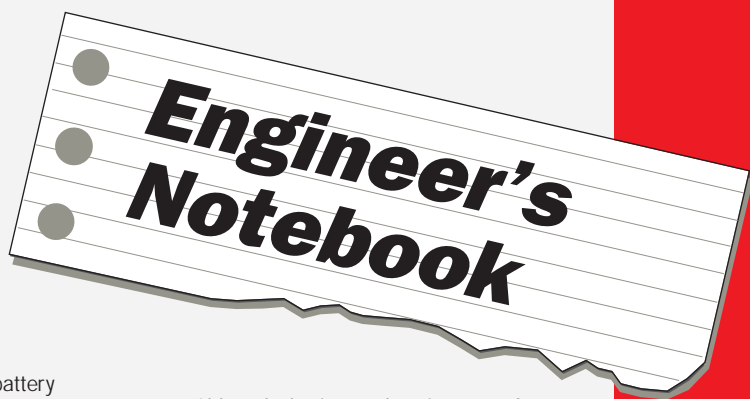


Testing Batteries without Fuss

All-power-all-the-time computer environments demand UPS battery testing without interruption



Industries that rely on uninterruptible power supply (UPS) units increasingly rely on battery testers to keep tabs on battery supply. Some battery manufacturers have adopted battery testers as standard equipment for follow-up maintenance service.

UPS systems increasingly are installed in facilities where equipment cannot be allowed to stop operating due to a power failure or maintenance. One new way to test secondary battery performance while keeping the UPS on-line is to check its internal resistance. The internal resistance of a secondary battery is measured with low-resistance measurement techniques.

Reasons to Use a Battery Tester

Battery testers offer the following advantages to users:

1. The battery in a UPS can be checked without shutting down the power line. This is essential for UPS units used in hospitals, computing facilities, telecom companies, and financial institutions where power interruptions can be disastrous.
2. High-performance battery testers can perform battery checks and report the results without intricate operation. The latest testers feature an internal memory function that retains the measurement values and results. In some cases, more than 200 pieces of data can be stored—enough capacity to sufficiently cover one UPS unit. The data can also be printed along with statistics using a tester's printer or commercial standard printer.
3. Battery testers are easy to use. Users not familiar with measuring instruments can use battery testers with ease. Battery testers show results using a three-rank LED lamp and audible beeping if the comparison threshold values are input in advance. The three-rank lamp evaluates the battery state at either Pass, Warning or Fail. The comparison threshold values

to input depend on the battery manufacturer and type.

Besides internal resistance and voltage, today's battery testers can also measure battery temperature. The operational life of a battery varies greatly depending on the environmental conditions, making it essential to measure the temperature of a battery in order to understand its state.

Secondary Battery

A secondary battery is one that can be used repeatedly after recharging and differs from primary batteries, such as manganese dry cells, that cannot be used anymore once they are discharged. Another distinction of secondary batteries from primary batteries is that secondary batteries are capable of discharging large current; as a result, they are used for equipment that requires large current. Typically secondary batteries are lead-acid batteries and nickel cadmium (Ni-Cd) batteries. However, in order to address environmental concerns and the need for batteries that can power smaller devices for longer periods for time, new nickel metal hydride (Ni-MH) and lithium ion (Li-ion) batteries were developed and put into use. These batteries are smaller, provide a large capacity, and pose little danger of polluting the environment.

Checking Battery Deterioration

There are basically two general methods for checking battery deterioration: the charging/discharging test method, and the internal-resistance measuring method. Each method has strengths and weaknesses.

The charging/discharging test method is capable of accurately measuring the discharge capacity of the battery but requires a considerable amount of time. There are two methods for conducting this type of testing: discharging a fully charged battery until it is completely discharged and discharging a fully charged battery for a few minutes and then using that information to estimate when the battery will be fully discharged. Measuring the internal resistance evaluates the deterioration of the battery on the basis of the correlation between the measured internal resistance and the discharge capacity of the battery. Research indicates a correlation between a decrease in a secondary battery's capacity and increase in its internal resistance.

Although the internal resistance of secondary batteries varies according to battery type and its capacity, the figure generally ranges from several milliohms to several hundred ohms. For secondary batteries, internal resistance is measured by applying a constant alternating current to avoid any effects from the DC voltage generated by the second battery. This method is called the ac four-terminal method and is distinguished from the DC four-terminal method in which direct current is applied.

In resistance measurement, the four-terminal method is used to measure items, such as batteries, with very low resistance. The AC four-terminal method is a popular one. The input impedance of the voltmeter is large. Therefore, practically no test current flows to the voltmeter. As a result, it is possible to measure the resistance of the subject only, with the lead resistance and the contact resistance excluded.

Although the accuracy of the measured results suffers somewhat, the internal-resistance test can be conducted very quickly, and the test equipment can be fairly small.

Voltage and Temperature Measurement

Voltage measurement is performed simultaneously with the measurement of specific gravity during maintenance for lead storage batteries and alkaline storage batteries. If the voltage is extremely low, the battery may be damaged (it may have an internal short circuit). If the voltage is high, it is possible that a charger or another battery connected in series with the battery in question could suffer damage.

Temperature measurement is important for two reasons. One: Because the internal resistance changes according to the temperature. This allows workers to use the temperature of the electrolytic solution to determine the extent of battery deterioration. The second reason is to discover damaged batteries. A battery with an internal short circuit will reveal itself by heating up when it is charged.

Material for this article contributed by Hioki USA Corp., manufacturer of the 3550 series of internal-resistance battery testers.

Battery Testing

Hioki Battery Capacity Testers

Check battery condition in seconds with the battery in service

B

- Test Condition Without Shutting Down Battery
- Simultaneously Measure Battery Resistance, Voltage, Temperature (24125E/24127E only)
- Compare Against Recalled or Entered Values
- Rates Conditions as Pass, Warning, or Fail
- Memory Function Stores Test Results (24125E/24127E only)
- Three Models Available for Testing High-, Medium-, and Low-Capacity Batteries
- Complete Selection of Accessories, Including Portable Digital Printer
- Compact and Lightweight

The 3551 allows you to print statistics, histograms, and graphs for each resistance, voltage, and temperature value stored



These testers check sealed batteries used in demanding electronic and industrial electric applications. They're critical for determining whether a battery will continue to hold a charge or has a short circuit that could overheat the battery or cause a fire. Whether you're testing batteries in a process manufacturing plant, a hospital, or refinery—or checking the batteries in your maintenance staff's cell phones or pagers—these will do the job.

Specifications and Ordering Information

Mfg#	3550	3551	3555
Battery Types Tested:	Medium Capacity alkali and lead-acid	High Capacity alkali and lead-acid	Compact storage batteries
Battery Capacity:	0 to 500 AH	0 to 12,000 AH	0 to 200 AH
Resistance Ranges:	30 mΩ, 300 mΩ, 3Ω	3 mΩ, 30 mΩ, 300 mΩ	300 mΩ, 3Ω, 30Ω
Resolution:	10 μΩ, 100 μΩ, 1 mΩ	1 μΩ, 10 μΩ, 100 μΩ	100 μΩ, 1 mΩ, 10 mΩ
Accuracy:		0.8% rdg 6 digits, 30 mΩ thru 30Ω ranges; 1.0% rdg 8 digits, 3 mΩ range	
Measurement Current:	50 mA, 5 mA, 500A	50 mA, 50 mA, 5 mA	5 mA, 500A, 50A
Frequency:		1 kHz ±30 Hz	
Accuracy:		±10%	
Voltage Measurement:		3V, 30V	
Resolution/Accuracy:		1 mV, 10 mV/0.1% rdg ±6 digits	
Temperature Measurement:		-10 to +60°C	
Resolution/Accuracy:		0.1°C/±0.5% rdg ±10 digits	N/A
Comparator Settings:		Resistance upper and lower limits, voltage lower limit	
Memory:	10 sets of values	99 sets of values	10 sets of values
Data Memory:	260 data sets	250 data sets	N/A
Maximum Input Voltage:	50 VDC	60 VDC	50 VDC
Power Supply:		Six LR6 alkaline batteries	
Size (HWD):	5.12 x 1.97 x 7.72" (130 x 50 x 196 mm)	5.12 x 2.56 x 7.72" (130 x 65 x 196 mm)	5.12 x 1.97 x 7.72" (130 x 50 x 196 mm)
Weight w/Batteries:	1.56 lbs (710g)	1.89 lbs (860g)	1.5 lbs (680g)
Order #	MP24125E	MP24127E	MP24129E
Price			

Accessories

Order #	Mfg #	Description	Price
MP24132E-1	9287	Optional Clip Leads for 24129E	
MP24132E-2	9460	Optional Clip Leads with Temperature Sensor for 24127E	
MP24132E-3	9467	Optional Large-Clip Leads for 24125E	
MP24132E-5	9418-10	Optional AC Adapter for 24127E	
MP24132E-7	9203	Optional Digital Printer for 24125E/24127E	
MP24132E-9	9425	Optional Connecting Cable for Digital Printer (use with 24132E-13)	
MP24132E-11	9233	Optional Recording Paper for Digital Printer	
MP24132E-13	PI115A-C	Optional Centronics-to-RS-232 Converter Box (requires 24132E-9)	

Each 24125E Includes: Clip-type leads with temperature sensor, carrying case, dust cover, and operating instructions.

Each 24127E Includes: Pin-type leads, remote control switch, carrying case, dust cover, and operating instructions.

Each 24129E Includes: Pin-type leads and operating instructions.

Storage Battery Systems Digital Hydrometers

- Measures Lead Acid Battery Specific Gravity of SG Temperature and Voltage
- Digital Readout
- Cut Battery Testing Time in Half (2-Second Response)
- Automatic Temperature Compensation to 25°C (77°F)

The SBS-1001 Digital Hydrometer sets you free from the ordinary nuisance of battery testing, with a digital readout of the electrolyte's specific gravity, temperature, and cell voltage for lead acid batteries.

Simply insert the sensor tip into battery electrolyte or pump into bulb. The specific gravity shows up instantly in bright LED numbers, adjusted at 25°C. It also indicates both voltage and acid temperature in digits. Data logger option logs the SG, voltage, and temperature of up to 50,000 batteries. Data can be viewed, printed, saved to disk, or exported to ASCII file.

Each Kit Includes: Hydrometer, test leads, sensor, sensor adjustment tool, 9V alkaline battery, and carrying case.

SBS-1001B Also Includes bulb option

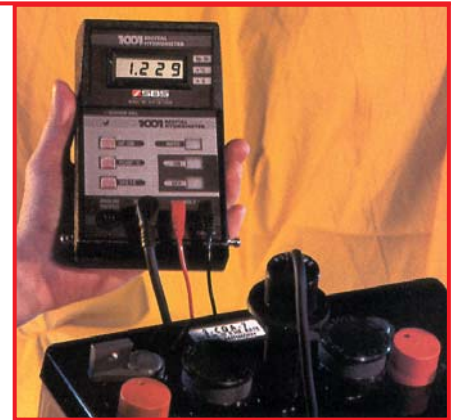
DL-1000 Includes: Software and interface cable - Windows™ compatible

1001HOLBP Includes: Carrying holster, dualbattery pack, and charger.

Ordering Information

Order #	Mfg #	Description	Price
MPSBS-1001	SBS-1001	Digital Hydrometer	
MPSBS-1001B	SBS-1001B	Bulb Digital Hydrometer	
MPBULB1	BULB1	Bulb Option for SBS-1001	
MPDL-1000	PDL-1000	Data Logger and Software	
MP1001HOLBP	1001HOLBP	Holster with Extended Run Time Battery, Charger, & Case	

SBS-1001 ▶



Specifications

Sensor:	Sensor probe dia: 0.9" (23 mm) fits into vent well of most stationary or motive power batteries (bulb screws on to allow use with any type lead acid battery!)
Method of Detection:	Specific gravity: optics, temp: silicon diode resistance
Indicator:	LCD digital indicator
Measurement Range	
Specific Gravity:	1.050 to 1.350
Acid Temp.:	10°C to 50°C
Voltage:	19.99V
Accuracy	
Specific Gravity:	±0.003
Acid Temp.:	±1°C (0–40°C)
Voltage:	±0.01V
Power Supply:	DC 9V alkaline or manganese dry battery
Size:	7.5 x 4 x 2.25" HWD (190 x 101 x 57 mm)
Sensor Size:	7" L x 0.9" D (182 x 23 mm) (Bulb 1/8" x4")

Storage Battery Systems Digital Hydrometers

- 5 Times Faster than Conventional Methods
- Measures Specific Gravity and Temperature
- Automatically Temperature Compensated to 25°C (77°F)

Battery testing has never been this easy. Simply insert the nozzle into the battery, depress the finger pump, and extract a few drops of Sulfuric Acid (H₂SO₄) electrolyte. Touch one button and the processor does the rest. Within three seconds you have an accurate reading of specific gravity and temperature.

Each SBS-2002 Includes: Sampling tube, 9V alkaline batteries, case, and instructions.

SBS-2002 ▶



Specifications

Method of Detection:	Specific gravity; light refraction system
Temperature:	Platinum membrane thermal sensor
Range:	1–1.300
Indicator:	LCD display; temperature (inside sample)
Accuracy:	±0.002/±0.005
Temperature:	(10–30°C)/(-10 to 10°C and 30 to 50°C)
Measuring Time:	Within 4 secs after pushing "START" button
Power Supply:	DC 9V alkaline or manganese dry battery
Size:	2.95 x 1.81 x 8.66" HWD (7.5 x 4.6 x 22 cm)
Suction Nozzle:	Approx. 7.8" L (20 cm)

Don't forget to order the protective holster.

Ordering Information

Order #	Mfg #	Description	Price
MPSBS-2002	SBS-2002	Digital Hydrometer	
MPSBSHOL	SBSHOL	Holster for SBS-2002	

B

Electrical Test Instruments