

H500, SA2500, H600, SA2600, RF Scout, Y400 and Y350C Lithium-Ion Battery Maintenance

Instructions

www.tektronix.com



071-3117-00

Tektronix

Copyright © Tektronix. All rights reserved. Licensed software products are owned by Tektronix or its subsidiaries or suppliers, and are protected by national copyright laws and international treaty provisions.

Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specifications and price change privileges reserved.

TEKTRONIX and TEK are registered trademarks of Tektronix, Inc.

Contacting Tektronix

Tektronix, Inc.
14150 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Lithium-Ion battery maintenance overview

Lithium-Ion rechargeable batteries require routine maintenance and care in their use and handling. Read and follow the information in this document to safely use Lithium-Ion batteries and achieve the maximum battery life span.

This document covers Lithium-Ion batteries used in the following products:

H500	SA2500	H600	SA2600	Y400-based instruments (Y400 + YBT250 module and/or YBA250 module)	Y350C-based instruments (Y350C + YBT250 module and/or YBA250 module)
------	--------	------	--------	--	--

Key information

Use only Tektronix-approved batteries in your Tektronix products.

Do not leave batteries unused for extended periods of time, either in the product or in storage. When a battery has not been used for six months, check the charge status and charge or dispose of the battery as appropriate.

The typical estimated life of a Lithium-Ion battery is about two to three years or 300 to 500 charge cycles, whichever occurs first. One charge cycle is a period of use from fully charged, to fully discharged, and fully recharged again. Use a two to three year life expectancy for batteries that do not run through complete charge cycles.

Rechargeable Lithium-Ion batteries have a limited life and will gradually lose their capacity to hold a charge. This loss of capacity (aging) is irreversible. As the battery loses capacity, the length of time it will power the product (run time) decreases.

Lithium-Ion batteries continue to slowly discharge (self-discharge) when not in use or while in storage. Routinely check the battery's charge status. The product user manual typically includes information on how to check battery status, as well as battery charging instructions. The latest product manuals are available at www.tektronix.com/manuals.

Battery maintenance

- Observe and note the run time that a new fully-charged battery provides for powering your product. Use this new battery run time as a basis to compare run times for older batteries. The run time of your battery will vary depending on the product's configuration and the applications that you run.
- Routinely check the battery's charge status.
- Carefully monitor batteries that are approaching the end of their estimated life.
- Consider replacing the battery with a new one if you note either of the following conditions:
 - The battery run time drops below about 80% of the original run time.
 - The battery charge time increases significantly.

Charging

Always follow the charging instructions provided with your product. Refer to your product's user manual and/or online help for detailed information about charging its battery. The latest version of your Tektronix product user manual is available at www.tektronix.com.

NOTE. *When you troubleshoot battery issues for dual battery configurations, test one battery and one battery slot at a time. A defective battery can prevent the battery in the opposite slot from charging, leaving you with two uncharged batteries.*

Storage

- Charge or discharge the battery to approximately 50% of capacity before storage.
- Remove the battery and store it separately from the product.
- Store the battery at temperatures between 5 °C and 20 °C (41 °F and 68 °F).
- Charge the battery to approximately 50% of capacity at least once every six months.

NOTE. *The battery self-discharges during storage. Higher temperatures (above 20 °C or 68 °F) reduce the battery storage life.*



CAUTION. *If a battery is stored or otherwise unused for an extended period without following these instructions, and the battery has no charge remaining when you check it, consider it to be damaged. Do not attempt to recharge it or to use it. Replace it with a new battery.*

Handling precautions

- Do not disassemble, open, crush, bend, deform, puncture, or shred a battery.
- Do not drop a battery or expose the battery to excessive shock or vibration.
- Do not short circuit a battery or allow metallic or conductive objects to contact the battery terminals.
- Do not dispose of a battery in fire or water.
- Do not use the battery to power any devices other than the instrument for which it was designed.
- Keep the battery away from personnel that are not trained to use the instrument.
- Do not expose a battery to temperatures above 60 °C (140 °F).
- Keep the battery away from children.
- Do not use a damaged battery.
- If a battery pack is leaking fluids, do not touch any fluids. Properly dispose of a leaking battery pack (see *Disposal and Recycling* in this document).



WARNING. *In case of eye contact with battery fluids, do not rub eyes. Immediately flush eyes thoroughly with water for at least 15 minutes, lifting upper and lower lids, until no evidence of the fluid remains. Seek medical attention.*

Transportation

The capacity of the Lithium-Ion rechargeable battery pack in this product is under 100 Wh. The lithium equivalent content has been shown to meet the applicable requirements as defined by the UN Manual of Tests and Criteria Part III Subsection 38.3.

- Always check all applicable local, national, and international regulations before transporting a Lithium-Ion battery.
- Transporting an end-of-life, damaged, or recalled battery may, in certain cases, be specifically limited or prohibited.
- The battery pack must be adequately protected against short-circuit or damage during transport.

Disposal and recycling

- Lithium-Ion batteries are subject to disposal and recycling regulations that vary by country and region. Always check and follow your applicable regulations before disposing of any battery. Contact Rechargeable Battery Recycling Corporation (www.rbrcc.org) for U.S.A. and Canada, or your local battery recycling organization.
- Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles.
- Place only discharged batteries in a battery collection container. Use electrical tape or other approved covering over the battery connection points to prevent short circuits.



This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2002/96/EC and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

H500, SA2500, H600, SA2600, RF Scout, Y400 and Y350C-specific battery maintenance

Instrument run time

The instrument run time depends on power consumption, which in turn depends on the instrument measurement mode. For example, DPX™ Spectrum Display, Spectrum analyzer, and audio demodulation measurements consume more power than other measurements because they are continuously acquiring data.

With two new, fully charged batteries, you can run the DPX Spectrum Display measurement for approximately four hours, or the Spectrum analyzer measurement for five to six hours. Both of these run times are with the instrument power management mode disabled. Enabling instrument power management increases the instrument run time.

Battery aging and the increasing number of charge/discharge cycles causes the battery charge capacity to decrease, which in turn decreases the instrument run time.

The instrument uses one battery at a time. The battery with the lowest remaining capacity is used first.

Battery charge time

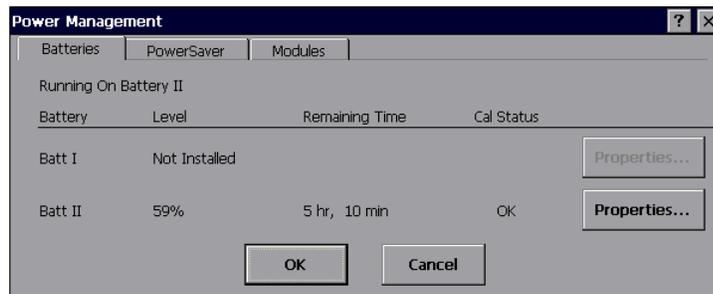
With the instrument powered on, it can take more than 20 hours to fully charge two batteries from a fully discharged state. The exact charge time depends on which measurements are running. When the instrument is powered off, it will take about 10 hours to fully charge two batteries.

Checking the battery charge status

1. Double-tap the **Power Management** icon in the system tray to open the **Power Management** dialog box. The system tray shows the battery icon when the instrument is operating from batteries, and a power plug icon when the instrument is operating from an external power supply.



2. Tap the **Batteries** tab. This tab shows the charge level of each battery, the estimated remaining run time for the in-use battery (with the current measurement settings), and the battery calibration status. The instrument uses one battery at a time: the battery with the lowest remaining capacity is used first.



Each battery contains circuitry that monitors the charge level and estimated remaining run time. This circuit becomes uncalibrated after a number of partial discharge and charge cycles. When the Cal Status is **Uncalibrated**, the reported level and remaining time are not accurate, which means that the battery is not calibrated. See the *Calibrating a Battery* section in this document.

3. Tap the **Properties** button adjacent to a battery listing to show that battery's Design Capacity, Serial Number and the Manufacturer Date. Use the serial number to identify and keep track of each battery's charge and capacity history.



Calibrating a battery

To calibrate a battery, you must first fully charge, then fully discharge, and finally fully charge the battery to reset the internal battery monitoring circuitry.

Fully charging a battery.

NOTE. *During charging, keep the instrument environment temperature between 0 °C and 45 °C (32 °F and 113 °F), and the relative humidity between 0% and 80%.*

1. Install the single battery that you want to charge.
2. Connect the external power adaptor, but do not power up the instrument. The BATTERIES CHARGER LED on the front panel should be lit, indicating that the instrument is charging the battery. If the BATTERIES CHARGER LED on the front panel is not lit, check the following:
 - The external power adaptor plug is fully seated in the instrument external power connector
 - There is power being supplied to the external power adaptor
 - The battery is fully seated in the instrument battery compartment
3. When the battery is fully charged, the BATTERIES CHARGER LED on the front panel turns off.
4. Power on the instrument and double-tap the **Power Management** icon in the system tray.
5. Verify that the Level field shows **Fully Charged** for the installed battery.

Fully discharging a battery.

NOTE. During battery discharge, keep the instrument environment temperature between $-10\text{ }^{\circ}\text{C}$ and $50\text{ }^{\circ}\text{C}$ ($14\text{ }^{\circ}\text{F}$ and $122\text{ }^{\circ}\text{F}$), and the relative humidity between 0% and 80%.

1. Disconnect the external power adaptor.
2. Install the single battery that you want to discharge.
3. Power on the instrument and a measurement application.
4. Double-tap the **Power Management** icon in the system tray.
5. Tap the **Power Saver** tab and select **No Power Saver actions**.
6. Set the instrument to a high-power-consumption measurement (such as DPX Spectrum for the H500, SA2500, H600, SA2600, or Audio Demod for the RF Scout or Y400 with a YBT250 module).
7. Let the instrument and measurement run. The instrument automatically shuts down when the battery is fully discharged. The battery is now completely discharged.

When to replace a battery

Record the date, battery serial number, charge time and run time when you start using a new instrument, or when you install new batteries. Set up a schedule to check and record the battery charge and calibration status. See the *Checking the Battery Charge Status* section in this document.

Compare the charge time and instrument run times with those for new batteries at least every six months. When any of the following behaviors occur, you should consider replacing your batteries:

- It takes significantly longer (>150%) to charge used batteries than it does to charge new batteries.
- The BATTERIES CHARGER LED on the front panel does not stay on continuously while the batteries are charging.
- After the battery is fully charged, the instrument run time is significantly shorter (<80%) with older fully-charged batteries than it is with new batteries.
- A charge cycle never completes.
- The Power Management Batteries tab does not show a **Fully Charged** status after a charge cycle.
- The battery is more than three years old.