Cadex C5100B

Battery Tester

User Guide

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Warranty & Service

Cadex Electronics Inc. warrants the Cadex C5100B Battery Tester unit against defective materials and workmanship for two (2) years. Warranty starts from the original date of shipment.

The warranty does not cover:

- Damage caused by abusive operation, negligence, accident, or improper installation.
- Damage caused by an attempted repair not authorized by Cadex.
- Cosmetic damage caused by normal wear and tear.
- Damage from external causes such as leakage spills, power fluctuations, or failure, inadequate packaging.

- If the product is without the appropriate model number, serial number, or safety markings.
- If the product is used for rental purposes.
- Changes or modifications to the equipment not expressly approved by Cadex Electronics Inc.

To obtain service, contact service@cadex.com or (Canada) 1-604-231-7777, (USA Toll Free) 800-565-5228, or (Europe) +49 (0) 6105 975 11-0.

To ensure that you have the most up to date information regarding use of its products, Cadex recommends that you visit www.cadex.com/support/technical for the all revisions to the User Manual.

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Section 1: General Precautions and Information

Safety Notice

- Read, understand and follow all instructions in this user guide before using the Cadex C5100B Battery Tester unit.
- Refer to the battery manufacturer MSDS (Material Safety Data Sheet) for specific handling and safety information.
- Always inspect a battery for physical damage before testing the battery.
- Install the equipment near a socket-outlet where it is easily accessible.

Use of Equipment

The Cadex C5100B Battery Tester is designed with adequate safeguards to protect users from shock and other hazards when used as specified within this document. However, if the equipment is used in a manner not specified by this documentation, the protection provided by this equipment may be impaired. Please read this document and equipment labeling before using the equipment.

Modification of Equipment

CE, FCC, CSA, UL, and other approvals apply only to the Cadex C5100B Battery Tester in the factory-authorized configuration. Changes or modification to the equipment not expressly approved by Cadex will void the approvals.

ROHS Compliance

The C5100B Battery Tester complies with the European Union's Directive 2002/95/EC, Restrictions of Hazardous Substances (RoHS).

Explosion Hazard

Batteries can burst if treated improperly. Follow these precautions at all times:

- ✓ Clean battery contacts before servicing. To clean battery contacts, use a lint-free cotton swab dipped in 100% isopropyl alcohol.
- ✓ Ensure the battery is making a good connection with the adapter contacts.
- ✓ Ensure that the selected Q-code / C-code is correct for the chemistry, voltage, and rating of the battery being serviced.
- ✓ Observe battery temperature. Service batteries between 5°C (41°F) and 50°C (122° F). Stop service if battery becomes very hot. The temperatures cited here are the battery temperatures, not the ambient temperatures. Fast charging outside this temperature range may damage or reduce the life of the battery. Allow cold batteries to warm up and hot batteries to cool before charging.
- x Do not attempt to charge non-rechargeable and primary batteries such as alkaline, carbon-zinc, or non-rechargeable lithium batteries.
- x Do not short the positive and negative battery terminals together at any time.
- x Do not exceed the battery manufacturer's recommended charge current and voltage limits for batteries.
- x Do not remove the adapter from the analyzer while the battery is running.

Charging and Discharging Lithium-ion (Li-ion) Batteries

Lithium-ion (Li-ion) batteries are safe when used as directed. Battery safety cannot be assured when a battery pack is built with

individual cells of an unknown nature with a series and parallel connection. Not all Li-ion cells are suited for multi-cell packs. Only cells that meet tight voltage and capacity tolerances can be used for series and parallel connection. Mismatched packs are subject to overcharge resulting in venting with flame and fire. Check with the cell manufacturer to see if the cells are suitable for multi-cell packs.

In the past, single Li-ion cells were only available to authorized battery manufacturers. Today, imports are becoming readily available and often fall into the hands of the inexperienced. While most brand name cells are equipped with an internal cell disconnect that permanently opens the current path on high pressure, some brands do not provide this safeguard. Many brands don't use a separator that shuts down the battery when high temperatures are reached. The internal safety features are omitted for cost reasons.

Please follow the following guidelines when charging and discharging lithium-ion cell(s) and packs. Failing to follow these rules could result in venting with flame, explosions, fire, and personal injury.

- x Never connect cells in parallel and/or series that are not designed for that purpose. A cell mismatch may overcharge and vent with flames
- x Never charge or discharge the battery without connecting a working protection circuit. Each cell must be monitored individually and the current disconnected if an anomaly occurs.
- x Never leave the battery unattended while under charge or discharge.
- ✓ Always attach a temperature sensor when charging and discharging the battery. The temperature sensor must disconnect the current on excess temperature.
- ✓ Only connect cells that are matched and have identical state-of-charge.
- ✓ Pay special attention when using an unknown brand. Not all brands contain intrinsic safety features that protect the cell when stressed.
- ✓ During experiments, place the test battery into a well-ventilated fireproof container.

Shock Hazard

The Cadex C5100B Battery Tester contains high-voltage circuits, and can pose a shock hazard when the unit is opened. Do not attempt to open the unit – there are no user-serviceable items inside.

- ✓ To reduce the risk of electrical shock hazard, service batteries only when they are removed and disconnected from their end-use equipment.
- ✓ Use the tester only as specified in the documentation. Other uses may impair the protection provided by the unit.
- ✓ Use only a grounded AC outlet to power the tester.

Warranty & Service

Cadex Electronics Inc. warrants the Cadex C5100B Battery Tester against defective materials and workmanship for a period of two (2) years from the original purchase date.

The warranty does not cover:

- Damage caused by abusive operation, negligence, accident, or improper installation.
- Damage caused by an attempted repair not authorized by Cadex.
- Cosmetic damage caused by normal wear and tear.
- Damage from external causes such as leakage spills, power fluctuations, power failure, or inadequate shipping.
- Products received without the appropriate model number, serial number, or safety markings.
- Products used for rental purposes.

Warranty Service

Before sending the unit for service, contact Cadex Technical Support at (Canada) 1-604-231-7777, (USA Toll Free) 1-800-565-5228, or (Europe) +49 (0) 6105 975 11-0 or service@cadex.com . If the product requires warranty service, the representative will provide a Return Authorization form or number and the location of the nearest service center.

- Ship the product to the service center with freight, insurance, and customs duties prepaid. The Return Authorization form must be included to obtain warranty service.
- Ensure that the unit(s) is properly packed before shipping, preferably in the original Cadex boxes. Damage caused in transit due to improperly packed items is not covered under warranty.
- Products returned from warranty service are shipped with freight prepaid by Cadex.

Non-Warranty Repairs

Before sending the unit in for service, contact Cadex Technical Support at (Canada) 1-604-231-7777, (USA Toll Free) 800-565-5228, or (Europe) +49 (0) 6105 975 11-0, or service@cadex.com. If the tester is not covered by warranty, the representative will provide the contact information for the nearest service center. Contact the service center directly to arrange to send the product in for service. A Return Authorization form or number will be provided only if the product is returning to the Cadex Head Office.

- Ship the product to the service center with freight, insurance, and custom duties prepaid.
- Ensure that the unit(s) is properly packaged before shipping.

Note: Cadex Electronics Inc. and Cadex authorized service centers require a Purchase Order or written authorization to proceed with repairs.

Radio Interference

This equipment generates, uses, and radiates radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference with radio communications. It has been tested and found to comply with the limits for a Class "A" digital device pursuant to Subpart B of Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case the user, at their expense, is required to take whatever measures needed to correct the interference.

EN55022 Warning: This is a Class A product according to EN55022. In a domestic environment, this product may cause radio interference, in which case the user, at their own expense, may be required to take adequate corrective measures.

The equipment is designed with adequate safeguards to protect the user from shock and other hazards when used as specified within this document. If the equipment is used in a manner not specified by the documentation, the protection provided by the equipment may be impaired. Please read the documentation and equipment labeling before using the equipment.

Disposal of Waste Electrical and Electronic Equipment (WEEE) in the European Union

This symbol on the product and package indicates that this product must not be disposed with unsorted municipal waste. Instead, it is your responsibility to dispose of WEEE by handing it over to a designated collection point for the disposal. The separate collection and recycling of waste equipment will help conserve natural resources and ensure that it is disposed in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for disposal, please contact your local municipal office, waste disposal service or where you purchased the product.

Section 2: Introduction

The Cadex C5100B Battery Tester is a tester and charger for Li-ion or Li-polymer type batteries. The C5100B uses a proprietary algorithm known as QuickSort™ to determine the current State of Health (SoH) of the battery.

The Cadex C5100B Battery Tester Package

The Cadex C5100B Battery Tester package contains the following items:

- Cadex C5100B Battery Tester unit.
- Universal/Configurable Battery Adapter.
- Country-specific AC power cord.
- C5100B/BatteryStore Quick Start Guide
- BatteryStore Installation Guide

IMPORTANT NOTICE

Use only grounded AC power cord(s) and outlets with the Cadex C5100B Battery Tester. Install the equipment near a socket-outlet where it is easily accessible.

Cadex C5100B Battery Tester Features

The LCD backlight on the Cadex C5100B Battery Tester automatically turns off after five minutes of inactivity. The LCD backlight will turn itself on when any key is pressed on the unit or when the running program is completed

The front panel of the Cadex C5100B Battery Tester has three LEDs: Run (yellow), Ready (green), and Fail (red). The front panel also contains three buttons (Test, Charge, and Cycle) and two scroll buttons.

Test	Performs battery rapid tests using Cadex QuickSort™ technology to determine the battery's State of Health.
Charge	Charges a battery. Approximately 3 hrs.
Cycle	Cycles a battery with charge/discharge/charge and displays measured capacity as a percentage of the Q-Code/C-Code capacity rated value. Approximately 7 hrs.
Directional keys	Scrolls through menus and results.
Main Display	LCD viewing panel.
LEDs	LED status indicators.

Serial port	Used to connect to an Optional Receipt Printer.
AC Power Inlet	Attach to power outlet.
USB Port	Used to connect to a computer for use with BatteryStore. Type B USB connector.

Section 3: Battery Testing

Available Programs

The **Boost** program reactivates batteries that fall asleep due to over-discharge and brings the battery back to life. The program charges the battery for two minutes at 100mA.

The **Test** program performs a battery rapid test using Cadex QuickSort™ technology to classify the status of the battery as Good, Fair, Low, or Poor.

- QuickSort™ - Good, Low, or Poor (below 1400mAh)
- QuickSort™ 3.0 - Good, Fair, or Poor (only through BatteryStore™)
- QuickSort™ 4.0 - Good or Poor (1400mAh or Above)

QuickSort™ and QuickSort™ 3.0 can test a battery within 30 seconds and QuickSort™ 4.0 can test a battery in 4 minutes. Q-codes required for Cadex's QuickSort™ 3.0 is only available through BatteryStore. Please refer to Cadex C5100B BatteryStore™ V1.6 User Guide for details on how to test a battery with QuickSort™ 3.0. The range is nominal 3.6V to 3.85V Li-ion or Li-polymer with rated capacity values of 500-4000mAh. Batteries outside this range will not be tested and a message *No QuickSort Support* appears.

The **Charge** program charges the battery based on the parameters in the selected Q-code / C-code within approximately 3 hours.

The **Cycle** program performs a charge/discharge/charge sequence on the battery based on the parameters in the selected Q-code / C-code, and displays measured capacity as a % of the Q-code / C-code rated value within approximately 7 hours.

Voltage Look-up Table

Nominal Voltage will be converted to Max Charge Voltage as follows:

Nominal Voltage (V)	Max Charge Voltage (V)
3.60	4.20
3.70	4.20
3.80	4.35
3.85	4.40

Boost a Li-ion Battery

Applies 100mA Charge for Two Minutes

1. Apply AC power to turn on the Cadex C5100B Battery Tester. Ensure battery adapter is installed, but the Li-ion battery is not connected yet.
2. There should be no LEDs on and LCD should display "Battery Not Detected".
3. Hold down any program key (Charge, Test, or Cycle) for two seconds. The C5100B will display 3.*70V, Boost Selected,* and then *Select Voltage* ▲▼.
4. Scroll to the battery's nominal voltage with ▲▼ and press the Test key to select.
5. The C5100B will now display *500mAh, Boost Selected,* and then *Select Capacity* ▲▼.
6. Scroll to the battery's rated capacity with ▲▼ and press the Test key to select.
7. The C5100B will now display *Caution! Boosting*, *Press* ▼ *to Escape*, *Check Polarity!,* and then *Press* ▲ *to Continue*.
8. Once the ▲ key is pressed, it will display *Press Program key for 2 seconds*.
9. Insert the Li-ion battery to boost.
10. Press and hold a program key (Charge, Test, or Cycle) for 2 seconds to activate the **Boost** program.
11. **Boost** can be cancelled anytime by pressing the down arrow key.

Test a Li-ion Battery

Rapidly Test the Battery Condition using Cadex QuickSort™ Technology

1. Apply AC power to turn on the Cadex C5100B Battery Tester. Ensure battery adapter is installed.
2. There should be no LEDs on and LCD should display "Battery Not Detected".
3. Insert the Li-ion battery to test. The C5100B will display *3.70V* and then *Select Voltage* ▲▼.
4. Scroll to the battery's nominal voltage with ▲▼ and press the Test key to select.
5. The C5100B will now display *500mAh* and then *Select Capacity* ▲▼.
6. Scroll to the battery's rated capacity with ▲▼ and press the Test key to select.
7. The Run indicator will flash and LCD should also display corresponding voltage, capacity and the type of Test: QuickSort™ (30sec) or QuickSort™ 4.0 (4min).
8. Press **Test**. The battery test begins.
9. When the battery test is completed, the test result will appear on the screen.
10. Disconnect the battery to clear the test result screen.

Good Battery: A battery for which the QuickSort 4.0 algorithm has determined to have a capacity higher than the Target Capacity. For QuickSort or QuickSort 3.0, the algorithm has determined that the battery capacity is between 80%-100%. The Ready LED light also will turn on.

Poor Battery: A battery that has any of the following: shorted, open cells, or the QuickSort 4.0 algorithm has determined that the battery capacity is less than the Target Capacity. For QuickSort or QuickSort 3.0, this result is displayed when the battery capacity is less than 70%. The Fail LED light also will turn on.

Low / Fair Battery: A battery that does not have any of the following: shorted cells, open cells, or above normal impedance; and for which the QuickSort or QuickSort 3.0 algorithm has determined that the battery capacity is between 70% and 80%. Low Battery will turn Ready LED and Fair Battery will turn Run LED on.

Note: QuickSort 3.0 is only available with Cadex C5100B BatteryStore™ V1.6 software.

Charge a Li-ion Battery

A battery is charged in about three hours.

1. Apply AC power to turn on the Cadex C5100B Battery Tester. Ensure battery adapter is installed.
2. There should be no LEDs on and LCD should display "Battery Not Detected".
3. Insert the Li-ion battery to charge. The C5100B will display *3.70V* and then *Select Voltage* ▲▼.
4. Scroll to the battery's nominal voltage with ▲▼ and press the Test key to select.
5. The C5100B will now display *500mAh* and then *Select Capacity* ▲▼.
6. Scroll to the battery's rated capacity with ▲▼ and press the Test key to select.
7. The Run indicator will flash with the updated C-Code.
8. Press **Charge** and confirm the voltage and the capacity entered previously by pressing the Test key. The C5100B will perform a fast charge.
9. When the battery has finished charging, the Ready LED will be lit and the battery's resistance in mΩ and voltage in V will be displayed. If there was a problem during charging, the Fail LED will be lit.

Cycle a Li-ion Battery

The Cycle button charges/discharges/charges a battery and displays the battery's capacity in % in about 7 hours.

1. Apply AC power to turn on the Cadex C5100B Battery Tester. Ensure battery adapter is installed.
2. There should be no LEDs on and LCD should display "Battery Not Detected".
3. Insert the Li-ion battery to charge. The C5100B will display *3.70V* and then *Select Voltage* ▲▼.
4. Scroll to the battery's nominal voltage with ▲▼ and press the Test key to select.
5. The C5100B will now display *500mAh* and then *Select Capacity* ▲▼.

6. Scroll to the battery's rated capacity with ▲▼ and press the Test key to select.
7. The Run indicator will flash with the updated C-Code.
8. Press **Cycle** and confirm the voltage and the capacity entered previously. The C5100B will perform charge/discharge/charge and indicate the measured capacity result in %.
9. When the battery has finished cycling, the Ready LED will be lit and the battery's resistance in mΩ, capacity in % and voltage in V will be displayed. If there was a problem during cycling, the Fail LED will be lit.

Select Target Capacity

Select desired Target Capacity between 60, 70, 80 and 90%.

1. Apply AC power to turn on the Cadex C5100B Battery Tester. Ensure battery adapter is NOT installed.
2. There should be no LEDs on and LCD should display "Install Battery Adapter".
3. Press the Test key for 2 seconds and the C5100B will display *System Setup*▲▼, *Target Capacity* or *Print Mode.*
4. Scroll to **Target Capacity** with ▲▼ and press the Test key to select.
5. Scroll through **60%**, **70%**, **80%**, and **90%** by pressing up and down arrow keys and select with the Test key.

Select Print Mode

Select desired Print Mode between Auto, Manual and Disable.

1. Apply AC power to turn on the Cadex C5100B Battery Tester. Ensure battery adapter is NOT installed.
2. There should be no LEDs on and LCD should display "Install Battery Adapter".
3. Press the Test key for 2 seconds and the C5100B will display *System Setup*▲▼, *Target Capacity* or *Print Mode.*
4. Scroll to **Print Mode** with ▲▼ and press the Test key to select.
5. Scroll through **Auto**, **Manual** and **Disable** by pressing up and down arrow keys and select with the Test key.

Possible Fault Messages

Contact Cadex Technical Support at (Canada) 1-604-231-7777, (USA Toll Free) 800-565-5228, or (Europe) +49 (0) 6105 975 11-0, or service@cadex.com for further information.

Fault Codes

Code	Name	Description
-3115	Target Capacity Not Met	Battery Capacity < Target Capacity
-3120	Over Voltage	Battery voltage too high
-3121	Battery Reversed	Battery inserted backwards
-3122	Battery Shorted	Battery has an internal Short.
-3129	Intermittent Battery	Battery processing interrupted more than 5 times.
-3142	Discharge Timeout	Discharge longer than specified timeframe.
-3144	Charge Timeout	Charge longer than specified timeframe
-3150	Thermistor Failure	Unable to read temperature
-3159	Hot Battery	Battery is too hot to start processing.
-3160	Bad Fuse Or Driver	No current for more than 30 seconds.
-3201	Cold Battery	Battery is too cold to start processing.
-3202	Battery Low	Battery voltage is too low to charge safely.

Warning Codes

Code	Name	Description
-2159	Hot Battery	Battery became too hot during processing. Processing is put on hold and will continue when the battery cools down.
-2201	Cold Battery	Battery became too cold during processing. Processing is put on hold and will continue when the battery warms up.
-2203	System Over Temperature	The system became too hot during processing. Process is put on hold and will continue when the system cools down.
-2206	System Under Temperature	The system became too cold during processing. Processing is put on hold and will continue when the system warms up.

Section 4: Maintenance and Spare Components

To maintain accuracy in test results and to achieve long product life, Cadex Electronics Inc. recommends the following steps to maintain the C5100B Battery Tester.

Clean the Battery Adapter or RigidArm Contacts

Clean the battery adapter contacts regularly with a lint free cotton swab and isopropyl alcohol. This will ensure that the readings are accurate.

Clean the Cadex C5100B Battery Tester

1. Wipe the unit with a clean damp cloth.
2. Do not use any cleaning solution on the C5100B unit.

Spare Components

The following replacement parts may be purchased from Cadex Electronics Inc. Please contact service@cadex.com for pricing and delivery.

Description	Part Number
IEC320 6′ UK Plug AC Power Cord	68-723-1805
IEC320 6′ Euro Plug AC Power Cord	68-723-1806
IEC320 6′ North American AC Power Cord	68-723-1810
RigidArm Universal Battery Adapter	07-110-0193
RigidArm Thin Pin (for batteries with blade-type contacts)	92-470-0051
USB Type A to Type B Cable	68-931-0008
DB9 Male to Male Connector	00-004-3033

Section 5: Specifications

Application: Single-station standalone battery tester.

Range: Supports nominal 3.6V to 3.85V single-cell or 7.2V and 7.4V double-cell Li-ion batteries, user-selectable. Test program only supports nominal 3.6V to 3.85V Li-ion or Li-polymer, 500-4000mAh batteries, user-selectable.

Charge/discharge: 2A max.

Battery Interface: Custom and universal adapters; Cadex SnapLock™ system; read-only application, temperature sensor.

Line voltages: 100-240VAC, 50/60Hz 0.6A, internal power supply, IEC320 grounded inlet, country-specific AC power cords available.

Programs: 3 buttons, up/down selection keys

Test	~30sec QuickSort™, QuickSort™ 3.0 or ~4min QuickSort™ 4.0
Charge	3h fast charge
Cycle	Charge/Discharge/Charge
Boost	Reactivates batteries that have protection circuits activated due to low discharge

Display: LCD screen 2X20, backlit; RUN, READY, FAIL light signals.

Data Ports: USB Type B for connection to BatteryStore application and firmware upgrade, RS232 9 pin female DSUB for optional printer connection.

Physical: H 92; W 160; L 285mm (3.6x 6.3x11.2"); 0.82kg net (1.8lb)

Approvals: CSA/UL/EN60950, CE marked, ROHS and WEEE.

Warranty: Two (2) years for materials and workmanship.

Note: Specifications subject to change without notice.