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## **INTRODUCTION AND PRODUCT DESCRIPTION**

The CAL-100A is an instrument designed to verify the performance and to calibrate Battery Charger-Analyzers used on Nickel-Cadmium, Lead-Acid and other types of batteries. It is principally designed for the Superseder line of battery test instruments but it can also be applied to other types of chargers and charger-analyzers.

The instrument is basically a digital Ammeter and Voltmeter that is connected between the charger under test and the battery. In addition, it provides a low current adjustable voltage source to simulate the various battery voltage cut-off points and a Temp-Plate simulator to test the battery overtemp portion of the Superseder line of Charger-Analyzers.

Two 3-1/2 digit LED meters provide the simultaneous monitoring of voltage and current on the charger and battery under test. The voltmeter can also be used independently by way of the two external meter lead jacks.

Current and voltage measurement can be performed through the external cables, fitted with a Battery Cable Plug and a Battery Receptacle, or through the front panel binding posts, for other types of tests at reduced currents.

**SEC 1 - SPECIFICATIONS**

- 1.1 **CURRENT CAPACITY:**
  - Through the rear posts: 50A max, continuous, 100A max, intermittent.
  - Through the front panel binding posts: 10A max.
- 1.2 **VOLTAGE MEASUREMENT CAPACITY:**
  - 0 to 20V (19.90V) or 0 to 200V (199.9), internal or external.
- 1.3 **VOLTAGE SOURCE:**
  - Externally adjustable: 0 to 100V, 25mA max.
- 1.4 **SHUNT: 1mV/A (200mV/200A), .25% accuracy.**
- 1.5 **METERS:**
  - Type: LED, 3-1/2 digit.
  - Voltage: 0 to 19.9V and 0 to 199.9V.
    - Accuracy: .25% of reading,  $\pm 1$  digit.
  - Current: 0 to 199.9A
    - Accuracy: .5% of reading  $\pm 1$  digit.
- 1.6 **STATUS INDICATORS:**
  - Calibrator on-line, connected to the charger under test (rear/front posts).
- 1.7 **CONTROLS:**
  - Voltmeter source and scale selector.
  - Potentiometer for calibrator voltage adjustment.
  - Calibrator ON LINE/OFF (connected to the output/disconnected) selector switch.
  - Calibrator polarity (normal and reverse) selector switch.
  - Thermistor selector switch.
  - Thermistor temperature simulator selector switch.
  - Power ON/OFF switch (on rear power block).
  - Line voltage selector (on rear power block).
- 1.8 **CONNECTORS:**
  - Front panel binding posts (fused).
  - External voltmeter meter banana jacks.
  - Rear posts with cables with battery connectors.
  - Shunt monitor banana jacks.
  - Temp-Plate simulator cable connector.
- 1.9 **FUSES:**
  - Power: .5A slo-blow (.25A SB for 230V operation).
  - Output: 12A, slow-blow (for the front panel binding posts).
- 1.10 **LINE VOLTAGE:**
  - 115/230VAC  $\pm 10\%$ , 50-60Hz.
- 1.11 **AMBIENT:**
  - 5° C to 35° C.

**SEC 2 - CONTROLS AND DISPLAYS****2.1 Front Panel:**

- M1 Ammeter Display  
M2 Voltmeter Display  
DS1 Calibrator output on-line  
Indicates that the Calibrator is connected to the charger (rear/front posts) to simulate the battery.  
J1 Calibrator output (+)  
Separate, independent output  
J2 Calibrator output (-)  
Separate, independent output  
*NOTE: There is always a voltage present at the Calibrator jacks (as set by the potentiometer). This output can be used to test other units, independent of the Charger/Battery connections to the CAL-100 (provided that the Calibrator is not on-line). Maximum current is 20mA.*  
SW1 Calibrator on-line/off selector switch.  
SW2 Calibrator polarity normal/reverse selector switch.  
SW3 Voltmeter Source and Scale Selector  
R1 Calibrator voltage adjust potentiometer.  
J3 Charger Input (+)  
J4 Charger Input (-)  
J5 External Voltmeter Input (+)  
J6 External Voltmeter Input (-)  
J7 Output to the Battery (+)  
J8 Output to the Battery (-)

FIG 1 - FRONT PANEL



FIG 2 - REAL PANEL



**2.2 Rear Panel:**

- F1 Calibrator Output Fuse (.25A)  
Protects the Calibrator output circuit in case of connection to a negative voltage.
- SW3 Temp-Plate Temperature Simulator Selector switch.
- SW4 Thermistor Selector switch.
- J9 Thermistor Monitor (+)
- J10 Thermistor Monitor (-)
- J11 Temp-Plate Simulator  
Connects to the Temp-plate cable in the Superseder Battery Cable.
- J12 Shunt Monitor (+)  
Reads the Shunt output.
- J13 Shunt Monitor (-)  
Reads the Shunt output.
- J14 Power Entry Block  
Combined line cord receptacle, line voltage selector, fuse and power on-off switch.
- F2 Shunt Fuse (12A SB).  
For protection while using the front panel jacks only.
- (+) Input Post. Connection to the Charger (-).
- (-) Input Post. Connection to the Charger (-) (common).
- (+) Output Post. Connection to the Battery (+).
- (-) Output Post. Connection to the Battery (-) (common).

## SEC 3 - OPERATING INSTRUCTIONS

**NOTE: Do not use the front panel and rear panel current connections at the same time.**

### 3.1 SUPERSEDER VOLTAGE AND CURRENT MONITORING:

- 3.1.1 Set the CAL-100 voltmeter selector to INTERNAL 200V and the calibrator ON LINE and REV POL switches to off (down).
- 3.1.2 Connect one ELCON connector on the Superseder Battery Cable to the receptacle at the charger side of the CAL-100. Short the remaining ELCON on the Battery Cable (on the Temp-Plate).
- 3.1.3 Connect the ELCON connector on the CAL-100 to the battery.  
*NOTE: Other than voltmeters, make no connections to the binding posts on the front panel of the instrument while the output cables are in use.*
- 3.1.4 The voltmeter will indicate battery voltage. Verify that the reading on the Superseder matches the reading on the CAL-100.  
*NOTE: Exact Voltmeter readings must be done with no current flow to eliminate the errors due to voltage drops on the Superseder cables and shunt and cables on the CAL-100.*
- 3.1.5 Start the Superseder and verify its current readings against the CAL-100.

### 3.2 SUPERSEDER VOLTMETER TESTING/CALIBRATION:

- 3.2.1 Refer to the calibration instructions in the Superseder manual.
- 3.2.2 Connect the calibrator output jacks of the CAL-100 to the Superseder external voltmeter jacks.
- 3.2.3 Set the voltmeter selector on the CAL-100 to CALIBRATOR 200V.
- 3.2.4 Adjust the calibrator output to obtain the required voltage.
- 3.2.5 Calibrate the voltmeter as required.

**3.3 SUPERSEDER VOLTAGE CUT-OFF TESTING AND CALIBRATION:**

*NOTE: No battery connection for this test.*

- 3.3.1 Refer to the calibration instructions in the Superseder manual.
- 3.3.2 Connect the calibrator cable to the Superseder battery cable (Short the remaining connector on the battery cable).
- 3.3.3 Set the Superseder current selectors to zero. (MAIN and TOPPING).
- 3.3.4 Set the voltmeter selector on the CAL-100 to INTERNAL 200V and the calibrator ON LINE to on (up). The REV POL switch is used normal position (down) except when a reverse polarity test is called for.
- 3.3.5 Adjust the calibrator output voltage as required to test/calibrate the Superseder Open Circuit, Reverse Polarity, Overvoltage and Discharge Cut-Off functions.

**3.4 SUPERSEDER AMMETER CALIBRATION:**

- 3.4.1 Refer to the calibration instructions in the Superseder Manual.
- 3.4.2 Set the calibrator ON LINE to off (down) and the voltmeter selector to INTERNAL 200V.
- 3.4.3 Connect the CAL-100 to the Superseder and to a battery.
- 3.4.4 Start the Superseder and adjust the charging current to the required level. Test/Calibrate the Superseder ammeter as required.
- 3.4.5 Verify readings on discharge.

**3.5 SUPERSEDER TEMP-PLATE SIMULATION:**

- 3.5.1 Connect the Temp-plate end of the Superseder Battery Cable to the CAL-100. The Superseder red OVERTEMP light must turn-off.
- 3.5.2 Set the thermistor simulator to HOT. No alarm indication must occur.
- 3.5.3 Set the thermistor simulator to OVERTEMP. The alarm must sound.
- 3.5.4 The following voltages must be registered at the thermistor monitor jacks:
  - NORMAL: 7.5V +- .15V
  - HOT: 6.36V +- .127V
  - OVERTEMP: 6.23V +- .124V

**SEC 4 - VERIFICATION OF PERFORMANCE AND CALIBRATION (CAL-100)**

**NOTE: Verify performance and calibrate every 6 months.**

**NOTE: Verify performance first by executing the tests without the adjustments.  
Proceed with adjustments when the tests indicate a deviation.**

**4.1 METERS CIRCUIT BOARD:****4.1.1 Voltmeter:**

Set the voltmeter selector to EXT 20V.

Connect the a DC voltage source (or power supply) to the External Volmeter Jacks and to an external reference voltmeter.

Set the voltage source for a voltage between 19 and 20V and adjust R17 to match the reading on the CAL-100.

Verify tracking by comparing readings at other voltages between 0V and 20V (ie: every 5V).

Set the scale to EXT 200V. Verify readings at various voltages between 0V and 200V (or 100V).

*NOTE: The 200V scale is generated by a divider. No adjustment is available.*

**4.1.2 Ammeter:**

With no input or load connections adjust R3 for a zero reading on the CAL-100.

Connect a Charger to the input (charger) side of the CAL-100 and connect the output (battery) side to a battery through a reference ammeter or shunt. A high current power supply and a suitable load can also be used in place of a charger and a battery.

Set the Charger (or Power Supply) for a current of 50A (40A minimum) and adjust R17 to match the reading on the CAL-100.

Verify tracking by comparing readings at other currents.

**FIG 3 - METERS BOARD ADJUSTMENTS**



## 4.2 CALIBRATOR CIRCUIT BOARD:

### 4.2.1 Maximum Voltage:

Connect the output of the Calibrator to a reference voltmeter.

Set the Voltage Adjustment Potentiometer (CAL-100 front panel) to maximum (CW) and adjust R1 for an output of 100.0V.

### 4.2.1 Maximum Current:

Set the calibrator output for 50.0V

Connect a 2K-Ohm, 5W resistor (for 25mA) or a 2.5K-Ohm resistor (for 20mA) to the output of the calibrator.

Adjust R2 to insure that the output remains at 50.0V when loaded by the resistor.

## 4.3 TEMP-PLATE SIMULATOR:

### 4.3.1 Resistance test:

Measure with an Ohm-Meter at the thermistor monitor (no connection to the Superseder).

Normal: 30.1K-ohm, +- 1% (301 Ohms).

Hot: 17.5K-ohm, +- 1% (175 Ohms).

Overtemp: 16.5K-ohm, +- 1% (165 Ohms).

### 4.3.2 Active test:

Measure with a Voltmeter at the thermistor monitor with the Temp-plate cable connected to the Superseder (with power on).

Normal: 7.5V, +- .15V

Hot: 6.36V, +- .127V

Overtemp: 6.23V, +- .124V

# FIG 4- CALIBRATOR BOARD ADJUSTMENTS



## **SEC 5 - TROUBLESHOOTING**

- 5.1 DOES NOT TURN ON:  
Unit not plugged in. Open line fuse. Problems with the Power Supplies.
- 5.2 NO VOLTMETER READING WITH BATTERY CONNECTED:  
Voltmeter not on internal.
- 5.3 CANNOT READ CURRENT OR VOLTAGE THROUGH THE FRONT PANEL BINDING POSTS:  
Open Shunt fuse.
- 5.4 CANNOT OBTAIN AN OUTPUT FROM THE CALIBRATOR:  
Open Calibrator fuse.
- 5.5 VOLTMETER INDICATES A READING WITHOUT A BATTERY CONNECTED:  
Calibrator set to on-line or voltmeter set to calibrator.

## SEC 6 - LINE VOLTAGE CHANGE

- 6.0 Change from 115V to 230V operation.
- 6.1 Remove the line cord.
- 6.2 Remove the plate that covers the power block.
- 6.3 Remove the line voltage selector plug-in board and re-install with the indicator on 220V.
- 6.4 Remove the fuse holder and replace the .5A SB fuse with a .25A SB fuse.  
*NOTE: If both sides of the line must be fused, reverse the fuse holder and install two miniature .25A fuses. Re-install the fuse holder.*
- 6.5 Re-install the cover and line cord.

**WIRING DIAGRAM**

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## REVISION INDEX

<b>REVISION</b>	<b>DATE</b>	<b>NOTES</b>
1.0	24 May 1990	released
1.0.1	16 Sep 1992	changes in AQS address page
1.1	29 Aug 1994	re-type, additional figures
1.1.1	26 Aug 1997	re-type
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