CF-1 Calibration Procedure

CF1_Calibration Rev.B 10/26/2015

INTRODUCTION:

The CF-1 Calibration Fixture is used to perform field calibration of all BC-XXXX series battery capacity testers and battery chargers. The CF-1 provides an adjustable voltage reference and current shunt for setting BC-XXXX calibration points.

SCOPE:

This document provides instructions on how to perform the annual calibration for the CF-1.

- Check the adjustable voltage reference.
- Check current shunt calibration.

ADJUSTABLE VOLTAGE REFERENCE TEST EQUIPMENT REQUIRED:

1. Calibrated volt meter with leads.
2. 24Vdc power supply.
3. Adaptor cable assembly P/N 4161-60.

   Note: This adaptor comes with the BC-XXXX machines or can be purchased from Advanced Power Products. (909)-599-7319

   www.**advancedpowerproducts**.com

PROCEDURE:

INITIAL SETUP:

1. Plug the 4161-60 adaptor cable assembly into the CF-1 gray connector located on the left hand side of the CF-1.

CF-1 label has an arrow pointing to the left and labeled BATTERY.

2. Attach the 24Vdc power supply positive output to the RED wire positive ring terminal on the 4161-60.
3. Attach the 24Vdc power supply negative output to the BLACK wire ring terminal on the 4161-60.

4. Connect the ***calibrated*** volt meter input leads to the CF-1 test jacks labeled V1+ (RED) and V- (BLACK). Set the voltmeter to read DC volts. See Figure1,2
5. Set the CF-1 toggle switch to the +10V position.
6. Rotate the reference voltage adjust knob to the center position.

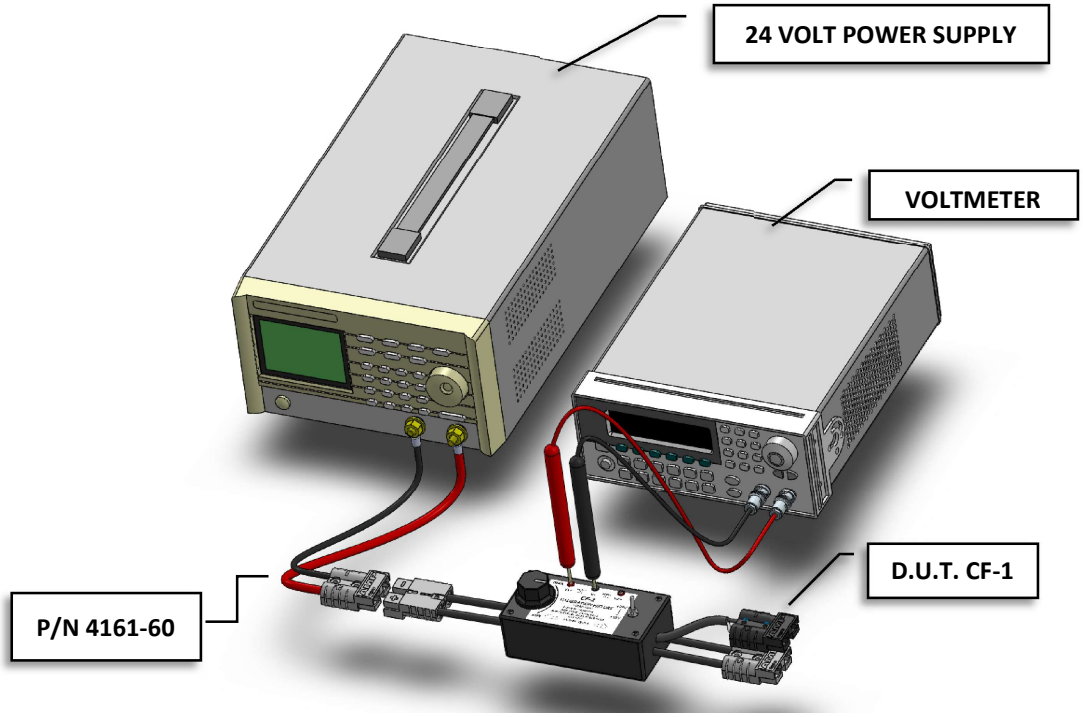

Figure 1

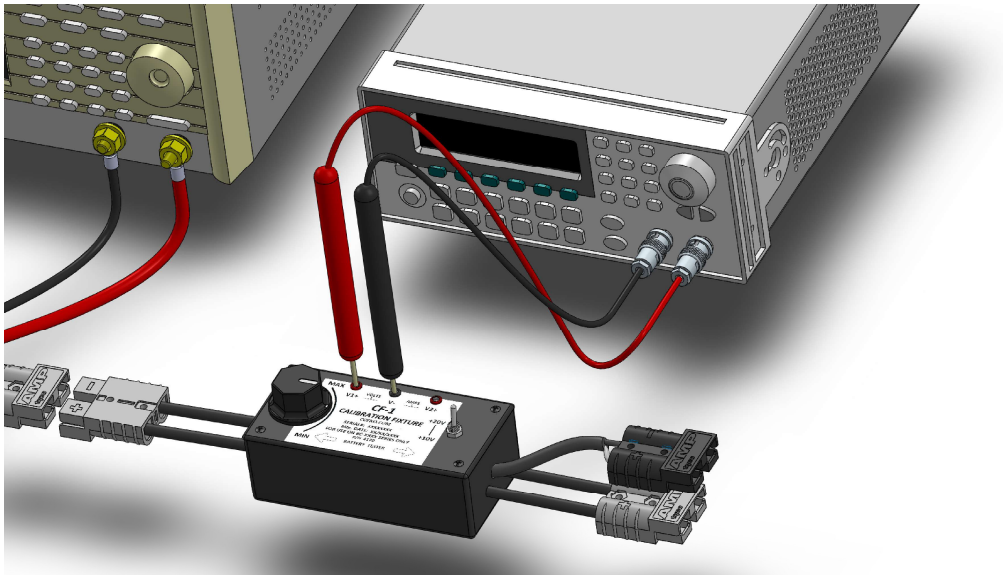

Figure 2

Voltage Reference Test:

1. Turn the 24Vdc power on. The voltmeter should display a voltage close to +10 volts. Rotating the adjustment knob from MIN to MAX will cause the output voltage to range from approximately 8.5 to 11.5 volts.

2. Connect the voltmeter input leads to the CF-1 BLACK connector output pins. The Black connector is located on the right hand side of the CF-1. See Figure 3,4

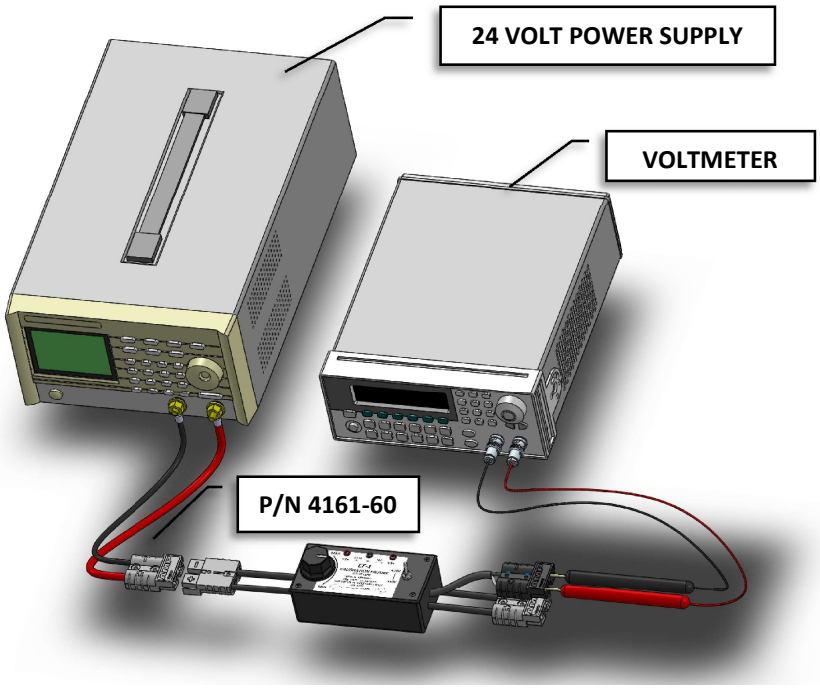

Figure 3

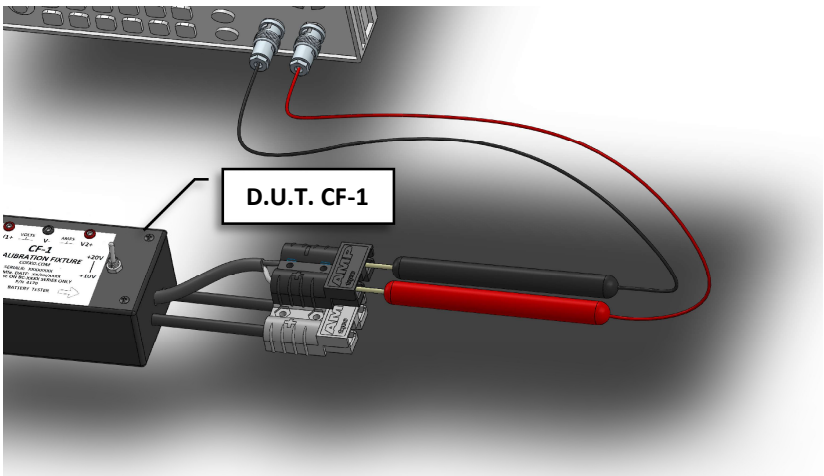

Figure 4

3. Set the CF-1 toggle switch to the +20V position.
4. The volt meter should display a voltage close to +20 volts. Rotating the adjustment knob from MIN to MAX will cause the voltage to range from approximately 9.0 to 21.0 volts.
5. Relocate the voltmeter input leads back to V1+(RED) and V- (BLACK) test jacks. Repeat line 4. This completes the CF-1 voltage reference test.
6. Turn off the 24V power supply. Disassemble the setup.

CURRENT SHUNT TEST EQUPMENT REQUIRED:

Note: If the CF-1 Field Calibration Fixture's current shunt needs to be characterized and certified it meets the initial 1/4% tolerance, using the resources of a certified calibration shop would be the best option. If this is not possible, the following ***comparison calibration procedure*** would verify the CF-1 current shunt meets an accuracy sufficient for the BC-XXXX series of products published specifications.

1. Adjustable constant current source. (0 to 50A)
2. (2) Calibrated volt meters (6-1/2 digit or better) with leads.
3. Calibrated Standard Shunt of 0.001 ohms (0.05% 500ppm or better)
4. (2) Adaptor cable assembly P/N 4161-60.

   Note: The 4161-60 adaptor comes with the BC-XXXX machines or can be purchased from Advanced Power Products. (909)-599-7319 or www.**advancedpowerproducts**.com

5. 50 watt 0.01 ohm load resistor.

PROCEDURE:

Note: All these readings should be performed with a stable laboratory temperature of 25 degrees Centigrade.

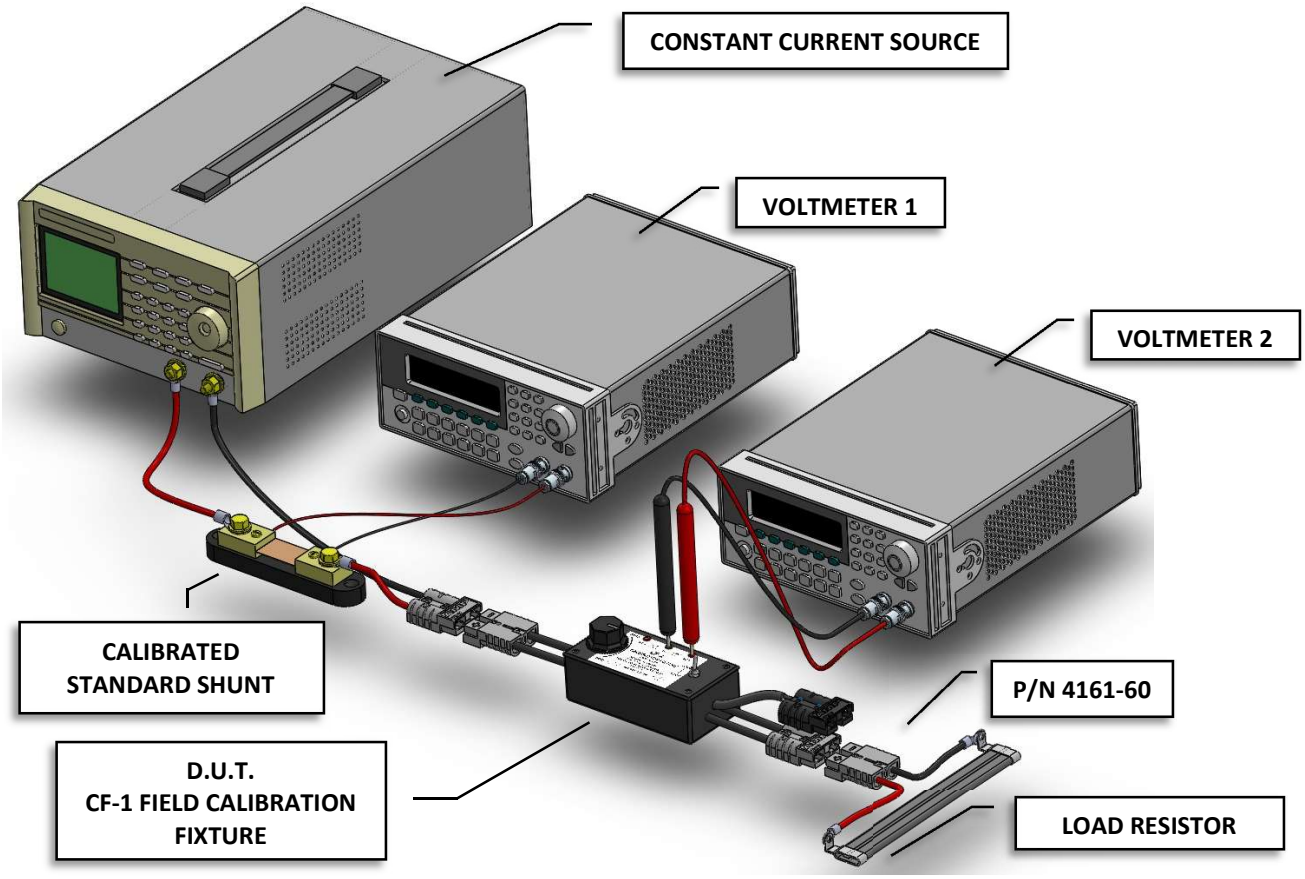

Figure 5

1. Connect the Calibrated Standard Shunt to the positive output of the adjustable constant current source following the shunts manufacturer's connection guidelines to minimize connection generated errors. See Figure 5
2. Connect the Calibrated Standard Shunt output to the RED wire of a 4161-60 adaptor cable.
3. Connect the 4161-60 BLACK wire to the negative return terminal of the constant current source.
4. Connect voltmeter 1 input leads to the Calibrated Standard Shunts millivolt signal output voltage points, following the shunt manufacturer's guidelines.

See figure 5. Set the voltmeter 1 to read DC millivolts.

5. Plug the 4161-60 adaptor cable from the Calibrated Standard Shunt into the CF-1 Gray connector located on the left side of the CF-1 box. The CF-1 label has an arrow pointing to the left labeled ⇦ ***BATTERY***.
6. Attach the 0.01 ohm load resistor to a 4161-60 adaptor cable. Plug the adaptor cable and load resistor assembly into the CF-1 Gray connector located on the right-side. The CF-1 label has an arrow pointing to the right labeled ***TESTER*** ⇨ .
7. Connect voltmeter 2 input leads to the CF-1 test jacks labeled V2+ (RED) and V- (BLACK). The voltmeter positive input lead connects to V2+ and the negative COMMON lead to V-. Set the voltmeter to read DC millivolts. See Figure 6.

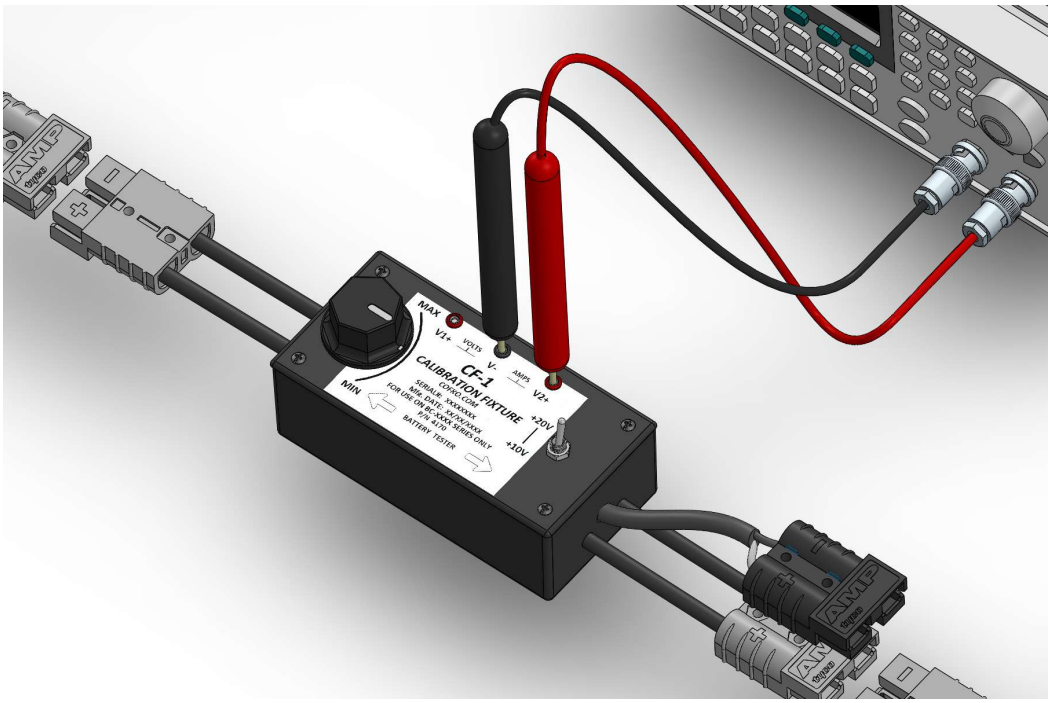

Figure 6

8. Set the constant current source output voltage to a 1 volt maximum output.
9. Set the constant current amps output to the zero output position.
10. Set the constant current input power switch to the ON position. Slowly increase the output current from zero until the voltmeter 1 connected to the Calibrated Standard Shunt reads a stable 0.010 volts.

This indicates 10 amps are passing thru the shunt.

11. Now observe and record the readings on voltmeters 1 and 2.
12. Now increase constant current output to 25 amps. The Calibrated Standard Shunt reading on voltmeter 1 will be 0.025 volts. The voltmeter 2 reading should match this closely. Record voltmeters 1 and 2 readings.
13. Now increase the constant current output to 50 amps. The Calibrated Standard Shunt reading on voltmeter 1 will be 0.050 volts. Voltmeter 2 reading should match this closely. Record voltmeters 1 and 2 readings.
14. Set the constant current source power switch to the OFF position and disassemble the setup.

With the recorded readings and applying Ohm's Law formulas, the CF-1 current shunt can be characterized it meets the published initial resistance tolerance (+/-) 1/4% accuracy. This accuracy is sufficient to meet the BC-XXXX series of products published specifications.

Shunt Resistance (SR) = Volts / Amps

Volts = 0.050
Amps =50.00

SR = 0.050 / 50.00
SR = 0.001 Ohms

Shunt Signal Voltage (SSV) = Amps x Shunt Resistance

Amps = 50.00
SR = 0.001 Ohms

SSV = 50.00 A x 0.001 Ohms
SSV = 0.050

CF-1 Shunt Resistance nominal = 0.001 Ohms +/- 1/4% @ 25C

+/- 1/4% = 0.0025 x 0.001 Ohms = 0.0000025 Ohms

SR (+) = 0.001 Ohms + 0.0000025 Ohms

= 0.0010025 Ohms @ 25C

SR (-) = 0.001 Ohms – 0.0000025 Ohms

= 0.0009975 Ohms @ 25C

CF-1 Shunt Signal Voltage (SSV)

SSV (+) = 50A x 0.0010025 Ohms

= 0.050125 Volts

SSV (-) = 50A x 0.0009975 Ohms

= 0.049875 Volts

SSV Low Limit = 0.049875 volts @ 50Adc ; 25C deg.

SSV Nominal = 0.050 volts @ 50Adc ; 25c deg.

SSV High Limit = 0.050125 volts @ 50Adc ; 25C deg.

Shunt Resistive Material (Manganin) resistance rises about 0.002% per degree C. (room ambient 25 C deg.)