

TECHNICAL MANUAL
CALIBRATION PROCEDURE
FOR
MAINFRAME AND ELECTRONIC LOAD MODULE
Model 6050A w/60501B, 60502B, 60503B, 60504B, and
60507B Modules, Model 6060B

(HEWLETT-PACKARD)



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MAINFRAME AND ELECTRONIC LOAD MODULE

**Model 6050A w/60501B, 60502B, 60503B, 60504B, and 60507B Modules,
Model 6060B**

(HEWLETT-PACKARD)

1 CALIBRATION DESCRIPTION:

Table 1.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Voltage Readback	Range: Module 60501B, 3 to 60 VDC; Module 60502B, 3 to 60 VDC; Module 60503B, 3 to 240 VDC; Module 60504B, 3 to 60 VDC; Module 60507B, 3 to 150 VDC; Model 6060B, 3 to 60 VDC Accuracy: Module 60501B, $\pm(0.05\% \text{ rdg} + 45 \text{ mV})$; Module 60502B, $\pm(0.05\% \text{ rdg} + 45 \text{ mV})$; Module 60503B, $\pm(0.1\% \text{ rdg} + 150 \text{ mV})$; Module 60504B, $\pm(0.1\% \text{ rdg} + 45 \text{ mV})$; Module 60507B, $\pm(0.1\% \text{ rdg} + 90 \text{ mV})$; Model 6060B, $\pm(0.05\% \text{ rdg} + 45 \text{ mV})$	Apply a known voltage
External Voltage Monitor	Range: 0 to 10 VDC Accuracy: Module 60501B, $\pm(0.25\% \text{ input} + 40 \text{ mV})$; Module 60502B, $\pm(0.25\% \text{ input} + 40 \text{ mV})$; Module 60503B, $\pm(0.4\% \text{ input} + 240 \text{ mV})$; Module 60504B, $\pm(0.4\% \text{ input} + 60 \text{ mV})$; Module 60507B, $\pm(0.4\% \text{ input} + 120 \text{ mV})$; Model 6060B, $\pm(0.25\% \text{ input} + 40 \text{ mV})$	Apply a known voltage and monitor external output with a Digital Multimeter
Current Readback	Range: Module 60501B, 0 to 30 ADC; Module 60502B, 0 to 60 ADC; Module 60503B, 0 to 10 ADC; Module 60504B, 0 to 120 ADC; Module 60507B, 0 to 60 ADC; Model 6060B, 0 to 60 ADC	Apply a known current

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Current (Cont.) Readback	*Accuracy: Module 60501B, $\pm(0.06\% \text{ rdg} + 40 \text{ mA})$; Module 60502B, $\pm(0.05\% \text{ rdg} + 65 \text{ mA})$; Module 60503B, $\pm(0.12\% \text{ rdg} + 10 \text{ mA})$; Module 60504B, $\pm(0.1\% \text{ rdg} + 110 \text{ mA})$; Module 60507B, $\pm(0.1\% \text{ rdg} + 65 \text{ mA})$; Model 6060B, $\pm(0.05\% \text{ rdg} + 65 \text{ mA})$	Apply a known current
External Current Monitor	Range: 0 to 10 VDC Accuracy: Module 60501B, $\pm(4.0\% \text{ input} + 40 \text{ mA})$; Module 60502B, $\pm(4.0\% \text{ input} + 85 \text{ mA})$; Module 60503B, $\pm(3.0\% \text{ input} + 10 \text{ mA})$; Module 60504B, $\pm(4.0\% \text{ input} + 170 \text{ mA})$; Module 60507B, $\pm(3.0\% \text{ input} + 85 \text{ mA})$; Model 6060B, $\pm(4.0\% \text{ input} + 85 \text{ mA})$	Apply a known current and monitor external output with a Digital Multimeter
Power Readback	Range: Module 60501B, 0 to 150 W; Module 60502B, 0 to 300 W; Module 60503B, 0 to 250 W; Module 60504B, 0 to 600 W; Module 60507B, 0 to 500 W; Model 6060B, 0 to 300 W Accuracy: Module 60501B, $\pm(0.2\% \text{ rdg} + 2 \text{ W})$; Module 60502B, $\pm(0.2\% \text{ rdg} + 4 \text{ W})$; Module 60503B, $\pm(0.2\% \text{ rdg} + 3 \text{ W})$; Module 60504B, $\pm(0.2\% \text{ rdg} + 8 \text{ W})$; Module 60507B, $\pm(0.2\% \text{ rdg} + 8 \text{ W})$; Model 6060B, $\pm(0.2\% \text{ rdg} + 4 \text{ W})$	Compared to a known voltage multiplied by a known current
Constant Resistance	Range: Module 60501B, 0.067 Ω to 10 k Ω ; Module 60502B, 0.033 Ω to 10 k Ω ; Module 60503B, 0.2 Ω to 50 k Ω ; Module 60504B, 0.017 Ω to 5 k Ω ; Module 60507B, 0.033 Ω to 10 k Ω ; Model 6060B, 0.033 Ω to 10 k Ω	Resistance is calculated by dividing known voltage by known current

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Constant Resistance (Cont.)	<p>Accuracy:</p> <p>Module 60501B, 2 Ω range with ≥ 3 A at input, $\pm(0.8\% \text{ input} + 16 \text{ m}\Omega)$; 2 and 10 k$\Omega$ ranges with ≥ 6 V at input, $\pm(0.3\% \text{ input} + 5 \text{ m}\Omega)$</p> <p>Module 60502B, 1 Ω range with ≥ 6 A at input, $\pm(0.8\% \text{ input} + 8 \text{ m}\Omega)$; 1 and 10 k$\Omega$ ranges with ≥ 6 V at input, $\pm(0.3\% \text{ input} + 8 \text{ m}\Omega)$</p> <p>Module 60503B, 24 Ω range with ≥ 1 A at input, $\pm(0.8\% \text{ input} + 200 \text{ m}\Omega)$; 10 and 50 k$\Omega$ ranges with ≥ 24 V at input, $\pm(0.3\% \text{ input} + 0.3 \text{ m}\Omega)$</p> <p>Module 60504B, 0.5 Ω range with ≥ 12 A at input, $\pm(0.8\% \text{ input} + 5 \text{ m}\Omega)$; 500 Ω and 5 kΩ ranges with ≥ 6 V at input, $\pm(0.3\% \text{ input} + 18 \text{ m}\Omega)$</p> <p>Module 60507B, 2.5 Ω range with ≥ 6 A at input, $\pm(0.8\% \text{ input} + 16 \text{ m}\Omega)$; 2.5 and 10 k$\Omega$ ranges with ≥ 15 V at input, $\pm(0.3\% + 5 \text{ m}\Omega)$</p> <p>Model 6060B, 1 Ω range with ≥ 6 A at input, $\pm(0.8\% \text{ input} + 8 \text{ m}\Omega)$; 1 and 10 k$\Omega$ ranges with ≥ 6 V at input, $\pm(0.3\% \text{ input} + 8 \text{ m}\Omega)$</p>	Resistance is calculated by dividing known voltage by known current
Constant Current	<p>Range:</p> <p>Module 60501B, 0 to 30 ADC; Module 60502B, 0 to 60 ADC; Module 60503B, 0 to 10 ADC; Module 60504B, 0 to 120 ADC; Module 60507B, 0 to 60 ADC; Model 6060B, 0 to 60 ADC</p>	Measured with a Current Shunt that is monitored by a Digital Multimeter

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Constant Current (Cont.)	*Accuracy: Module 60501B, $\pm(0.1\% \text{ input} + 40 \text{ mA})$; Module 60502B, $\pm(0.1\% \text{ input} + 75 \text{ mA})$; Module 60503B, $\pm(0.15\% \text{ input} + 10 \text{ mA})$; Module 60504B, $\pm(0.12\% \text{ input} + 130 \text{ mA})$; Module 60507B, $\pm(0.1\% \text{ input} + 80 \text{ mA})$; Model 6060B, $\pm(0.1\% \text{ input} + 75 \text{ mA})$	Measured with a Current Shunt that is monitored by a Digital Multimeter
Constant Voltage	Range: Module 60501B, 3 to 60 VDC; Module 60502B, 3 to 60 VDC; Module 60503B, 3 to 240 VDC; Module 60504B, 3 to 60 VDC; Module 60507B, 3 to 150 VDC; Model 6060B, 3 to 60 VDC Accuracy: Module 60501B, $\pm(0.1\% \text{ input} + 50 \text{ mV})$; Module 60502B, $\pm(0.1\% \text{ input} + 50 \text{ mV})$; Module 60503B, $\pm(0.12\% \text{ input} + 120 \text{ mV})$; Module 60504B, $\pm(0.1\% \text{ input} + 50 \text{ mV})$; Module 60507B, $\pm(0.1\% \text{ input} + 125 \text{ mV})$; Model 6060B, $\pm(0.1\% \text{ input} + 50 \text{ mV})$	Measured with a power supply that is monitored with a Digital Multimeter

*After 30 second wait.

2 EQUIPMENT REQUIREMENTS:

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1 TRANS-CONDUCTANCE AMPLIFIER	Range: 0 to 100 ADC Accuracy: N/A	Ballantine 1620A	
2.2 METER CALIBRATOR	Range: 0 to 60 VDC Accuracy: $\pm 0.0125\%$	Fluke 5700A	
2.3 CURRENT SHUNT	Range: 0 to 100 ADC Accuracy: $\pm 0.05\%$ (3.6:1 TAR)	Guildline 9211A	
2.4 DIGITAL MULTIMETER	Range: 0 to 10 VDC Accuracy: $\pm 0.16\%$	Fluke 8840AAF	

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.5 DIGITAL MULTIMETER	Range: 0 to 100 mV DC Accuracy: $\pm 0.01\%$	Fluke 8506A	
2.6 POWER SUPPLY	Range: 0 to 60 VDC @ 0 to 10 ADC Accuracy: N/A	Hewlett-Packard 6010B	
2.7 *POWER SUPPLY	Range: 0 to 240 VDC @ 0 to 1.5 ADC Accuracy: N/A	*Hewlett-Packard 6448B	

*Only required for Modules 60503B and 60507B.

3 PRELIMINARY OPERATIONS:

3.1 Review and become familiar with entire procedure before beginning Calibration Process.

WARNING

Unless otherwise designated, and prior to beginning the Calibration Process, ensure that all test equipment voltage and/or current outputs are set to zero (0) or turned off, where applicable. Ensure that all equipment switches are set to the proper position before making connections or applying power.

3.2 Connect test equipment to appropriate power source. Set all POWER switches to ON and allow warm-up as required by manufacture.

3.3 Connect the Electronic Load Module to be calibrated to the Mainframe. Set TI LINE switch to On and allow a 30 minute warm-up period.

3.4 Only use that portion of the Calibration Process that corresponds to TI being calibrated.

3.5 Select Mainframe channel to be calibrated by pressing CHANNEL, #, ENTER (# = the channel with the Electronic Load Module to be calibrated).

3.6 For Model 6060B, verify that the factory check mark on rear panel LINE FUSE RATING label corresponds to nominal line voltage, and the rear panel SENSE switch is set to the LCL position.

CAUTION

Do not use lubricants or contact cleaners on the TI binding posts. Certain chemical agents can damage the LEXAN material of the binding post, causing the part to fail.

4 CALIBRATION PROCESS:

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

4.1 VOLTAGE CALIBRATION:

4.1.1 Connect equipment as shown in Figure 1, except connect Model 6060B as shown in Figure 2. Use Power Supply (2.7) for Modules 60503B and 60507B, and Power Supply (2.6) for all others.

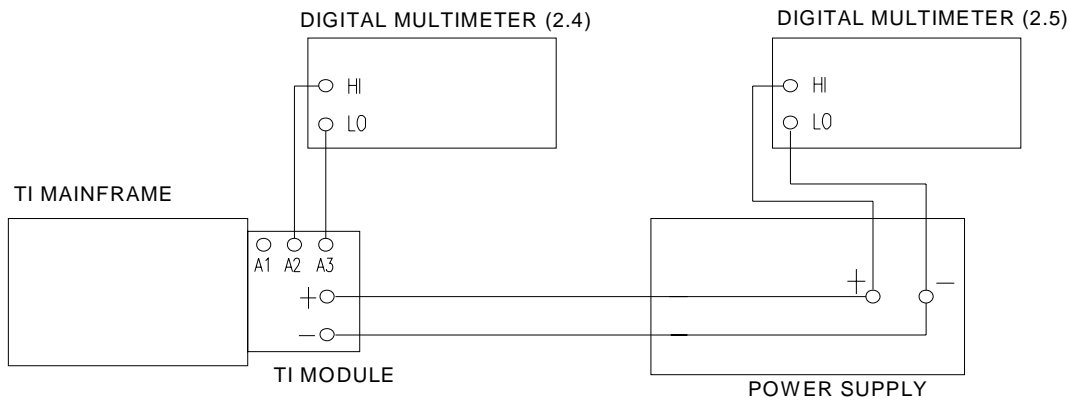


Figure 1.

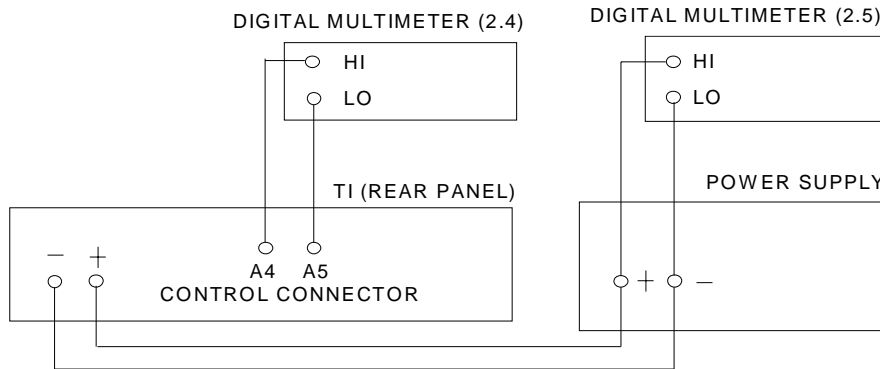


Figure 2.

4.1.2 Set each Digital Multimeter FUNCTION to VDC and select AUTO range.

4.1.3 Set TI to factory default values by pressing RECALL, 7, ENTER. Select Constant Voltage mode by pressing MODE, VOLT, ENTER and then press VOLT, XX, ENTER (XX = value listed below for TI being calibrated).

Modules 60501B, 60502B, 60504B, Model 6060B	60
Module 60507B	150
Module 60503B	240

4.1.4 Press TI METER button until display indicates voltage.

4.1.5 Adjust the Power Supply output voltage until Digital Multimeter (2.5) indicates the first value listed in the Applied column of the appropriate Table 2 through Table 5 for TI being calibrated.

NOTE

If the Power Supply cannot be adjusted to the resolution given in the table, adjust it as close as possible and recalculate TI limits.

4.1.6 The TI LCD VOLTS display must indicate within the corresponding values listed in the Display Limits column and Digital Multimeter (2.4) must indicate within the External Monitor Limits column of the appropriate Table 2 through Table 5 for TI being calibrated.

4.1.7 Set the Power Supply output to minimum.

4.1.8 Repeat steps 4.1.5 through 4.1.7 for each remaining applied voltage listed in the appropriate Table 2 through Table 5 for TI being calibrated.

4.1.9 Disconnect test setup.

Table 2.

Applied (VDC)	Module 60501B, 60502B, and Model 6060B Display Limits (VDC)	External Monitor Limits
10	9.95 to 10.05	N/A
20	19.94 to 20.06	N/A
30	29.94 to 30.06	4.9475 to 5.0525 VDC
40	39.93 to 40.07	N/A
50	49.93 to 50.07	N/A
59	58.93 to 59.07	N/A
60	N/A	9.935 to 10.065 VDC

Table 3.

Applied (VDC)	Module 60503B Display Limits (VDC)	External Monitor Limits
40	39.8 to 40.2	N/A
80	79.8 to 80.2	N/A
120	119.7 to 120.3	4.74 to 5.26 VDC
160	159.7 to 160.3	N/A

Table 3. (Cont.)

Applied (VDC)	Module 60503B Display Limits (VDC)	External Monitor Limits
200	199.6 to 200.4	N/A
230	229.6 to 230.4	N/A
240	N/A	9.72 to 10.28 VDC

Table 4.

Applied (VDC)	Module 60504B Display Limits (VDC)	External Monitor Limits
10	9.94 to 10.06	N/A
20	19.93 to 20.07	N/A
30	29.92 to 30.08	4.92 to 5.08 VDC
40	39.91 to 40.09	N/A
50	49.90 to 50.10	N/A
59	58.90 to 59.10	N/A
60	N/A	9.90 to 10.10 VDC

Table 5.

Applied (VDC)	Module 60507B Display Limits (VDC)	External Monitor Limits
25	24.9 to 25.1	N/A
50	49.9 to 50.1	N/A
75	74.8 to 75.2	4.86 to 5.14 VDC
100	99.8 to 100.2	N/A
125	124.8 to 125.2	N/A
140	139.8 to 140.2	N/A
150	N/A	9.84 to 10.16 VDC

4.2 CURRENT CALIBRATION:

Use extreme caution during the following tests. Failure to do so may result in injury.



Ensure correct sub-paragraph is used for TI being calibrated.

4.2.1 60501B MODULE CALIBRATION:

4.2.1.1 Connect equipment as shown in Figure 3.

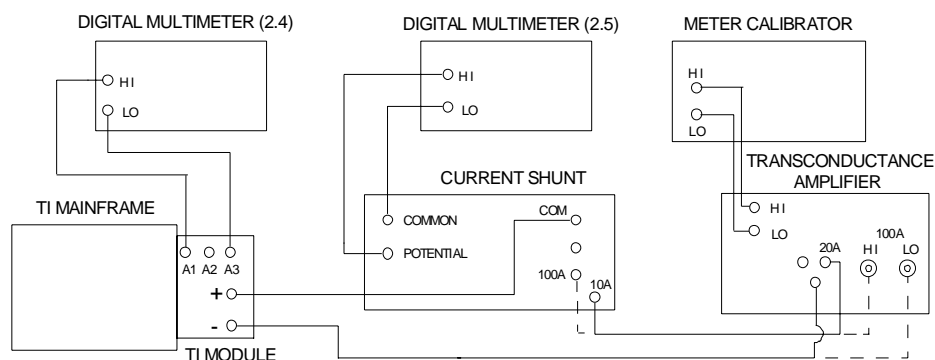


Figure 3. *

* Reconnect as per dotted lines when instructed in text.

4.2.1.2 Insert the Current Shunt shorting plugs into the 10 A receptacles.

4.2.1.3 Set each Digital Multimeter FUNCTION to VDC and select AUTO range.

4.2.1.4 Set TI to factory default values by pressing RECALL, 7, ENTER. Select Constant Current mode by pressing MODE, CURR, ENTER and then press RANGE, 3, ENTER, CURR, 3, ENTER.

4.2.1.5 Press TI METER button until display indicates current.

4.2.1.6 Set the Transconductance Amplifier RANGE to 20 A.

4.2.1.7 Multiply the Current Shunt 10 A range Certified Resistance Value by 1.5.

4.2.1.8 Set the Meter Calibrator for 0.15 VDC and switch to OPR.

4.2.1.9 Switch the Transconductance Amplifier to OPERATE.

4.2.1.10 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.1.7 (a 5 digit fluctuation in the Digital Multimeter indication is allowable).

4.2.1.11 After about 30 seconds the TI LCD AMPS display must indicate within 1.46 to 1.54 A and Digital Multimeter (2.4) must indicate within 466.67 to 533.33 mV DC.

4.2.1.12 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.

4.2.1.13 Change TI to the 30 A range by pressing RANGE, 3, 0, ENTER, CURR, 3, 0, ENTER.

4.2.1.14 Switch the Current Shunt input connections from the 10 AMP connector to the 100 AMP connector. Move the shorting plugs to the 100 A receptacle.

4.2.1.15 Multiply the Current Shunt 100 A range Certified Resistance Value by 15.

■ 4.2.1.16 Set the Meter Calibrator for 1.5 VDC and switch to OPR.

4.2.1.17 Switch the Transconductance Amplifier to OPERATE.

4.2.1.18 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.1.15 (a 5 digit fluctuation in the Digital Multimeter indication is allowable).

4.2.1.19 After about 30 seconds the TI LCD AMPS display must indicate within 14.95 to 15.05 A and Digital Multimeter (2.4) must indicate within 4.7867 to 5.2133 VDC.

4.2.1.20 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.

4.2.1.21 Move the Transconductance Amplifier output leads from the 20 A output connectors to the 100 A HI and LO connectors. Ensure that the leads will carry the applied current (12 gauge for 30 A).

4.2.1.22 Set the Transconductance Amplifier RANGE to 100 A.

4.2.1.23 Multiply the Current Shunt 100 A range Certified Resistance Value by 28.

4.2.1.24 Set the Meter Calibrator for 0.28 VDC and switch to OPR.

4.2.1.25 Switch the Transconductance Amplifier to OPERATE.

4.2.1.26 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.1.23 (a 5 digit fluctuation in the Digital Multimeter indication is allowable).

4.2.1.27 After about 30 seconds the TI LCD AMPS display must indicate within 27.94 to 28.06 A and Digital Multimeter (2.4) must indicate within 8.9467 to 9.7200 VDC.

4.2.1.28 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.

4.2.1.29 Disconnect test setup.

4.2.2 60502B MODULE CALIBRATION:

4.2.2.1 Connect equipment as shown in Figure 3.

4.2.2.2 Insert the Current Shunt shorting plugs into the 10 A receptacles.

4.2.2.3 Set each Digital Multimeter FUNCTION to VDC and select the AUTO range.

- 4.2.2.4 Set TI to factory default values by pressing RECALL, 7, ENTER. Select Constant Current mode by pressing MODE, CURR, ENTER and then press RANGE, 6, ENTER, CURR, 6, ENTER.
- 4.2.2.5 Press TI METER button until display indicates current.
- 4.2.2.6 Set the Transconductance Amplifier RANGE to 20 A.
- 4.2.2.7 Multiply the Current Shunt 10 A range Certified Resistance Value by 3.
- 4.2.2.8 Set the Meter Calibrator for 0.3 VDC and switch to OPR.
- 4.2.2.9 Switch the Transconductance Amplifier to OPERATE.
- 4.2.2.10 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.2.7 (a 5 count fluctuation in the Digital Multimeter indication is allowable).
- 4.2.2.11 After about 30 seconds the TI LCD AMPS display must indicate within 2.93 to 3.07 A and Digital Multimeter (2.4) must indicate within 465.83 to 534.17 mV DC.
- 4.2.2.12 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.
- 4.2.2.13 Change TI to the 60 A range by pressing RANGE, 6, 0, ENTER, CURR, 6, 0, ENTER.
- 4.2.2.14 Switch the Current Shunt input connections from the 10 AMP connector to the 100 AMP connector. Move the shorting plugs to the 100 A receptacles.
- 4.2.2.15 Move the Transconductance Amplifier output leads from the 20 A output connectors to the 100 A HI and LO connectors. Ensure that the leads will carry the applied current (10 gauge for 55 A).
- 4.2.2.16 Multiply the Current Shunt 100 A range Certified Resistance Value by 30.
- 4.2.2.17 Set the Meter Calibrator for 0.3 VDC and switch to OPR.
- 4.2.2.18 Switch the Transconductance Amplifier to OPERATE.
- 4.2.2.19 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.2.16 (a 5 count fluctuation in the Digital Multimeter indication is allowable).
- 4.2.2.20 After about 30 seconds the TI LCD AMPS display must indicate within 29.92 to 30.08 A and Digital Multimeter (2.4) must indicate within 4.7858 to 5.2142 VDC.
- 4.2.2.21 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.
- 4.2.2.22 Multiply the Current Shunt 100 A range Certified Resistance Value by 50.
- 4.2.2.23 Set the Meter Calibrator for 0.5 VDC and switch to OPR.
- 4.2.2.24 Switch the Transconductance Amplifier to OPERATE.
- 4.2.2.25 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.2.22 (a 5 count fluctuation in the Digital Multimeter indication is allowable).

4.2.2.26 After about 30 seconds the TI LCD AMPS display must indicate within 49.91 to 50.09 A and Digital Multimeter (2.4) must indicate within 7.9858 to 8.6808 VDC.

4.2.2.27 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.

4.2.2.28 Disconnect test setup.

4.2.3 60503B MODULE CALIBRATION:

4.2.3.1 Connect equipment as shown in Figure 3.

■ 4.2.3.2 Insert the Current Shunt shorting plugs into the 1 A receptacles.

4.2.3.3 Set each Digital Multimeter FUNCTION to VDC and select AUTO range.

4.2.3.4 Set TI to factory default values by pressing RECALL, 7, ENTER. Select Constant Current mode by pressing MODE, CURRENT, ENTER and then press RANGE, 1, ENTER, CURR, 1, ENTER.

4.2.3.5 Press TI METER button until display indicates current.

4.2.3.6 Set the Transconductance Amplifier RANGE to 20 A.

■ 4.2.3.7 Multiply the Current Shunt 1 A range Certified Resistance Value by 0.5.

4.2.3.8 Set the Meter Calibrator for 0.05 VDC and switch to OPR.

4.2.3.9 Switch the Transconductance Amplifier to OPERATE.

4.2.3.10 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.3.7 (a 5 count fluctuation in the Digital Multimeter indication is allowable).

4.2.3.11 After 30 seconds the TI LCD AMPS display must indicate within 0.49 to 0.51 A and Digital Multimeter (2.4) must indicate within 475 to 525 mV DC.

4.2.3.12 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.

4.2.3.13 Change TI to the 10 A range by pressing RANGE, 1, 0, ENTER, CURR, 1, 0, ENTER.

■ 4.2.3.14 Change the Current Shunt shorting plugs from the 1 A to the 10 A receptacles.

4.2.3.15 Multiply the Current Shunt 10 A range Certified Resistance Value by 5.

4.2.3.16 Set the Meter Calibrator for 0.5 VDC and switch to OPR.

4.2.3.17 Switch the Transconductance Amplifier to OPERATE.

4.2.3.18 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.3.15 (a 5 count fluctuation in the Digital Multimeter indication is allowable).

4.2.3.19 After about 30 seconds the TI LCD AMPS display must indicate within 4.98 to 5.02 A and Digital Multimeter (2.4) must indicate within 4.84 to 5.16 VDC.

- 4.2.3.20 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.
- 4.2.3.21 Multiply the Current Shunt 10 A range Certified Resistance Value by 9.
- 4.2.3.22 Set the Meter Calibrator for 0.9 VDC and switch to OPR.
- 4.2.3.23 Switch the Transconductance Amplifier to OPERATE.
- 4.2.3.24 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.3.21 (a 5 count fluctuation in the Digital Multimeter indication is allowable).
- 4.2.3.25 After about 30 seconds the TI LCD AMPS display must indicate within 8.98 to 9.02 A and Digital Multimeter (2.4) must indicate within 8.72 to 9.28 VDC.
- 4.2.3.26 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.
- 4.2.3.27 Disconnect test setup.

4.2.4 60504B MODULE CALIBRATION:

- 4.2.4.1 Connect equipment as shown in Figure 3.
- 4.2.4.2 Insert the Current Shunt shorting plugs into the 10 A receptacles.
- 4.2.4.3 Set each Digital Multimeter FUNCTION to VDC and select the AUTO range.
- 4.2.4.4 Set TI to factory default values by pressing RECALL, 7, ENTER. Select Constant Current mode by pressing MODE, CURR, ENTER and then press RANGE, 1, 2, ENTER, CURR, 1, 2, ENTER.
- 4.2.4.5 Press TI METER button until display indicates current.
- 4.2.4.6 Set the Transconductance Amplifier RANGE to 20 A.
- 4.2.4.7 Multiply the Current Shunt 10 A range Certified Resistance Value by 6.
- 4.2.4.8 Set the Meter Calibrator for 0.6 VDC and switch to OPR.
- 4.2.4.9 Switch the Transconductance Amplifier to OPERATE.
- 4.2.4.10 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.4.7 (a 5 count fluctuation in the Digital Multimeter indication is allowable).
- 4.2.4.11 After about 30 seconds the TI LCD AMPS display must indicate within 5.88 to 6.12 A and Digital Multimeter (2.4) must indicate within 474.17 to 525.83 mV DC.
- 4.2.4.12 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.
- 4.2.4.13 Change TI to the 120 A range by pressing RANGE, 1, 2, 0, ENTER, CURR, 1, 2, 0, ENTER.
- 4.2.4.14 Switch the Current Shunt input connections from the 10 AMP connector to the 100 AMP connector. Move the shorting plugs to the 100 A receptacles.

4.2.4.15 Move the Transconductance Amplifier output leads from the 20 A output connectors to the 100 A HI and LO connectors. Ensure that the leads will carry the applied current (8 gauge for 60 A).

4.2.4.16 Multiply the Current Shunt 100 A range Certified Resistance Value by 60.

4.2.4.17 Set the Meter Calibrator for 0.6 VDC and switch to OPR.

4.2.4.18 Switch the Transconductance Amplifier to OPERATE.

4.2.4.19 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.4.16 (a 5 count fluctuation in the Digital Multimeter indication is allowable).

■ 4.2.4.20 After about 30 seconds the TI LCD AMPS display must indicate within 59.8 to 60.2 A and Digital Multimeter (2.4) must indicate within 4.7858 to 5.2142 VDC.

4.2.4.21 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.

4.2.4.22 Multiply the Current Shunt 100 A range Certified Resistance Value by 90.

4.2.4.23 Set the Meter Calibrator for 0.9 VDC and switch to OPR.

4.2.4.24 Switch the Transconductance Amplifier to OPERATE.

4.2.4.25 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.4.22 (a 5 count fluctuation in the Digital Multimeter indication is allowable).

4.2.4.26 After about 30 seconds the TI LCD AMPS display must indicate within 89.8 to 90.2 A and Digital Multimeter (2.4) must indicate within 7.1858 to 7.8142 VDC.

4.2.4.27 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.

4.2.4.28 Disconnect test setup.

4.2.5.1 60507B MODULE CALIBRATION:

4.2.5.1 Connect equipment as shown in Figure 3.

4.2.5.2 Insert the Current Shunt shorting plugs into the 10 A receptacles.

4.2.5.3 Set each Digital Multimeter FUNCTION to VDC and select AUTO range.

4.2.5.4 Set TI to factory default values by pressing RECALL, 7, ENTER. Select Constant Current mode by pressing MODE, CURR, ENTER and then press RANGE, 6, ENTER, CURR, 6, ENTER.

4.2.5.5 Press TI METER button until display indicates current.

4.2.5.6 Set the Transconductance Amplifier RANGE to 20 A.

■ 4.2.5.7 Multiply the Current Shunt 10 A range Certified Resistance Value by 3.

4.2.5.8 Set the Meter Calibrator for 0.3 VDC and switch to OPR.

- 4.2.5.9 Switch the Transconductance Amplifier to OPERATE.
- 4.2.5.10 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.5.7 (a 5 digit fluctuation in the Digital Multimeter indication is allowable).
- 4.2.5.11 After about 30 seconds the TI LCD AMPS display must indicate within 2.93 to 3.07 A and Digital Multimeter (2.4) must indicate within 470.83 to 529.17 mV DC.
- 4.2.5.12 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.
- 4.2.5.13 Change TI to the 60 A range by pressing RANGE, 6, 0, ENTER, CURR, 6, 0, ENTER.
- 4.2.5.14 Switch the Current Shunt input connections from the 10 AMP connector to the 100 AMP connector. Move the shorting plugs to the 100 A receptacles.
- 4.2.5.15 Move the Transconductance Amplifier output leads from the 20 A output connectors to the 100 A HI and LO connectors. Ensure that the leads will carry the applied current (8 gauge for 60 A).
- 4.2.5.16 Multiply the Current Shunt 100 A range Certified Resistance value by 30.
- 4.2.5.17 Set the Meter Calibrator for 0.3 VDC and switch to OPR.
- 4.2.5.18 Switch the Transconductance Amplifier to OPERATE.
- 4.2.5.19 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.5.16 (a 5 count fluctuation in the Digital Multimeter indication is allowable).
- 4.2.5.20 After about 30 seconds the TI LCD AMPS display must indicate within 29.90 to 30.10 A and Digital Multimeter (2.4) must indicate within 4.7083 to 5.2917 VDC.
- 4.2.5.21 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.
- 4.2.5.22 Multiply the Current Shunt 100 A range Certified Resistance value by 50.
- 4.2.5.23 Set the Meter Calibrator for 0.5 VDC and switch to OPR.
- 4.2.5.24 Switch the Transconductance Amplifier to OPERATE.
- 4.2.5.25 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.5.22 (a 5 count fluctuation in the Digital Multimeter indication is allowable).
- 4.2.5.26 After about 30 seconds the TI LCD AMPS display must indicate within 49.88 to 50.12 A and Digital Multimeter (2.4) must indicate within 8.0691 to 8.5975 VDC.
- 4.2.5.27 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.
- 4.2.5.28 Disconnect test setup.

4.2.6 MODEL 6060B CALIBRATION:

4.2.6.1 Connect equipment as shown in Figure 4.

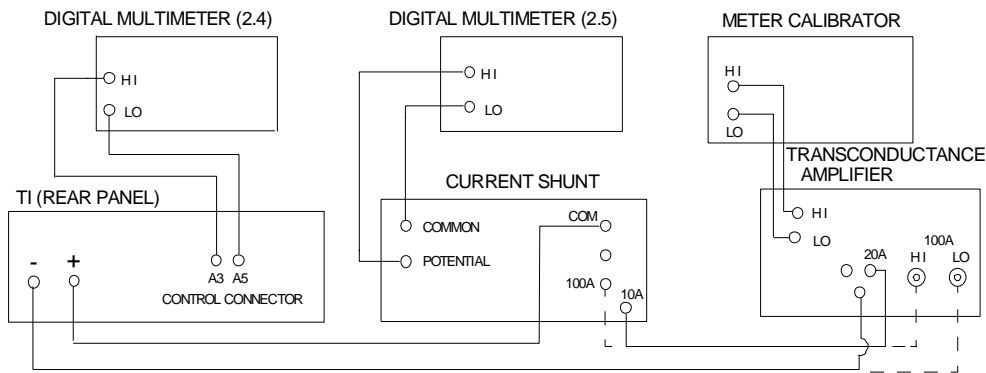


Figure 4.*

*Reconnect as per dotted lines when instructed in text.

4.2.6.2 Insert the Current Shunt shorting plugs into the 10 A receptacles.

4.2.6.3 Set Digital Multimeter FUNCTION to VDC and select AUTO range.

4.2.6.4 Set TI to factory default values by pressing RECALL, 7, ENTER. Select Constant Current mode by pressing MODE, CURR, ENTER and then press RANGE, 6, ENTER, CURR, 6, ENTER.

4.2.6.5 Press TI METER button until display indicates current.

4.2.6.6 Set the Transconductance Amplifier RANGE to 20 A.

4.2.6.7 Multiply the Current Shunt 10 A range Certified Resistance Value by 3.

4.2.6.8 Set the Meter Calibrator for 0.3 VDC and switch to OPR.

4.2.6.9 Switch the Transconductance Amplifier to OPERATE.

4.2.6.10 Edit the Meter Calibrator output voltage until the Digital Multimeter (2.5) indicates the value obtained in step 4.2.6.7 (a 5 digit fluctuation in the Digital Multimeter indication is allowable).

4.2.6.11 After about 30 seconds the TI LCD AMPS display must indicate within 2.93 to 3.07 A and Digital Multimeter (2.4) must indicate within 465.83 to 534.17 mV DC.

4.2.6.12 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.

4.2.6.13 Change TI to the 60 A range by pressing RANGE, 6, 0, ENTER, CURR, 6, 0, ENTER.

4.2.6.14 Switch the Current Shunt input connections from the 10 AMP connector to the 100 AMP connector. Move the shorting plugs to the 100 A receptacles.

4.2.6.15 Move the Transconductance Amplifier output leads from the 20 A output connectors to the 100 A HI and LO connectors. Ensure that the leads will carry the applied current (10 gauge for 55 A).

4.2.6.16 Multiply the Current Shunt 100 A range Certified Resistance Value by 30.

4.2.6.17 Set the Meter Calibrator for 0.3 VDC and switch to OPR.

4.2.6.18 Switch the Transconductance Amplifier to OPERATE.

4.2.6.19 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.6.16 (a 5 digit fluctuation in the Digital Multimeter indication is allowable).

4.2.6.20 After about 30 seconds the TI LCD AMPS display must indicate within 29.92 to 30.08 A and Digital Multimeter (2.4) must indicate within 4.7858 to 5.2142 VDC.

4.2.6.21 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.

4.2.6.22 Multiply the Current Shunt 100 A range Certified Resistance Value by 50.

4.2.6.23 Set the Meter Calibrator for 0.5 VDC and switch to OPR.

4.2.6.24 Switch the Transconductance Amplifier to OPERATE.

4.2.6.25 Edit the Meter Calibrator output voltage until Digital Multimeter (2.5) indicates the value obtained in step 4.2.6.22 (a 5 count fluctuation in the Digital Multimeter indication is allowable).

4.2.6.26 After about 30 seconds the TI LCD AMPS display must indicate within 49.91 to 50.09 A and Digital Multimeter (2.4) must indicate within 7.9858 to 8.6808 VDC.

4.2.6.27 Set the Transconductance Amplifier to STANDBY and the Meter Calibrator to STBY.

4.2.6.28 Disconnect test setup.

4.3 **POWER READBACK CALIBRATION:**

4.3.1 Connect equipment as shown in Figure 5, observing polarity.

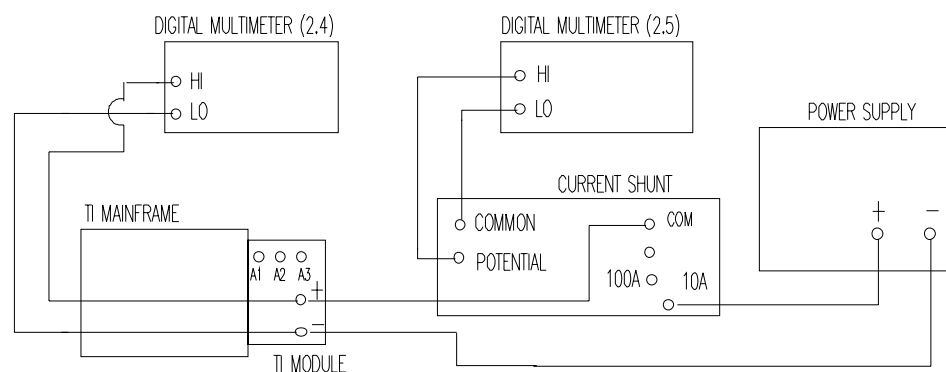


Figure 5.

4.3.2 Insert the Current Shunt shorting plugs into the 10 A receptacles.

4.3.3 Set TI to factory default values by pressing RECALL, 7, ENTER. Select Constant Resistance mode by pressing MODE, RES, ENTER. Select TI Resistance Range by pressing RANGE, #, ENTER (# = 1 for Modules 60501, 60502, 60503, 60507 and Model 6060B, or 2 for Module 60504).

4.3.4 Set TI Constant Resistance value to 1 Ω by pressing RES, 1, ENTER.

4.3.5 Press TI METER button until display indicates power.

4.3.6 Adjust the Power Supply output until TI indicates 100 W. Record Digital Multimeter (2.5) indication.

4.3.7 Divide the value recorded in step 4.3.6 by the Current Shunt Certified Resistance value. Multiply the result by Digital Multimeter (2.4) indication.

4.3.8 The result obtained in step 4.3.7 must indicate within the following value that corresponds to the TI being calibrated:

Module 60501B	97.8 to 102.2 W
Module 60502B	95.8 to 104.2 W
Module 60503B	96.8 to 103.2 W
Module 60504B	91.8 to 108.2 W
Module 60507B	91.8 to 108.2 W
Model 6060B	95.8 to 104.2 W

4.3.9 Set the Power Supply output to minimum.

4.4 CONSTANT RESISTANCE CALIBRATION:

4.4.1 Set TI to factory default values by pressing RECALL, 7, ENTER. Select Constant Resistance mode by pressing MODE, RES, ENTER. Select TI Resistance Range by pressing RANGE, #, ENTER (# = 1 for Modules 60501, 60502, 60503, 60507 and Model 6060B, or 2 for Module 60504).

4.4.2 Set TI Constant Resistance value to 1 Ω by pressing RES, 1, ENTER.

4.4.3 Adjust the Power Supply until Digital Multimeter (2.4) indicates about 10 VDC. Record actual indication.

4.4.4 Divide Digital Multimeter (2.5) indication by the Current Shunt 10 A Certified Resistance value.

4.4.5 Divide the value recorded in step 4.4.3 by the value obtained in step 4.4.4. Verify the result is within the following value that corresponds to the TI being calibrated:

Module 60501B	0.976 to 1.024 Ω
Module 60502B	0.984 to 1.016 Ω
Module 60503B	0.792 to 1.208 Ω
Module 60504B	0.979 to 1.021 Ω
Module 60507B	0.976 to 1.024 Ω
Model 6060B	0.984 to 1.016 Ω

4.4.6 Set the Power Supply output to minimum.

4.5 CONSTANT CURRENT CALIBRATION:

4.5.1 Set TI to factory default values by pressing RECALL, 7, ENTER. Select Constant Current mode by pressing MODE, CURR, ENTER.

4.5.2 Set TI Constant Current Range by pressing RANGE, #, ENTER (# = 10 for Module 60503B, 30 for Module 60501B, 60 for Modules 60502B, 60507B and Model 6060B, 120 for Module 60504B).

4.5.3 Set TI Constant Current value to 10 A by pressing CURR, 1,0, ENTER.

4.5.4 Slowly increase Power Supply output until Digital Multimeter (2.5) indication no longer increases.

4.5.5 After about 30 seconds, divide Digital Multimeter (2.5) indication by the Current Shunt Certified Resistance value and verify the result is within the following value that corresponds to the TI being calibrated:

Module 60501B	9.95 to 10.05 ADC
Module 60502B	9.915 to 10.085 ADC
Module 60503B	9.975 to 10.025 ADC
Module 60504B	9.858 to 10.142 ADC
Module 60507B	9.91 to 10.09 ADC
Model 6060B	9.915 to 10.085 ADC

4.5.6 Set the Power Supply output to minimum.

4.6 CONSTANT VOLTAGE CALIBRATION:

4.6.1 Set TI to factory default values by pressing RECALL 7, ENTER. Select Constant Voltage mode by pressing MODE, VOLT, ENTER.

4.6.2 Set TI Constant Voltage value to 10 V by pressing VOLT, 1, 0, ENTER.

4.6.3 Slowly increase Power Supply output until Digital Multimeter (2.4) indication no longer increases.

4.6.4 Verify Digital Multimeter (2.4) indication is within the limits for the TI being calibrated:

Module 60501B	9.94 to 10.06 VDC
Module 60502B	9.94 to 10.06 VDC
Module 60503B	9.868 to 10.132 VDC
Module 60504B	9.94 to 10.06 VDC
Module 60507B	9.865 to 10.135 VDC
Model 6060B	9.94 to 10.06 VDC

4.6.5 Set Power Supply output to minimum. Disconnect and secure all equipment.

CALIBRATION PERFORMANCE TABLE

4.1 VOLTAGE CALIBRATION:

Module 60501B and 60502B, and Model 6060B		
<u>Applied (VDC)</u>	<u>Display Limits (VDC)</u>	<u>External Monitor Limits</u>
10	9.95 to 10.05	N/A
20	19.94 to 20.06	N/A
30	29.94 to 30.06	4.9475 to 5.0525 VDC
40	39.93 to 40.07	N/A
50	49.93 to 50.07	N/A
59	58.93 to 59.07	N/A
60	N/A	9.935 to 10.065 VDC
Module 60503B		
<u>Applied (VDC)</u>	<u>Display Limits (VDC)</u>	<u>External Monitor Limits</u>
40	39.8 to 40.2	N/A
80	79.8 to 80.2	N/A
120	119.7 to 120.3	4.74 to 5.26 VDC
160	159.7 to 160.3	N/A
200	199.6 to 200.4	N/A
230	229.6 to 230.4	N/A
240	N/A	9.72 to 10.28 VDC
Module 60504B		
<u>Applied (VDC)</u>	<u>Display Limits (VDC)</u>	<u>External Monitor Limits</u>
10	9.94 to 10.06	N/A
20	19.93 to 20.07	N/A
30	29.92 to 30.08	4.92 to 5.08 VDC
40	39.91 to 40.09	N/A
50	49.90 to 50.10	N/A
59	58.90 to 59.10	N/A
60	N/A	9.90 to 10.10 VDC

CALIBRATION PERFORMANCE TABLE (Cont.)

4.1 VOLTAGE CALIBRATION: (Cont.)

<u>Applied (VDC)</u>	Module 60507B <u>Display Limits (VDC)</u>	<u>External Monitor Limits</u>
25	24.9 to 25.1	N/A
50	49.9 to 50.1	N/A
75	74.8 to 75.2	4.86 to 5.14 VDC
100	99.8 to 100.2	N/A
125	124.8 to 125.2	N/A
140	139.8 to 140.2	N/A
150	N/A	9.84 to 10.16 VDC

4.2 CURRENT CALIBRATION:

<u>Applied (ADC)</u>	Module 60501B <u>Display Limits (ADC)</u>	<u>External Monitor Limits (VDC)</u>
1.5 (3 A Range)	1.46 to 1.54	466.67 to 533.33 mV
15 (30 A Range)	14.95 to 15.05	4.7867 to 5.2133
28 (30 A Range)	27.94 to 28.06	8.9467 to 9.7200
<u>Applied (ADC)</u>	Module 60502B <u>Display Limits (ADC)</u>	<u>External Monitor Limits (VDC)</u>
3 (6 A Range)	2.93 to 3.07	465.83 to 534.17 mV
30 (60 A Range)	29.92 to 30.08	4.7858 to 5.2142
50 (60 A Range)	49.91 to 50.09	7.9858 to 8.6808
<u>Applied (ADC)</u>	Module 60503B <u>Display Limits (ADC)</u>	<u>External Monitor Limits (VDC)</u>
0.5 (1 A Range)	0.49 to 0.51	475 to 525 mV
5 (10 A Range)	4.98 to 5.02	4.84 to 5.16
9 (10 A Range)	8.98 to 9.02	8.72 to 9.28

CALIBRATION PERFORMANCE TABLE (Cont.)

4.2 CURRENT CALIBRATION: (Cont.)

<u>Applied (ADC)</u>	<u>Module 60504B Display Limits (ADC)</u>	<u>External Monitor Limits (VDC)</u>
6 (12 A Range)	5.88 to 6.12	474.17 to 525.83 mV
60 (120 A Range)	59.8 to 60.2	4.7858 to 5.2142
90 A (120 A Range)	89.8 to 90.2	7.1858 to 7.8142

<u>Applied (ADC)</u>	<u>Module 60507B Display Limits (ADC)</u>	<u>External Monitor Limits (VDC)</u>
3 (6 A Range)	2.93 to 3.07	470.83 to 529.17 mV
30 (60 A Range)	29.90 to 30.10	4.7083 to 5.2917
50 (60 A Range)	49.88 to 50.12	8.0691 to 8.5975

<u>Applied (ADC)</u>	<u>Model 6060B Display Limits (ADC)</u>	<u>External Monitor Limits (VDC)</u>
3 (6 A Range)	2.93 to 3.07	465.83 to 534.17 mV
30 (60 A Range)	29.92 to 30.08	4.7858 to 5.2142
50 (60 A Range)	49.91 to 50.09	7.9858 to 8.6808

4.3 POWER READBACK CALIBRATION:

<u>Applied (W)</u>	<u>Module/Model</u>	<u>Limits (W)</u>
100	60501B	97.8 to 102.2
100	60502B	95.8 to 104.2
100	60503B	96.8 to 103.2
100	60504B	91.8 to 108.2
100	60507B	91.8 to 108.2
100	6060B	95.8 to 104.2

4.4 CONSTANT RESISTANCE CALIBRATION:

<u>Setting</u>	<u>Module/Model</u>	<u>Limits (Ω)</u>
1 Ω (2 Ω Range)	60501B	0.976 to 1.024
1 Ω (1 Ω Range)	60502B	0.984 to 1.016

CALIBRATION PERFORMANCE TABLE (Cont.)

4.4 CONSTANT RESISTANCE CALIBRATION: (Cont.)

<u>Setting</u>	<u>Module/Model</u>	<u>Limits (Ω)</u>
1 Ω (24 Ω Range)	60503B	0.792 to 1.208
1 Ω (500 Ω Range)	60504B	0.979 to 1.021
1 Ω (2.5 Ω Range)	60507B	0.976 to 1.024
1 Ω (1 Ω Range)	6060B	0.984 to 1.016

4.5 CONSTANT CURRENT CALIBRATION:

<u>Setting</u>	<u>Module/Model</u>	<u>Limits (ADC)</u>
10 A (30 A Range)	60501B	9.95 to 10.05
10 A (60 A Range)	60502B	9.915 to 10.085
10 A (10 A Range)	60503B	9.975 to 10.025
10 A (12 A Range)	60504B	9.858 to 10.142
10 A (60 A Range)	60507B	9.91 to 10.09
10 A (60 A Range)	6060B	9.915 to 10.085

4.6 CONSTANT VOLTAGE CALIBRATION:

<u>Setting</u>	<u>Module/Model</u>	<u>Limits (VDC)</u>
10 V	60501B	9.94 to 10.06
10 V	60502B	9.94 to 10.06
10 V	60503B	9.868 to 10.132
10 V	60504B	9.94 to 10.06
10 V	60507B	9.865 to 10.135
10 V	6060B	9.94 to 10.06