GFM-40ac

Ground Circuit Tester

Instruction Manual

COMPLIANCE WEST USA

Dear Customer:

Congratulations! Compliance West USA is proud to present you with your Ground Fault Circuit Tester. Your instrument features a groundbreaking circuit design and ergonomic front panel and represents the latest in high current laboratory and development testing.

To fully appreciate all the features of your new meter, we suggest that you take a few moments to review this manual. Compliance West USA stands by your instrument with a full one-year warranty and a loaner instrument policy. If the need arises, please don't hesitate to call on us.

Thank you for your trust and confidence.

Rev. 1.1 October 13, 2004

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Section 1

Introduction and Specifications

Introduction

This manual contains complete operating, maintenance and calibration instructions for the Compliance West USA Model GFM-40ac Ground Circuit Tester.

The instrument is a portable bench-type ground circuit tester.

The GFM-40ac indicates actual current and voltage readings while the test is in progress. The current ouput is adjustable by a front panel control from 10 to 40 amps ac. A one-time setup procedure allows the instrument to dynamically compensate for lead resistance throughout its current range, allowing a true measurement of the grounding circuit of the equipment under test. The GFM-40ac may be used in a manual mode for production line tests. See "Operating Techniques" for further information.

Your tester is warranted for a period of one year upon shipment of the instrument to the original purchaser.

Specifications

Specifications for the Tester is listed in Table 1-1.

ELECTRICAL	
Output	10-40 Amps ac ± 3% into any load - short circuit to 100 milliohms
Duty cycle	100 %
Current Range (GFM-40ac)	10 - 40 amps ac
Timer Range	1 – 120 seconds
ENVIRONMENTAL	
Operating Temperature	15-40°C
Relative Humidity Range	0-90% non-condensing
GENERAL	
Input power requirements	108-127 or 216-254 volts, 50/60 Hz
Weight	11 lbs

Table 1-1. GFM-40ac Specifications

Non-Detachable Cordset AWG	Non-Detachable Cordset Maximum Length*
18	6 feet
16	10 feet
14	14 feet
12	20 feet

Table 1-2. Non-Detachable Cordset Maximum Length.
*Custom configurations available for longer non-detachable cords. Contact factory.

Section 2

Operation

This section describes how to set up and make measurements with your tester. We recommend that you read the entire section carefully so that you can use all of the features of your Tester.

Setting up your tester

Your tester is shipped in a special protective container that should prevent damage to the instrument during shipping. Check the shipping order against the contents of the container and report any damage or short shipment to Compliance West USA. The container should include the following:

- The GFM-40ac Tester
- A 10 AWG Test Lead
- An 18 AWG Line Power Cord
- A 10 AWG Test Cord
- A plastic calibration screwdriver
- An alligator clip/wire assembly
- This Instruction Manual

If reshipment of the instrument is necessary, please use the original shipping container. If the original shipping container is not available, be sure that adequate protection is provided to prevent damage during shipment. We recommend that the instrument be surrounded by at least three inches of shock-absorbing material on all sides of the container.

Remove the Tester from its container and place it on a test bench.

AC Line Voltage Requirements

AC line voltage requirements for your Tester are noted on the rear panel of the instrument. Do not connect the instrument to a different voltage source.

Fuse Replacement

There is a user-replaceable fuse (F1) located on the rear panel of the instrument. It is located behind a door in the Power Inlet-Power Switch-Fuseholder device. The fuse rating is noted on the rear panel. Do not attempt to replace it with a fuse of any other rating.

Use the following procedure to replace the fuse F1:

1. Turn the power switch to the O or off position.
2. Unplug the instrument from the source of suppy.
3. Remove the power inlet cord from the instrument.
4. Using a small screwdriver, pry open the fuseholder door.
5. Replace the fuse with a new one of the correct rating.
6. Replace the fuseholder door and power inlet cord.

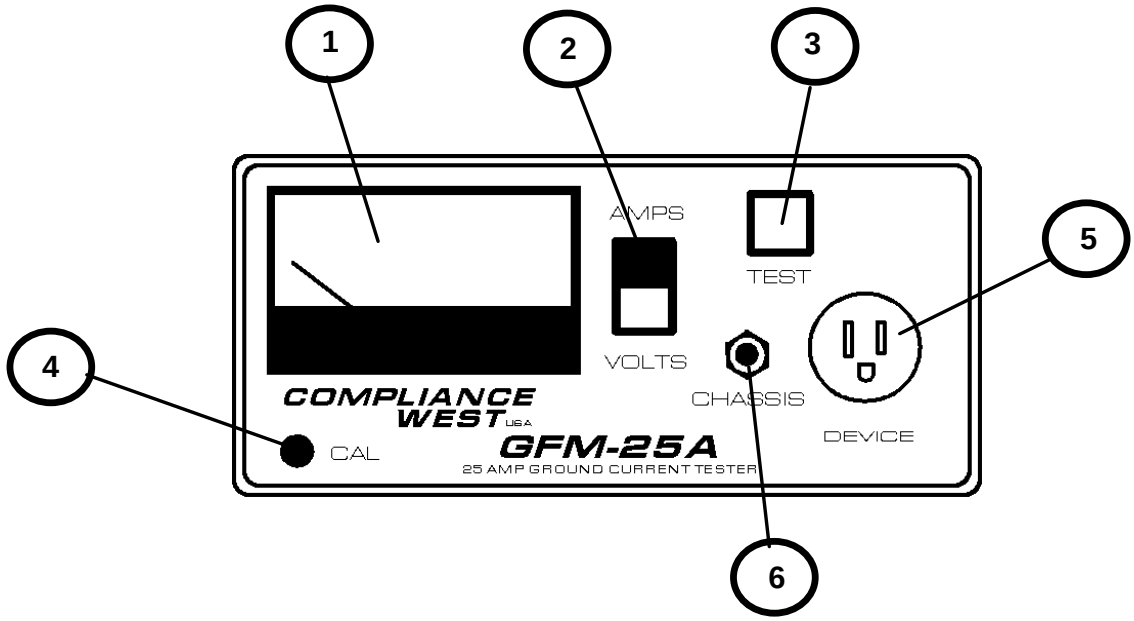

Figure 2-1. Controls, Indicators, Connectors – Example Model GFM-40ac Front Panel

ITEM NO.	NAME	FUNCTION
1	Volts/Amps Meter	Indicates tester output voltage or amperage, depending on setting of Switch, Item 2.
2	Volts/Amps Switch	Selects reading shown on Meter, either voltage output or current output.
3	Test Button / Blue Indicator Lamp	Switch and incandescent lamp. When lamp lit, indicates tester power is on and ready to test. When button is pushed, test current is applied to the equipment under test. Test continues until button is released.
4	Current adjustment knob	Adjusts current output of tester.
5	"Device" Receptacle	NEMA 5-15R receptacle. For connection of the Equipment Under Test with a non-removable power cord or with 10 AWG test cord provided.
6	"Chassis" Jack	Isolated banana plugJack. Connect the 10 AWG Test Lead here.

Table 2-1. Control, Indicators, Connectors - Model GFM-40ac Front Panel

Front Panel Features

Before using your Tester, take a few minutes to become familiar with the use of its controls, indicators and connectors. The front panel features of the GFM-40ac are shown in Figure 2-1 and described in Table 2-1. The rear panel features of the GFM-40ac are shown in Figure 2-2 and described in Table 2-2.

Initial Checkout Procedure

The following procedure will allow you to verify that the Tester is working correctly before use. The only test equipment required is the unit itself, the 10 AWG Test Lead, the 10 AWG Test Cord, and the alligator clip/wire assembly .

CAUTION

High current. Risk of burns. Remove any conductive jewelry before using the Tester.

1. Connect your Tester to a correctly rated source of supply and turn the power switch to the I or ON position. The tester will perform a self-diagnostic test. Tthe meter may briefly deflect and return to zero.
2. Plug the split end plug of the 10 AWG Test Lead into the Return Lead Receptacle of the Tester.
3. Plug the 10 AWG Test Power Cord into the "Device" Receptacle of the Tester. Attach the alligator clip/wire assembly to the center lead of the IEC connector on the exposed end of the supplied 10 AWG Test Power Cord. Connect the two cords together with the alligator clips.
4. Set the front panel switch to the Amps range. Push the Test Button and adjust the "CAL" knob on the front panel. The GFM-40ac meter should swing to indicate from 10 - 40 amps.
5. Disconnect the Test leads and carefully lay them on a non-conductive surface. Push the Test button. The GFM-40ac should indicate 0 amps on the meter.

If your Tester yielded the proper results, it is working properly. If it did not, call Compliance West USA for assistance.

Voltage Zero Adjustment

Setting Voltage Zero using the supplied IEC Test Cordset

1. Connect your GFM-40ac Tester to a correctly rated source of supply and turn the power switch to the I or ON position. The tester will perform a self-diagnostic test. If the Volts/Amps switch is set to Volts, the meter will briefly swing.and return to zero.
2. Plug the split end plug of the 10 AWG Test Lead into the "Chassis" Receptacle of the Tester.
3. Plug the supplied 10 AWG Test Power Cord into the "Device" Receptacle of the Tester. Insert the alligator clip/wire assembly into the center lead of the IEC connector and firmly connect the alligator clips of the two leads together. It is imperative that the connection made is solid, as the accuracy of the *v=ir*tual current sense is extremely dependent onthe integrity of this connection.
4. Set the meter selection switch on the front panel to amps.
5. Insert the plastic calibration screwdriver into the potentiometer behind the upper hole in the rear panel marked "Voltage Zero".
6. Push and hold the Test Button; the test will continue until the button is released. Adjust the "CAL" knob on the front panel so the meter reads 25 amps.
7. With the Test Button pressed, set the meter selection switch to Volts and adjust the "Voltage Zero" potentiometer until the meter output reads 0 volts.
8. Confirm proper operation of the *v=ir*tual voltage sense circuit by unclipping the alligator clips from each other and clipping them to the leads of the rear panel calibration resistor.
9. With the Volts/Amps switch set to "Amps", adjust the "CAL" knob on the front panel so the meter shows a 25A output.
10. Move the Volts/Amps switch to "VOLTS". Proper operation is confirmed by a 2.5 volt reading, the voltage drop expected in the resistor alone.

Setting Voltage Zero for products with non-removable power cords

NOTE

Ensure that the non-detachable power cord used on the product to be tested meets the length and conductor size requirements of Table 1-1 before attempting to calibrate the tester. If a non-detachable power cord not meeting the length requirements in Table 1-1 is used, the tester voltage zero procedure may not be successful. However, if the voltage zero procedure is successful, the GFM-40ac will test products correctly.

1. The voltage zero procedure requires the use of a power cord assembly from the EUT. Remove the power cord assembly from the EUT or use a representative sample. Crimp or solder an alligator clip to the green (grounding) conductor of the cord at the non-plug end.
2. Connect your GFM-40ac Tester to a correctly rated source of supply and turn the power switch to the I or ON position. The tester will perform a self-diagnostic test. If the Volts/Amps switch is set to Volts, the meter will swing.
3. Plug the split end plug of the 10 AWG Test return lead into the "Chassis" Receptacle of the Tester.
4. Plug the EUT Power Cord prepared in Step 1 above into the "Device" Receptacle of the tester. Firmly attach the alligator clip previously crimped or soldered to the EUT Power Cord to the alligator clip of the Return lead. It is imperative that the connection made is solid, as the accuracy of the voltage zero adjustment is dependent on the integrity of this connection.
5. Set the meter selection switch on the front panel to Volts.
6. Insert the plastic calibration screwdriver into the potentiometer behind the upper hole in the rear panel marked "Voltage Zero".
7. Push and hold the Test Button. Holding the test button will continue the test until the button is released.
8. With the Test Button pressed, adjust the "CAL" knob on the front panel. Simultaneously adjust the rear panel potentiometer until the meter output remains steady while the "CAL" knob is adjusted throughout its range.
9. Confirm proper operation of the *v=ir*tual voltage sense circuit by unclipping the alligator clips from each other and clipping them to the leads of the rear panel calibration resistor.
10. With the Volts/Amps switch set to "Amps", adjust the "CAL" knob on the front panel so the meter shows a 25A output.
11. Move the Volts/Amps switch to "VOLTS". Proper operation is confirmed by a 2.5 volt reading, the voltage drop expected in the resistor alone.

Operating Techniques

The following paragraphs describe how to operate your GFM-40ac Tester in both laboratory use and on the production line. In the following sections, EUT means Equipment Under Test.

Testing the EUT (Laboratory Use)

This section describes how the Tester is used to conduct an actual test.

CAUTION

High current. Risk of burns. Remove any conductive jewelry before using the Tester.

NOTE

If the EUT is equipped with a detachable power cord, use the supplied 10 AWG Test Power Cord , not the EUT power cord. The accuracy of the calibration procedure depends on use of the same power cord type for all testing.

1. Connect your Tester to a correctly rated source of supply and turn the power switch to the I or ON position. The tester will perform a self-diagnostic test.If the

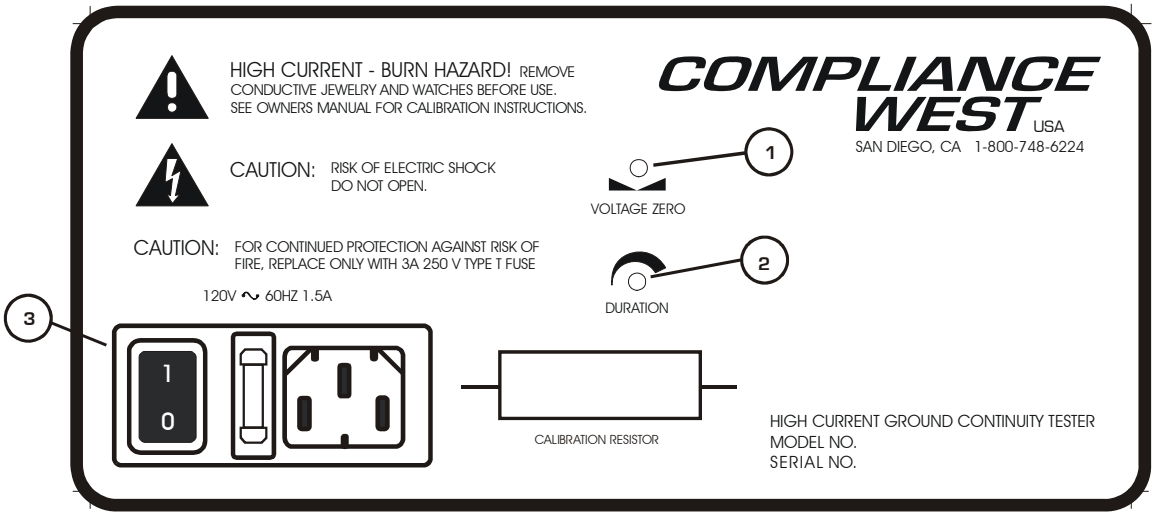

Figure 2-2. Controls, Indicators, Connectors - Model GFM-40ac Rear Panel

ITEM NO.	NAME	FUNCTION
1	Voltage Zero	Used to adjust meter. See "Calibrating the GFM-40ac Tester" section of this manual for procedure.
2	Test Duration Setting	Used to set test duration. Set to test durations between 1 and 120 seconds.
3	Appliance Inlet / Fuseholder / Power Switch	Uses 18 AWG cordset to connect tester to appropriate source of supply. Replace line fuse. Turn tester ON/OFF.

Table 2-2. Controls, Indicators, Connectors - Model GFM-40ac Rear Panel

Volts/Amps switch is set to Volts, the meter will swing.

2. Set the "CAL" knob on the front panel to its minimum (furthest counter-clockwise) position.
3. Set the front panel switch to Amps.
4. Plug the split end plug of the 10 AWG Test Lead into the "Chassis" Receptacle of the Tester.
5. Plug the supplied 10 AWG Test Power Cord or non-detachable EUT power cord into the "Device" Receptacle of the Tester, and then into the power inlet of the equipment to be tested.
6. Connect the alligator clip end of the Test Lead to the chassis of the equipment to be tested.
7. Push the test button. While the Test Button is pressed, set the current to the desired level with the current knob. The test will continue only as long as the test button is pressed.
8. The results of the test will be shown on the front panel meter. Voltage and current can be read by cycling the volts/amps switch on the front panel.

Test results (Laboratory Use)

By noting current and voltage readings, the resistance of the grounding path of the EUT can be easily determined. Check the appropriate Safety Standard for the product category and safety agency to determine acceptable grounding circuit resistance.

For new designs, start at a low current and gradually increase to the full 25 amps so the EUT is not damaged. Following this strategy, you will be able to locate weak links in the grounding chain and redesign them before production.

Using the GFM-40ac for Production Line Testing

The GFM-40ac can be used effectively in low-volume production line testing. Set the voltage zero point and the current level each time a different length or gauge test lead or Cord is used, and every time the instrument is returned to production line use following an annual calibration or laboratory testing. In the following section, EUT means equipment under test.

CAUTION

High current. Risk of burns. Remove any conductive jewelry before using the Tester.

NOTE

If the EUT uses a detachable power cord, use the supplied 10 AWG Test Power Cord, not the EUT power cord. The accuracy of the calibration procedure depends on use of the same power cord type for all testing.

Setting the Current Level

1. Set the voltage zero point as shown on page 5. This adjustment allows the GFM-40ac to compensate for the resistance of the cordset and the return lead.
2. Connect your Tester to a correctly rated source of supply and turn the power switch to the I or ON position. The tester will perform a self-diagnostic test.
3. Set the current adjustment knob on the front panel to its minimum (furthest counter-clockwise) position.
4. Set the volts/amps switch on the front panel to Amps.
5. Plug the split end plug of the 10 AWG Test return lead into the "Chassis" Receptacle of the Tester.
6. Plug the supplied 10 AWG Test Power Cord or non-detachable EUT power cord into the "Device" Receptacle of the Tester.
7. Using the alligator clip/wire assembly, short the Test Cordset (or non-detachable EUT power cord used in the voltage zero procedure) together.
8. Push and hold the test button and adjust the current to the desired level.
9. Set the volts/amps switch on the front panel to Volts.

Production Line Testing

During the Production Line Testing procedure, it is important that the current adjustment knob on the front panel is not moved to ensure the desired amount of current is flowing.

1. Connect your Tester to a correctly rated source of supply and turn the power switch

to the I or ON position. The tester will perform a self-diagnostic test.If the Volts/Amps switch is set to Volts, the meter will swing.

2. Set the Duration control to maximum counterclockwise position using the supplied tool.
3. Confirm that the volts/amps switch on the front panel is set to Volts.
4. Plug the split end plug of the 10 AWG Test return lead into the "Chassis" Receptacle of the Tester.
5. Plug the supplied 10 AWG Test Power Cord or non-detachable EUT power cord into the "Device" Receptacle of the Tester.
6. Connect the alligator clip end of the Test Lead to the chassis of the equipment to be tested.
7. Push the test button. The test will continue only as long as the test button is pressed. A test time of 5 seconds is recommended.
8. The voltage drop of the grounding circuit alone, not counting the resistance of the test leads, will be shown on the front panel meter.
9. To test for longer times, we recommend the method above be used first to validate test setup. After the test setup is reliable, set the Duration control on the rear panel to the desired test duration. The test will continue for the desired time after the TEST button is pressed.

Test results (Production Line Use)

By noting the voltage readings, dc resistance of the grounding path of the EUT can be easily determined. In the vast majority of cases, the acceptable resistance of a grounding circuit, neglecting the resistance of the power supply cord, is 0.1Ω. If this is the case, and a current of 25 amps was set, a voltage result of less than 2.5 volts would be acceptable.

Section 3

Maintenance

WARNING

THESE SERVICE INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

Introduction

This section of the manual contains maintenance information for the Model GFM-40ac High Current Ground Tester. This maintenance information is divided into service information, general maintenance, a performance test, a calibration procedure, and a troubleshooting procedure. The performance test is recommended as an acceptance test when the instrument is first received, and later as a preventative maintence tool to verify proper instrument operation. A 1-year calibration cycle is recommended to maintain the specifications given in Section 1. The Test equipment required for both the performance test and calibration procedure is a DMM able to read true rms 0-4VAC ± 1%.

Service Information

The GFM-40ac is warranted to the original purchaser for a period of 1 year . The warranty does not cover problems due to misuse or neglect.

Malfunctions which occur within the limits of the warranty will be corrected at no charge. Mail the instrument post paid to the manufacturer. Dated proof of purchase is required for all in-warranty repairs.

The manufacturer is also available for calibration and / or repair of instruments that are beyond their warranty period. Contact the manufacturer for a cost quotation. Ship the instrument and your remittance according to the instructions given by the manufacturer.

General Information

Interior Access

NOTE

To avoid contaminating the PWB with oil from your fingers, handle it by the edges or wear gloves. If the PWB becomes contaminated, refer to the cleaning procedures given later in this section.

Calibration Access

Use the following procedures to gain access to the calibration adjustments of your instrument.

1. Set Line Power switch to OFF.

2. Disconnect the power cord from the rear of the instrument.

3. Remove the two upper screws on each side of the unit.

4. Grasp the top of the enclosure clamshell and lift it off the front and rear panels.

5. All calibration adjustments are now accessible.

NOTE

With the power cord replaced, the instrument is operational for service.

WARNING

Dangerous voltages exist when the GFM-40ac is energized. Exercise extreme care when working on an energized circuit.

6. To reassemble, reverse steps 1-5 above.

Cleaning

CAUTION

Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. These solutions will react with the plastic materials used in the instrument.

Clean the front panel and case with a mild solution of detergent and a damp sponge. Clean dust from the PWB with clean, dry, low pressure (<20 psi).

Performance Test

The performance test compares the performance of your instrument with the list of specifications given in Section 1. This test is recommended for incoming inspection, as a preventative maintenance check, and to verify the specifications. If the instrument fails any part of the performance test, calibration and / or repair is indicated.

Allow the instrument to stabilize and perform the test at an ambient temperature of 23°C ±5°C (73 °F ±9°F).

Operation/Meter Function Test

1. Connect the GFM-40ac to a proper source of supply using the included 18 AWG power supply cord.

2. Disconnect all other leads and turn the GFM-40ac on.

3. Verify the blue lamp is lit.

4. Using a test lead, short the ground of the front panel test power receptacle to the return lead receptacle.

5. Press and hold the Test button and adjust the "CAL" knob on the front panel.

6. Adjust the Voltage Zero control on the rear panel using the supplied plastic screwdriver until the front panel meter reads 0 voltage as the current varies when the "CAL" knob is turned.

CAUTION

Prolonged or repeated test in this mode can cause overheating of the test lead. 25A flows through the test lead during this test.

NOTE

After these tests confirm proper operation, the Voltage Zero point must be reset as shown in Section 2 above before use.

Calibration Procedure

The Calibration Procedure should be used any time your instrument has been repaired or fails to pass the performance test. The calibration procedure consists of three parts:

- The Turn-On Check verifies the proper power supply voltage.
- The Voltage Calibration adjustment calibrates the voltage output.
- The Current Calibration adjustment calibrates the current output.

Before starting the Calibration procedure, perform the Calibration access procedure given earlier in this Section.

NOTE

Allow the instrument to stabilize for approximately five minutes. Perform all calibration adjustments at an ambient temperature of 23°C ±5°C (73° F ±9°F).

WARNING

CALIBRATION ADJUSTMENTS ARE PERFORMED ON ENERGIZED CIRCUITS. EXERCISE CAUTION AT ALL TIMES, AND USE A NON-CONDUCTIVE TOOL FOR ALL ADJUSTMENTS.

Voltage Calibration Adjustment

Use the following procedure to calibrate the Output Voltage Range.

1. Using supplied Test Lead and 10 AWG Test Power Cord, perform the Voltage Zero Calibration. See Page 5, "Setting Voltage Zero using the supplied IEC Test Cordset" for details.

2. Connect the Test Lead and the ground of the IEC Test Cordset to the back panel (or other) 0.1 ohm resistor using the alligator clip/wire assembly.

3. Connect the DMM across the 0.1 ohm resistor.

4. Switch the Volts/Amps switch on the front panel of the GFM-40ac to Volts.

5. Adjust the "CAL" knob on the front panel of the GFM-40ac until the DMM reads 2.5Vdc.

6. Push the Test Button on the front panel and adjust the resistor marked R26 until the front panel meter of the GFM-40ac reads 2.5 volts.

Current Calibration Adjustment

Use the following procedure to calibrate the Current Output.

1. Perform the voltage calibration adjustment procedure above.

2. With the DMM and test leads connected per the voltage calibration adjustment procedure, switch the Volts/Amps switch of the GFM-40ac to Amps.

3. Push and hold the Test Button on the front panel of the GFM-40ac. Adjust the "CAL" knob on the front panel of the GFM-40ac until the DMM reads 2.5 volts.

4. Adjust the resistor marked R25 until the front panel meter of the GFM-40ac reads 2.5 volts. .

Troubleshooting Guide

Problem encountered	Possible Solution
Meter deflects, then returns to zero when tester is turned on and turned off.	Normal operation. The meter movement is fully protected and swings will not harm it .
Unit will not pass Voltage Zero adjustment when the EUT has a non-detachable power cord	Cord is too long. Check Table 1-2.
Blue light does not light.	Blue light is the pilot light for secondary AC power. Check for proper operation. If unit does not work, check supply voltage and fuse F1. If unit works correctly, check pilot light and replace if necessary with a 14V type 73 bulb.
Meter will not fully deflect on Amps scale.	Check for full voltage deflection. If meter fully deflects, go to next paragraph. If not, service is required. Perform voltage zero adjustment with supplied IEC cordset. If meter fully deflects during this adjustment, the resistance in your test setup is too high. Check for open grounding circuit or excessive lead resistance.
Voltage Zero adjustment not effective (voltage drifts when current is varied)	Rerun Voltage Zero adjustment making sure the connection between the alligator clips is very tight. Check EUT for degradation of grounding path under high current.

Technical Assistance

For Technical Assistance
Phone: (800) 748-6224

Technical Assistance is available from Compliance West USA between the hours of 8:30 AM and 4:00 PM Pacific Time.

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