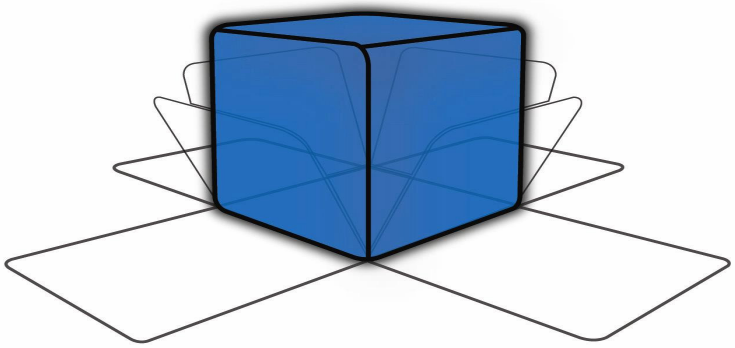
HT-2800P

Dielectric Withstand Tester

0-2800 Volts DC Output

Instruction Manual



COMPLIANCE WEST USA

Dear Customer:

Congratulations! Compliance West USA is proud to present you with your Dielectric Withstand Tester. Your instrument features a groundbreaking logic-controlled circuit design and ergonomic front panel, and represents the latest in high voltage production line testing.

To fully appreciate all the features of your new meter, we suggest that you take a few moments to review this manual. If the need arises, please don't hesitate to call on us.

Thank you for your trust and confidence.

Rev. 5.3, October 2009

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Section 1

An Introduction to Dielectric Withstand Testing with the HT-2800P

The continuity test/dielectric withstand test is a production line test which is recognized by safety agencies worldwide as a valid criterion of safe assembly of end-use equipment. The test ensures that the primary circuit power and ground conductors were properly wired and connected for safe operation. It also applies a high-voltage potential between power and ground conductors to make sure that no unintentional leakage or arcing paths exist between power and ground. The test consists of a ground continuity check, a leakage current check and a high voltage check. It is non-destructive to the equipment under test, and can be accomplished in a short time.

Safety Precautions

The dielectric withstand test generates voltages of up to 2800 volts dc at potentially lethal current levels. Currents of as little as 5 mA at 120 volts can cause death, and the HT-2800P is capable of generating 5 mA at up to 2800 volts. The HT-2800P has been designed to minimize exposure to high voltages. However, the potential for serious injury or death exists and personnel should be aware when they conduct this test.

Test Personnel

Personnel require special training to conduct the dielectric withstand test. They should understand electrical fundamentals clearly, and be aware that high voltage is adept and creative at completing a path to ground. Instructions should include a warning against any metal jewelry. Operators should not allow others in the testing area, especially when tests are being conducted. Organization is to be stressed. The operator should keep the area free of unused leads and equipment.

Testing Area

The area used for conducting the dielectric withstand test should be as remote as possible from normal production line activities. Only personnel actually conducting the test should be allowed in the area, and it should be taped or roped off to preclude casual entry by other employees. In addition, the area should be marked "WARNING - HIGH VOLTAGE TESTING" or the equivalent to warn others of the nature of the testing taking place.

The bench being used should be non-conductive, and any exposed metal parts should be tied together and grounded. If a conductive surface must be used, it should be grounded.

Because of sparking during a dielectric test failure, it is not safe to conduct dielectric withstand tests in combustible atmospheres.

It is imperative that a good ground be provided to the HT-2800P. Before connecting the HT-2800P, ensure that a low-resistance ground is provided by the building wiring. If the HT-2800P is used on a high-resistance grounding circuit, dangerous high voltages may be present to the operator. In addition, the power to the Testing Area should be provided with an easily reached shutoff switch which can be actuated by personnel outside the Area if needed.

Safety Techniques

The high voltage circuit of the HT-2800P can be shut off at any time by pressing the **RESET** button. The HT-2800P has been provided with a Reset switch to provide an unarmed "Standby" setting when it is energized, but idle. When the red **RESET** button is lit, the tester will not provide high voltage until the **RESET** button and the **TEST** button have been pressed in order. To prevent inadvertent operation, the operator should be instructed not to press the **RESET** button until the test is ready.

The HT-2800P is equipped with a Ground Continuity Check which will not allow high voltage to be applied if the Test Return Lead is not properly connected. This is an important safety feature and should not be defeated unless two wire products are being tested. In that event, it is imperative that the operator make absolutely sure the Test Return Lead is properly connected to the equipment being tested. If the lead is not properly connected, a dielectric withstand test failure may energize exposed dead metal of the equipment being tested. Additionally, the HT-2800P may not recognize the failure. The test will continue for its normal length of time, and the HT-2800P may show a "PASS".

The HT-2800P has been designed for one-touch operation with the right hand. If possible, it should be set up to the left and in front of the equipment under test. The equipment under test should be connected to the HT-2800P and then left alone by the operator. After the operator is clear of the Tester and the equipment under test, he should press the **RESET** Button, then the **TEST** Button, with his right hand. This will allow the greatest separation between the operator and the test being conducted.

The HT-2800P is designed to bleed the high voltage away after the test has concluded. In order to ensure that any voltage present in the equipment being tested has been completely bled away, the operator should not unplug the equipment under test from the HT-2800P until the front panel meter reads zero volts.

Using the HT-2800P Dielectric Withstand Tester

The dielectric withstand test involves high voltage and caution should be exercised when using the tester. The tester's return lead is connected to ground potential and when properly connected to the equipment being tested, it will guard against the operator contacting high voltage. Always make sure the return lead is firmly connected to exposed dead metal. In the sections below, the three tests are discussed.

Ground Check

The Ground check ensures that the grounding pin of the power supply cord is properly connected to the exposed dead metal of the chassis. If this connection is absent, the exposed dead metal of your product could be at line potential indefinitely after an internal wiring fault, causing risk of shock to anyone touching it.

If the green **Ground OK** LED lights and the test continues, the connection between the grounding pin and the exposed dead metal of the equipment being tested has a resistance of below three ohms*.

Ground Check Failures

If the red **Ground Open** LED lights, the buzzer sounds, and the test is terminated. The connection between the grounding pin of the attachment plug cap and the exposed dead metal of the chassis has a resistance of greater than three ohms*. This indicates a problem with the connection of the HT-2800P to the equipment being tested, or that the ground connection in the equipment being tested is defective. The connection to the tester should be checked by removing

the Test Return Lead clip from the equipment under test and reconnecting it, taking care to make a good connection. The unit should then be retested. If a failing result is repeated, the connection between the power supply cord ground pin and the chassis of the equipment being tested should be checked and reworked until a passing result is obtained.

*Special calibrations available by internal adjustment. Must be performed by qualified service personnel. See Sec. 5.

Defeating the Ground Check

The Ground check can only be conducted on equipment using a three wire grounded power supply cord. Some equipment, such as most portable lamps and all double insulated tools, have only a two wire power supply cord, so the Ground test cannot be conducted.

Please note that defeating the Ground check should not be done except when necessary to test two-wire devices. The Ground check feature provides an extra level of operator safety because high voltage will not be applied if the Test Return Lead is not properly connected to the exposed dead metal of the equipment being tested. If the Test Return Lead is not properly connected, a dielectric withstand failure may energize exposed dead metal. Additionally, the HT-2800P may not recognize the failure. The test will continue for its normal length of time, and the HT-2800P may show a "PASS".

To allow the HT-2800P to test equipment using a two wire power supply cord, the Ground Check can be defeated by turning the rear panel Ground Check switch to the Off position. To remind the operator that the Ground Check is not being conducted, both the green **Ground OK** and red **Ground Open** LED's will be lit continuously during the test. When testing with the Ground Check switch in the Off position, the operator must ensure that the Test Return Lead is properly connected to exposed dead metal of the equipment being tested for safety and to ensure that the HT-2800P properly reports all failures.

Leakage Test

The HT-2800P leakage test uses a separate low-frequency circuit to check for excessive leakage between primary power components and ground. There is not a specific leakage current level pass/fail requirement at this time for most equipment, however, higher than normal leakage current on a particular part may indicate an assembly or component problem in the primary circuit.

The leakage current is also monitored by the HT-2800P to ensure that excessive leakage does not keep the tester from developing full voltage required for the high voltage test. The HT-2800P will provide full voltage at any leakage current level up to 5 mA. The leakage current trip level is adjustable on the rear panel.

The leakage test is conducted by shorting the power and neutral conductors of the power supply cord and applying high voltage between them and the exposed dead metal of the chassis of the equipment being tested.

Excessive leakage current is not grounds for failure of the dielectric withstand test. Leakage current is a normal result of capacitance in the primary circuit between neutral or line conductors and ground. (In dielectric tests of some larger electric motors, leakage currents of as high as 95 mA are considered acceptable by safety agencies.) However, leakage currents higher than normally anticipated for a particular model should not be ignored. This indicates problems of low resistance up to a short circuit between line/neutral and ground, and failures should be investigated. Failure modes are discussed below.

If the green **Full Voltage** LED lights and the test continues, the leakage current was below the amount set by the rear panel adjustment.

Sporadic Leakage Current Failures

If the red **Excess Leakage** LED lights, the buzzer sounds, and the test is terminated, the leakage current delivered to the equipment being tested was over the amount set by the rear panel adjustment. If other equipment of the same type routinely passes this test, there may be a problem with the primary circuit of the example being tested. The unit should be checked and reworked if necessary.

High Voltage Dielectric Withstand Test

This test checks for insulation system breakdowns between the primary and ground circuits. The HT-2800P uses a separate high-frequency transformer circuit to check for and detect arc breakdowns.

The dielectric withstand test is conducted by shorting the line and neutral conductors of the power supply cord and applying high voltage between them and the exposed dead metal of the chassis of the equipment being tested. The duration of the test is controlled by the test time control on the back panel. The test time is counted from the time the **Full Voltage** LED is lit to the completion of the test.

If the green **Hipot Pass** LED lights, the test cycle has been successfully completed. The equipment under test is in accordance with the preset test parameters. The HT-2800P is ready to test the next piece of equipment.

High Voltage Dielectric Withstand Test Failures

If the red **Hipot Fail** LED lights, a problem has been found with the insulation system between primary and ground. The equipment under test should be examined, reworked and successfully tested before being shipped.

High Voltage Discharge

The HT-2800P is designed to discharge the high voltage after completion of the dielectric withstand test. The equipment being tested should remain connected to the HT-2800P until the voltage has discharged to a safe level to protect the operator and also to ensure that there is no energy stored in the tested equipment.

Testing Equipment with non-Standard Plugs or Pigtail Operation

The front panel of the HT-2800P is provided with a NEMA Type 5-15R receptacle, suitable for testing cord-equipped single-phase products designed for use on a 15 amp branch circuit in North America. For other types of products, a different receptacle type or pigtail leads may be required. Various adapters and pigtail leads are available from Compliance West USA, or you can make your own. If tests of this type are contemplated, call us for information.

Section 2

Introduction and Specifications

This manual contains complete operating, maintenance and calibration instructions for the Compliance West USA Model HT-2800P Dielectric Withstand Tester.

The HT-2800P is a bench-type Dielectric Withstand Tester with DC Output, designed for production line testing.

The HT-2800P features automatic one button operation, with numerous safety features designed to protect the operator:

- The Return Lead is directly connected to ground potential for operator safety.
- In case of trouble, the test can be immediately terminated at any time by pressing the **RESET** button.
- Before the test can commence, the unit must be armed by pressing the **RESET** Button. The test will not begin until the **TEST** Button is pushed.
- If a failure is encountered, the high voltage is immediately shut down, a buzzer sounds, and any voltage stored in the equipment being tested is bled off by a resistor bank in the HT-2800P. The voltage discharge progress is shown by the front panel meter.
- Failure modes are shown by the front panel LED's for quick troubleshooting.

Convenience and testing features include:

- Test results are determined quickly, without operator intervention.
- Operator instructions are printed on the rear panel for quick reference.
- The HT-2800P allows custom setups for voltage ramp, test time and leakage limit.
- The Ground check can be defeated by a switch on the rear panel for testing of products using a two wire power supply cord.
- Voltage is discharged by a resistor bank within the HT-2800P upon test completion. Discharge progress is shown on the front panel meter.
- Ground continuity Pass/Fail resistance level is adjustable during the annual calibration procedure.

The HT-2800P meets all safety agency criteria for automatic production line dielectric withstand testers.

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

Specifications

Specifications for the HT-2800P are listed in Table 1 on the next page.

ELECTRICAL	
Output	0-2800 Volts DC Pigtail and Receptacle adapters available for most configurations. Consult factory.
Leakage Current	1-5 mA
Pass/Fail Criteria:	
Ground Continuity:	3 ohm ± 5% * (defeatable)
Leakage Current:	User adjustable 1-5 mA
Dielectric Breakdown:	Separate high frequency detection circuit for breakdown spike detection
Test Time:	User adjustable 1-60 sec.
Voltage Ramp Time:	User adjustable 1-5 sec.
Pass/Fail Repeatability	± 3%
Meter accuracy	± 2% from 500-2800 volts DC
Duty cycle	100 %
Discharge Time	Voltage dependent; discharge progress displayed on front panel meter
Test adjustments	Tamperproof operation available
ENVIRONMENTAL	
Operating Temperature	15-40°C
Relative Humidity Range	0-90% non-condensing
GENERAL	
Input power requirements	See rear panel for input voltage and fuse ratings Weight 10½ lbs
SAFETY AGENCY TOPICS	
Transformer Output	< 500VA Visual Indication of Voltage Output Provided by front panel meter, directly connected to high voltage output
Failure Indication	Audible, provided by internal buzzer Visual, provided by red LED's on front panel Test automatically terminated on failure
Ground Test	Provided; 3 ohm pass/fail point*. May be defeated for testing of products with two wire power supply cords.
Leakage Test	Provided; 2 mA factory set pass/fail point, user adjustable.
Operation Instructions	Provided on rear panel.

Table 1. HT-2800P Specifications

*Ground Continuity Pass/Fail Level can be adjusted from .5 to 5 ohms during the calibration procedure.

Section 3

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 HT-2800P Dielectric Withstand Tester
- An 18 AWG Test Lead (Alligator Clip/Banana Plug ends, black)
- An 18 AWG Line Power Cord to provide power to the HT-2800P
- 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-Fuse Holder 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 supply.
3. Remove the power inlet cord from the instrument.
4. Using a small screwdriver, pry open the fuse holder door.
5. Replace the fuse with a new one of the correct rating.
6. Replace the fuse holder door and power inlet cord.

Front and Rear 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 HT-2800P are shown in Figure 2 and described in Table 2. The rear panel features of the HT-2800P are shown in Figure 3 and described in Table 3.

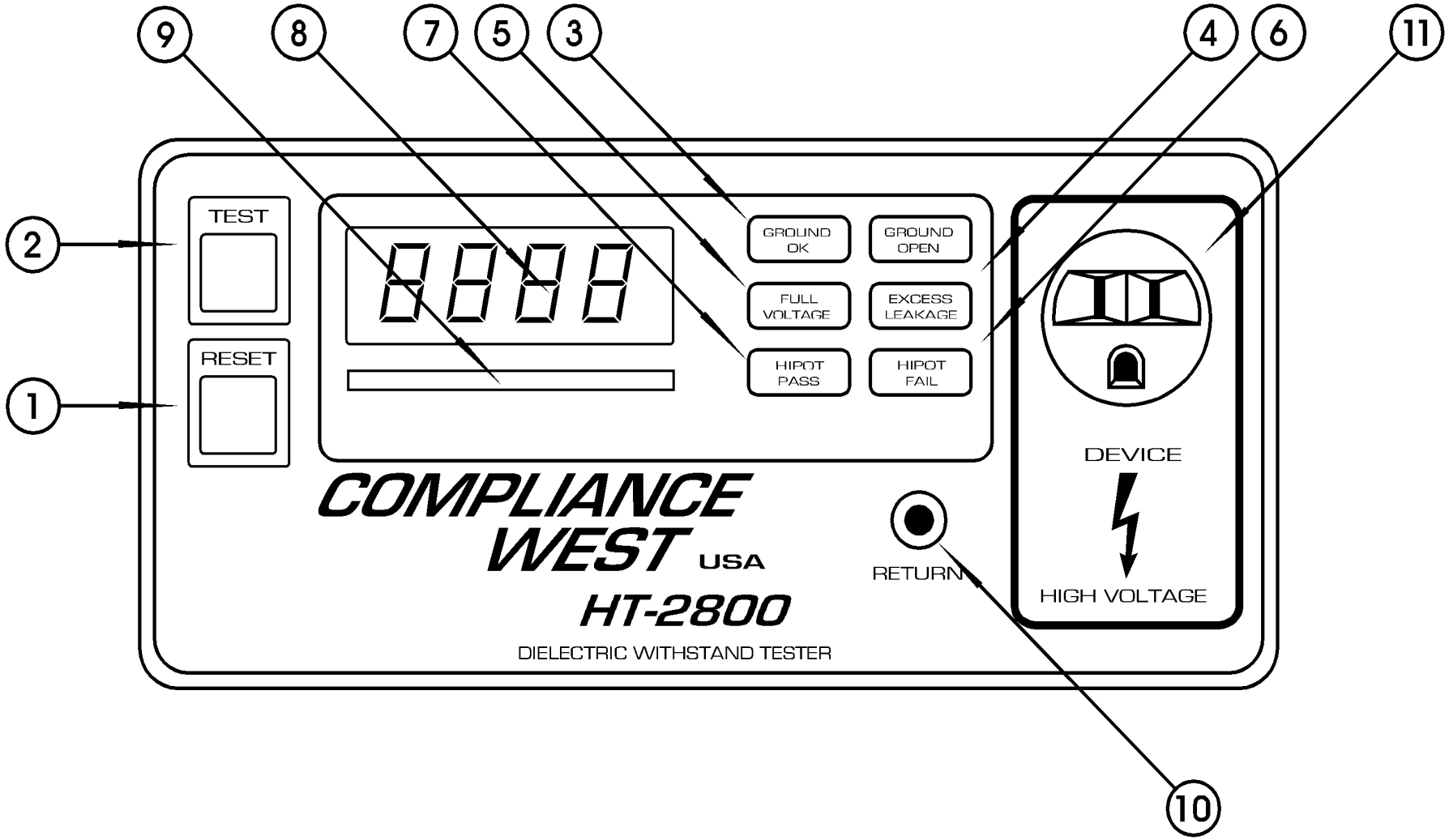

Figure 2. Controls, Indicators, Connectors - Model HT-2800P Front Panel

ITEM	NAME	FUNCTION
1	**RESET** Button / Red Indicator	When lit, indicates that the HT-2800P is unarmed. This button must be pushed before the **TEST** Button is functional. When the **RESET** Button is pressed, the red **RESET** indicator goes out and the yellow **TEST** indicator is lit. **PRESSING THE RESET BUTTON AT ANY TIME STOPS TEST**.
2	**TEST** Button / Yellow Indicator	When lit, indicates that the HT-2800P is ready to test the connected equipment. The yellow **TEST** indicator goes out when the **TEST** Button is pressed.
3	**Ground OK / Ground Open** LED's	Indicates result of Ground test between grounding pin of the line cord and exposed metal parts of the equipment under test. If the ground circuit has more than three ohms resistance, or if the leads are not properly connected, the red **Ground Open** LED will light, the internal buzzer will sound, and the test will be terminated. If the ground circuit resistance is acceptable, the green **Ground OK** LED will light and the test will continue. If the continuity test is defeated by the operator, both LED's will be lit for the duration of the test.
4	**Excess Leakage** LED	Indicates failure of leakage current test. If leakage current between the primary circuit and ground is higher than the preset value, the red **Excess Leakage** LED will light, the internal buzzer will sound, and the test will be terminated.
5	**Full Voltage** LED	If full voltage is successfully reached, the green **Full Voltage** LED will light and the high voltage duration timer starts.
6	**Hipot Fail** LED	Indicates failure of high voltage test. If arcing or a flashover of the insulation system between primary parts and ground is encountered, the red **Hipot Fail** LED will light, the internal buzzer will sound, and the test will be terminated.
7	**Hipot Pass** LED	At the end of the preset high voltage duration time, if no insulation breakdowns are encountered, the green **Hipot Pass** LED will light and the test will terminate
8	Voltage Meter	Provides visual indication to the operator of the actual output voltage of the tester. Used to set the automatic voltage level during the setup procedure.
9	Ramp Bar Graph LED's	Individual LED's light in sequence from left to right as the test voltage ramps from zero to full voltage. LED's turn off (ramp back down) at end of test.
10	Return Lead Receptacle	Grounded banana plug receptacle. The 18 AWG Test Return Lead provided is connected here.
11	High Voltage Device Receptacle	NEMA 5-15R receptacle. For connection of the equipment under test.

Table 2. Controls, Indicators, Connectors - Model HT-2800P Front Panel

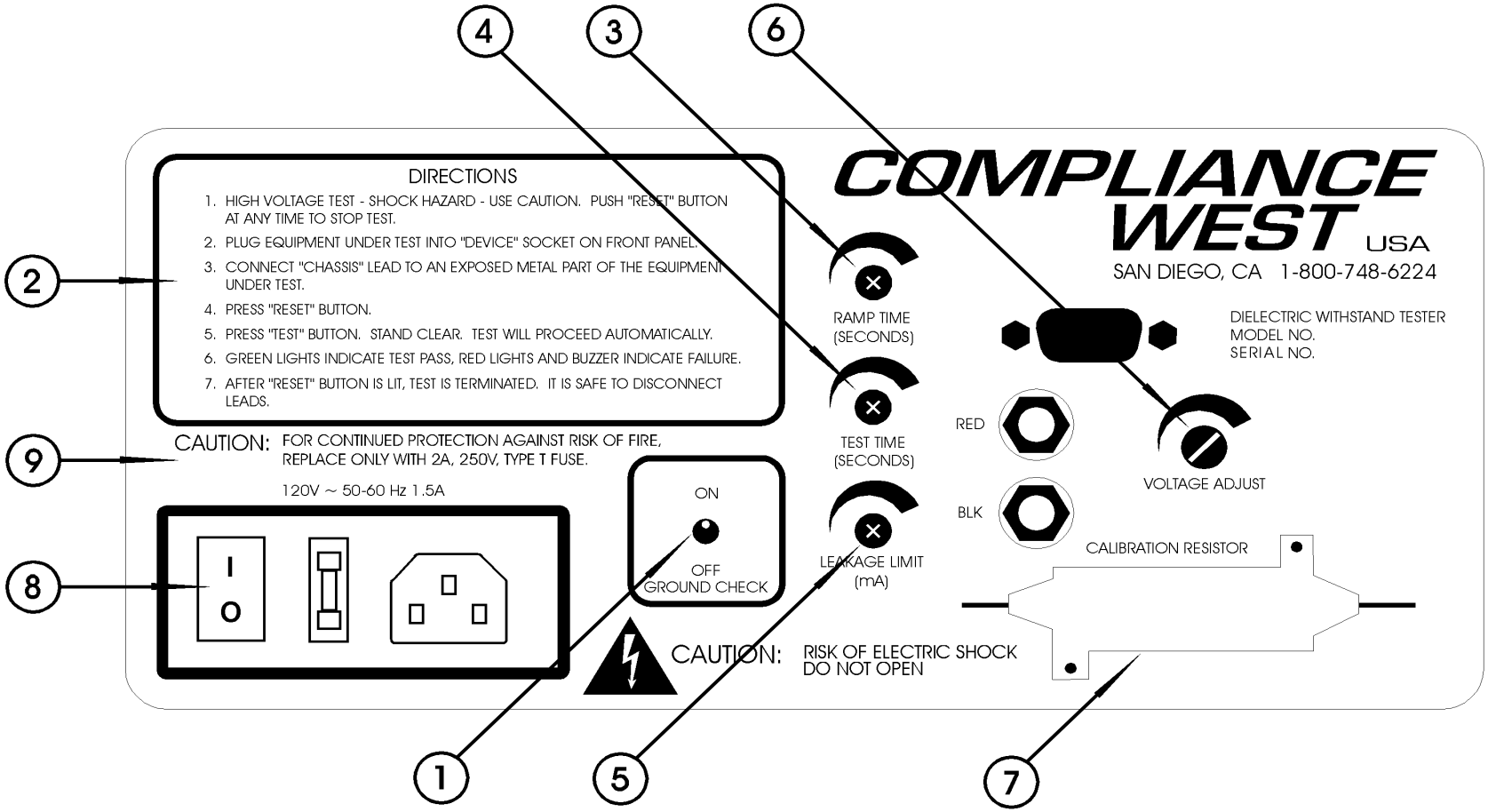

Figure 3. Controls, Indicators, Connectors - Model HT-2800P Rear Panel

ITEM NO.	NAME	FUNCTION
1	Ground Check Switch	Turn ON for use with three-wire (grounded) power supply cords. Turn OFF for use with two-wire power supply cords. (When ON, conducts Ground Test between the chassis and the grounding pin of the line cord of the equipment being tested. When OFF, Ground Test is bypassed for testing of double-insulated equipment and other types of equipment without a grounding pin in the line cord.)
2	Directions	Provides directions for tester operation to test personnel.
3	Ramp Time Adjustment	Used to adjust the amount of time used to increase the high voltage from zero volts to the required level. See "Adjustment of the High Voltage Ramp Time" for this procedure.
4	Test Time Adjustment	Used to adjust high voltage test duration. See "Adjustment of the High Voltage Test Duration" section for this procedure.
5	Leakage Limit Adjustment	Used to adjust the trip level for the excessive leakage current test. See "Adjustment of the Leakage Current Level" section for this procedure.
6	Voltage Adjust	Used to adjust the High Voltage output. See "Adjustment of the High Voltage Level" section for this procedure.
7	Calibration Resistor	(Optional)
8	Appliance Inlet / Fuse holder / Power Switch	Use supplied cord set to connect tester to appropriate source of supply. Replace line fuse. Turn Tester ON/OFF.
9	Fuse replacement warning / Rating of supply	Specifies replacement fuse and required supply voltage.

Table 3. Controls, Indicators, Connectors - Model HT-2800P Rear Panel

Initial Checkout Procedure

The following procedure will verify that the HT-2800P is working correctly. We recommend that this procedure be conducted periodically to ensure proper operation of the tester. (A Compliance West HTT-1 function tester may also be used to verify the HT-2800P is working correctly.)

The following items are needed to conduct this procedure:

- A three inch piece of 18 AWG insulated hookup wire with each end stripped back ½".
- A extra test lead with a banana plug on one end. The other end will be clipped to the alligator clip end of the black test lead supplied with the HT-2800P.

CAUTION

High voltage (up to 2800 Volts DC) generated by the HT-2800P is exposed during this test. A risk of shock exists. Exercise care when using the HT-2800P.

Performance Test

1. Connect the tester to a proper source of supply using the included 18 AWG power supply cord. Turn the HT-2800P on.
2. Turn the **Ground Check** switch on the rear panel to the Off position.
3. Disconnect all leads.
4. Push the red **RESET** button. Verify the yellow **TEST** indicator is lit.
5. Push the yellow **TEST** button.
6. The Tester should conduct a test sequence. At the end of the test, the **Ground OK**, **Ground Open**, **Full Voltage**, **Hipot Pass**, and red **RESET** LED's should be lit.
7. Turn the **Ground Check** switch on the rear panel to the On position.
8. Verify that all test leads are disconnected from the HT-2800P.
9. Push the red **RESET** button, then the yellow **TEST** button.
10. The tester should sound the buzzer. The red **Ground Open** and red **RESET** LED's should be lit.
11. Plug the supplied return test lead into the **RETURN** receptacle on the front panel.
12. Connect the banana plug end of the extra test lead from above into the grounding jack of the orange **DEVICE** receptacle. The grounding jack is circular in shape and is located at the bottom of the **DEVICE** receptacle.
13. Connect the other end of the extra test lead from above to the black lead plugged into the **RETURN** receptacle.
14. Push the red **RESET** button and then the yellow **TEST** button.
15. The tester should conduct a test sequence. At test termination, the **Ground OK**, **Full Voltage**, **Hipot Pass**, and Red **RESET** LED's should be lit.
16. Turn the **Ground Check** switch on the rear panel to the Off position.
17. Disconnect the extra test lead from the **DEVICE** receptacle. The black lead should remain plugged into the **RETURN** receptacle on the front panel.
18. Connect one end of the hookup wire to the clip of the black lead and insert the other end into one of the vertical parallel slots in the **DEVICE** receptacle on the front panel. **Keep clear of the wire while the test is in progress**.
19. Push the red **RESET** button and then push the yellow **TEST** button.
20. The tester should conduct a test sequence, terminated with a buzzer. At test termination, the **Ground OK**, **Ground Open**, **Excess Leakage**, and red **RESET** LED's should be lit.

    Note: The **Hipot Fail** LED may also light during this test.

Note: The following procedure tests the "Hipot Breakdown" circuit of the HT-2800P and involves high voltage. The only exposed parts during this test are at ground potential. However, the voltage inside the High Voltage Device socket may be as much as 2800 volts. Proceed with caution.

21. Make sure the black lead is still plugged into the **RETURN** jack on the front panel.
22. Make sure the **Ground Check** switch on the rear panel is in the Off position.
23. Remove the hookup wire from the **DEVICE** receptacle, but leave it connected to the clip of the black lead. Carefully hold the black lead by its insulated alligator clip boot.
24. Push the red **RESET** button, then the yellow **TEST** button. After the **Full Voltage** LED lights, and before the **Hipot Pass** LED has lit, insert the other end of the hookup wire into one of the vertical parallel slots in the High Voltage Device receptacle on the front panel.
25. The test should immediately terminate with a buzzer. The **Ground OK**, **Ground Open**, **Full Voltage**, **Hipot Fail** and red **RESET** LED's should be lit.
    Note: Depending on how the connection between the High Voltage Test Receptacle and the hookup wire is made, the **Excess Leakage** LED may light, and in some instances, the **Ground OK** LED may extinguish.

Passage of these tests indicates that the HT-2800P is functioning properly and that it is safe to use. If the results of the performance test are not in accordance with the above, service is required. Remove the HT-2800P from service and contact Compliance West USA, Inc. for servicing information.

Setting up the HT-2800P for Production Line Testing

This section describes procedures for setting the Pass/Fail leakage current level, high voltage ramp time, high voltage level, and high voltage test time. The HT-2800P is calibrated as shown below at the factory to be usable without adjustment in the majority of applications. If the factory settings are acceptable, you may skip this section.

Factory Settings

The unit is configured as shown when shipped from Compliance West USA:

Leakage Current Level:	2 mA
High Voltage Ramp Time:	1 second
High Voltage Level:	1700 volts
High Voltage Test Time:	2 seconds

Adjustment of the various settings are shown below.

CAUTION

High voltage is generated by the HT-2800P. Although the chassis of the equipment under test is grounded by the HT-2800P, a risk of shock exists. Exercise care when using the HT-2800P.

NOTE

These adjustment procedures set the use parameters of the HT-2800P. They do not take the place of the annual calibration required by the safety agencies.

Display of Leakage Limit and Duration settings

To view the Test Duration and Leakage Limit current settings, hold down the **RESET** button for 2 seconds. The meter will display "L" with the Leakage Limit value in mA. Hold down the **RESET** button again for 2 seconds and the meter will display "d" with the Test Duration set time in seconds.

Adjustment of the Leakage Current Level

DC Leakage Current can be set to levels of up to 5 mA. To set the leakage limit follow the steps below.

1. Connect the HT-2800P to a correctly rated source of supply and turn the power switch to the I or ON position. Push the **RESET** button. The yellow **TEST** indicator should light, indicating that the HT-2800P is ready to test.
2. On the rear panel turn the **Leakage Limit** potentiometer. As soon as the potentiometer starts turning, the meter will start blinking, display "L", and the value can be set in 0.1 mA increments from 1.0 to 5.0 mA.
3. If tamperproof settings are desired, the **Leakage Limit** control shaft may be pulled away with a slight tug. (It may be reinserted for future adjustments.)

Adjustment of the High Voltage Ramp Time

This procedure controls the amount of time used to ramp the high voltage to the required level. The factory setting of two seconds is adequate for most situations. Use this procedure if adjustment to a different ramp time within the range of <1-5 seconds is required.

1. Defeat the **Ground Check** by turning the rear panel switch to the Off position.
2. Connect the HT-2800P to a correctly rated source of supply and turn the power switch to the I or ON position. Push the **RESET** button. The yellow **TEST** indicator should light, indicating that the HT-2800P is ready to test.
3. Make sure there are no test leads connected to the HT-2800P. Push the **TEST** button.
4. When the **TEST** button is pressed, the voltage will ramp and hold. Adjust the **Ramp Time** control on the rear panel until the desired ramp time is reached. The test can be terminated at any time by pressing the **RESET** button.
5. If tamperproof settings are desired, the **Ramp Time** control shaft may be pulled away with a slight tug. (It may be reinserted for future adjustments.)
6. Check the position of the **Ground Check** switch before testing.

Adjustment of the High Voltage Level

This procedure controls the high voltage level used in the dielectric withstand test. It is specified by safety agency personnel. Most safety agencies will allow a shorter test (usually 1 sec. vs. 1 min.) if the voltage is increased by 20%. The HT-2800P is factory set for 1700 volts, a voltage level used for the one second test for many types of equipment. Consult the safety agencies for the required voltage level for the type of equipment being tested. If a different voltage level is required, use this procedure to set it.

1. Defeat the **Ground Check** by turning the rear panel switch to the Off position.
2. Adjust the Test Time control to approximately the middle of its travel.
3. Connect the HT-2800P to a correctly rated source of supply and turn the power switch to the I or ON position. Push the **RESET** button. The yellow **TEST** indicator should light, indicating that the HT-2800P is ready to test.

4. Make sure there are no test leads connected to the Tester. Push the **TEST** button.
5. After the **TEST** button is pressed, the voltage will ramp and hold. Set the **Voltage Adjust** control on the rear panel to the desired voltage.
6. If tamperproof operation is desired, we suggest placing a calibration-style label over the voltage adjust hole.
7. Check the position of the **Ground Check** switch, and reset the test time using the procedure **Adjustment of the High Voltage Test Time**.

Adjustment of the High Voltage Test Time

This procedure sets the length of time the HT-2800P will conduct the high voltage test. The test time is specified by the safety agencies and is tied to the test voltage. Most safety agencies will allow a much shorter test (usually 1 second vs. 1 minute) if the voltage is increased by 20%. The HT-2800P is factory set for 2 seconds. Consult the safety agencies for the test time for the type of equipment being tested. If a different test time is required, use this procedure to set it.

1. Defeat the **Ground Check** by turning the rear panel switch Off.
2. Connect the HT-2800P to a correctly rated source of supply and turn the power switch to the I or ON position. Push the **RESET** button. The yellow **TEST** indicator should light, indicating that the HT-2800P is ready to test.
3. On the rear panel turn the **Test Time** potentiometer. As soon as the potentiometer starts turning, the meter will display "d" and the value can be set in 1 second increments from 1 to 60 seconds.
4. If tamperproof settings are desired, the **Leakage Limit** control shaft may be pulled away with a slight tug. (It may be reinserted for future adjustments.)
5. Check the position of the **Ground Check** switch before conducting testing.

Setting the Ground Check Switch

This switch controls whether the Ground Test is conducted between the chassis and the power supply cord grounding pin of the unit being tested. The safety agencies require that this test be conducted on all equipment using a three-wire power supply cord. For other types of equipment, such as some portable lamps and all double-insulated equipment, there are only two wires in the power supply cord and the ground continuity check is waived by the safety agencies.

If the power supply cord of the equipment being tested has only two pins, the **Ground Check** switch should be set to the Off position. When the **Ground Check** switch is turned Off, both the green **Ground OK** and red **Ground Open** LED's on the front panel are lit as a reminder to the operator that the ground continuity test is not being conducted.

If the power supply cord of the equipment being tested has three pins, the **Ground Check** switch should be set to the On position.

When testing with the **Ground Check** switch Off, the operator must ensure that the **Return** lead is properly connected to exposed dead metal of the equipment being tested for safety and to ensure that the HT-2800P properly reports all failures.

The small size of the **Ground Check** switch will allow a calibration-type adhesive label to be placed over it to allow for tamper-proof operation.

Operating Techniques

The following paragraphs describe how to operate your HT-2800P Dielectric Withstand Tester. Before proceeding with testing, the HT-2800P tester should be set up for production line testing. See Section above before continuing.

CAUTION:

High voltage is generated by the HT-2800P. Although the chassis of the equipment under test is grounded by the HT-2800P, a risk of shock exists. Exercise care when using the HT-2800P.

Daily Operation Test

The operation of the HT-2800P should be audited daily by conducting the tests described in the **Initial Checkout Procedure** section of this Manual. Compliance West also offers the model HTT-1, which can be used to quickly verify the operation of your HT-2800P. Contact the factory for details.

Testing

This section describes how the HT-2800P is used to conduct a hipot test. Before continuing, we recommend that you read Section 1, "An Introduction to Dielectric Withstand Testing with the HT-2800P". It contains valuable safety, operation, and test result evaluation information which can help you conduct the test safely and correctly. The test can be stopped immediately at any time by pressing the red **RESET** button on the front panel.

Test Verification procedure when using the HTT-1 function checker:

1. Connect the HT-2800P to a correctly rated source of supply and turn the power switch to the I or ON position. Push the **RESET** button. The yellow **TEST** indicator should light, indicating that the HT-2800P is ready to test.
2. Connect HTT-1 to the HT-2800P tester using the cables supplied with the HTT-1.
3. Set all three switches on the HTT-1 to 'PASS'.
4. Run a test with the HT-2800P and verify passing result on the HT-2800P.
5. Set the **Ground** switch on the HTT-1 to 'FAIL'; set both other switches to 'PASS'.
6. Run a test with the HT-2800P and verify **Ground Open** failure on the HT-2800P.
7. Set **Leakage** switch on the HTT-1 to 'FAIL'; set both other switches to 'PASS'.
8. Run a test with the HT-2800P and verify **Excess Leakage** failure on the HT-2800P.
9. Set **Hipot** switch on the HTT-1 to 'FAIL'; set both other switches to 'PASS'.
10. Run a test with the HT-2800P and confirm high voltage breakdown by watching for spark in Arc Detect window of HTT-1; verify **Hipot Fail** failure on the HT-2800P.

Test Verification procedure when NOT using the HTT-1 function checker:

1. Connect the HT-2800P to a correctly rated source of supply and turn the power switch to the I or ON position. Push the **RESET** button. The yellow **TEST** indicator should light, indicating that the HT-2800P is ready to test.
2. Plug the black test lead into the **Return** receptacle on the front panel of the HT-2800P.
3. Plug the power supply cord of the equipment being tested into the **Device** receptacle on the front panel of the HT-2800P.
4. Connect the alligator clip end of the black return lead to an exposed metal part on the chassis of the equipment to be tested.
5. Make sure the power switch on the equipment being tested is in the 1 or ON position.
6. Push the **TEST** button. The HT-2800P will:

a. Check for continuity between exposed metal parts and the grounding pin of the power supply cord.

   - If the ground circuit resistance is higher than three ohms, the red **Ground Open** LED will light, the buzzer will sound, and the test will terminate.

   - If the ground circuit resistance is three ohms or lower, the green **Ground OK** LED will light and the test will continue.

b. Ramp the voltage at the rate set by the Ramp Time procedure.

   If leakage current between the AC pins of the power supply cord and the chassis ground of the unit rises above the value set by the Leakage Limit procedure, the red **Excess Leakage** LED will light, the buzzer will sound, and the test will terminate.

   If the leakage current level is below the set level when the high voltage set by the High Voltage Level procedure is reached, the green **Full Voltage** LED will light and the test will continue.

c. Conduct the high voltage test for the amount of time set in the Test Duration procedure.

   If a breakdown of the insulation system between primary voltage and ground is detected, the red **Hipot Fail** LED will light, the buzzer will sound, and the test will terminate.

   If no breakdown is detected, the high voltage will be bled off, the green **Hipot Pass** LED will light, and the red **RESET** switch will light.

7. For safety, the operator should not disconnect the cords until the **Hipot Pass** LED is lit and the reading on the front panel voltage meter has dropped to zero. This will ensure that the test voltage has been bled off.
8. The operator can now remove the equipment from the HT-2800P and connect another. The HT-2800P should then be armed by pressing the **RESET** button. When ready, the operator then presses the **TEST** button and the test procedure will be conducted again.

Test results

Hipot Pass

If the green **Hipot Pass** LED is lit, the equipment being tested passed all test parameters.

Red LED/Buzzer

Any red LED/buzzer test result means the equipment being tested failed a test phase. The equipment should be set aside, reworked and retested with acceptable results before it is shipped. General interpretations of test failures are included in Section 1, "Using the HT-2800P Dielectric Withstand Tester".

Section 4

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 4:30 PM Pacific Time.

Compliance West USA
2120 Jimmy Durante Blvd., Suite 118
Del Mar, CA 92014

Phone: (858) 481-6454
FAX: (858) 481-8527

Section 5

Maintenance and Calibration

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 HT-2800P Dielectric Withstand Tester. This maintenance information is divided into service information, general maintenance, a performance test, and a calibration procedure. The performance test is recommended as an acceptance test when the instrument is first received, and later as a preventative maintenance tool to verify proper instrument operation. A 1-year calibration cycle is recommended to maintain the specifications given in Section 1. A three inch piece of approx. 18 AWG insulated hookup wire with each end stripped back ½" and a lead with a banana plug on one end are required to conduct the performance test. The test equipment required for the calibration procedure is a DMM able to read true rms 0-2800 Vdc ± 1% and a 3-ohm 1/4 w 1% resistor.

Service Information

The HT-2800P is warranted to the original purchaser for a period of 1 year. This 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 Maintenance

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

WARNING

Dangerous voltages exist when energized. Exercise extreme care when working on an energized circuit.

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).

Calibration Procedure

The Calibration Procedure should be performed annually and any time your instrument has been repaired. The calibration procedure consists of two parts:

1) The Voltage Calibration adjustment calibrates the voltage output to agree with the meter reading.
2) The Continuity Calibration adjustment sets the pass/fail point for the continuity check.

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.

Calibration and Software Version Information

This will allow the user to see the version of the software as well as who performed the last calibration.

1. Turn off the HT-2800P tester.
2. Hold in the **Reset** button while turning on the tester.
3. The meter will display 3 items:
   A) The model number of the tester, 2800.
   B) The version of the software
   C) Laboratory number to designate who performed the last calibration:
   (1= Compliance West USA, 2= another company)

Continuity Calibration Adjustment

Use the following procedure to adjust the Pass/Fail point of the Ground Check test. Pot P101 is located on the top board near the left edge.
Two leads, each having a banana plug on one end and an alligator clip on the other, and a 3 ohm 1% resistor, are needed for this calibration procedure.

NOTE: It is possible to adjust the Pass/Fail point through a range of approx. .5 -5 ohm using the range of P101. If a special calibration was performed by the factory, it will be noted on a calibration sticker on the inside of the enclosure. If no special calibration sticker exists, the factory calibration point was 2.85-3 ohms.

If a special calibration point is desired, change the value of the 3 ohm resistor used in the following procedure to the desired value of the Pass/Fail point.

1. Perform the voltage calibration adjustment procedure above.
2. Remove all test leads from the HT-2800P.
3. Connect the banana plug end of one lead to the **RETURN** jack and the alligator clip end to the 3 ohm resistor.
4. Connect the banana plug end of the other lead to the round (grounding) jack of the **DEVICE** receptacle and the alligator clip end to the 3 ohm resistor.
5. Turn the **Ground Check** switch on the rear panel to the On position.
6. Push the **RESET** button, then the **TEST** button.
7. The **Ground OK** or **Ground Open** LED will immediately light. Push the **RESET** switch.
   a. If the **Ground OK** LED lights, turn P101 clockwise and push the **TEST** button.
   b. If the **Ground Open** LED lights, turn P101 counterclockwise and push the **TEST** button.
8. Continue adjusting P101 until the highest clockwise setting which lights the **Ground OK** LED has been attained.

Voltage Calibration Adjustment

Use the following procedure to calibrate the output voltage.

1. Ensure that all test leads are removed from the HT-2800P.
2. Turn OFF the HT-2800P tester.
3. To enter the **Calibration Mode** you MUST follow the following sequence:
   - Hold in both the **Test** and **Reset** buttons.
   - Turn on the HT-2800P tester.

- Release the **Test** button, release the **Reset** button, press and hold the **Reset** button, press and hold the **Test** button, release the **Test** button, and then release the **Reset** button.

4. If the correct sequence was entered, the display will read "Sure", if not, start again at step 2 above.
5. While "Sure" is displayed on the screen you can:
   A) Press **Reset** to exit out of the **Calibration Mode** and keep all of the currently programmed calibration settings or
   B) Press **Test** to enter the **Calibration Mode** and create new calibration settings. (Be sure you want to enter the **Calibration Mode** as this will change the laboratory number so it will show the calibration was not performed by Compliance West USA).
6. Once the **Calibration Mode** has been entered, the **Reset** button toggles between the 5 calibration menus: Volt, V1, V2, curr, and bars. Make sure "V1" is displayed on the meter.
7. Hook up a calibrated 1000:1 voltage probe and a calibrated DMM between the Device receptacle and the Return jack on the front panel.
8. Turn the Voltage Adjust on the rear panel to minimum (counterclockwise). Press the **Test** button and 2500 will be displayed on the front panel meter. Be careful as the HT-2800P will be putting out voltage at this point.
9. Turn the Voltage Adjust on the rear panel clockwise until the output on the DMM equals 2500 volts DC and press the Test button. The display will now display "V1" again.
10. Press the **Reset** button until "V2" is displayed on the front panel meter.
11. Turn the Voltage Adjust on the rear panel to minimum (counterclockwise). Press the **Test** button and 500 will be displayed on the front panel meter. Be careful as the HT-2800P will be putting out voltage at this point.
12. Turn the Voltage Adjust on the rear panel clockwise until the output on the DMM equals 500 volts DC and press the Test button. The display will now display "V2" again. The voltage is now be calibrated.
13. Turn Off the HT-2800P tester.
14. The voltage can be verified by turning on the HT-2800P, running a test, and using the 1000:1 voltage probe to check the meter at different voltages. If the voltages are not within +/- 2% at each voltage, the voltage calibration must be performed again starting at step 1 above.

Current Calibration Adjustment

1. You must be in **Calibration Mode** as in step 3 under the Voltage Calibration Adjustment above.
2. Turn the Voltage Adjust on the rear panel to minimum (counterclockwise).
3. Connect the output of the HT-2800P through a 240K ohm, 100 watt high voltage resistor in series with a calibrated DMM capable of measuring 5.0mA DC and returning to the Return jack on the front panel of the HT-2800P.
4. In the calibration mode, hit the Reset button until "curr" is displayed on the front panel.
5. Once "curr" is displayed, press the Test button once and 5.0 will be displayed.
6. Slowly increase the variac watching the current flowing on the DMM. Adjust the variac until 5.0mA DC is displayed on the DMM and then press the Test button.
7. The display will show "hold".
8. Wait until the display returns to "curr". At this point the leakage current is calibrated.