PT-600 series
Telephone Equipment Tester

Instruction Manual

COMPLIANCE
WEST USA

Dear Customer:

Congratulations! Compliance West USA is proud to present you with your PT-600 Telephone Tester. Your instrument features a groundbreaking logic-controlled circuit design and ergonomic front panel and represents the latest in high voltage testing.

To fully appreciate all the features of your new instrument, 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. If the need arises, please don't hesitate to call on us.

Thank you for your trust and confidence.

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Section 1

An Introduction to Testing with the PT-600 series tester

The PT-600 can conduct high current tests to simulate crossed wiring in accordance with UL/CSA 60950 Annex and GR-1089. In addition, it is separately equipped to conduct the High Impedance Inductive Source Test described in GR-1089. It has three main areas; the 600Vac Test Area, colored Blue; the 1000Vac/1500Vac Test Area, colored Yellow; and the High Impedance Induction Test Area colored Violet. All reas are provided with voltage and current meters and scaled BNC jacks. The PT-600 performs the test only; results must be judged by reference to the Standard.

It is also equipped with TestMinder PT, an option that allows tests to be started under computer control, timing of multiple tests, and writing test information to a file.

Safety Precautions

The 60 Hz surge test can generate voltages of 1000 V rms at potentially lethal current levels. Currents of as little as 5 mA at 120 volts can cause death; the PT-600 can deliver currents of more than 60 Amps. The potential for serious injury or death exists and personnel should be aware when they conduct this test.

The PT-600 is equipped with an interlocked clear plexiglass door covering all outputs for operator safety. When the plexiglass door is opened, the outputs are disabled. The High Impedance Induction Test Area outputs are additionally controlled by the ON/OFF Switch, Figure 2, Item 1. This switch should be placed in the OFF position when the High Impedance Induction Test is not being conducted. The Voltage Adjust knob at the bottom of the PT-600 should be set to zero when conducting the High Impedance Induction Test, so all other outputs are at zero potential. For switch and knob locations, see Figure 2, Item 1.

The Blue and Yellow areas of the PT-600 are controlled by a timer circuit, located at the top of the front panel. The tests conducted from all outputs in the can be stopped at any time by pressing the **RESET** button or pushing the **EMERGENCY STOP** button. If the emergency stop button is pressed, it must be twisted to reset before tests can be conducted. **Do not use the interlock on the plexiglass door as an emergency shutoff option. This action will expose the operator to the live circuit area.**

Some outputs are rated for intermittent duty or require use of the Line Simulator Fuse. Ignoring these caveats may cause hazards for the operator and/or cause damage to the PT-600. Please respect the caveats noted in Section 4.

Two Line Simulator Fuses are provided. A red LED adjacent to the fuses will light when the fuses are open.

Because of the nature of the tests conducted with the PT-600, the operator should be protected from the EUT to guard against explosion hazards.

Test Personnel

Personnel require special training to conduct the 60 Hz line cross test. They should understand electrical fundamentals clearly, and be aware that high voltage is present. 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 60 Hz line cross test should be as remote as possible from normal 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 possible sparking during a test failure, it is not safe to conduct testing in combustible atmospheres.

It is imperative that a good ground be provided to the PT-600 tester. Before connecting the equipment, ensure that the building wiring provides a low-resistance ground. If the PT-600 tester is used on a high-resistance grounding circuit, dangerously high voltages may be present to the operator. The power to the Testing Area must be provided with an easily reached shutoff switch which can be actuated by personnel outside the Area if needed.

Safety Techniques

The outputs of the PT-600 can be shut off at any time by pressing the front panel EMERGENCY STOP switch. There are live voltages present inside the enclosure regardless of the setting of the front panel switches. Mains power must be removed from the equipment before the inside of the enclosure is safe for access.

Using the PT-600 Impulse Tester

The 60 Hz surge test involves high voltage and caution should be exercised when using the Tester. The **RETURN** and **GROUND** receptacles on the front panel are referenced to building ground when properly connected. The **GROUND** receptacles are green and directly connected to ground, while the **RETURN** receptacles are black and are referenced to ground through a current transformer winding. The **OUTPUT** and **RETURN** leads must always be treated as Hazardous when testing with the PT-600.

The PT-600 cross line tester generates the 60 Hz source output only. It does not determine Passing or Failing results. It is Operator's responsibility to monitor the output waveform and determine Passing or Failing results, using the Standard.

Section 2

Introduction and Specifications

Introduction

This manual contains complete operating, maintenance and calibration instructions for the Compliance West USA PT-600 series tester.

In case of trouble, tests can be immediately terminated at any time by pressing the front panel EMERGENCY STOP switch to the OFF position.
In case of trouble, the High Impedance Induction Test can also be terminated by turning the switch at the top of the Violet Band to the OFF position. Please see Figure 2, Item 1 for location.
Before tests can commence, the unit must be armed by pressing the **ARM** Button. The **TEST** button is disabled until the **ARM** button has been pressed. The test will not begin until the **TEST** Button is pushed.
To conduct High Impedance Induction Tests, the switch at the top of the Violet Band must be turned to the ON position. The Voltage Adjust knob at the bottom of the PT-600 should be set to zero when conducting the High Impedance Induction Test, so all other outputs are at zero potential. For switch and knob locations, see Figure 2, Item 1.

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

IMPORTANT SAFETY WARNINGS: PLEASE READ

The PT-600 is capable of generating EXTREMELY HAZARDOUS Voltage, Current and Energy levels. During a test, the Equipment Under Test (EUT) and/or interconnecting wiring may become a shock and/or fire hazard. It is recommended that the EUT be placed in a safe area, away from the operator.

Make sure that there is clear access to the **EMERGENCY STOP** switch on the PT-600.

The interlocked plexiglass door covers the outputs of the PT-600 during operation. Opening the door defeats the outputs, but use of the RESET button or the Emergency Stop switch is recommended instead, for safety reasons. To halt High Impedance Induction Testing, the switch at the top of the Violet Band can be turned to the OFF position. To ensure operator safety, set the High Impedance Induction Test Switch to the OFF position when this test is not being conducted. Conversely, the Voltage Adjust knob at the bottom of the PT-600 should be set to zero when conducting the High Impedance Induction Test, so all other outputs are at zero potential. For switch and knob locations, see Figure 2, Item 1.

The 600V 2 ohm output MUST be used with the Line Simulator Fuse is series with the Output. Use of this output alone will cause serious damage to the PT-600. There are other limitations for some test circuits. See Section 4 of this Manual for more information.

Tests are controlled by the Timer, located at the top of the front panel. There are no interlocks to prevent the operator from conducting too long a test on one of the intermittent outputs. When setting the Timer, care must be taken to set durations in accordance with the Standard and the caveats noted in Section 4 to lessen hazards to the operator and prevent damage to the PT-600.

The High Impdance Induction test is controlled by the timer, door interlocks, RESET or

EMERGENCY STOP buttons. To conduct this test, turn the switch at the top of the Violet Band ON. For safety, this switch should be turned off when these tests are completed. Conversely, the Voltage Adjust knob at the bottom of the PT-600 should be set to zero when conducting the High Impedance Induction Test, so all other outputs are at zero potential. For switch and knob locations, see Figure 2, Item 1.

Test personnel must be properly trained, and equipped with safety goggles and/or face shields. Always ensure that there is a suitable fire extinguisher nearby.

Refer to Section 1 of this Manual for additional safety precautions. Refer to Section 4 of the Manual for further information on limitations of some test circuits.

Specifications

Specifications for the PT-600 are listed in Table 1.

Definitions

DMM – Digital Multi-Meter

EUT – Equipment Under Test

Model	Input power requirements	Output Voltage / Current ranges Sensing points
PT-600-480-2-60	480 V, 2 conductor + ground, 150 A input current maximum for 5 seconds (100 A service / fusing OK)	**BLUE AREA:** **Output Voltage and Current** 0-600V, 10 Ohm source impedance, up to 60A; 2 channels, 5 sec. max. 0-600V, 15 Ohm source impedance, up to 40A; 2 channels, 5 sec. max. 0-600V, 20 Ohm source impedance, up to 30A; 2 channels, 5 sec. max. 0-600V, 85.7 Ohm source impedance, up to 7A; 2 channels, 5 sec. max. 0-600V, 120 Ohm source impedance, up to 5A; 2 channels, continuous duty 0-300V, 15 Ohm source impedance, up to 20A; 2 channels, continuous duty 0-277V, 11.1 Ohm source impedance, up to 25A; 2 channels, continuous duty 0-277V, 13.8 Ohm source impedance, up to 20A; 2 channels, continuous duty 0-230V, 10 Ohm source impedance, up to 23A; 2 channels, continuous duty 0-230V, 20 Ohm source impedance, up to 11.5A; 2 channels, continuous duty 0-230V, 40 Ohm source impedance, up to 5.8A; 2 channels, continuous duty 0-230V, 80 Ohm source impedance, up to 2.9A; 2 channels, continuous duty 0-120V, 8.4 Ohm source impedance, up to 25A; 2 channels, continuous duty 0-600V, 90-272 Ohm source impedance continuously variable, up to 2.2A continuous or 3A for one sec., 2 channels, continuous duty 0-600V, 272-440 Ohm source impedance continuously variable, up to 600V, 2 channels, continuous duty 0-600V, 440-2390 Ohms source impedance continuously variable, up to 600V, 2 channels, continuous duty 0-600V, 2350-13.6Kohm source impedance, continuously variable, up to 600V, 2 channels, continuous duty 0-600V, 2 Ohm source impedance, up to 300A; 2 channels, 0.5 sec. max. (must be used in conjunction with Line Simulator Fuse adjacent) **Sensing Points:** Meters and BNC jacks for each channel. See Fig. 2.

		YELLOW AREA: (First Level AC Power Fault) **Output Voltage and Current** 0-1000V, 1Kohm source impedance, up to 1A; 4 channels, continuous duty 0-1000V, 200 ohm source impedance, up to 5A; 4 channels, 0.5 sec. max. **VIOLET AREA: (High Impedance Inductive Source Test)** **Output voltage and current** 0-600V, In accordance with GR-1089, Third Edition, Table 4-7 Test 5 and Table 4-8 Test 5; Circuit as shown in GR-1089, Third Edition, Figure 4-4. Supplied with outputs V_T and V_R. **Sensing Points;** Sense points V and V'; V_T and V_R in accordance with GR-1089, Third Edition, Figure 4-4.

Mechanical: Weight: 800 lbs
Dimensions: 31"W x 27"D x 82"H
Environmental: 15-40°C operating temperature / 0-90% Relative Humidity, non-condensing

Table 1. PT-600 series specifications

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 PT-600 Surge Tester
- Casters and hardware
- This Instruction Manual

If reshipment of the instrument is necessary, please use the original shipping containers. If the original shipping container is not available, be sure that adequate protection is provided to prevent damage during shipment.

Remove the Tester from its container and place it at the installation location.

Follow the instructions that are enclosed with the casters, for the proper installation of these components.

Resistor Field Adjustment

Final adjustment of internal adjustable resistors of the higher-power circuits are dependent on the characteristics of the building the PT-600 is installed in. Instructions for these adjustments are included elsewhere in this manual, and specific information is attached to the tester, if needed. After making the adjustments, please keep the information with the Manual for future reference.

AC Line Voltage Requirements

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

IMPORTANT: An external all-pole disconnect switch must be provided in the installation, as well as overcurrent protection as specified in Table 1.

Fuse Replacement Information

Fuse replacement information and fuse location is located inside the rear door of the PT-600. For reference, fusing and nameplate information is also included as Figure 7 of this Manual.

Door Interlocks

The rear door and the clear plexiglass door over the front lower middle panel are interlocked. If either of these doors are opened, the 600V and 1000V outputs are disabled**. The outputs of the High Impedance Induction Test are unaffected by the interlocks. To disable the High Impedance Induction Test, the switch at the top of the Violet Band must be in the OFF position. This switch is illustrated in Figure 2, Item 1.**

Fuse Replacement

There are service-replaceable fuses located inside the cabinet of the equipment, accessible from the rear door. The fuse ratings are noted adjacent to the fuses. Do not attempt to replace fuses with a fuse of any other type or rating. A

map of the fuse locations and ratings is also included in Figure 7 of this Manual for reference.

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 control panel features of the PT-600 Timer Control Panel (Green Section) are shown in Figure 1 and described in Table 2. The Channel Voltage Adjust Knobs for the Line Cross and High Impedance Induction Test are shown in Figure 2 and described in Table 3. Output Terminals and Measuring Terminals are shown in Figure 3 and described in Table 4. Finally, the Main Voltage Adjust knob (Brown Section) is shown and described in Figure 4. Tests that can be conducted with this version of the PT-600 are described in Section 4, while actual test instructions are discussed later in this Section.

Other Equipment Needed

- Jumper cables equipped with banana jacks, to connect output sense terminals to the DMMs described above, to connect the Line Simulator Fuse in series with an output when required by the Standard or this Manual, and to connect the EUT.

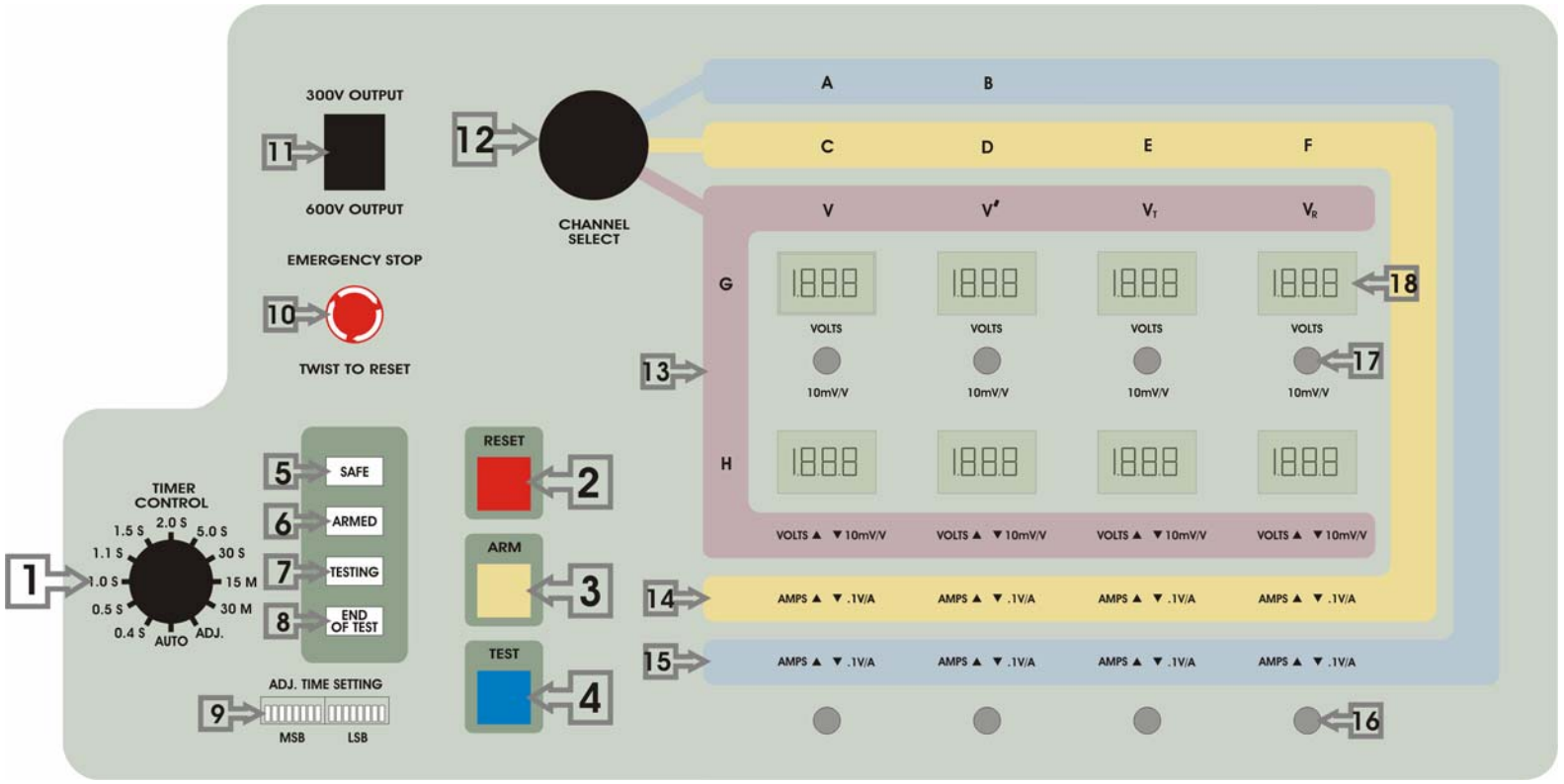


Figure 1. Controls, Indicators – PT-600 Timer Control and Metering Panel

ITEM	NAME	FUNCTION
1	**TIMER CONTROL** knob	Set to desired test time. Other test times are available using the ADJ setting. Refer to item number 9 below for details on setting ADJ test times.
2	**RESET** switch	Press this button after the end of test to reset the logic. Can also be pressed during a test to stop the test immediately. The switch is illuminated when pressing the **RESET** switch is the next step in a test sequence.
3	**ARM** switch	Press this button to enable the high voltage output. The switch is illuminated when pressing the **ARM** switch is the next step in a test sequence.
4	**TEST** switch	Press this switch to begin the test. The output voltage will appear at the **OUTPUT** terminals for the time specified; Meters and BNC outputs measure output. The switch is illuminated when pressing the **TEST** switch is the next step in a test sequence.
5	**SAFE** indicator	This Green indicator is illuminated to show that no output voltage is present on any of the front panel terminals. The tester can be put into the SAFE mode by pressing the **RESET** switch, pressing the **EMERGENCY STOP** switch, opening the clear front door, or opening the rear door.
6	**ARMED** indicator	This Yellow indicator is illuminated to show that the tester is armed, and the Voltage Meters and Voltage BNC outputs will function.
7	**TESTING** indicator	This Yellow indicator is illuminated when a test is in progress.
8	**END OF TEST** indicator	This Green indicator is illuminated at the end of the test, indicating that the test has been completed for the set duration. All outputs are defeated. Pressing the **RESET** switch turns this indicator OFF.
9	**ADJ. TIME SETTING** switches	These switches can be set so that arbitrary test times can be generated. Switch position DOWN is OFF, (digital "0"); switch position UP is ON (digital "1"). The switches represent a 16-bit binary number which is the desired test duration in 10ths of a second. For example, if a test duration of 15 seconds is desired, the switches (left to right) should be set for: 0000 0000 1001 0110, which is 150 (150 tenths of a second).
10	**EMERGENCY STOP** switch	Pressing this button at any time will immediately disable tester output. Testing is prevented until the switch is released by twisting the knob in the direction shown. When the switch is released, testing will not start automatically - the test must be re-started by pressing the **RESET, ARM,** and **TEST** switches as described in items 2, 3, and 4 of this table.
11	**300V Output / 600V Output**	Sets variac range. For 600V tests, leave in the 600V position. When conducting 300V tests, set the switch to the 300V setting.
12	**CHANNEL SELECT Switch**	Set to display the correct output to the Front Panel Meters and BNC jacks. When testing using the Fixed or Variable Outputs of the Blue Area of the tester, set the pointer toward the BLUE band. When conducting the High Impedance Induction Test, set the pointer toward the VIOLET band. When conducting the First Level Power Fault Test, set the pointer toward the YELLOW band. For meter channel information, see Items 13-15 below.

13	**High Impedance Induction Test Meters and BNC outputs**	When set to the Violet band, meters display output for Channel G (Row 1: V, V', Vt and Vr) and Channel H (Row 2: V, V', Vt and Vr). BNC Row 17 outputs voltage reference at 10mV/V for the corresponding outputs of Channel G. BNC Row 16 outputs voltage reference at 10mV/V for the corresponding outputs of Channel H.
14	**Power Fault Test Meters and BNC outputs**	When set to the Yellow band, meters display output for Channel C (Column 1: Top-Volts Bottom-Amps), Channel D (Column 2: Top-Volts Bottom-Amps), Channel E (Column 3: Top-Volts Bottom-Amps) and Channel F (Column 4: Top-Volts Bottom-Amps). BNC Row 17 outputs reference Voltage output at 10mV/V for each of the channels. BNC Row 16 outputs reference Current output at .1V/A for each of the channels.
15	**Fixed and Variable Output Meters and BNC outputs**	When set to the Blue band, meters display output for Channel A (Column 1: Top-Volts Bottom-Amps) and Channel B (Column 2: Top-Volts Bottom-Amps). BNC Row 17 outputs reference Voltage output at 10mV/V for each of the two channels. BNC Row 16 outputs reference Current output at .1V/A for each of the channels. NOTE: Meters and BNC jacks in Columns 3 and 4 do not display information when the Channel Select switch is set to the Blue band.
16	**BNC Jacks (Lower row)**	Outputs voltage information for the Violet Band and Current information for the Blue and Yellow Bands. See Items 13-15 for detailed information.
17	**BNC Jacks (Upper row)**	Outputs voltage information for Violet, Blue and Yellow Bands. See Items 13-15 for detailed information.
18	**Meters**	Eight meters are supplied on the front panel, and they are used in conjunction with the Channel Select switch to show voltage and/or current outputs for the various test outputs on the PT-600.

Table 2. Controls, Indicators – PT-600 Timer Control and Metering Panel

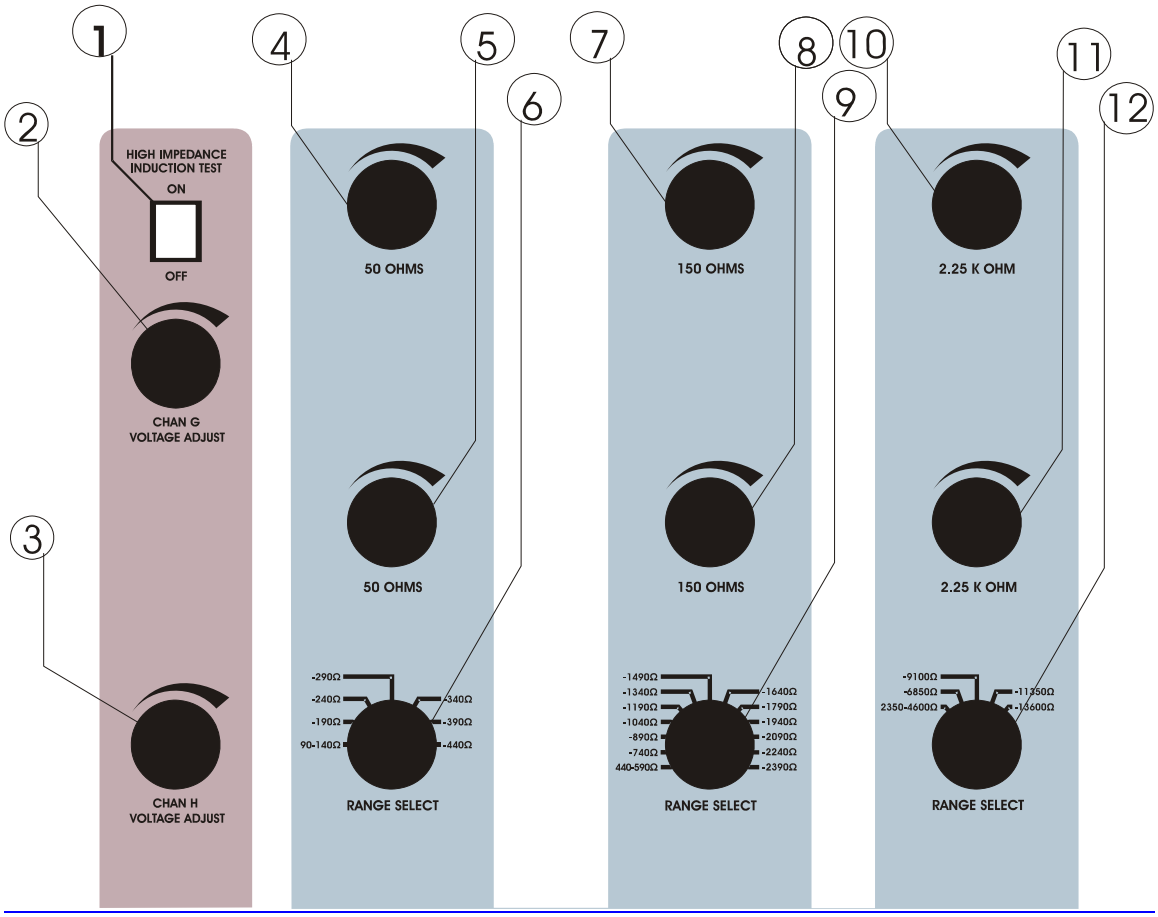


Figure 2. PT-600 Channel Voltage Adjustment Knobs

ITEM	NAME	FUNCTION
1	High Impedance Induction Test Switch	Enables the outputs of the High Impedance Inductive Source Test Circuit. For safety, this switch should be turned to the OFF position when this circuit is not in use. For operator safety, set this switch to the OFF position when this test is not being conducted.
2	Channel G Voltage Adjust	Rheostat used to adjust the voltage output of Channel G in accordance with GR-1089, Third Edition, Figure 4-4. The Channel G outputs are the top row of banana jacks in the Violet Section. This rheostat may be adjusted at any time.
3	Channel H Voltage Adjust	Rheostat used to adjust the voltage output of Channel H in accordance with GR-1089, Third Edition, Figure 4-4. The Channel H outputs are the bottom row of banana jacks in the Violet Section. This rheostat may be adjusted at any time.
4	Channel A Voltage Adjust, 90-440 Ohm Range	Fine adjustment for the 90-440 ohm variable output. 50 Ohm rheostat used to adjust the output of Channel A. Currents up to 2.2A continuous, 3A for 1 sec. up to 272 ohms; up to 600V for resistances 272-440 ohms. The Channel A output is the top banana plug directly below this rheostat. This rheotstat may be adjusted at any time. Measure between this banana plug and return. Set the coarse adjustment, Item 6, first.
5	Channel B Voltage Adjust, 90-440 Ohm Range	Fine adjustment for the 90-440 ohm variable output. 50 Ohm rheostat used to adjust the output of Channel B. Currents up to 2.2A continuous, 3A for 1 sec. up to 272 ohms; up to 600V for resistances 272-440 ohms. The Channel B output is the bottom banana plug directly below this rheostat. This rheostat may be adjusted at any time. Measure between this banana plug and return. Set the coarse adjustment, Item 6, first
6	90-440 Ohm Range Select	Coarse adjustment for the 90-440 ohm variable output. **In order to prevent damage to the PT-600, do not change the setting of this switch while the outputs are energized**.
7	Channel A Voltage Adjust, 440-2390 Ohm Range	Fine adjustment for the 440-2390 ohm variable output. 150 Ohm rheostat used to adjust the output of Channel A. Voltages up to 600V. The Channel A output is the top banana plug directly below this rheostat. Measure between this banana plug and return. This rheostat may be adjusted at any time. Set the coarse adjustment, Item 9, first.
8	Channel B Voltage Adjust, 440-2390 Ohm Range	Fine adjustment for the 440-2390 ohm variable output. 150 Ohm rheostat used to adjust the output of Channel B. Voltages up to 600V. The Channel B output is the bottom banana plug directly below this rheostat. Measure between this banana plug and return. This rheostat may be adjusted at any time. Set the coarse adjustment, Item 9, first.
9	440-2390 Ohm Range Select	Coarse adjustment for the 440-2390 ohm variable output. **In order to prevent damage to the PT-600, do not change the setting of this switch while the outputs are energized.**

10	Channel A Voltage Adjust, 2350-13.6 Kohm Range	Fine adjustment for the 2350-13.6 Kohm variable output. 2.25 Kohm rheostat used to adjust the output of Channel A. Voltages up to 600V. The Channel A output is the top banana plug directly below this rheostat. Measure between this banana plug and return. This rheostat may be adjusted at any time. Set the coarse adjustment, Item 12, first
11	Channel B Voltage Adjust, 2350-13.6 Kohm Range	Fine adjustment for the 2350-13.6 Kohm variable output. 2.25 Kohm rheostat used to adjust the output of Channel B. Voltages up to 600V. The Channel B output is the bottom banana plug directly below this rheostat. Measure between this banana plug and return. This rheostat may be adjusted at any time. Set the coarse adjustment, Item 12, first.
12	2350-13.6 Kohm Range Select	Coarse adjustment for the 2350-13.6 Kohm variable output. **In order to prevent damage to the PT-600, do not change the setting of this switch while the outputs are energized.**

Table 3. PT-600 Channel Voltage Adjustment Knobs

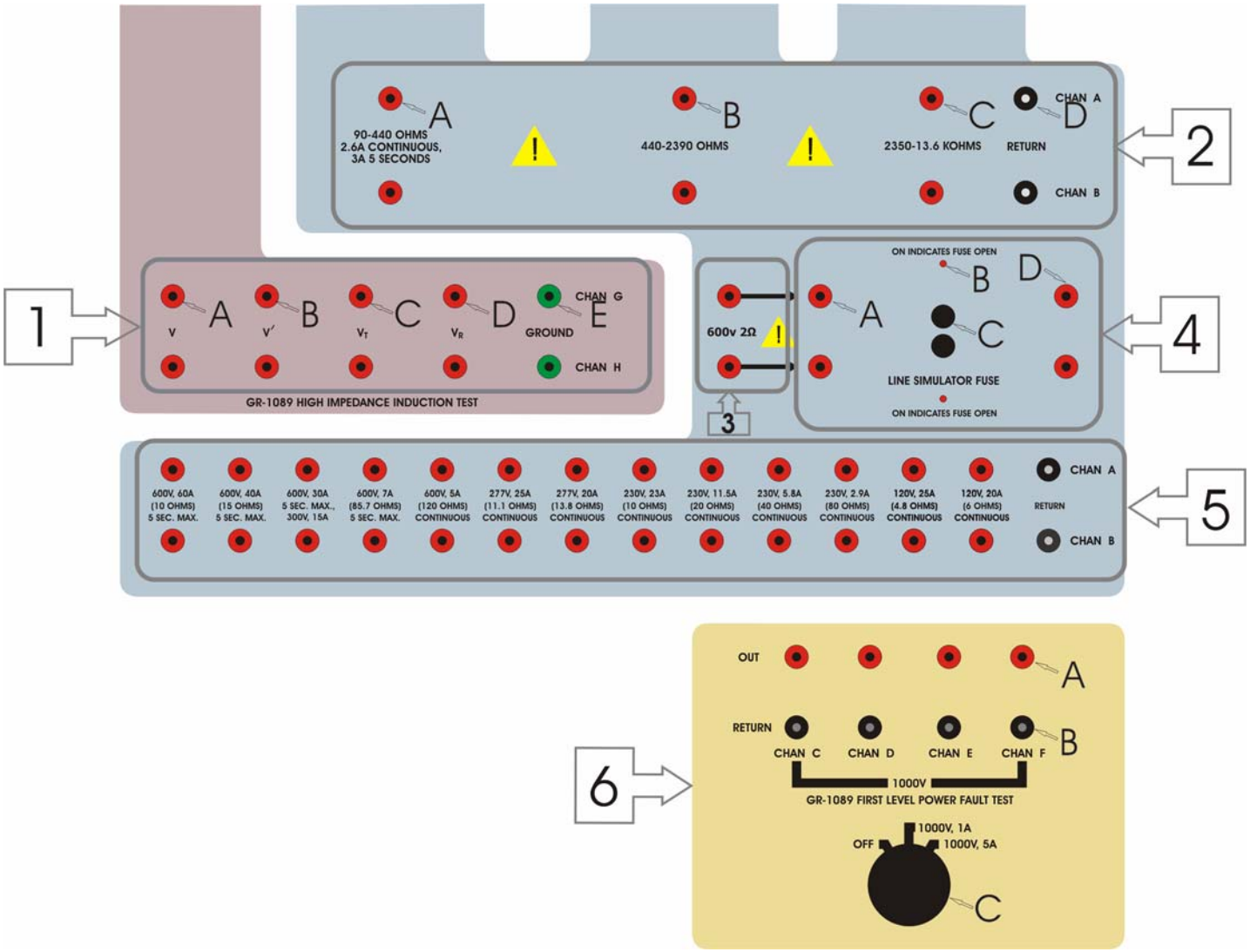


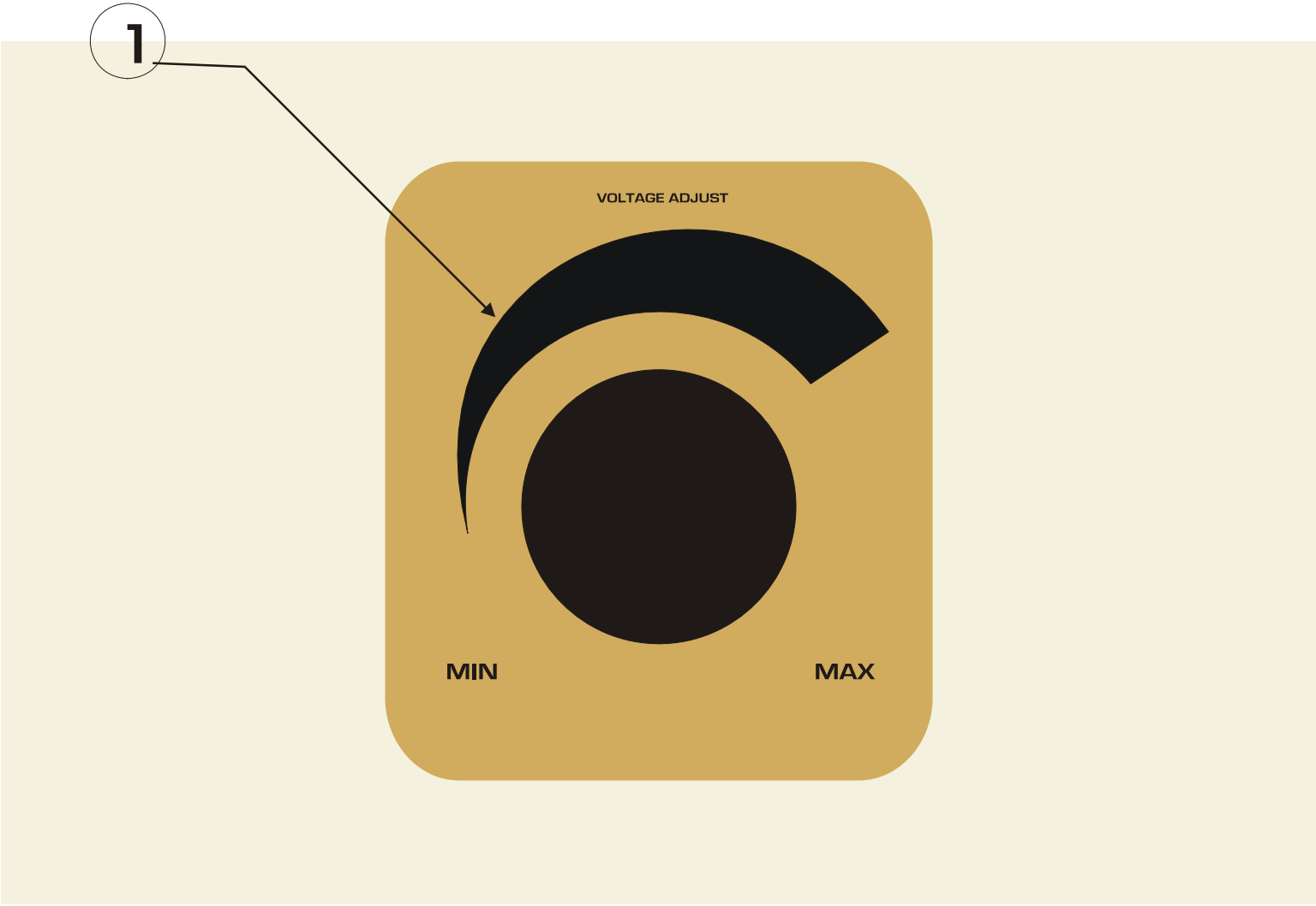
Figure 3. PT-600 Output Terminals

Table 4. PT-600 Output Terminals and Measuring Terminals

ITEM	NAME	FUNCTION
1	**High Impedance Induction Test – Violet Area**	This set of outputs are in accordance with GR-1089, Third Edition, Figure 4-4. The top row of banana jacks are called Channel G, and the bottom row of banana jacks are called Channel H. Jacks are called out below for a typical channel. Important Note: The front and rear door interlocks, Timer controls, RESET and EMERGENCY STOP switches do not control this circuit. For operator safety, set the switch to the OFF position when this test is not being conducted.
1a	V	Sensing jack per GR-1089, Third Edition, Figure 4-4.
1b	V’	Sensing jack per GR-1089, Third Edition, Figure 4-4.
1c	V_T	Sensing/Output jack per GR-1089, Third Edition, Figure 4-4.
1d	V_R	Sensing/Output jack per GR-1089, Third Edition, Figure 4-4.
1e	Ground	Chassis potential and Ground per GR-1089, Third Edition, Figure 4-4.
2	**Line Cross Variable Outputs – Blue Area**	This set of outputs are in accordance with Line Cross Tests in CSA/UL 950 and GR-1089. The top row of banana jacks are called Channel A, and the bottom row of banana jacks are called Channel B. Jacks are called out below for a typical channel.
2a	90-440 Ohms	Outputs for 90-440 ohm variable output. Output can be monitored using Output Sense jacks; see 3. below for details.
	600V, 3A, 1 sec. max. (200 Ohm)	For conducting First Level AC Power Test (GR-1089, Second Edition, Table 4-7, Test 8) when set for 200 ohms.
2b	440-2390 Ohms	Outputs for 440-2390 ohm variable output. Output can be monitored using Output Sense jacks; see 3. below for details.
2c	2350-13.6 Kohms	Outputs for 2350-13.6 Kohm variable output. Output can be monitored using Output Sense jacks; see 3. below for details.
2d	Return	High current return. Return receptacles are black and are referenced to ground through a current transformer winding
3	**600V 2 ohm Output - Blue Area**	600V, 2 ohm output in accordance with GR-1089, Clause 4.5.11. Must be used in accordance with the Line Simulator Fuseholder, Area 4, provided with a 1.6A fuse in accordance with this Clause. Otherwise, serious damage to the PT-600 will result.
4	**Line Simulator Fuse - Blue Area**	These fuses are provided for operator convenience. They have no internal connections to the PT-600 circuits. Any connections to the Line Simulator Fuses are made by the operator on the front panel. There are two fuseholders, which are both connected identically. Only one fuseholder is described here as 4c; the other is identical in function. This allows two channels to be simultaneously protected by separate fuses. In addition, both fuseholders are provided with a fuse status light, Item 4b. When the light is on the corresponding fuse is open. One fuseholder is connected between points 4a and 4d, and must be connected to the circuit desired to be fused. This allows a fuse to be connected between the outputs of the PT-600 and the EUT. The wiring simulators must be used when required by the Standard or fuses in the PT-600 may open.
5	**Fixed Voltage Outputs - Blue Area**	This set of outputs are designed to be used at a fixed voltage and supply a stated current. The top row of banana jacks are called Channel A, and the bottom row of banana jacks are called Channel B. Jacks are called out below for a typical channel.
4a	600V, 60A; 5 sec. max.	For conducting the Second Level AC Power Fault Test. (GR-1089, Third Edition, Table 4-7)

4b	600V, 40A; 5 sec. max. 300V, 20A; continuous duty	For CSA/UL Annex 950 Tests.
4c	600V, 30A; 5 sec. max.	For CSA/UL Annex 950 Tests.
	300V, 15A; continuous duty	For Second Level AC Power Fault (GR-1089, Third Edition, Clause 4.5.15.1, Condition 1). Note this output is rated for continuous duty.
4d	600V, 7A; 5 sec. max.	For conducting the Second Level AC Power Fault Test. (GR-1089, Third Edition, Table 4-7).
4e	600V, 5A; continuous duty	
4g	277V, 25A; continuous duty	For conducting the Second Level AC Power Fault Test. (GR-1089, Third Edition, Table 4-7) and CSA/UL 950 Annex Test L5
	277V, 20A; continuous duty	For conducting the Second Level AC Power Fault Test, GR-1089, Third Edition, Clause 4.6.15, Test R4-18.
4h	230V, 23A; continuous duty	ITU-T Mains Power Contact Test; Table 2b/K.20
4i	230V, 11.5A; continuous duty	ITU-T Mains Power Contact Test; Table 2b/K.20
4j	230V, 5.8A; continuous duty	ITU-T Mains Power Contact Test; Table 2b/K.20
4k	230V, 2.9A; continuous duty	ITU-T Mains Power Contact Test; Table 2b/K.20
4l	120V, 25A; continuous duty	For conducting the Second Level AC Power Fault Test. (GR-1089, Third Edition, Table 4-7) and UL/CSA 950 Annex Test L5
	120V, 20A; continuous duty	For conducting the Second Level AC Power Fault Test, GR-1089, Third Edition, Clause 4.6.15, Test R4-18
4m	Return	High current return. Return receptacles are black and are referenced to ground through a current transformer winding.
7	**First Level AC Power Fault Area (1000V) – Yellow Area**	The Yellow Area contains outputs to test to GR-1089, Third Edition, Table 4-6, Tests 4 and 9. Outputs are up to 1000Vac 1A continuous, and up to 1000V ac 5A for 0.5 sec. There are four channels called Channel C, Channel D, Channel E and Channel F. Output can be chosen between 1A, 5A, or defeated by a switch.
7a	Output jack	1000V jacks x 4 for conducting the AC Power Induction Test.
7b	Return	High current return. Return receptacles are black and are referenced to ground through a current transformer winding.
7c	Selector switch	Selects the output of the Yellow Area. Output can be defeated by setting the switch to the off position, or output can be selected between 1A continuous duty, or 5A, 0.5 sec. max. Leave this switch in the OFF position when this test is not being conducted.

Table 4. PT-600 Output Terminals and Measuring Terminals



ITEM	NAME	FUNCTION
1	**Main Voltage Adjust Knob – Brown Area**	Adjusts 0-600V for the BLUE and 0-1000V for the YELLOW outputs. This knob has no effect on the High Impedance Induction Test.

Figure 4. Main Voltage Adjust Knob

Initial Checkout Procedure – Yellow and Blue Areas

The following procedure should be used to verify that the outputs in the Blue and Yellow Areas of the PT-600 are working correctly. We recommend that this procedure be conducted periodically to ensure proper operation of the PT-600. (This procedure can be conducted on any of the Yellow or Blue outputs, but to verify tester operation in these Instructions, we have chosen to conduct it on Channel A of the 600V, 5A Output in the Blue Area. Since this output is fixed and rated for continuous duty, verification of proper operation of the PT-600 in general is simplified.)

Please note this test is a short circuit test, to verify current. Open circuit voltage will also be verified in these Instructions before the test is conducted.

The following items are needed to conduct this procedure:

1. A DMM or oscilloscope capable of measuring AC voltage of 0.5 volts, for reading current on the BNC jacks.

2. Jumper cables equipped with banana jacks, to connect outputs on the front panel, and to connect to the EUT.

CAUTION

High voltage and current generated by the PT-600 tester is present during this test. A risk of shock exists. Exercise care when using the PT-600 tester.

1. Make sure the PT-600 is not energized.
2. Set the **MAIN VOLTAGE ADJUST** knob is set to minimum by turning the knob to the fully counterclockwise position.
3. Open the plexiglass door covering the Output Terminals.
4. Prepare the metering section of the PT-600 and connect voltage and current test leads as described in Figure 1 and Table 2. In this example, all connections are made to Channel A:
   a. Turn the Channel Select Knob to the Blue Section. The voltage for Channel A can be read on the top leftmost meter; the current for channel A is read on the bottom leftmost meter.
   b. Connect the Voltage DMM to the Channel A voltage BNC jack, directly under the Voltage Meter.
   c. Connect the Current DMM to the Channel A current BNC jack, directly under the current meter. Set the DMM to read voltage at 0.1V/A, which in the example would be 0.5Vac.
   d. Connect a jumper cable between the 600V, 5A Output and Return in the Blue Area.
5. Set the Timer Control switch (Fig. 1 Item 1) to the 30 sec position. Any convenient time may be chosen to allow time to set up the Output Voltage. If a non-continuous output is used to conduct this test, do not set the Timer Control switch to a longer duration than the output is rated for, or damage to the PT-600 may result.
6. Close the transparent front door. Check that the **EMERGENCY STOP** button is not depressed. Otherwise, the **ARM** switch and **TEST** switch will not function.
7. Energize the PT-600.
8. Press the **RESET** switch, and then press the **ARM** switch. (When the **ARM** switch is pressed, the Voltage Meters in the Blue Area only are energized.) Watch the Voltage Meter and DMM and turn the **MAIN VOLTAGE ADJUST** knob so that the output voltage is at the desired level. (For the example, set the voltage to 600Vac.)
9. Press the **TEST** switch. Verify that the output current, as read on the Current DMM, is at the desired level, and the test runs for the expected duration. **Do not exceed test times stipulated on the front panel or in this Manual, or use the 600V 2 ohm output without the Line Simulator Fuse. Serious damage to the PT-600 will result.** In any case, if the test runs for longer that the anticipated test duration, or to shut down the PT-600 immediately, press the **RESET** button or the **EMERGENCY STOP** button. After using the **EMERGENCY STOP** button, it must be twisted to be released before any additional test can be conducted.
10. Remove power to the PT-600 before changing or removing any leads.
11. Repeat this procedure to verify other output connection points as needed to verify proper settings of the Tester. Specific information is available in Section 4.

Initial Checkout Procedure – High Impedance Induction Test Area

The following procedure should be used to verify that the High Impedance Induction Test of the PT-600 is working correctly. We recommend that this procedure be conducted periodically to ensure proper operation of the PT-600. In this test, the Standard stipulates voltages set between any two of the Output jacks. For this example, we will verify 600Vac between outputs V and V' of Channel G. All other combinations and Channels should also be verified before conducting a test.

Please note this test is an open circuit test, to verify voltage, in accordance with GR-1089, Third Edition, Figure 4-4.

The following items are needed to conduct this procedure:

1. A DMM capable of measuring AC voltage up to 6 V per the Standard in the High Impedance Induction Test.

2. Jumper cables equipped with banana jacks, to connect outputs on the front panel, and to connect to the EUT.

CAUTION

High voltage and current generated by the PT-600 tester is present during this test. A risk of shock exists. Exercise care when using the PT-600 tester.

1. Make sure the PT-600 is not energized.
2. Set the High Impedance Induction Test switch, located at the top of the Violet area, to OFF.
3. Set the **Chan G and Chan H Voltage Adjust** knobs to minimum by turning them to the fully counterclockwise position.
4. Open the plexiglass door covering the Output Terminals and Measuring Terminals.
   a. Connect the voltage DMM test leads between outputs V and V'
   b. Verify the DMM is set to read 6Vac.
5. Close the transparent front door.
6. Energize the PT-600.
7. Turn the High Induction Induction Test switch ON.
8. Watch the Voltage Meters on the top row and turn the **Chan G voltage adjust** knob so that the output voltage is 600Vac.
9. Remove power to the PT-600 before changing or removing any leads.

Repeat this procedure to verify other output connection points as needed to verify proper settings of the Tester. Specific information is available in GR-1089, Figure 4-4.

Testing – Blue and Yellow Areas

This section describes how the PT-600 Tester is used to conduct a test. The test can be stopped immediately at any time by pressing the **RESET** button or the **EMERGENCY STOP** button.

1. Make sure that the **MAIN VOLTAGE ADJUST** knob is turned fully counterclockwise (set @ 0), and energize the PT-600.
2. Perform the Initial Checkout Procedure for the desired output as described previously to verify that the output voltage and current are set to the desired level.
3. Press the **RESET** button. Verify that the output voltage is at a safe level (watching the voltage meter).
4. Open the plexiglass front door.
5. Remove the shorting jumper connected from the output to return or ground, and connect the EUT in its place. Keep in mind any caveats pertaining to the output regarding time constraints or the need for a Line Simulator Fuse in Section 4 of this manual, or in the Standard.
6. Close the plexiglass front door.
7. Energize the PT-600.
8. Press the **RESET** switch.
9. Set the **TIMER CONTROL** switch to the desired test duration. Do not exceed the duty cycle of any output or damage to the PT-600 may result.
10. Make sure that the transparent front door and the rear door are completely closed. Check that the **EMERGENCY STOP** button is not depressed. Otherwise, the **ARM** switch and **TEST** switch will not function.
11. Press the **ARM** switch.
12. Press the **TEST** switch. The test will proceed and stop after the time set into the Timer.

Testing – High Impedance Induction Test (Violet Area)

This section describes how the PT-600 Tester is used to conduct a High Impedance Induction Test. The test can be stopped immediately at any time by turning the High Impedance Induction Test switch OFF. This switch is located at the top of the Violet area of the front panel. For location information, refer to Figure 2, Item 1.

Please note that the front and rear door interlocks, Timer circuit, and RESET and EMERGENCY STOP switches do not function while conducting this test.

1. Perform the Initial Checkout Procedure for the desired output as described previously to verify that the output voltage and current are set to the desired level.
2. Turn the High Impedance Induction Test switch OFF.
3. Verify that the output voltage is at a safe level on the Front Panel Meter.
4. Open the plexiglass front door.
5. Connect the EUT as directed in GR-1089, Third Edition, Figure 4-4 or the current specification covering this test.
6. Close the plexiglass front door.
7. Use the High Impedance Induction Test switch to energize and deenergize the EUT in accordance with the Standard.

Section 4

Test Specifics

Testing Overview

In this version of the PT-600, there are three separate general tests that can be conducted, and each has its own color-coded area on the upper and lower middle front panels.

Line Cross Power Test (BLUE) Area (Fig. 3 Areas 2, 3, 4 and 5)

The Line Cross Power Test is conducted at up to 600V applied to the EUT as directed by various Standards. Test results are also dictated by the Standard. The PT-600 has two channels. Each channel has thirteen fixed and three variable outputs that can be used when this test is conducted, and they are located in the lower part of the Blue Band on the front panel of the PT-600. The tests are conducted between the output and return jacks adjacent. Voltage and current are read directly from the meters located on the upper panel. Channel A voltage and current are read from the leftmost column of meters; see Fig.1, Item 18. Voltage and current can also be monitored using an oscilloscope or DVM connected to the leftmost column of BNC jacks; see Fig. 1, Items 16 and 17. GR-1089 600V test outputs are also located in this area. For clarity, the two test channels for this Section are labeled Channel A and Channel B. Location references are keyed to the areas noted in Figure 3 of this Manual.

Caveats for these tests are noted below:

i. Variable Output 2a, 90-440 ohms.
   1. Max. voltage is 600V.
   2. Maximum continuous current is 2.6A.
   3. 3A is available for 5 sec. Max. Do not set the timer for any longer duration or you may damage the PT-600.
   4. Do not move the Range Select switch while the outputs are energized.

ii. Variable Outputs 2b and 2c:
   1. Max. voltage is 600V.
   2. These outputs may be run continuously.
   3. Do not move the Range Select switch while the outputs are energized.

iii. Fixed Output 600V, 60A.
   1. Max. time is 5 sec. Do not set the timer for any longer duration or you may damage the PT-600.

iv. Fixed Output 600V, 40A.
   1. Max. time is 5 sec. Do not set the timer for any longer duration or you may damage the PT-600.

v. Fixed Output 600V, 30A.
   1. Max. time is 5 sec. Do not set the timer for any longer duration or you may damage the PT-600.

vi. Fixed Output 600V, 7A.
   1. Max. time is 5 sec. Do not set the timer for any longer duration or you may damage the PT-600.

vii. Returns:
   1. Referenced to ground through a current transformer winding.

viii. Fixed 600V, 2 ohm.
   1. Use only in conjunction with Line Simulator Fuse adjacent.

ix. Voltage Sense Meters and BNC outputs are energized when the **ARM** button is pressed.

Using the Output Sense BNC Jacks

For accurate readings, only one set of outputs can be used at a time on each channel. Since the channels are independent, it is possible to use any one output from each channel and obtain accurate readings from the Output Sense jacks.

1. For reading the output voltage, connect a suitable DMM on the appropriate scale to the appropriate BNC jack. Output Voltages can be as high as 1000V, so the DVM should be capable of reading 100V.
2. Output current BNC jack reading is provided by a current transformer which outputs 0.1V/A. Connect a suitable DMM to the Current BNC Jacks. A 50 Amp circuit will read 5V on the DMM.

Adjusting the Variable Outputs using the Range Select Switches and Rheostats

The Variable Outputs are provided in accordance with Standards when circuits with overcurrent protection must be tested with a non-standard value. In order to provide the greatest range of resistance possible, the PT-600 has three discrete ranges of resistance available. Each of these ranges is broken into steps which are controlled by Range Select switches, located at the bottom of the upper middle panel, as shown in Figure 2 of this Manual. Final adjustment between these steps are made with the rheostats, located above their respective Range Select switches on the upper middle panel, as shown in Figure 2. The Range Select switches select the ranges for both Channel A and Channel B simultaneously (both channels must be in the same range), but a separate rheostat is provided for fine tuning the outputs of each channel. The rheostats may be adjusted at any time, but do not move the Range Select switches unless the outputs are not energized. In each Range, the upper rheostat controls Channel A, and the lower one controls Channel B.

Note: The following instructions apply to all variable resistance setups.

Setting variable Resistances for testing; Setting the 600V 3A (1 sec.) Output (Resistance Method)

This Section describes the method used to set up and test variable resistance values before testing the EUT. This Section describes a test conducted using Channel A; Channel B is set up in exactly the same way. For multi-channel tests, DMMs are required for each channel being monitored.

Equipment required by this Section:

1. Resistance DMM, for verifying resistance during the test setup. If properly rated, the Current DMM may be used for this purpose, as Resistance is read during test setup and Current is only read while the test is being conducted.
2. Jumper wires with banana plugs on both ends for connecting Outputs to Line Simulator Fuses and the EUT.

Location information below refers to Figure 3 of this Manual.

1. Calculate the resistance required for your test. For example, to conduct a 600V, 3A test, the resistance needed is 600/3=200 ohms.
2. Make sure the PT-600 is not energized.
3. Set the **MAIN VOLTAGE ADJUST** knob is to the minimum position.
4. Open the Plexiglass door covering the Output and Measuring Terminals. This door is interlocked and the PT-600 Outputs will be disabled when this door is opened.
5. Set the Channel Select Knob to the Blue band.
6. Voltage and current readings for Channel A will be shown by the leftmost column of meters, and Channel B on the second column of meters.
7. Connect the Resistance DMM between the 600V 2 ohm jack for the Channel being tested, and the correct Output Jack for the desired resistance. In the case of the example, the DMM would be connected between Channel A of the 600V 2 ohm Output Jack and the 90-440 Ohms Resistance Jack.
8. Set the Range Select Switch to the Resistance Range needed for the test. In the example, the Range Select Switch is set to the –240 Range (190-240 ohms).

9. Using the Resistance DMM, adjust the rheostat above the Range Select Switch until the desired resistance is obtained. Channel A is controlled by the top rheostat, and Channel B is controlled by the lower rheostat. In the example, the upper 50 ohm rheostat would be adjusted.
10. Remove the Resistance DMM.
11. Connect the Jumper between the Output Jack in question, and the Return jack for the Channel being tested. **Note: Do not connect the jumper to either of the 600V 2 ohm Jacks. This jack is used only to set the circuit series resistance in Steps 7-9 above, and is not used as a test output.**
12. Set the timer of the PT-600 for an appropriate time setting (See Figure 1 for timer location). In the example, the timer would be set for 0.5 sec.
13. Close the plexiglass door and make sure the interlock engages.
14. Energize the PT-600.
15. Push the **ARM** button. The Voltage Meters and BNC Jacks are energized when the **ARM** button is pressed.
16. Adjust the **MAIN VOLTAGE ADJUST** knob until the desired voltage appears on the Voltage DMM.
17. Push the **TEST** button. In this short circuit test, the output current is verified to be correct. Adjust the Channel rheostat as needed and retest until the short circuit current is correct. (In some cases where the time of the test is short, an oscilloscope connected to the appropriate Current BNC jack may have to be used to verify proper output current.)
18. Remove the short circuit connection. Connect the EUT to the PT-600 output and conduct the test as noted in the 'Testing' Section of this Manual.

Setting Continuous Duty Outputs for Testing - (Dynamic Adjustment Method)

Continuous Duty Outputs can be adjusted 'on the fly', with voltage and current outputs enabled, using the rheostat to dynamically adjust the current and voltage outputs. This Section describes a test conducted using Channel A; Channel B is set up in exactly the same way.

1. **Make sure the test contemplated is within the 2.6A continuous duty specifications of the PT-600 Variable Outputs before continuing**.
2. Make sure the PT-600 is not energized.
3. Set the **MAIN VOLTAGE ADJUST** knob to minimum.
4. Open the Plexiglass door covering the Output and Measuring Terminals. This door is interlocked and the PT-600 Outputs will be disabled when this door is opened.
5. Set the Channel Select Switch to the Blue band. Watch the leftmost column of meters for Channel A and the second column for Channel B. Voltage readings are read on the top meter and current readings on the bottom meter of the corresponding column.
6. Alternatively, BNC jack outputs may be used for connection of external meters. Voltage DMMs would be connected to the upper BNC jack in the correct meter column, and Current DMMs would be connected to the lower BNC jack in the correct meter column. between the desired Voltage Sense and Ground Jacks for the Channel being used for the test. The Voltage BNC output will be 10mV/V and the Current BNC output will be .5V/A.
7. Short the desired output (Jack 2a, 2b, or 2c) to Return (Jack 2d) with the Jumper.
8. Close the plexiglass door.
9. Set the timer for a long duration test that will allow sufficient time to adjust the outputs; 30 seconds is recommended.
10. Set the Range Select Switch to the Resistance Range needed for the test
11. Energize the PT-600.
12. Press the **ARM** button. When the **ARM** button is pressed, the Voltage Sense jacks in the Blue Section are energized.
13. Using the **MAIN VOLTAGE ADJUST** knob, set the desired test voltage on the Voltage DMM.
14. Press the **TEST** switch. The Output Jacks and the Current Sense Jacks will be energized.
15. Monitor the test current on the Current DMM. Adjust the rheostat above the Range Select switch until the test current is correct. The upper rheostat controls Channel A and the lower rheostat controls Channel B. Note: If the Range Select switch needs to be placed in another position to obtain correct

current readings, push **RESET** to disable the output first. Then place the Range Select switch in its new position and repeat steps 6-9 until correct results are obtained.

16. Push the **RESET** button.
17. Remove the jumper and connect the EUT.
18. Test per the 'Testing" Section of this Manual.

Note for Timed Duty Outputs (Reduced Voltage Method)

As an alternative to "Setting variable Resistances for testing; Setting the 600V 3A (1 sec.) Output (Resistance Method)", described earlier in this Section, the outputs may be treated as continuous duty outputs if the **MAIN VOLTAGE ADJUST** knob is set to 300V (½ the test voltage). Use the method described in the 'Note for Continuous Duty Outputs' above, but set the current outputs for ½ the contemplated test current. For example, setting the 600V 3A output can be accomplished by setting the voltage to 300V and the current for 1.5A, which is within the continuous duty current range of the output. This will allow the user to properly set the voltage using as much time as needed, while staying within the limits of the PT-600. After the test setup in complete, and before the actual test is conducted, be sure to turn the **MAIN VOLTAGE ADJUST** knob to the correct voltage (600V in the example).

First Level AC Fault Test Section-Yellow Area (Figure 3, Area 6)

The First Level AC Power Fault Test is conducted at 1000V, and the area of the front panel concerning this test is colored Yellow. These outputs are used to conduct GR-1089, Third Edition, Table 4-6, Test 4 and Test 9. The test output is switch selected (Switch 6c), and the switch should be used to disable the outputs entirely when these outputs are not used. The outputs and monitoring circuits are not energized until the TEST button is pressed. For clarity, the four test channels for this Section are labeled Channel C, Channel D, Channel E and Channel F. Location references are keyed to Figure 3 of this manual.

Meters and BNC Jacks are used by setting the Channel Select Switch to the Yellow Band. Voltage and current Meters and BNC Jacks are arranged in columns as noted in the Yellow Band on the front panel; Channel C being Column 1 (leftmost column), Channel D being Meter Column 2; Channel E being Meter Column 3; and Channel F being Meter Column 4. Voltage BNC jacks are scaled at 10mV/V. Current BNC jacks are scaled at .1V/A.

Caveats for this Section are noted below:

a. 1A output is rated for continuous duty.
b. 5A output is rated for 0.5 sec. max.
c. Voltage Sense Meters and BNC Jacks are not energized when the **ARM** button is pressed.

Adjusting the Open Circuit Voltage Output

This Section will describe the method used to set the 1000V open circuit output. Please note the Voltage Meters and BNC Jacks are not functional unless the **TEST** button is pressed. Testing on Channel C is discussed. Other Channels are identical.

1. Make sure the PT-600 is not energized.
2. Set the **MAIN VOLTAGE ADJUST** knob to minimum.
3. Leave the Outputs, Figure 3, Section 6 A and B, open.
4. Set the Switch (Switch 6c) to the range desired.
5. Close the plexiglass door and make sure the interlock engages.
6. Set the timer for a long duration test that will allow sufficient time to adjust the outputs; 30 seconds is recommended
7. Energize the PT-600.
8. Push the **ARM** button.
9. Push the **TEST** button.
10. Adjust the **MAIN VOLTAGE ADJUST** knob until the Voltage DMM reads 1000V.
11. Push the **RESET** button.
12. Set the Timer for 1 sec if the 5A test is being conducted; or 0.5 sec. if the 1A test is

being conducted. Section of this Manual.
13. Connect the EUT and test per the 'Testing'

600Vac, 2 ohm Test Section - Blue Area (Figure 3, Area 8)

The 600Vac, 2 ohm Test Section is provided in accordance with GR-1089, Second Edition, Clause 4.5.11. The output is not energized until the **TEST** button is pressed. There are two outputs, labeled Channel A and Channel B. Locations are referenced to Figure 3 of this Manual.
Caveats for this Section are noted below:

1. This output must be used with the Line Simulator Fuse. Serious damage to the PT-600 will result if this output is used without the Line Simulator Fuse in place. The Line Simulator Fuse may be used with other outputs as required. Line Simulator Fuse function and use are discussed in the following Section.

Line Simulator Fuse and Fuse Monitoring – Blue Area (Figure 3, Area 4)

The Line Simulator Fuse and Fuse Monitoring Circuit are used when required by Standard Testing. The inputs and outputs of this circuit are not internally connected to any PT-600 circuits, so all connections must be made on the front panel with jumper wires between the desired output of the PT-600 and the EUT. A Fuse Monitoring Circuit is also provided to alert the operator when the Line Simulator Fuse(s) are open.

High-Impedance Inductive Source Test Circuit – Violet Area (Figure 3, Area 1)

The High Impedance Induction Test is provided per the requirements of GR-1089 Third Edition, Table 4-7, Test 5; and Table 4-8, Test 5. The circuit is described in GR-1089, Third Edition, Figure 4-4, and provided for reference in Figure 9. There are two channels provided; Channel G and Channel H; each of which is independent. The channels are located in the Violet Band on the front panel of the PT-600
Caveats for this Section are listed below:

1. Meters and BNC Jacks are energized when the Channel Select knob is set to the Violet Band. All meters read Voltage. Row 1 is Channel G and Row 2 is Channel H. Scaling for the BNC Jacks is 10mV/V for all outputs.
2. The Ground jacks provided are directly connected to earth ground, in accordance with the test requirements.
3. The EUT is connected across Jacks V_T and V_R.
4. The outputs are continuously rated for 50VA.
5. The Timer does not work for this circuit.
6. To shut down this circuit, use the High Impedance Induction Test switch, located at the top of the Violet Band. See Figure 2, Item 1 for location information.

Conducting the High Impedance Induction Test

This Section describes conducting the High Impedance Induction Test. The circuit is fixed by the Standard, as are measurement specifics. Tests on Channel G and Channel H are set up identically. Rheostats are provided for each Channel; see Figure 2, Items 2 and 3. The following procedure is for channel G.

1. Be sure the PT-600 is not energized.
2. Turn OFF the High Impedance Induction Test switch, located at the top of the Violet Area.
3. Turn the **Channel G Voltage Adjust** knob to minimum.
4. Watch the Front Panel Meters for Voltage from V, V', V_T or V_R to the Ground Jack, on Channel G, in accordance with the Standard.

5. Set the timer for a long duration test that will allow sufficient time to adjust the outputs; 30 seconds is recommended
6. Close the plexiglass door.
7. Energize the PT-600.
8. Turn the High Impedance Induction Test Switch, to the ON position. The outputs will immediately be energized, and stay energized until the switch is turned OFF.
9. Set the **Channel G Voltage Adjust** knob until the Voltage meter reads 600V, or other desired voltage.
10. After correct voltage is obtained, stop the test by turning the High Impedance Induction Test switch OFF.
11. Open the plexiglass door and connect the EUT as shown in the Standard.
12. Close the safety door before commencing the testing.
13. Turn the High Impedance Induction Test switch ON. Testing will commence immediately and continue until the switch is turned OFF.
14. Test in accordance with the Standard and the 'Testing ' Section of this manual.
15. In all cases, turn the High Impedance Induction Test switch OFF before opening the plexiglass door.
16. After testing is completed, remove all test leads.
17. Set the High Impedance Induction Test switch OFF whenever the Violet Area is not used for testing.

Section 5

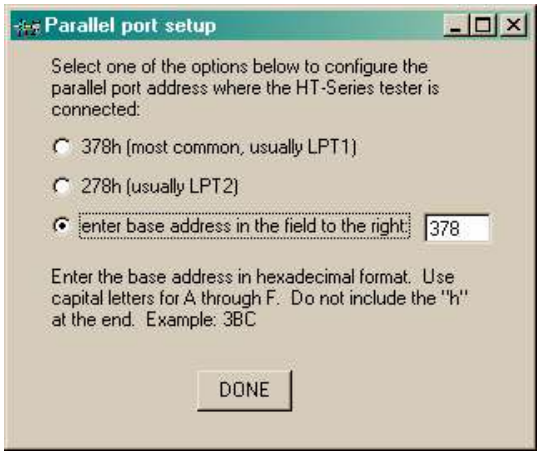
TestMinder MegaPulse

Description

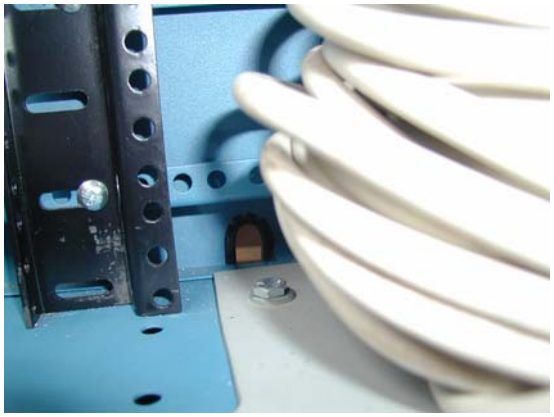
The TestMinder MegaPulse is an option that allows testing to be started and stopped from a Windows-equipped computer. Multiple tests using the same output voltage a jacks can also be conducted. A record of the test is sent to a file on the computer. The record can be set to be a .txt file or a .csv file. The .csv file can be read by Microsoft Excel.

File Installation and Program Setup

1. Insert the CD "Compliance West USA TestMinder MegaPulse" into the drive on your computer and follow the prompts. If the CD does not start automatically, browse to the CD and click the file "Setup.exe." The files will be installed to the location of your choice.
2. Browse to the CD again, and select the directory "DLPortIO", click it, and run the installation program "Port95nt.exe".
3. Using the computer's Setup Utility, configure the parallel port to SPP or PS/2. This is important as some parallel port emulations will not allow proper operation of TestMinder MP. For detailed information on this step, please see the readme.txt file on the CD.
4. Further configuration of the parallel port is available on the TestMinder PT screen. For most cases, the default parallel port 378H (LPT 1) will be used. If this needs to be changed, click the LPT Setup button on the screen and select the new port assignment. Click DONE when finished.



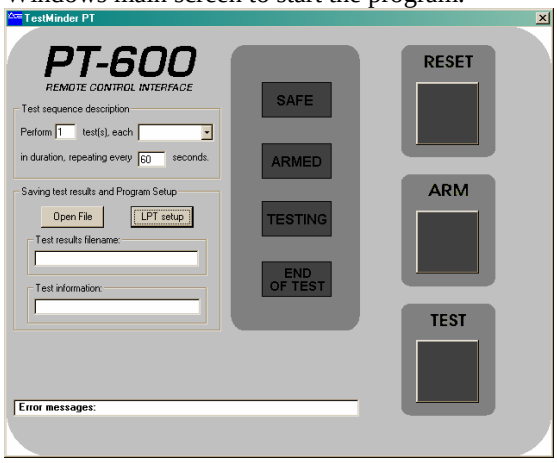
5. Connect the parallel port of the computer to the PT-600. For shipment, the I/O cable is coiled within the PT-600 on the bottom shelf, next to the variac. To access it, open the rear door. Remove the left side access panel by gently prying the six plastic fasteners and route the cable through the supplied slot . See photo for slot location. Uncoil the cable, route it through the slot, and connect it to the PC.



6. Further operational assistance is available through the popup windows as the mouse is moved over the program window.

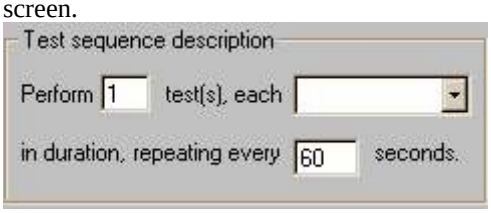
Test operation of the PT-600 with the MegaPulse MP

1. Click Start, Programs, TestMinder PT on the Windows main screen to start the program.



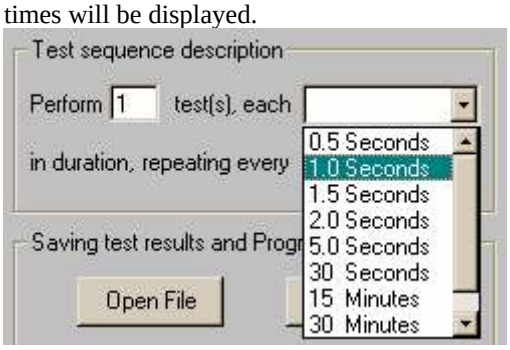
2. On the front of the PT-600, turn the Timer Knob at the top of the tester to the "AUTO" setting. If the knob is not set to the AUTO position, or if the Interlock circuit is not in the safe mode by all doors being closed, the TestMinder PT screen on the computer will gray out all the buttons. When the interlock is properly safe, and the Timer Knob is set to the AUTO position, the pictures of the buttons and lights will be shown in color.

3. To set the number of test repetitions, see the "Test Sequence Description" portion of the screen.



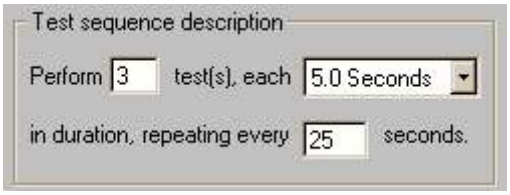
Set the number of tests in the sequence in the first box. If only one test is to be conducted, the numeral 1 is already entered. If multiple tests are to be conducted, enter the total number of tests to be conducted.

4. To set the test time, click the down arrow on the second box, and a menu showing test times will be displayed.



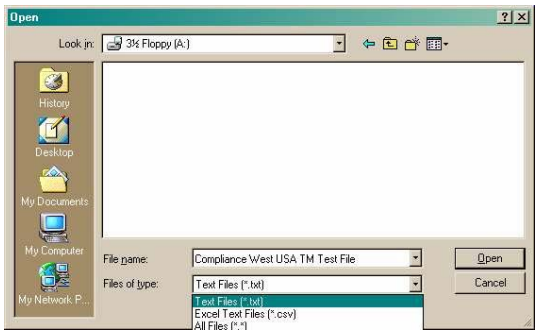
Click on the test time desired, and that time will appear in the window.

5. For multiple test runs, the repetition rate must be set in the third window. This value is the total period of the test including the rest time between tests. The window below demonstrates a multiple output test with the following parameters:
Number of Tests: 3
Test Duration: 5 seconds
Rest time between tests: 20 seconds



8. A test file must be selected. Click on the Open File button and select the type of file and location from the drop down window.

.txt or .csv files can be saved.



8. Testing can now commence. Sequence of buttons to be pressed will be indicated by the highlighted buttons shown on the screen. Press RESET when brightly lit to reset the tester, then ARM when lit to prepare the tester, then TEST when lit to actually perform the test. Status is shown by illumination of each of the four lights in the middle of the screen.

8. To stop the test at any time, press the spacebar as noted on the screen. The testing is also stopped by pressing the RESET button on the screen or on the PT-600; opening any door; or pressing the EMERGENCY STOP button on the top of the front panel of the PT-600.

Custom Time Settings with MegaPulse MP

Time settings not on the MegaPulse MP test time drop-down menu may be set using the Adjustable Time Setting DIP switches on the top Front Panel of the PT-600. This procedure describes the method used.

1. Start TestMinder as noted in the previous section, but set the Timer Knob on the front panel of the PT-600 to the ADJ setting.

2. On the computer screen, set the number of tests and test period as above, but set the test duration to "Adj. Time Set".

3. Set the dip switches on the front panel to the time desired as described in Section 3, Table 2 of this Manual.

Troubleshooting Guide

Refer to the following table if there are problems with the operation of the PT-600.

PROBLEM	POSSIBLE SOLUTION
Unit does not operate at all - there are no lights illuminated on the front panel.	- Check that mains power is connected. - Check the input fuses: the control circuit fuses may be open.
Unit seems to operate, but there is no output current on one or more of the output terminals.	- Check the output fuses: one or more may be open. The fuses will protect the internal resistors from damage if the test duration or output current level are incorrectly set. - Make sure that the EUT is connected to the proper output terminal. Refer to Figure 2 and Table 3 for details. - Check for internal loose wires or connections (remove mains power before opening the rear panel).
Unit seems to operate, but **ARM** and **TEST** buttons do not work.	- The **EMERGENCY STOP** button is engaged. Twist the switch to reset it. - One or more interlock switches may be open: make sure that the transparent front door is completely closed, and that the pin on the side of the door is making contact with the interlock switch that is mounted behind the front panel. The front door interlock pin length may be adjusted with pliers. - Make sure that the rear door is completely closed. There is an interlock switch located behind the rear door in the upper right-hand corner. Make sure that the door is engaging this switch when it closes. - The thermal switch on one of the output transformers has opened due to overheating: This will only occur only if extensive high-current testing has just been conducted. Allow the PT-600 to cool for at least 10 minutes and then re-check. The thermal switches are the self-resetting type.
Unit seems to operate, but the output current is low.	- Make sure that the output **VOLTAGE ADJUST** is set for the proper level. Refer to Figure 2 and Table 3 for details. - Make sure that the EUT is connected to the proper output terminal. Refer to Table 3 for details. - Check for internal loose wires or connections (remove mains power before opening the rear panel).

Section 5

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 5:00 PM Pacific Time.

Compliance West USA
2120 Jimmy Durante Blvd, Suite 124
Del Mar, CA 92014

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

info@compwest.com

Section 6

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 PT-600 series impulse 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. The test equipment required for the performance test is as follows:

1. A DMM capable of measuring AC voltage as low as 0.1 millivolts.

2. A DMM capable of measuring AC voltage up to 600 V.

3. A clamp-on or direct-reading current meter capable of reading AC current up to 60 A.

4. A direct-reading current meter capable of reading AC current up to 10 A, with a resolution of 0.1 A or better.

5. A digital oscilloscope or other means of verifying the test duration.

Service Information

The PT-600 tester 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. Contact the manufacturer for return instructions. 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

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

Using the supplied key(s), unlock and open the rear door of the PT-600. If additional access is needed, the side panels may be taken off by removing the four screws on each side, using a phillips screwdriver.

All calibration adjustments are now accessible.

WARNING

Under no circumstances is it necessary to access the inside of the PT-600 with mains power still connected. Do not attempt to do so.

Cleaning

CAUTION

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

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

Performance Test

The performance test evaluates the performance of the PT-600 to ensure that the logic, lights and high voltage sections are working properly. This test is recommended for incoming inspection, as a preventative maintenance check, and to verify proper operation during the calibration procedure. It is not necessary to disassemble the PT-600 to conduct these tests. If the PT-600 fails any part of the performance test, repair or adjustment is indicated.

Due to the very high currents present in the PT-600, the connections may work loose with frequent use. Before proceeding, and at periodic intervals, it is recommended to inspect the internal connections of the PT-600. Make sure that all screw/nut secured wires and connections are tight. Loose connections may result in erroneous readings, low output current levels, and/or overheating of internal connections.

Allow the PT-600 to stabilize and perform the test at an ambient temperature of 23°C ±5°C (73°F ±9°F).

1. Connect the PT-600 to a proper source of electrical supply. Make sure that the front panel **VOLTAGE** adjust knob is turned fully counterclockwise (set @ 0).
2. Connect test leads and voltage / current meters as described in Table 3. Connect a high-current shorting jumper wire from the highest **OUTPUT** current terminal (one of the terminals in Figure 2 Item 5) to the **RETURN** terminal (Figure 2 Item 6).
3. Set the Timer Control switch (Fig. 1 Item 1) to an appropriate test duration, making sure that the maximum test duration described in the notes to Table 1 is not exceeded.
4. Make sure that the transparent front door is completely closed. Check that the **EMERGENCY STOP** button is not depressed, otherwise, the **ARM** switch and **TEST** switch will not function.
5. Press the **RESET** switch, and then press the **ARM** switch. Turn the **VOLTAGE ADJUST** knob so that the output voltage (as read on an external meter, refer to Table 3) is at the desired level.
6. Press the **TEST** switch. Verify that the output current (as read on an external meter, refer to Table 3) is at the desired level, and the test runs for the expected duration. In general, it is best to limit short-circuit tests to no longer than 1.5 seconds. In any case, if the test runs for longer that the anticipated test duration, or to shut down the tester immediately, press the **RESET** button or the **EMERGENCY STOP** button. Note that the **EMERGENCY STOP** button must be released before any additional test can be conducted. Refer to Table 3 for additional details.
7. If the measured output current was not what was anticipated, it is possible to adjust the source impedance in order to change the short-circuit output current. The adjustable resistors are accessible by opening the rear door. **NOTE:** disconnect mains power before opening the rear door or attempting to adjust the source impedance resistors. Refer to Figure 5 for details.

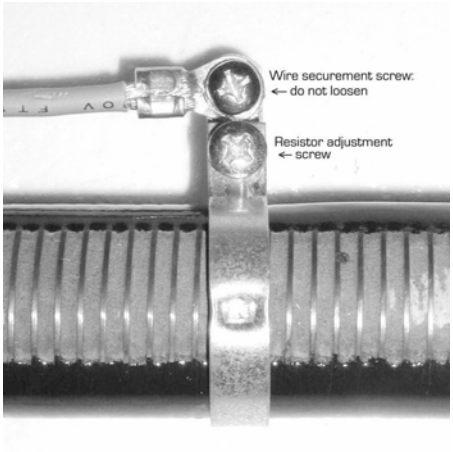


Figure 5. Resistor adjustment

8. The adjustable resistors are identified on the inside of the chassis. Find the

appropriate resistor, and loosen the bracket in the middle of the resistor using a phillips screwdriver. **Note:** it is not necessary to loosen the screw that secures the wire to the bracket. For 60A output current adjustment (not provided on all models) there are two adjacent brackets that must both be loosened. Slide the bracket towards the rear of the chassis to decrease the short-circuit output current. Slide the bracket towards the front of the chassis to increase the short-circuit output current.

9. Re-tighten the bracket, close and lock the rear door, and re-apply mains voltage. Repeat steps 2 through 6 as needed to verify proper settings of the PT-600.
10. The 60A (if provided), 40A, 7A, and 2.2A short-circuit output current levels are all based on an open-circuit output voltage of 600 Volts. Each output (on both channels, if provided) may be adjusted independently using the described procedure.

If the results of the performance test are not in accordance with the above, or the output current can not be adjusted to the appropriate level, then service is required. Remove the PT-600 from service and contact the manufacturer for servicing information. If the results of the tests above are correct, proceed with the Calibration Procedure.

Calibration Procedure

The PT-600 is essentially a power source. In order to simplify the calibration process, almost all of the settings on the PT-600 can be verified using external meters (not provided) that would be calibrated separately. It is also possible to adjust the source impedance resistors (as described previously in the Performance Test section). However, because the output voltage is adjustable, the output current (into a load or a short-circuit) will still depend on the output voltage setting, therefore, the calibration procedure is limited to verifying that the internal current shunt(s) are calibrated.

The Calibration Procedure should be performed annually and any time the instrument has been repaired. The calibration procedure consists of calibrating the internal current shunt(s). This can be accomplished with the current shunt(s) installed in the chassis, or alternatively the current shunt(s) may be removed and calibrated separately.

The Performance test in the previous section should be performed with satisfactory results before conducting the Calibration procedure.

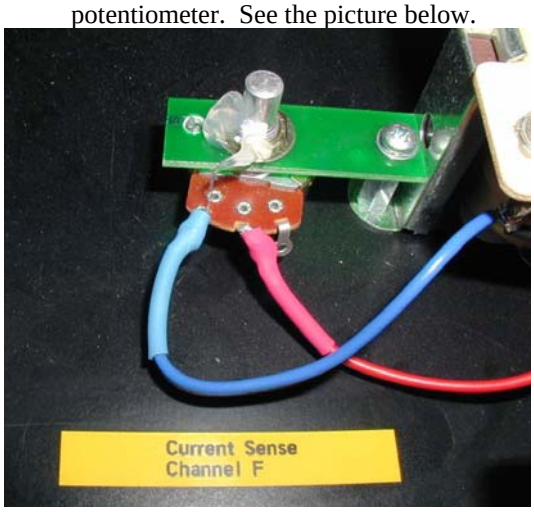
NOTE

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).

Current Sense Calibration Verification (internal)

1. Connect a high-current shorting jumper from the highest output current terminal (Figure 2 Item 5) to the Return terminal (Figure 2 Item 6). Alternatively, a direct-reading AC current meter may be used in place of the shorting jumper if the meter is rated to handle the output current of the PT-600.
2. Connect a calibrated clamp-on current meter over the shorting jumper from step 1. (This is not necessary if a direct-reading current meter was used in step 1.)
3. Connect a millivolt-reading AC voltmeter between the two Current Sense terminals on the PT-600 (Figure 2 Item 3). Connect a suitable DC voltage meter to the Voltage Output Test Points. The red test point is positive; the black test point is negative.
3. Set the Timer Control switch (Fig. 1 Item 1) to an appropriate test duration, making sure that the maximum test duration described in the notes to Table 1 is not exceeded.
4. Make sure that the transparent front door is completely closed. Check that the **EMERGENCY STOP** button is not depressed. Otherwise, the **ARM** switch and **TEST** switch will not function.
5. Press the **RESET** switch, and then press the **ARM** switch. Turn the **VOLTAGE ADJUST** knob so that the output voltage (as read on an external meter, refer to Table 3) is at the desired level (do not exceed 600 Volts).
6. Press the **TEST** switch. Verify that the output current (as read on the clamp-on or direct-reading AC current meter) is in

agreement with the current level as read on the AC millivolt meter. If it is not, then adjust the current sense by adjusting the potentiometer. See the picture below.



7. There are four current sense adjustments: Channel E; Channel F; Channels A,C,I; and Channels B,D,J. Repeat this procedure for all four current sense adjustments.

APPENDIX A: CALIBRATION INSTRUCTIONS

28 December, 2004, last updated 6 Feb, 2005

How to calibrate the PT600 outputs

In general, the higher-power outputs are calibrated using a lower-than-nominal input voltage in order to keep the output power levels reasonable. Output power levels greater than 20kW are calibrated using an input voltage of 120V. Output power levels between 5kW and 20kW are calibrated using an input voltage of 240V. Output power levels below 5kW are calibrated using the standard (480V) input voltage. In all cases the housekeeping circuit is plugged in to 120V.

The Simpson 50A current sense transformers are calibrated as follows:
The 20KOhm resistor across the output terminals of the Simpson is removed (leaving the 505 Ohm resistor in place. A 25KOhm pot (pins 1-2) is soldered in place of the resistor that was removed, and turned fully clockwise. To calibrate each 0.2V/A current sense output, connect a multimeter across the 0.2V/A sense, and conenct a second multimeter (set to read 10 A AC) across one of the outputs that is rated approx. 10A short circuit or more. Start with the output voltage at zero volts, and perform a test, increasing the output voltage until approx. 10A flows. Adjust the 25K potentiometer until the reading on the first multimeter is 0.2V/A (2.00V for 10A).

There are 4 trays of resistors in the PT-600; two identical groups of two trays each. From top to bottom in the chassis they are ordered as follows:

Channel A tray 1
Channel A (C,D,I) tray 2
Channel B tray 1
Channel B (E,F,J) tray 2

The steps below are conducted on Channel A, and repeated on Channel B. Note that there are individual steps for the 1000V, 5A and 1000V, 1A adjustments because there are a total of 4 channels of these outputs, and therefore 4 separate calibration adjustments.

Adjustable resistors are adjusted during the following steps. The output current is increased when the resistors are moved as specified below. To decrease the output current, move the resistor in the opposite direction. * Note: The following outputs specifically listed below must be adjusted in order. If the first output is adjusted, then all the other outputs must also be re-checked:

1. 600V, 5A
2. 600V, 7A; 230V, 2.9A; 1000V, 5A (CH D, F)

1500V, 7.5A (CH I, J): tray 2 top, front resistor 3 adjustable tap: move towards the front
1000V, 5A (CH C,E): tray 2 top, rear resistor 5 adjustable tap: move towards the front
1000V, 5A (CH D,F): tray 2 top, front resistor 9 adjustable tap: move towards the front
1000V, 1A (CH C,E): tray 2 top, rear resistor 7 adjustable tap: move towards the rear
1000V, 1A (CH D,F): tray 2 top, rear resistor 10 adjustable tap: move towards the front

600V, 60A: tray 1 top, rear resistor 2 (and 3) adjustable tap closest to the rear: move towards the front.
600V, 40A: tray 1 top, rear resistor 6 adjustable tap closest to the rear: move towards the rear.
600V, 30A: tray 2 top, front resistor 1 adjustable tap closest to the rear: move towards the rear.
600V, 7A: tray 2 top, front resistor 13 adjustable tap closest to the front: move towards the front.
* 600V, 5A: tray 2 top, front resistor 6 adjustable tap closest to the rear: move towards the front.
300V, 20A: tray 1 top, rear resistor 7 (and 6) adjustable tap closest to the front: move towards the rear.
277V, 25A: tray 1 top, front resistor 10 (and 11) adjustable tap closest to the rear: move towards the rear.
230V, 23A: tray 1 top, front resistor 10 (and 11) adjustable tap closest to the front: move towards the rear.

230V, 11.5A: tray 2 top, front resistor 1 adjustable tap closest to the front: move towards the rear.
230V, 5.8A: tray 2 top, front resistor 6 adjustable tap closest to the rear: move towards the rear.
230V, 2.9A: tray 2 top, front resistor 13 adjustable tap closest to the rear: move towards the front.
120V, 25A: tray 1 top, rear resistor 10 (and 11) adjustable tap: move towards the rear.

For 600V, 60A; 600V, 40A; outputs:

1. Set the "main" input voltage to 120V as measured from line-to-line on the external fuse block where the power cord is connected. Use the "cheap" voltmeter and leave it connected for all tests.

2. Connect a voltmeter from the CHAN A VOLTAGE SENSE to the CHAN A RETURN jacks.

3. Press the RESET button, then the ARM button.

4. Adjust the front-panel VOLTAGE ADJUST knob so that the voltmeter reads 150V (25% of the "rated" output voltage).

5. Press the RESET button, connect a high-current shorting wire (10 AWG) from the CHAN A OUTPUT jack (60A or 40A) to the RETURN jack. Connect the clamp-on current meter over the shorting cable.

6. Perform a 5-second test (RESET, ARM, TEST) and note (1) the input voltage on the meter from step 1, and (2) the current reading on the current meter from step 5. Note that the input voltage will sag, i.e. it will not be reading 120V while the test is in process.

7. Do the math to calculate what the short-circuit output current would be if the input voltage were 480V: Ic = (480/Vt) x It, where:

Ic = calculated output current
Vt = Input voltage during the test
It = Short-circuit current during the test

Adjust the appropriate resistor to increase or decrease the short circuit current. Repeat step 6 and 7.

8. Repeat steps 2 - 7 for CHAN B OUTPUT, and 40A outputs (CHAN A and CHAN B).

For the 600V, 30A; 300V, 20A; 277V, 25A; and 230V, 23A outputs:

9. Set the "main" input voltage to 240V as measured from line-to-line on the external fuse block where the power cord is connected. Use the "cheap" voltmeter and leave it connected for all tests.

10. Repeat steps 2-7 for all specified outputs on CHAN A and CHAN B except that in step 4, the output voltage is adjusted to 50% of the "rated" output voltage, i.e. for the 277V test, the voltage is adjusted to 139V. Note for tests where the "rated" output voltage is 300V or less, the front panel 600/300V select switch should be set for 300V.

For the 600V, 7A; 600V, 5A; 230V, 11.5A; 230V, 5.8A; 230V, 2.9A; and 120V, 25A outputs:

11. Set the "main" input voltage to 480V as measured from line-to-line on the external fuse block where the power cord is connected. Use the "cheap" voltmeter and leave it connected for all tests.

12. Repeat steps 2-7 for al specified outputs on CHAN A and CHAN B except that in step 4, the output voltage is adjusted to the full "rated" output voltage. Note for tests where the "rated" output voltage is 300V or less, the front panel 600/300V select switch should be set for 300V. Also note that for all except the 120V, 25A output it is possible to use a direct-reading multimeter set to measure "Amps AC" on the 10A scale, instead of using the shorting wire and clamp-on current meter from step 5.

For the 1500V, 7.5A; 1000V, 5A; 1000V, 1A outputs:

13. Set the "main" input voltage to 240V as measured from line-to-line on the external fuse block where the power cord is connected. Use the "cheap" voltmeter and leave it connected for all tests.

14. Connect a voltmeter from the OUTPUT (CHAN C,D,E,F,I or J) jack to the appropriate RETURN jack (CHAN C,D,E,F,I or J). Set the range of the meter to read up to 1000V AC.

15. Set the test duration switch to 30 seconds, press the RESET button, then the ARM button, then the TEST button.

16. Adjust the front-panel VOLTAGE ADJUST knob so that the voltmeter reads 750V or 500V (50% of the "rated" output voltage).

17. Press the RESET button, connect a multimeter set to measure "Amps AC" on the 10A scale from the appropriate OUTPUT (CHAN C,D,E,F,I or J) jack to the appropriate RETURN jack (CHAN C,D,E,F,I or J).

18. Perform a 5-second test (RESET, ARM, TEST) and note (1) the input voltage on the meter from step 13, and (2) the current reading on the current meter from step 17. Note that the input voltage will sag, i.e. it will not be reading 240V while the test is in process.

19. Do the math to calculate what the short-circuit output current would be if the input voltage were 480V: Ic = (480/Vt) x It, where:

Ic = calculated output current
Vt = Input voltage during the test
It = Short-circuit current during the test

Adjust the appropriate resistor to increase or decrease the short circuit current. Repeat step 17 and 18.