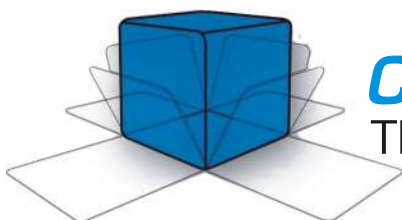


MegaPulse

IMPULSE TESTER

1.2x50-16PF PV

Instruction Manual



COMPLIANCE WEST USA

The blue box that tests. And tests.

Dear Customer:

Congratulations! Compliance West USA is proud to present you with your MegaPulse 1.2x50-16PF PV Impulse Tester. Your instrument features a groundbreaking logic-controlled circuit design and ergonomic front panel and represents the latest in high voltage impulse 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 Impulse Testing with the MegaPulse series tester

The impulse test is designed to simulate impulse surges which occur in everyday life due to nearby lightning strikes, switching transients, and other high-frequency faults on the power distribution network. Impulse testing is the fundamental method for empirical verification of the adequacy of insulation. Other methods of ensuring adequate insulation (AC or DC Dielectric Withstand testing, measurement of over-surface creepage, through-air clearance, or distance-through-insulation) are all extrapolated from the results of impulse testing. The impulse test is performed to ensure that the insulation in question will be able to function properly when subjected to similar impulse surges in the field.

Safety Precautions

The impulse withstand test can generate voltages in excess of 16 KV peak at potentially lethal current levels. Currents of as little as 5 mA at 120 volts can cause death; the MegaPulse can deliver currents of more than 3500 Amps peak for a very short time duration. 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 impulse 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 impulse 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 an impulse test failure, it is not safe to conduct impulse testing in combustible atmospheres.

It is imperative that a good ground be provided to the MegaPulse tester. Before connecting the equipment, ensure that the building wiring provides a low-resistance ground. If the MegaPulse tester 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 MegaPulse can be shut off at any time by turning OFF the rear power switch. Note that there are residual voltages inside the equipment that may take up to 5 minutes to bleed off to safe levels.

The MegaPulse tester is provided with a **VOLTAGE ADJUST** knob on the front panel. This voltage setting should always confirm by pressing the **VOLTAGE ADJUST** knob before start any testing.

The MegaPulse tester is provided with a **CHARGE** switch that is in the unarmed "Standby" setting when the tester is first turned ON. When the yellow **CHARGE** button is lit, the tester will not provide high voltage until the **CHARGE** Button and the **TRIGGER** Button have been pressed in order. To prevent inadvertent operation, the operator should be instructed not to press the **CHARGE** Button until the test is ready.

The MegaPulse tester 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 MegaPulse tester and then left alone by the operator. After the operator is clear of the tester and the equipment under test, the operator should turn the rear-panel power switch to ON, press the **CHARGE** Button, adjust the voltage to the desired level (as displayed on the front panel meter), then press the **TRIGGER** Button, with his right hand. This will allow the greatest separation between the operator and the test being conducted.

The MegaPulse tester 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 MegaPulse until the front panel meter reads a safe level (40 volts or less is generally considered a safe level). Pressing the **TRIGGER** button before disconnecting main power (or turning the equipment off) will ensure that the internal capacitors are discharged as much as possible.

Using the MegaPulse Impulse Tester

The impulse test involves high voltage and caution should be exercised when using the tester. Both the **OUTPUT** and **RETURN** leads are floating (not referenced to chassis ground). The impulse output waveform is Positive on the **OUTPUT** lead relative to the **RETURN** lead when the output is configured for Normal (**NOR**) polarity. The impulse output waveform is Negative on the **OUTPUT** lead relative to the **RETURN** lead when the output is configured for Reverse (**REV**) polarity. Both the **OUTPUT** and **RETURN** leads must always be treated as Hazardous whenever the power switch of the MegaPulse is in the ON position.

The MegaPulse impulse tester generates the impulse waveform only; it does not determine Passing or Failing results. It is the operator's responsibility to monitor the output waveform and determine Passing or Failing results. In monitoring the impulse waveform, consider the following points:

The Impulse waveform is high voltage, and high frequency (short duration). Always ensure that the measuring instrument (usually an oscilloscope with a high-voltage probe) is rated for the voltage involved, and that the frequency response of the instrument and probe are capable of measuring the output waveform of the MegaPulse Impulse Tester. A measuring instrument or probe with a low frequency response will result in erroneous readings that could be mis-read.

Pressing the **POLARITY** switch on the front panel can change the polarity of the output waveform. The polarity is Normal when the **NOR** indicator is lit. In this case, the high voltage will appear on the **OUTPUT** as a positive pulse relative to the **RETURN** jack. When the

polarity switch is in the Reverse position (**REV** indicator is lit), the high voltage will appear on the **OUTPUT** as a negative pulse relative to the **RETURN** jack. The polarity switch only operates when the **CHARGE LED** is lit, i.e. the output is not charged.

Note that the voltage meter may indicate that some residual voltage is present on the main storage capacitor, even when the tester is first turned ON. This is due to inherent charging of the internal capacitors. Pressing the **TRIGGER** switch will discharge the capacitors (be sure not to touch the output and return leads when pressing the trigger switch).

Note that the peak amplitude of the measured output waveform is the voltage that is read on the front panel of the MegaPulse prior to triggering the output. This is the peak open-circuit output into any capacitive load from 0 to 180nF. If the load is outside this capacitance range, or is a significant resistive or inductive load, the peak output voltage will be lower than shown on the front panel meter. The output impedance of the MegaPulse tester is low (approximately 2.5 Ohms) and the MegaPulse is capable of delivering thousands of Amps of current into a short circuit. While the MegaPulse can withstand a short-circuit at the output terminals, it should NOT be used in this way. It is important to measure the peak amplitude of the output waveform, and adjust the output of the MegaPulse to achieve the desired peak output voltage at the Equipment Under Test.

Determination of Passing and Failing results can prove difficult. To obtain the most accurate results, it is generally necessary to perform multiple impulse tests on a few different test samples (that have adequate insulation to pass the impulse test). Take note of the impulse waveshape, amplitude, and duration. Also note how much variance there is in the waveshape from test to test. Also (if possible), perform impulse testing on some test samples that are known to have inadequate (or damaged) insulation. Take note of the impulse waveshape, amplitude, and duration, when an insulation breakdown occurs. A passing result will generally allow the MegaPulse to generate the full 1.2 x 50uS waveform as shown in figure 1. A failing result will typically show an abrupt reduction in the output voltage, either before the expected peak, or soon after (Figure 2).

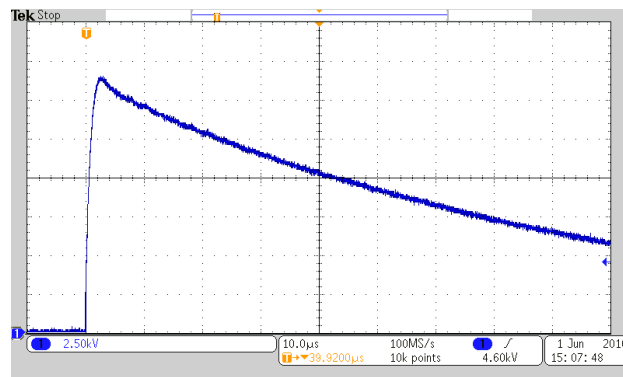


Figure 1: Full 1.2 x 50uS waveform (typical)

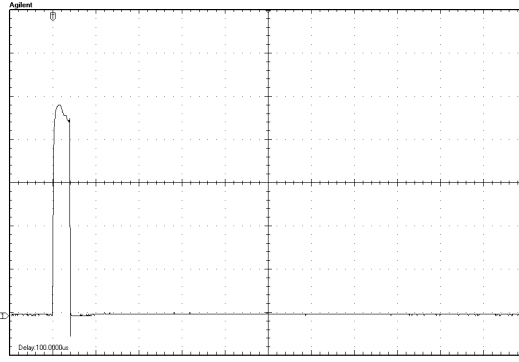


Figure 2: Impulse output with breakdown after the peak

Section 2

Introduction

This manual contains complete operating, maintenance and calibration instructions for the Compliance West USA MegaPulse 1.2x50-16PF PV Impulse Tester.

- In case of trouble, the test can be immediately terminated at any time by turning the rear-panel power switch to the OFF position.
- Before the test can commence, the unit must be armed by pressing the **CHARGE** Button. The test will not begin until the **TRIGGER** Button is pushed.
- Voltage is discharged by a resistor bank within the MegaPulse tester upon test completion. Discharge progress is shown on the front panel meter.

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

Specifications

Output Peak:	800V – 16kV Tolerance $\pm 3\%$
Voltage Rise Time:	1.2 μ s, tolerance -10%, +50% [Trise=1.67(T90%-T30%)]
Voltage Duration Time:	50 μ s, tolerance $\pm 20\%$
Voltage Control:	Knob or optional USB computer control
PV capacitance range:	0nF – 180nF
Voltage Display:	5 digit LED display
Voltage Meter Accuracy:	1% of reading $\pm 10V$
Duty Cycle:	60 Seconds between pulses
Charge Rate:	> 500V/Sec.
Line Voltage:	120V AC, 50/60Hz *optional different line voltage
Input Fuse:	T2A, 250V for 120V operation.

Environmental

Operating Temperature:	15-40 °C
Relative Humidity Range:	0-90% non-condensing

General

Dimensions:	24" wide x 30" high x 23" in deep
Weight:	140 lbs approx.

Options:

TMM:

Testminder USB computer interface software. The tester can be controlled with a computer. It can also be set to automatically follow test sequences varying test voltage and time between tests and keep a record with test information. Compatible with Windows 32bit platform.

220, 230 or 240:

If a different line voltage is desired, with this option we install a step down transformer to be compatible with your line voltage. 220 is for 220V, 230 for 230V and 240 for 240V.

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 MegaPulse 1.2x50-16PF PV Tester
- Two large alligator clips with insulating boots (one red, one black)
- An 18 AWG Line Power Cord
- This Instruction Manual
- Calibration certificate with waveform calibration pictures

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. CAUTION: The MegaPulse tester is very heavy. Two-person lift is required.

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. The cord packaged with your MegaPulse Tester is for use in the United States. If another power cord must be used, the cord must be rated for the maximum current noted on the rear panel. It must also meet the requirements of IEC 227 or IEC 245, and mains cords that are certified or approved by any recognized national test house are regarded as meeting this requirement.

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, and also listed in the Specifications section of this manual. 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 MegaPulse are shown in Figure 3 and described in Table 1. The rear panel features of the MegaPulse are shown in Figure 4 and described in Table 2.

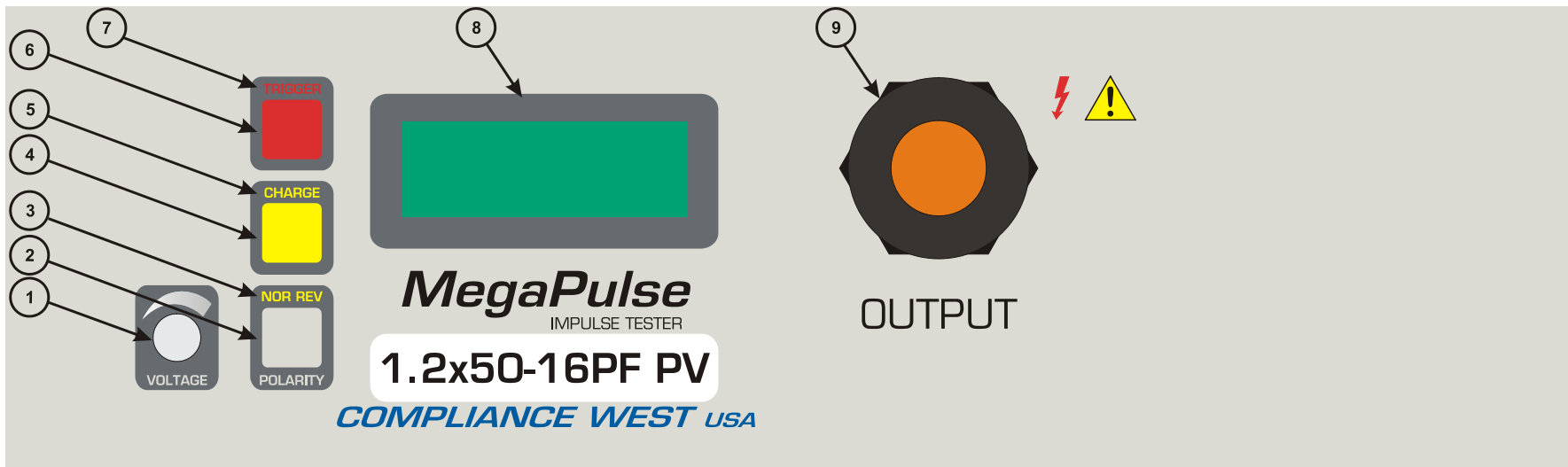


Figure 3. Controls, Indicators, Connectors – MegaPulse 1.2x50-16PF PV Front Panel

ITEM	NAME	FUNCTION
1	VOLTAGE Adjust Knob	Adjust the digital voltage set point in the tester. Press the voltage knob to display the voltage set point. This setting will blink for a few seconds on the front meter. Turn Clockwise to increase the setting Voltage Setting Point before pressing CHARGE button.
2	POLARITY switch	The polarity switch only operates when the CHARGE indicator is lit, i.e. the output is not charged. The polarity of the output waveform can be changed by pressing the POLARITY switch on the front panel. Press this switch to toggle the output polarity from Normal to Reverse. The polarity is Normal when the NOR indicator is lit. In this case, the High Voltage will appear on the OUTPUT (red lead) as a positive pulse relative to the RETURN (black lead). When the polarity switch is in the Reverse position (REV indicator is lit), the High voltage will appear on the OUTPUT (red lead) as a negative pulse relative to the RETURN (black lead).
3	NOR REV indicator	Indicates the state of the Output Polarity switch. NOR indicate Normal position, REV indicates Reverse position.
4	CHARGE switch	Press this switch to begin charging the impulse storage capacitor. The CHARGE indicator will turn off after the CHARGE switch is pressed, and the TRIGGER indicator will turn on. The voltage on the capacitor will appear on the voltage meter, Item 8. This voltage will appear across the output leads when the TRIGGER switch is pressed. Note that the POLARITY switch is prevented from operating after the CHARGE switch has been pressed.
5	CHARGE indicator	This Yellow indicator is lit to show that pressing the CHARGE switch is the next logical step in a test sequence. Pressing the Charge switch causes the CHARGE indicator to go out.
6	TRIGGER switch	Press this switch (after pressing the CHARGE switch to charge the storage capacitor) to trigger the output impulse waveform. The impulse waveform will appear across the output leads.
7	TRIGGER indicator	This Red indicator is lit to show that pressing the TRIGGER switch is the next logical step in a test sequence. This indicator will turn on after the CHARGE switch is pressed, and will remain on until the TRIGGER switch is pressed. Pressing the TRIGGER switch causes the TRIGGER indicator to go out.
8	VOLTAGE meter	Displays the output voltage set point. This voltage is the open-circuit peak voltage that will appear across the output leads when the trigger button is pressed. The voltage reading will increase from zero to the voltage set point when the Charge switch is pressed. Note that the Voltage meter may indicate that some residual voltage is present on the main storage capacitor, even when the tester is first turned ON. This is due to inherent charging of the internal capacitors. Pressing the TRIGGER switch will discharge the capacitors (be sure not to touch the output and return leads when pressing the trigger switch).
9	OUTPUT cable	This cable includes both the OUTPUT (red) and RETURN (black) test leads. The provided large alligator clips may optionally be connected to the ends of the test leads. These test leads should not be touched when a hazardous voltage is indicated on the VOLTAGE meter.

Table 1. Controls, Indicators, Connectors – MegaPulse 1.2x50-16PF PV Front Panel

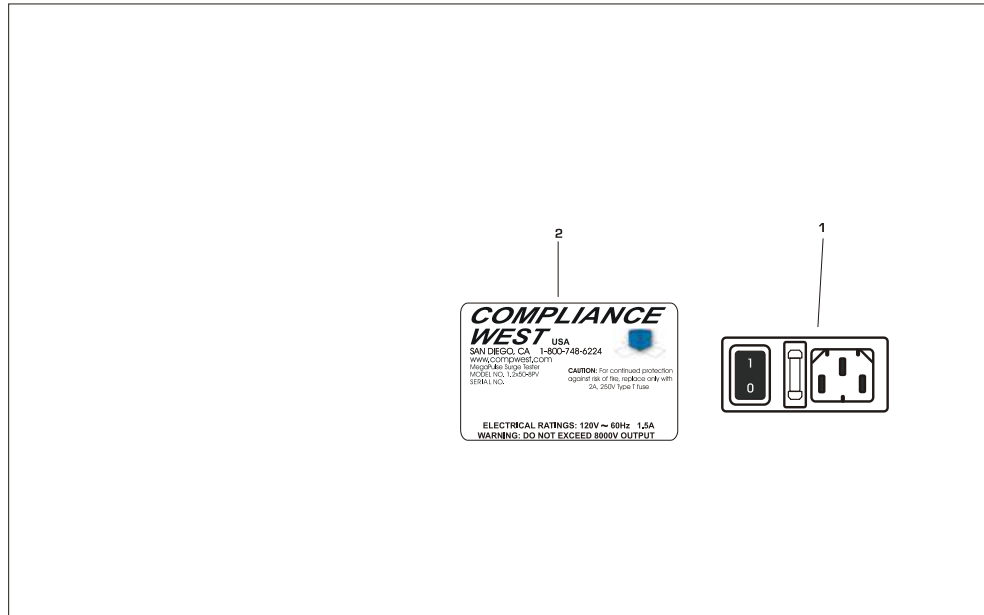


Figure 4. Controls, Indicators, Connectors – MegaPulse 1.2x50-16PF PV Rear Panel

ITEM NO.	NAME	FUNCTION
1	Appliance Inlet / Fuse holder / Power Switch	Use the supplied cordset to connect the MegaPulse tester to appropriate source of supply. Fuse holder provides access for Fuse replacement, and the Power Switch is used to turn the tester ON and OFF.
2	Fuse replacement warning / Rating of supply	Specifies replacement fuse and required supply voltage.

Table 2. Controls, Indicators, Connectors – MegaPulse 1.2x50-16PF PV Rear Panel

Initial Checkout Procedure

The following procedure will verify that the MegaPulse 1.2x50-16PF PV tester is working correctly. We recommend that this procedure be conducted periodically to ensure proper operation of the tester. A measuring instrument to monitor the output waveform is needed to conduct this procedure. Always ensure that the measuring instrument (usually an oscilloscope with a high-voltage probe) is rated for the voltage involved, and that the frequency response of the instrument and probe are capable of measuring the output waveform of the MegaPulse 1.2x50-16PF PV tester. A measuring instrument or probe with a low frequency response will result in erroneous readings that could be mis-read.

CAUTION

High voltage generated by the MegaPulse tester is exposed during this test. A risk of shock exists. Exercise care when using the MegaPulse tester.

1. Connect the tester to a proper source of supply using the included 18 AWG power supply cord.
2. Connect the red and black test leads to the EUT.
3. Connect the ends of the test leads to an appropriate measuring instrument (typically an oscilloscope with a high-voltage probe).

NOTE: The output of the MegaPulse is a high-energy fast-rise ($>10\text{kV}/\mu\text{S}$) waveform. Depending on the measurement setup, it is possible to see very large common-mode noise which can be mis-interpreted as high-frequency noise on the front edge of the impulse waveform. Figure 5 shows a test setup to measure common-mode noise. The high-voltage oscilloscope probe, and the probe ground are both connected to one side of the MegaPulse output. In theory, the result should be that 0 volts is measured on the oscilloscope. In practice, because of the high-impedance of the high-voltage oscilloscope probe, the oscilloscope will measure a substantial high-frequency transient as shown in Figure 6. Before making measurements of the actual impulse output waveform, be sure to perform some measurements as shown in figure 5 and take steps to minimize the measured noise as much as possible. Some possible remedies to reduce common-mode noise are as follows:

- a) Use a suitable oscilloscope and high-voltage probe.
- b) Use a battery-powered oscilloscope.
- c) Isolate the oscilloscope from ground.
- d) Adjust the scope to limit the measurement bandwidth.
- e) Perform a two-channel differential-mode measurement, where the common-mode noise is subtracted from the impulse waveform.

If this common-mode noise is not eliminated in the test setup, the common-mode noise will also be measured when the high-voltage impulse output is measured. The result will look like the waveform shown in Figure 7, where the high-voltage common-mode noise is essentially added to the differential (impulse) voltage.

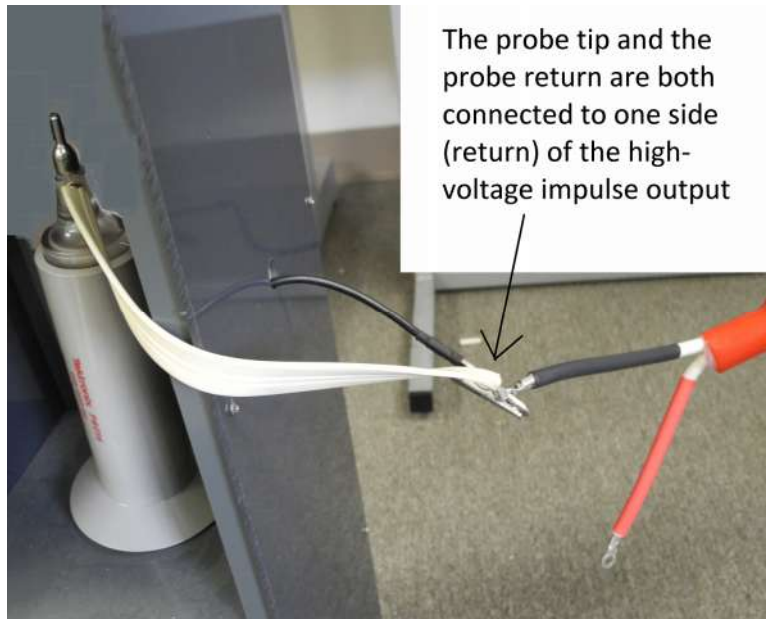


Figure 5: Common-mode noise measurement setup

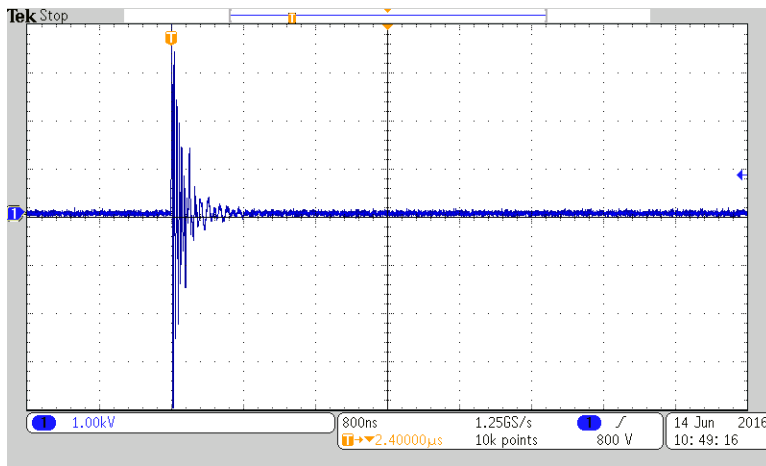


Figure 6: Common-mode noise

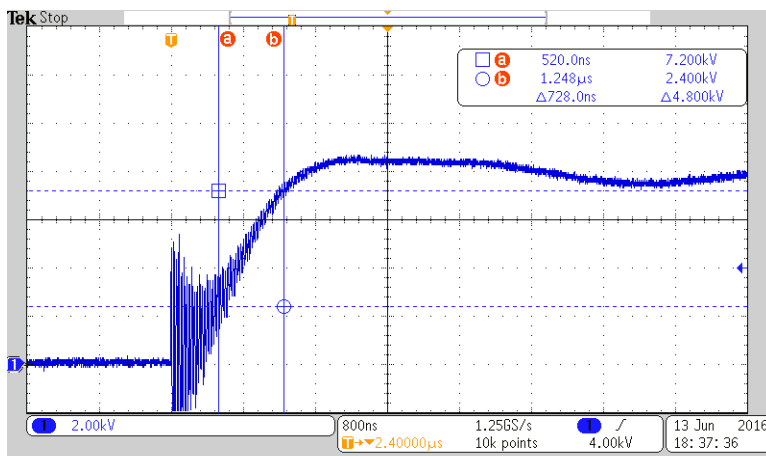


Figure 7: Common-mode noise superimposed on the output waveform

4. Turn the tester on. Toggle the **POLARITY** switch if necessary so that the **NOR** indicator is lit.
5. Note that the Voltage meter may indicate that some residual voltage is present on the main storage capacitor, even when the tester is first turned ON. This is due to inherent charging of the internal capacitors. Pressing the **TRIGGER** switch will discharge the capacitors (be sure not to touch the output and return leads when pressing the trigger switch).
6. Adjust the digital **VOLTAGE** knob to the desired value: press the voltage knob to display the voltage set point. This setting will blink for a few seconds on the front meter. Turn Clockwise to increase the setting Voltage Setting Point.
7. Push the yellow **CHARGE** button. Verify the red **TRIGGER** indicator is now lit.
8. After the front panel meter indicates that the desired test voltage has been reached, push the red **TRIGGER** button, and view the resulting impulse waveform on the measuring instrument.
9. Note that the peak amplitude of the measured output waveform is proportional to the voltage that is read on the front panel of the MegaPulse.
10. Repeat steps 4 through 9, except this time toggle the **POLARITY** switch so that the **REV** indicator is lit. Note that the impulse waveform will now be a negative pulse, so it will probably be necessary to make adjustments to the measuring instrument to get a proper reading.
11. Turn the rear-panel power switch OFF.

Testing

This section describes how the MegaPulse 1.2x50-16PF PV tester is used to conduct a test. The test can be stopped immediately at any time by turning OFF the rear-panel power switch.

1. Connect the tester to a proper source of supply using the included 18 AWG power supply cord.
2. Connect the red and black test leads to the EUT.
3. Turn the tester on. Toggle the **POLARITY** switch if necessary to select the output waveform polarity: **NOR** for positive polarity, and **REV** for negative polarity.
4. Note that the Voltage meter may indicate that some residual voltage is present on the main storage capacitor, even when the tester is first turned ON. This is due to inherent charging of the internal capacitors. Pressing the **TRIGGER** switch will discharge the capacitors (be sure not to touch the output and return leads when pressing the trigger switch).
5. Adjust the digital **VOLTAGE** knob to the desired value: press the voltage knob to display the voltage set point. This setting will blink for a few seconds on the front meter. Turn Clockwise to increase the setting Voltage Setting Point.
6. Push the yellow **CHARGE** button. Verify the red **TRIGGER** indicator is now lit.
7. After the front panel meter indicates that the desired test voltage has been reached, push the red **TRIGGER** button.
8. Turn the rear-panel power switch OFF.

Section 6

Maintenance and Calibration

Service Information

The MegaPulse 1.2x50-16PF PV 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. 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.

Calibration Information

The Megapulse 1.2x50-16PF PV has been fully calibrated at the factory in accordance to our published specifications. It is recommended that you have this instrument re-calibrated and safety check done at least once per year. The procedure consists on internal components tolerance verification and calibrating the meter reading to agree with the capacitor bank.

The Calibration procedure must be performed by qualified personnel. Contact Compliance West USA for the latest calibration procedure. Have ready the serial number of the Megapulse 1.2x50-16PF PV tester.

Technical Assistance

Technical Assistance from Compliance West USA is available:

Phone: (800) 748-6224

Hours: 8:00 AM - 4:00 PM Pacific Time.

Also available on our web site at: www.compwest.com

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