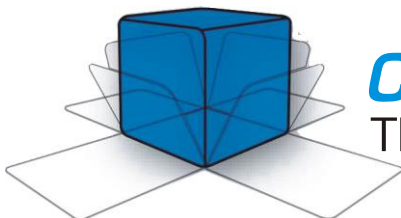


MegaPulse

IMPULSE TESTER

Defib-5PF-003

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 Defib-5PF-003 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

Introduction to Impulse Testing with the MegaPulse PF 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 creep age, 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 up to 5000V peak at potentially lethal current levels. Currents of as little as 5mA at 120 volts can cause death; the MegaPulse can deliver currents of more than 30 Amps peak for 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 Defib-5PF-003 can be shut off at any time by turning OFF the rear power switch. Always press TRIGGER to discharge the tester before turning OFF.









The MegaPulse tester is provided with a digital **VOLTAGE ADJUST** knob on the front panel. This should always be adjusted to the minimum position at the start of testing. In addition, this knob should be adjusted back to the minimum position at the completion of all 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. Note that the CHARGE process will stop after 2 minutes if the TRIGGER button is not pressed.

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.

Safety Markings

	Direct Current		On (Power)
	Alternating Current		Off (Power)
	Refer to instructions		Caution, possibility of electric shock
	Earth (ground) TERMINAL		High Voltage

Using the MegaPulse Impulse Tester

The impulse test involves high voltage and caution should be exercised when using the tester. The **RETURN** lead is referenced to building ground when properly connected. However, both the **OUTPUT** and **RETURN** leads must always be treated as Hazardous whenever the power switch of the MegaPulse is in the ON position.

In the case of the Defib-5PF-003 Impulse Tester, the **active** channel will be the **OUTPUT** and the remaining channels will act as **RETURN**.

The MegaPulse PF 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.

CAUTION

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

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 proportional to the voltage that is read on the front panel of the MegaPulse, but it will always be somewhat lower. This is because the meter on the MegaPulse is measuring the voltage on the main impulse storage capacitor. This voltage will intentionally dissipate to some extent before reaching the output leads. Therefore, it is important to measure the peak amplitude of the output waveform, and adjust the output of the MegaPulse accordingly.

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.

Section 2

Getting Started

This manual contains complete operating, maintenance and calibration information for the Compliance West USA MegaPulse Defib-5PF-003 Impulse Tester.

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

This section contains information for the unpacking, inspection, preparation for use and storage of your Compliance West product.

Unpacking and Inspection

Packaging

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. Please save the shipping carton and packing material for the carrier's inspection. Our customer support department will assist you in the repair or replacement of your instrument. Please do not return your product without first notifying us and receiving an RMA (return material authorization) number. To receive an RMA number, please contact our customer support department at (1-800-748-6224).

Product Package for Defib-5PF-003 Tester

	Description	Part Number
Defib-5PF-003	MegaPulse Tester	
	User Manual	
	High Voltage Test Lead, Red	00-HVL7R (Qty 6)
	18 AWG AC Power Cord	70-101
	User Manual	
TestMinder (Optional)	Software CD	MegaPulse TestMinder P/PF
	RS232 cable	60-134
	USB box	00-USBDDBOX
	USB cable	60-221

Returning the Instrument

When it's necessary to return the instrument for servicing or calibration, repackage the instrument in its original container, please include all accessories and test leads. Indicate the nature of the problem or type of service needed. Also, please mark the container as "FRAGILE" to insure proper handling.

If you do not have the original packaging materials, please follow these guidelines:

- Wrap the instrument in a bubble pack or similar foam including all the included cables.
- Use a strong double-wall container that is made for shipping instrumentation.
- Use a layer of shock absorbing material 70 to 100mm (3 to 4 inch) thick around all sides of the instrument. Protect the control panel with cardboard.
- Seal the container securely.
- Mark the container as "FRAGILE" to insure proper handling.
- Please contact Compliance West USA (1-800-748-6224) to inform about the service for your instrument.

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. 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 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

Section 3

Specifications and Controls

Specifications for the MegaPulse Defib-5PF-003 are listed in the table below and the component designations are shown in Figure 1.

Table 1 Defib-5PF-003 Tester Specifications

ELECTRICAL	
Output Voltage:	0 - 5100 V tolerance $\pm 1\%$
Main Capacitance:	32 μ F $\pm 10\%$
Voltage Control:	Digital Set point adjusted by frontal VOLTAGE knob or by PC TestMinder.
Voltage Display:	4 Digit LED Display.
Voltage Meter resolution:	2V
Duty Cycle:	1 pulse every 20s.
Selectable Input Voltage:	120V~ 60Hz 240V~ 50Hz
ENVIROMENTAL	
Operating Temperature:	15 - 40 °C
Relative Humidity Range:	0 - 90% non-condensing
Altitude	0 - 3000 meters
GENERAL	
Dimensions:	17" wide x 15.75" high x 17" in deep
Weight:	50 lbs. approx.

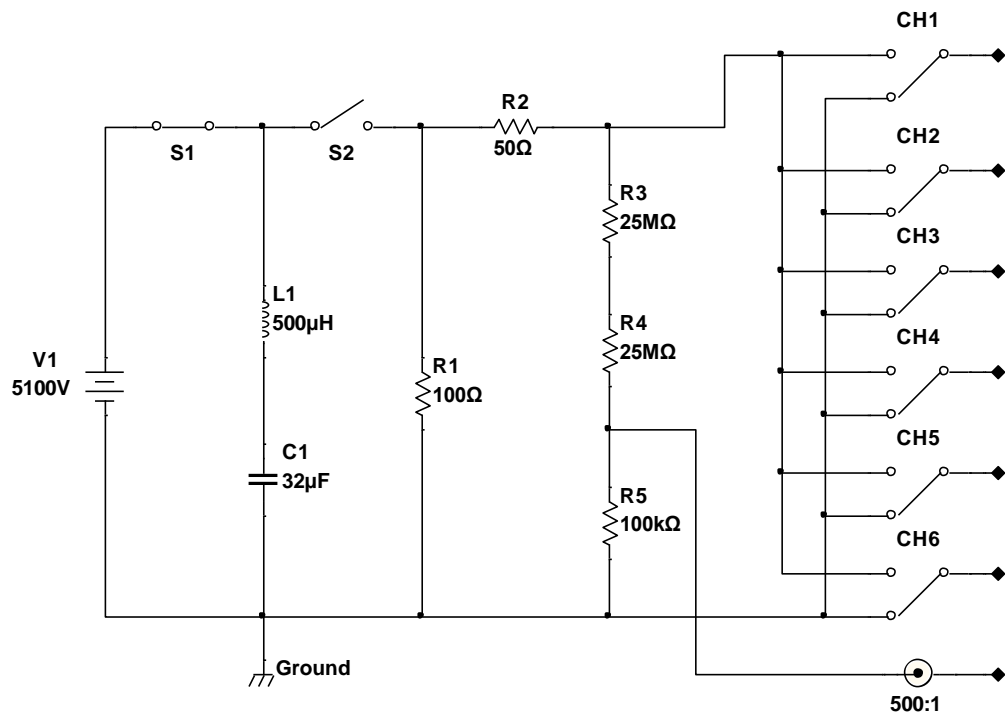


Figure 1 Defib-5PF-003 General Circuit Wiring

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 2 and described in Table 2. The rear panel features of the MegaPulse are shown in **Error! Reference source not found.** and described in Table 2.

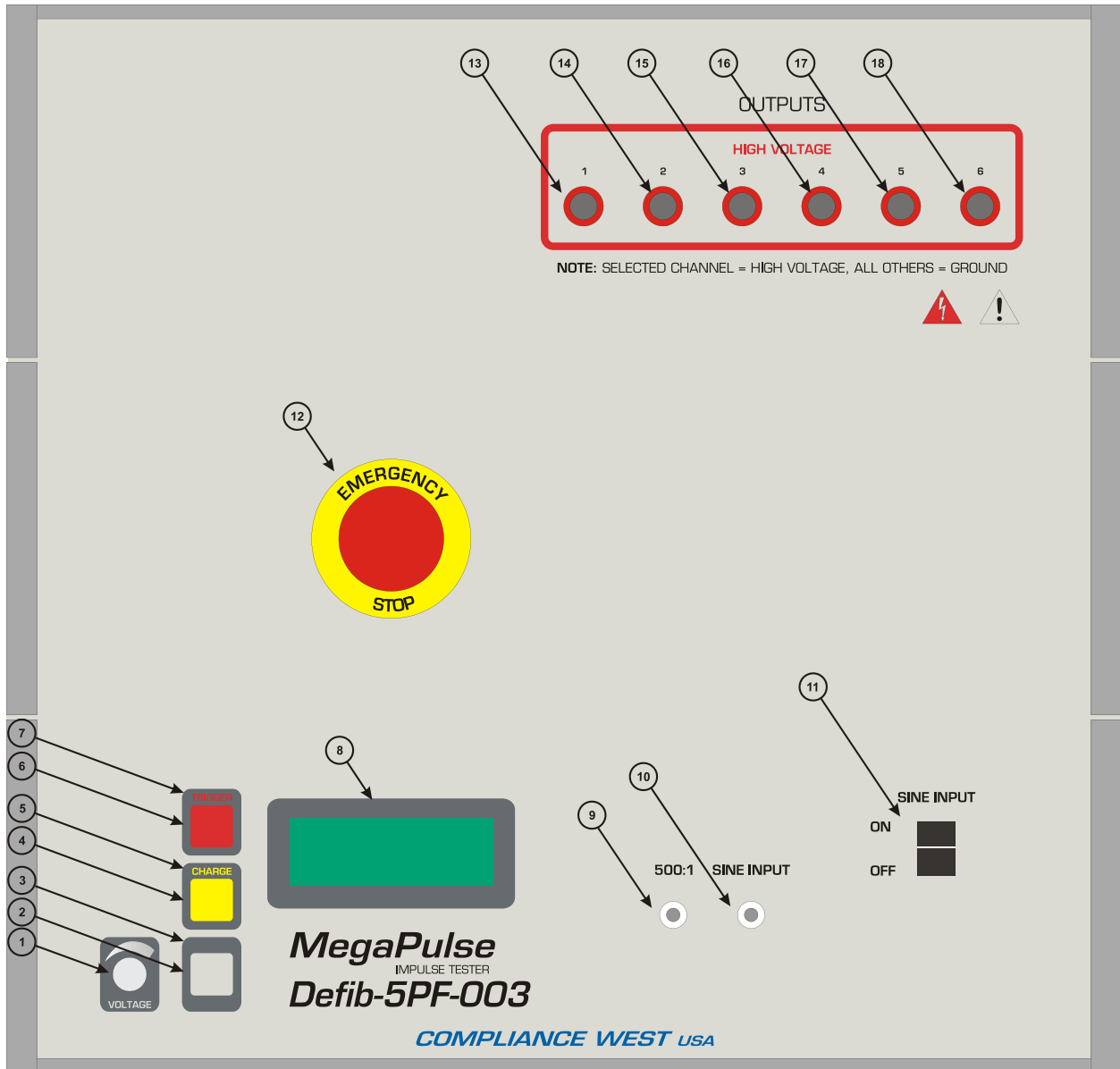


Figure 2 MegaPulse Defib-5PF-003 Front Panel

Table 2 MegaPulse Defib-5PF-003 Front Panel Features

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	Disabled on the Defib-5PF-003
3	NOR REV indicator	Indicates the state of the Output Polarity switch. NOR indicates Normal (Positive) position. REV indicates Reverse (Negative) position.
4	CHARGE switch	Starts the charge process of the tester capacitor. The CHARGE indicator will turn off after the CHARGE switch is pressed, and the TRIGGER indicator will turn on. The charge process will stop after 2 minutes if the TRIGGER button is not 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. CHARGE indicator is lit when the tester is turn ON an after pressing TRIGGER button. CHARGE indicator will go out after pressing CHARGE button. CHARGE and TRIGGER Indicators will be blinking if the Interlock Switch is open. (Only testers with Interlock Switch Option)
6	TRIGGER switch	Triggers the output impulse waveform. The impulse waveform will appear across the output leads.
7	TRIGGER indicator	This Red indicator is lit to show that the tester can be trigger. TRIGGER indicator is lit for 2 minutes after the CHARGE button is pressed. TRIGGER indicator will go out after pressing TRIGGER button. TRIGGER and CHARGE Indicators will be blinking if the Interlock Switch is open (Only testers with Interlock Switch Option) TRIGGER indicator will blink at when the Voltage. This effect will remain on until the TRIGGER switch is pressed. (Only testers with PC Interface option)
8	VOLTAGE meter	Displays the output voltage set point. The voltage reading will increase from zero to the voltage set point when the CHARGE button 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. Note that the peak amplitude of the measured output waveform is proportional to the voltage that is read of the front panel of the MegaPulse, but it will always be somewhat lower. This is because the meter on the MegaPulse is measuring the voltage on the main impulse storage capacitor. This voltage will intentionally dissipate to some extent before reaching the output leads. The meter will start to flash at 5100V to indicate that voltage is in the maximum limits. If unit includes PC Interface and the Keyboard is locked, the display will show OFF when a button is pressed.
9	500:1 BNC	500:1 reference to verify delivery of pulse
10	SINE INPUT signal	BNC input for sine wave
11	SINE INPUT switch	This switch enables or disables the sine input
12	Estop	Emergency Stop, tester will stop operation and discharge the main capacitor internally
13-18	OUTPUTS	6 Channel multiplexer outputs, each channel capable of delivering the pulse, channel activation is via commands from a PC via RS232 port.

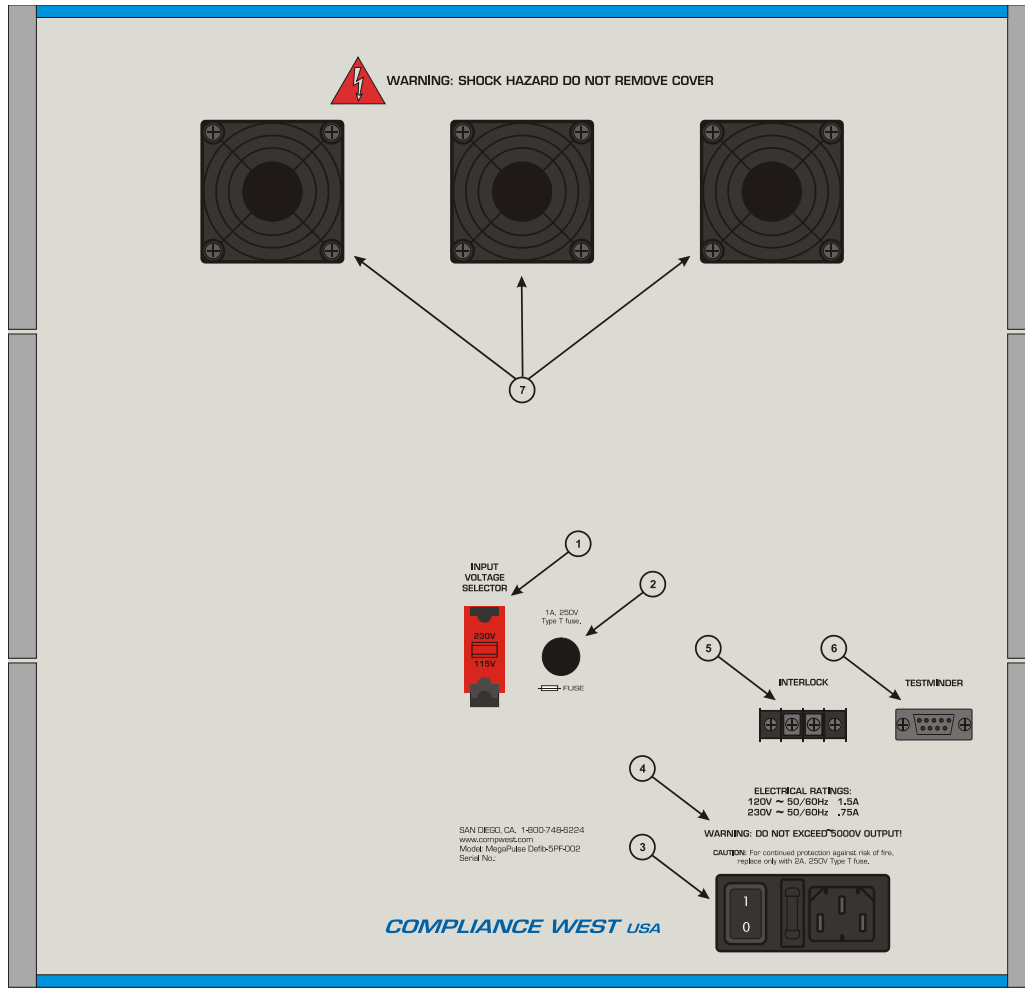


Figure 3 MegaPulse Defib-5PF-003 Rear Panel

Table 3 MegaPulse Defib-5PF-003 Rear Panel Feature

ITEM	NAME	FUNCTION
1	INPUT Switch	The switch allows the selection of 115V or 230V input
2	Fuse B	The fuse B is to protect the unit when supplying 230V.
3	Appliance Inlet	Use supplied cordset to connect the MegaPulse Defib-5PF-002 tester to an appropriate source of supply.
4	Fuse replacement warning / Rating of power supply	Specifies replacement fuse and required supply voltage for 115V input.
5	Interlock Switch	Emergency Stop Close: Enables the tester buttons for operation. Open: Stops any process in the tester and disables the buttons. The TRIGGER and CHARGE Indicators will be blinking
6	RS-232 Interface (Optional)	Allow the communication between the tester and computer interface; a RS-232 to USB is available.
7	FANS	The Fans on the rear panel maintain the air flow to cool down the tester. CAUTION: When installing equipment, make sure not to cover the fans and have it on a proper ventilated area.

Section 4

Operating Instructions

The Defib-5PF-003 tester consists of two parts; the pulse generation portion and the measurement portion. Please refer to the general electric circuit shown in Figure 1 to show the function of the Defib-5PF-003.

The following procedure will explain how to generate a high voltage pulse with the MegaPulse unit.

External Interlock

The external interlock is a two position terminal block located on the rear panel. When the External Interlock is open:

- TRIGGER and CHARGE lights will be blinking.
- The front keyboard will be disabled.
- Active Output Channel will be disabled.
- If unit is charged, it will be internally discharged.
- If the unit is connected with a computer with the TestMinder software, the interlock status will be shown on the computer, condition that will also disable polarity changes, charge, and trigger conditions.

When the Interlock is closed, it enables all normal operations of the MegaPulse features

Front Keyboard and Voltage Knob Enable

If the MegaPulse tester has disabled the keyboard or Voltage Knob, it is possible to enable them by using the next keyboard sequence:

1. Turn OFF the MegaPulse P tester.
2. Press and hold the **TRIGGER** and **NOR-REV** buttons.
3. Turn ON the MegaPulse tester.
4. Wait until the display shows rESE.
5. Release the TRIGGER and NOR-REV buttons.

Discharging Residual Voltage

Note that the Voltage meter may indicate that some residual voltage is present on the main storage capacitor, even when the MegaPulse tester is first turned ON. This is due to inherent charging of the internal capacitors. The following procedure will explain how to discharge a remaining voltage stored on the main internal capacitor.

CAUTION

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

1. Turn the rear-panel Power Switch OFF.
2. Disconnect the high voltage cables from the output connectors.
3. Turn the rear-panel Power Switch ON.
4. Press the red **TRIGGER** button to discharge the main capacitor into the internal resistor of the MegaPulse unit.
5. Turn the rear-panel Power Switch OFF.

Voltage Set Point Adjustment

NOTE

If the front display shows the word “Off” when trying the adjustment, it means the front Voltage knob had been disabled by the testminder software. See section “Front Keyboard and Voltage Knob Enable”

To adjust the Voltage Set Point:

1. Press the VOLTAGE Adjust knob one time to enable the adjustment mode, digits for thousands and hundreds will start blinking for a few seconds.
2. While digits still blinking, turn up or down the VOLTAGE Adjust knob to change the value of the blinking digits.
3. While digits still blinking, press again the VOLTAGE Adjust knob and the tens and unit digits will blinking for a few seconds.
4. While digits are blinking, turn up or down the VOLTAGE Adjust knob to change the value of the blinking digits.
5. After a few seconds without any change on the VOLTAGE Adjust knob, the me

Charge and Trigger a Pulse

The following procedure will explain how to generate a high voltage pulse with the MegaPulse unit. The Megapulse is capable to maintain a specific voltage charge selected by the Voltage Set Point.

CAUTION

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

1. Confirm the Voltage Set Point by pressing the VOLTAGE Adjust Knob, the setting will blink for a few seconds on the front meter.
2. If a different Voltage Set Point is need it, see section “Voltage Set Point Adjustment.”
3. Set the front panel switches depending the type of test need it. Follow the front panel directions or see Figure 3 for the electrical diagram.
4. Push the yellow CHARGE button to start charging the internal high voltage capacitor and wait until the front meter reaches value set on step1 or 2. Verify the red TRIGGER indicator is now lit.
5. Once the desired voltage is reached, press the red **TRIGGER** button to deliver the high voltage pulse (be sure not to touch the output and return leads when pressing the trigger switch).
6. Turn the rear-panel Power Switch OFF.

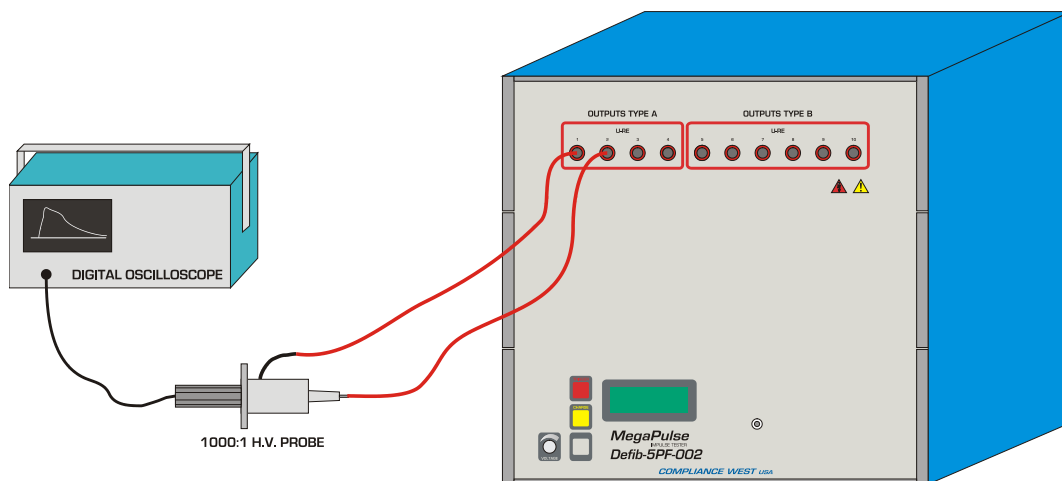


Figure 4 Waveform Measurement Setup (*Image for reference only)

Testing

The following procedure will verify that the MegaPulse Defib-5PF-003 tester is working correctly. We recommend that this procedure be conducted periodically to ensure proper operation of the tester. The following items are needed to conduct this procedure: A measuring instrument to monitor the output waveform. 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 is capable of measuring the output waveform of the MegaPulse Defib-5PF-003 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 power using the included 18 AWG cord.
2. Plug a pair of leads to the Output on the front panel. Use channel 1 and 2 for this test.
3. Connect the leads to an appropriate measuring instrument (typically an oscilloscope with a high-voltage probe). Note that the **RETURN** lead is referenced to the chassis ground of the tester, in this case we will connect channel 1 to the return of the probe, connect channel 2 to the High Voltage of the probe.
4. Connect the PC to the MegaPulse, using the RS232 port on the back of the tester.
5. Turn the Tester ON.
6. For the following steps refer to the commands table.
 - a. Send command to select channel 2 output
 - b. Send command to set voltage at 500V
 - c. Send command to Charge
 - d. Send command to Trigger
7. Capture the waveform on the oscilloscope.
8. Note that the peak amplitude of the measured output waveform is proportional to the voltage that is read of the front panel of the MegaPulse, but it will always be somewhat lower. This is because the meter on the MegaPulse is measuring the voltage on the main impulse storage capacitor. This voltage will intentionally dissipate to some extent before reaching the output leads.
9. Repeat step 5 charging at 5000V.
10. Manual control checkout. Make sure a channel has already been selected (**NOTE:** Multiplexer control can only be set via commands).
 - a. To set the voltage, press the voltage knob and turn it to 500V.
 - b. Press the Charge button, verify the meter reaches the set voltage.
 - c. Press Trigger to discharge.
11. Capture the waveform on the oscilloscope.
12. Repeat step 10 at 5000V.

NOTE: Polarity is disabled and the multiplexer can only be operated via PC commands.

Section 5

Maintenance and Calibration

WARNING

MAINTENANCE AND CALIBRATION INSTRUCTIONS ARE FOR QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THE CONTAINED IN THE OPERATING INSTRUCTIONS.

This section of the manual contains maintenance information for the MegaPulse Defib-5PF-003 impulse tester. A 1-year calibration cycle is recommended to maintain the specifications of the factory. The test equipment required for the performance test is a digital oscilloscope, high voltage oscilloscope probe, digital meter and a high voltage probe.

Service Information

The MegaPulse 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 postpaid to the manufacturer. Dated proof of purchase is required for all in-warranty repairs. The manufacturer is also available for calibration and / or repair of instruments that are beyond their warranty period. Contact the manufacturer for a cost quotation. Ship the instrument and your remittance according to the instructions given by the manufacturer.

General Maintenance

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

WARNING

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

Cleaning

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

CAUTION

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

Calibration Information

The Calibration Procedure should be performed annually and any time the instrument has been repaired. The calibration procedure should be performed at an ambient temperature of 23°C ±5°C (73.4°F ±9°F). 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, for more information contact Compliance West USA.

Voltage Stop Disable / Keyboard Enable by Keyboard.

If the MegaPulse Code 360 tester includes TestMinder option and has the Voltage Stop by the PC command activated, it is possible to disable it using the next keyboard sequence:

Note: Disabling Voltage Stop enables the keyboard.

Turn OFF the MegaPulse tester.

Hold in the **TRIGGER** and **NOR-REV** buttons.

Turn ON the MegaPulse tester.

Wait until the display shows **rESE**.

Release the **TRIGGER** and **NOR-REV** buttons.

Section 6

Technical Assistance

Technical Assistance from Compliance West USA is available:

Phone: (800) 748-6224

Hours: 8:30 AM - 4:30 PM Pacific Time.

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

Contact:

Compliance West USA
650 Gateway Center Way Suite D
San Diego, CA 92102 USA.

Phone: (619) 878-9696

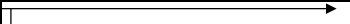
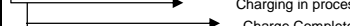
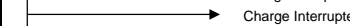
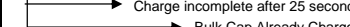
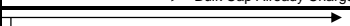
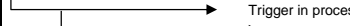
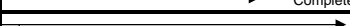



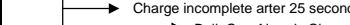
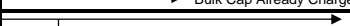


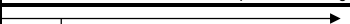
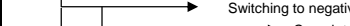


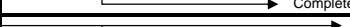


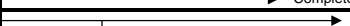













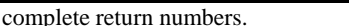


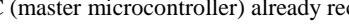






FAX: (858) 481-8527

Appendix A

A.1 Commands List

All the commands are 4 bytes in size. The first two bytes identify the type of command and the third and fourth bytes are the data for the specific command. For example “1 102” select the polarity for the surge test, where “11” is the type of command and “02” select a Negative option.

Note: The PC can control the MegaPulse directly even when it's running a test.

			32 bit word			Return Numbers
			High	Low		
Item		Description	Command	Data		Group 1 & 2
1	Reset	Reset 2nd group of four digits to "0000"	10	11		1011-0000
2	Charge button		18	CC		18CC-0000
						18CC-18C1
						18CC-18CC
						18CC-18C2
						18CC-18C3
3	Trigger button		18	71		18CC-18C5
						1871-0000
						1871-1872
						1871-1871
						
4	Charge & Trigger		18	75		1875-0000
						1875-18C1
						1875-1872
						1875-1871
						1875-18C2
5	Polarity	Positive	11	01		1875-18C3
					1875-18C5	
						
						
						
5	Polarity	Negative	11	02		1101-0000
					1101-1103	
					1101-1101	
					1101-1105	
						
6	Voltage set RAM memory	Select voltage from 10V to 13000 volts	12	xx		1101-1105
				Hi		12xx-0000
				Completed		12xx-12xx
6	Voltage set RAM memory	Select voltage from 10V to 13000 volts	13	xx		13xx-0000
				Low		13xx-13xx
				Completed		
7	Voltage set EEPROM memory	Select voltage from 10V to 13000 volts	14	xx		14xx-0000
				Hi		14xx-14xx
				Completed		
7	Voltage set EEPROM memory	Select voltage from 10V to 13000 volts	15	xx		15xx-0000
				Low		15xx-15xx
				Completed		
8	Keyboard	Enable	20	01		2001-0000
		Completed				2001-2001
8	Keyboard	Disable	20	03		2003-0000
		Completed				2003-2003
9	Safety Interlock	ON	40	01		4001-0000
		Completed				4001-4001
9	Safety Interlock	OFF	40	03		4003-0000
		Completed				4003-4003
10	Main Reset	Reset the USB microcontroller	EE	CC		Remain same numbers
11	USB Read Monitor	Enable	EE	01		EE01-xxxx
		If PC doesn't read the USB port in less of 500mS, the microcontroller will execute a reset and USB monitor will be disabled automatically				
		Disable			EE	03
	error	Error communication between pics	----			xxxx-EEEE
	start	initial condition when USB is plug in	----			xxxx-8888
	Rest PIC	Reset on the pic Central	----			xxxx-AAAA

Note: Each time a new command is sent it is necessary to wait for the complete return numbers.

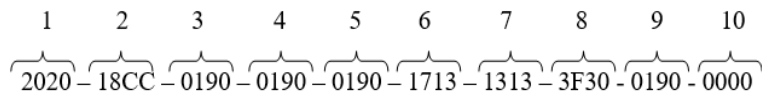
The returned numbers will show up in this order: **Blue** → **Red** → **Green** → **Purple**.

First the blue number will come, this means the USB pic already has the number.

After a short delay a red number will come, this means the second PIC (master microcontroller) already recognizes the command.

A.2 Return Numbers

The information returned is divided in ten different groups of four bytes.



To read each group it is necessary to know the position of each group and count the number of bytes. The positions are:

- Group 1 (from 1 to 4 byte)
- Group 2 (from 6 to 9 byte)
- Group 3 (from 11 to 14 byte)
- Group 4 (from 16 to 19 byte)
- Group 5 (from 21 to 24 byte)
- Group 6 (from 26 to 29 byte)
- Group 7 (from 31 to 34 byte)
- Group 8 (from 36 to 39 byte)
- Group 9 (from 41 to 44 byte)
- Group 10 (from 46 to 49 byte)

The bytes 5, 10, 15, 20, 25, 30, 35, 40, 45 & 50 always return this “-“.

				32 bit word		New
				High	Low	
Group	Bytes		Description	DATA (HEX)		
3	11-14	Voltage meter	00000V	00	00	
			30000V	32	C8	
4	16-19	Voltage stop set RAM	50V	00	32	
			30000V	32	C8	
5	21-24	Voltage stop set EEPROM	50V	00	32	
			30000V	32	C8	
6	26	Keyboard status	Enabled	1x	xx	
			Disabled	3x	xx	
	27	Polarity	Positive	x7	xx	
			Polarity Disabled	x1	xx	
Negative			xF	xx		
28	Free		xx	xx		
			xx	xx		
29	5 digit meter	Enable	xx	x1		
		Disabled	xx	x3		
7	31	Light Trigger	Off	3x	xx	
			On	1x	xx	
	32	Light Charge	Off	x3	xx	
			On	x1	xx	
33	Light Positive	Off	xx	3x		
		On	xx	1x		
34	Light Negative	Off	xx	x3		
		On	xx	x1		
8	36	Interlock by Hardware	Enabled	1x	xx	
			Disabled	3x	xx	
	37	Interlock by PC	Enabled	x7	xx	
			Disabled	xF	xx	
38	Meter OFF	Enabled	xx	1x		
		Disabled	xx	3x		
39	External Relay selected	"R" relay selected	xx	xR		
9	41-44	Voltage at trigger moment	00000V	00	00	
			30000V	75	30	
10	46-49	Free		xx	xx	

A.3 Custom Commands

Bytes -->	1	5	10	15	20	25	30	35	40	45	
	xxxx	-	xxxx	-	xxxx	-	xxxx	-	xxxx	-	xxxx
Group-->	1	2	3	4	5	6	7	8	9	10	

Item		Description	32 bit word		Return Numbers	New
			Command	Data		
			High	Low		
1	Reset	Reset 2nd group of four digits to "0000"	10	11	1011-0000	
2	Trigger 1 Duration Only if option Enabled	Set Trigger 1 Time Duration (from 1mS to 9999 mS) Time = (xx) x (1mS)	90	xx	90xx-0000 90xx-90xx	
		Read Trigger 1 Time Duration (from 1mS to 9999mS) Time = (xx) x (1mS)	91	07	9107-0000 9107-91xx	
3	Trigger 2 Duration Only if option Enabled	Set Trigger 2 Time Duration (from 1mS to 9999 mS) Time = (xx) x (1mS)	92	xx	90xx-0000 90xx-90xx	
		Read Trigger 2 Time Duration (from 1mS to 9999mS) Time = (xx) x (1mS)	93	07	9107-0000 9107-91xx	
4	Energy Only if option Enabled	Read Energy - Last pulse Energy = (xxxx) Joules	95	07	9507-0000 9507-xxxx 9507-95AA 9507-95BB	
5	External Relay Only if option Enabled	Activate relay xx will be the number of the relay to be activated Example: The command 5003, will activate the relay 3	50	xx	50xx-0000 50xx-50xx	
6	Main Reset	Reset the USB microcontroller	EE	CC	Remain same numbers	
7	USB Read Monitor	Enable If PC doesn't read the USB port in less of 500mS, the microcontroller will execute a reset and USB monitor will be disabled automatically	EE	01	EE01-xxxx	
		Disable	EE	03	EE03-xxxx	
	error	Error communication between pics	----		xxxx-EEEE	
	start	Initial condition when USB is plug in	----		xxxx-8888	
	Rest PIC	Reset on the pic Central	-----		xxxx-AAAA	

Note: Each time a new command is sent it is necessary to wait for the complete return numbers.

The returned numbers will show up in this order: **Blue** → **Red** → **Green** → **Purple**.

First the blue number will come, this means the USB pic already has the number.

After a short delay a red number will come, this means the second PIC (master microcontroller) already recognizes the command.

A.4 How to send commands

All the commands showed in this document don't have any security redundancy, the user needs to make sure that every command that is sent is received by the MegaPulse unit. We have an in-house software called Testminder and we will use it as an example of how to write your own scripts when you use our command set.

This is how Testminder for MegaPulse works to make sure every command is executed, see note at the end.

1. Example to send commands to USB D when bytes Hi and Low are required. This method will be required for changing the voltage in RAM.

Sending Data:

- Wait 20mS
- Send data Hi
- Wait 60mS
- Send data Low
- Wait 150mS
- Read the USB D data
- Wait 100mS

Make sure VOLTAGE in RAM is SET correctly, if not start again.

2. Sending the Relay selection. It will be much easier for a relay change because it is a single transfer.

Sending Data:

- Send Relay data
- Wait 100mS
- Read USB data and make sure the relay selected is already set, if not send the command again.

There is another message in the command set that is **EEEE**, this one is sent by the MegaPulse when it recovers from a disconnection between it and the USB D box, you can use it as warning or ignore it, but it'll depend on what you want to do in this situation, our recommendation is to verify that everything is ok with the MegaPulse and compare the last command you sent with the current status.

Appendix B

Defib-5PF-003 Schematics

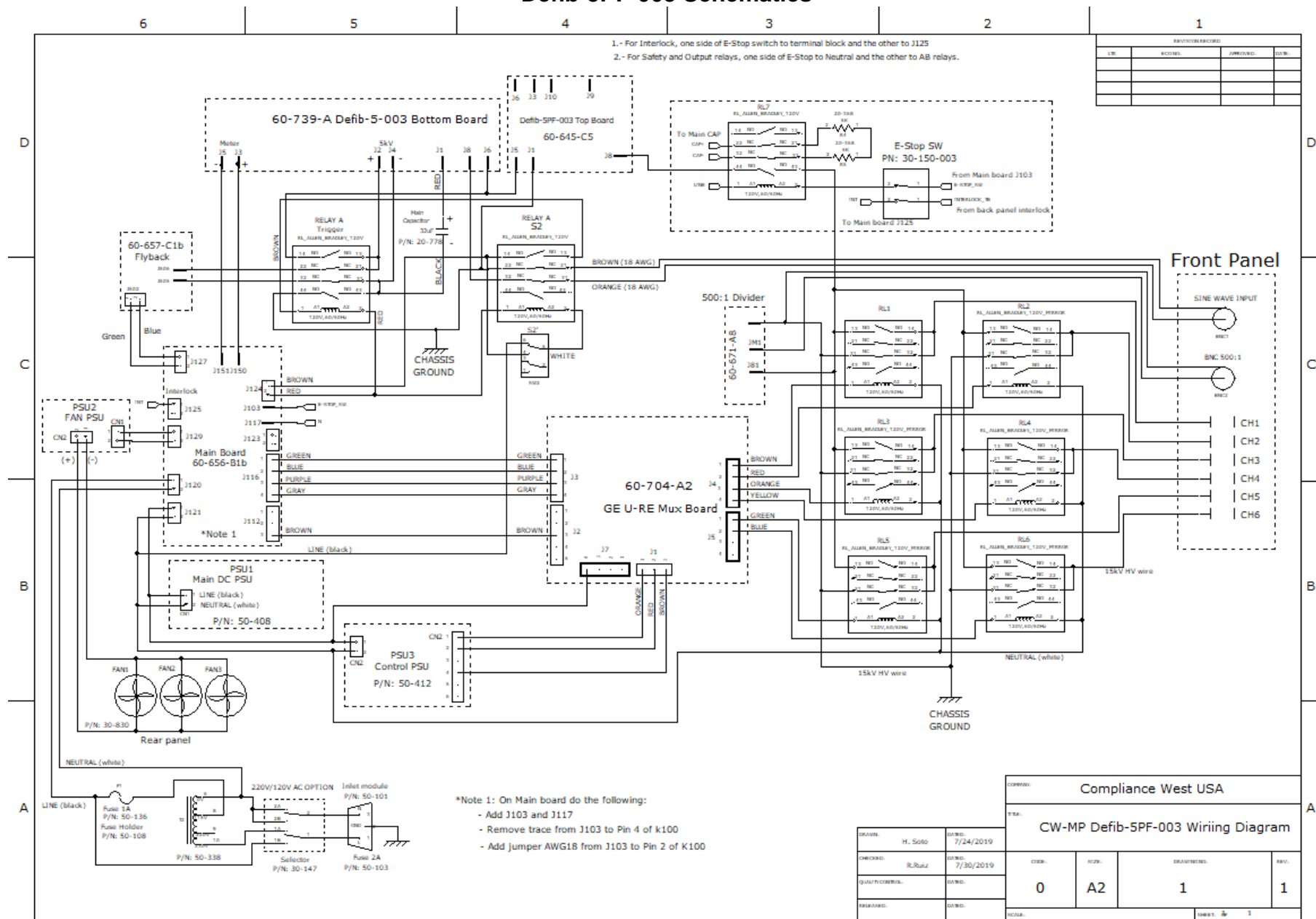


Figure 5 Defib-5PF-003 General Wiring Diagram

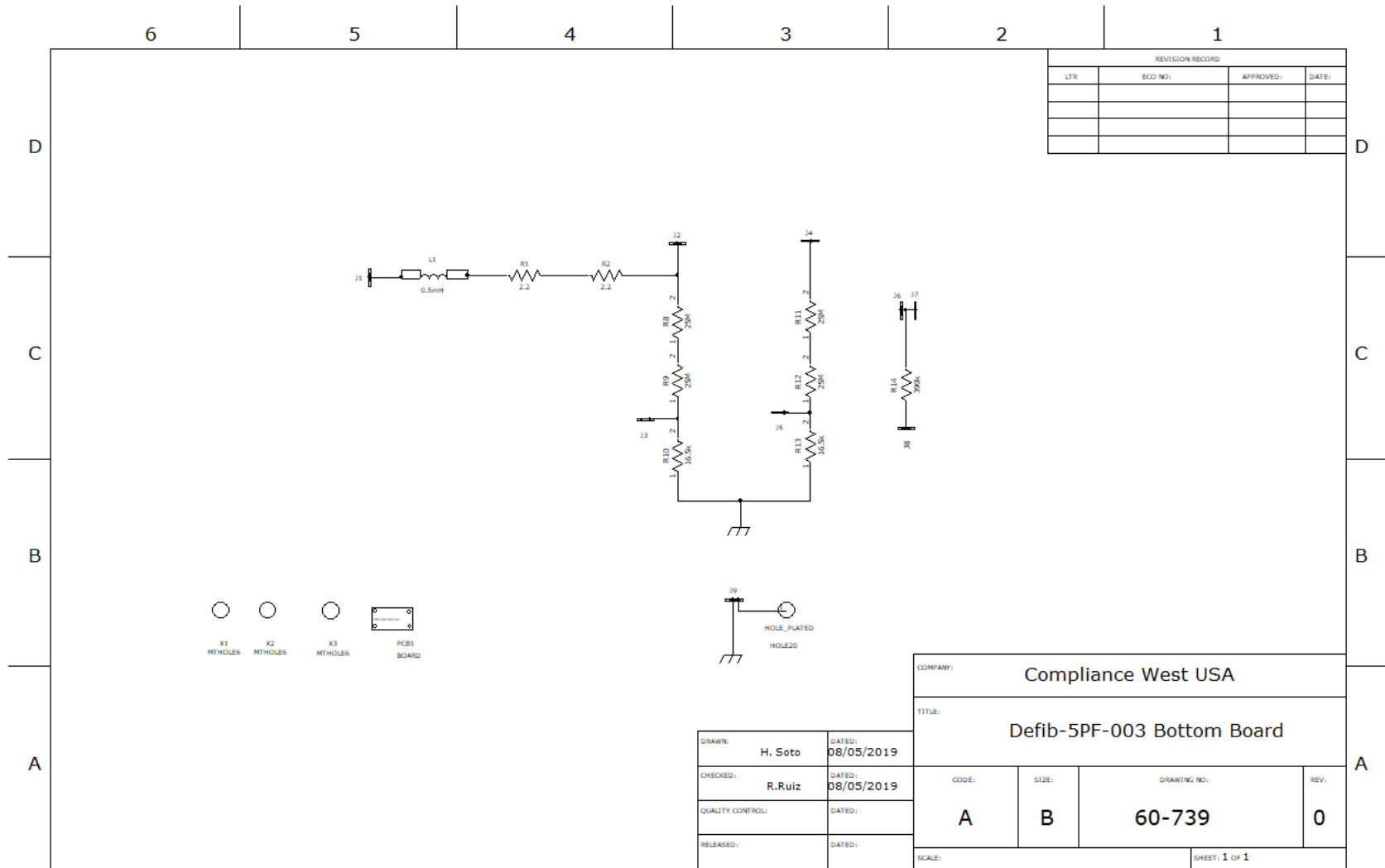
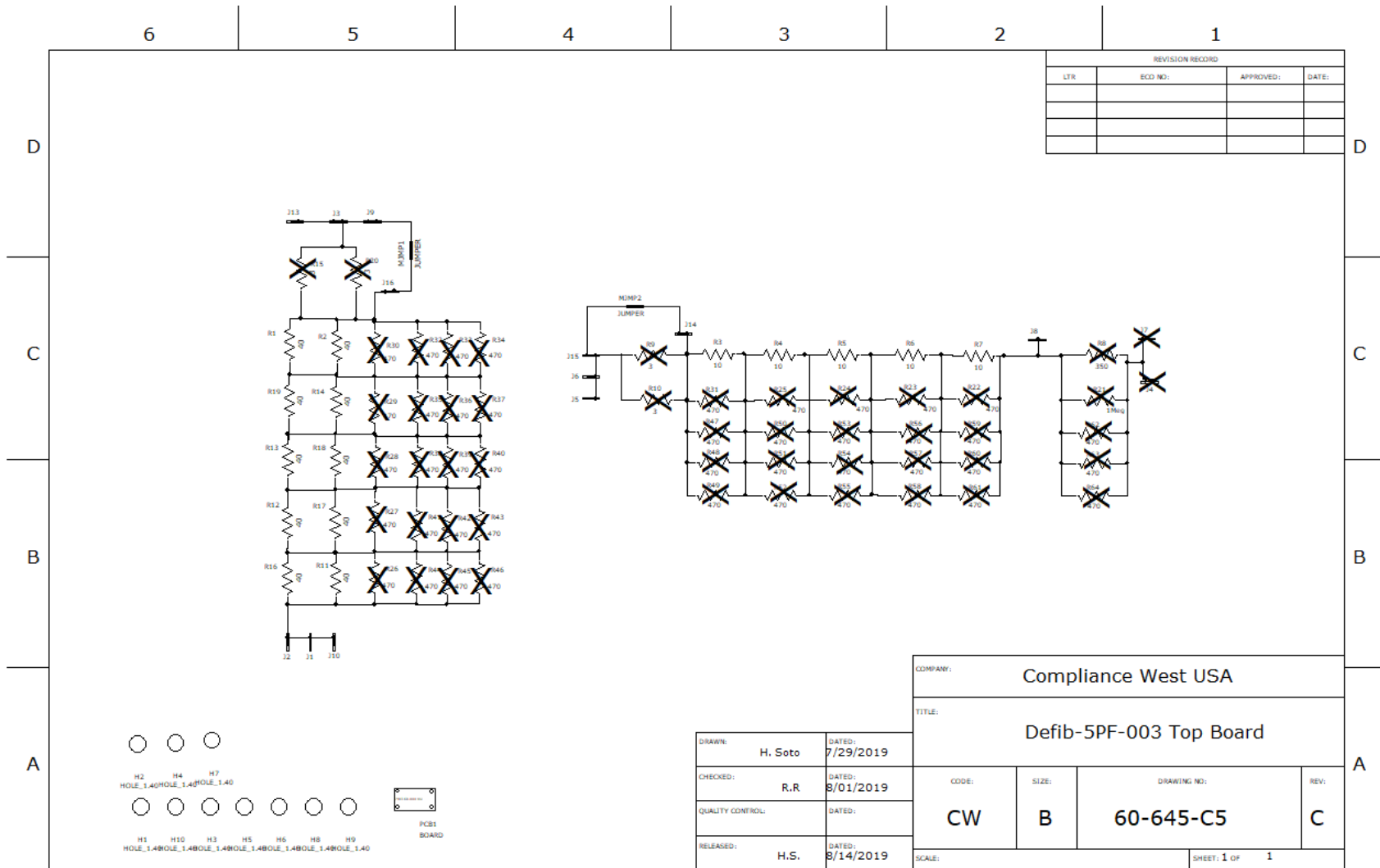


Figure 6 Defib-5PF-003 Bottom Board



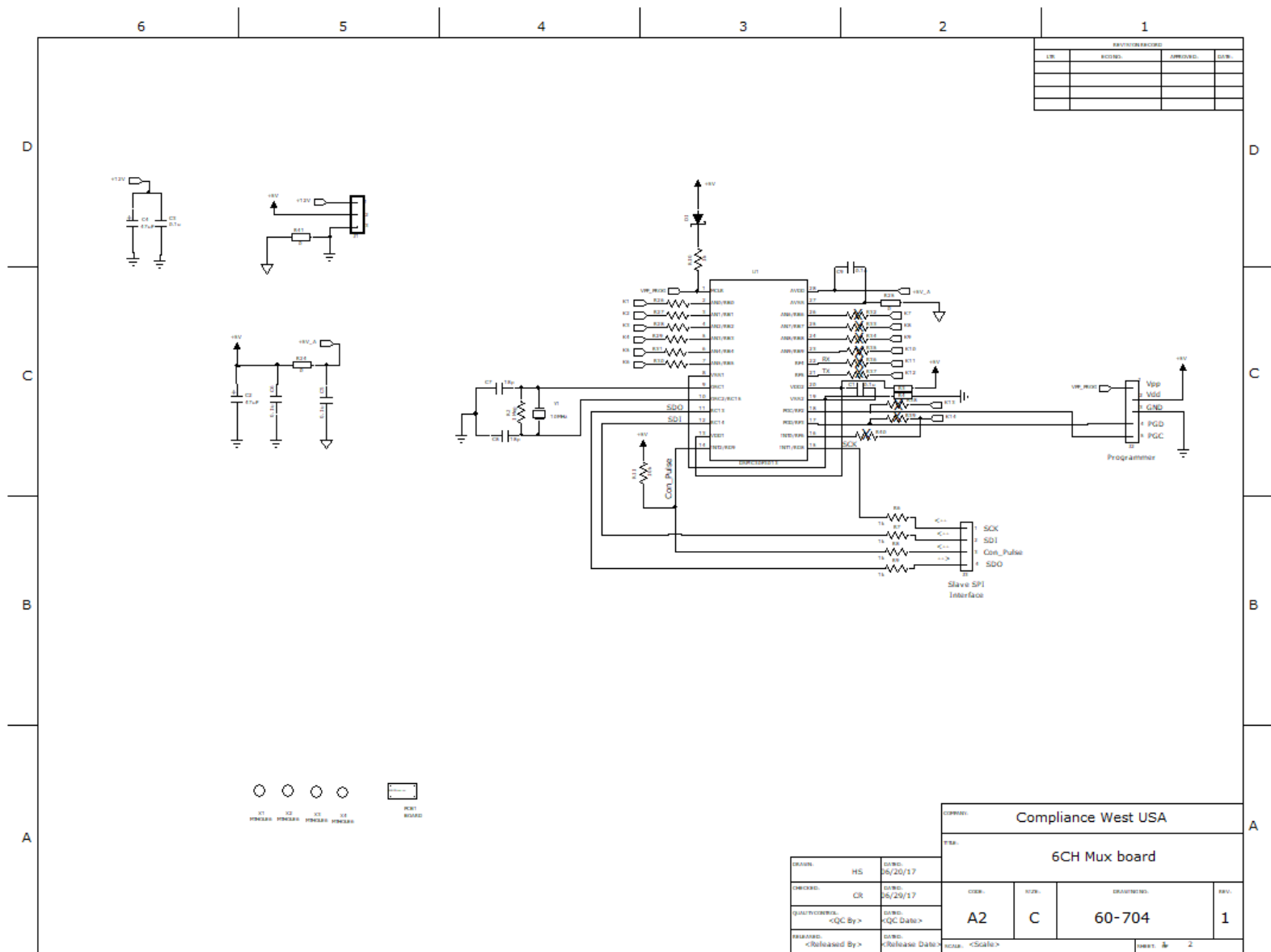


Figure 8 Defib-5PF-003 MUX Control Board Part 1

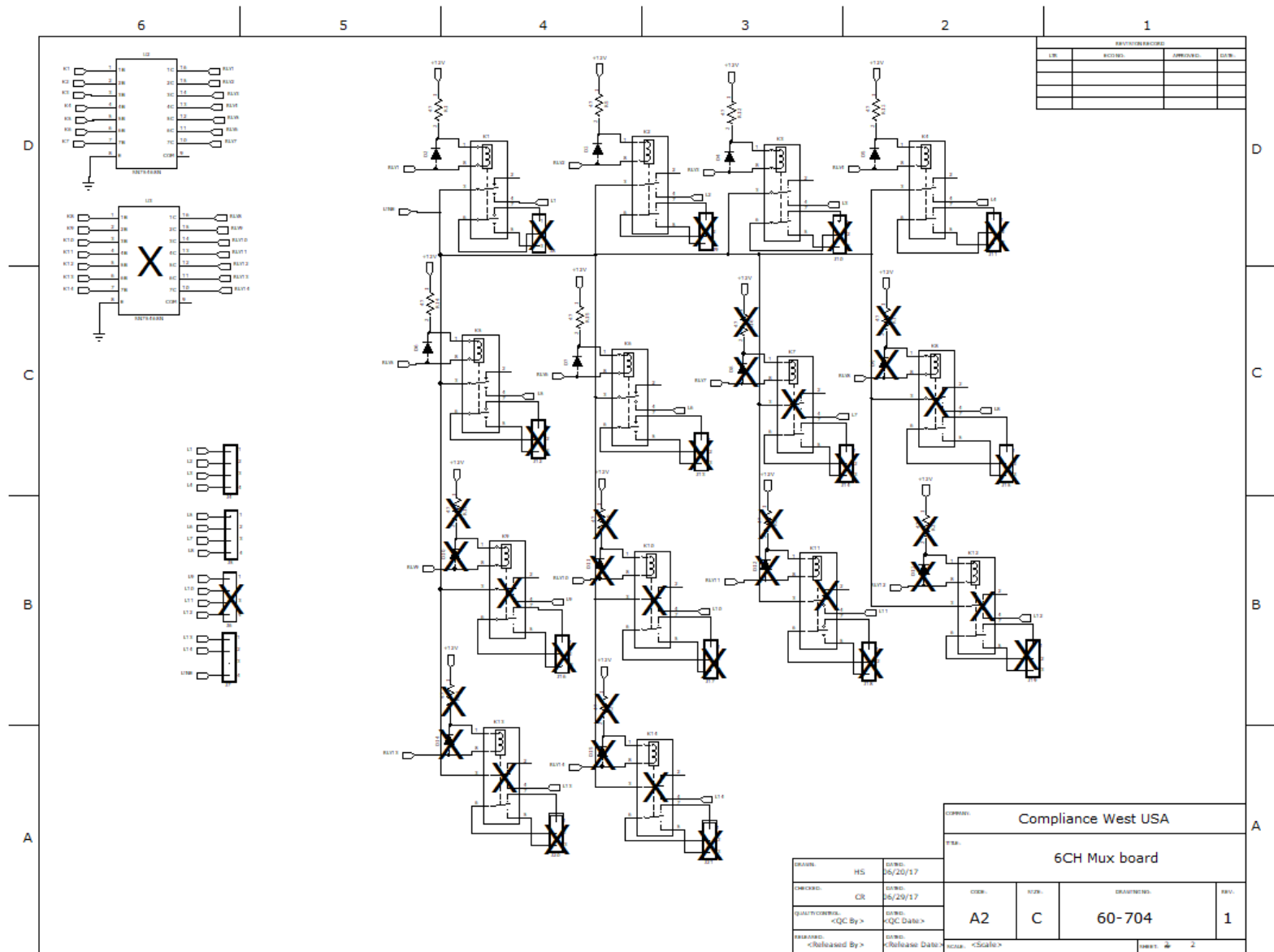


Figure 9 Defib-5PF-003 MUX Control Board Part 2

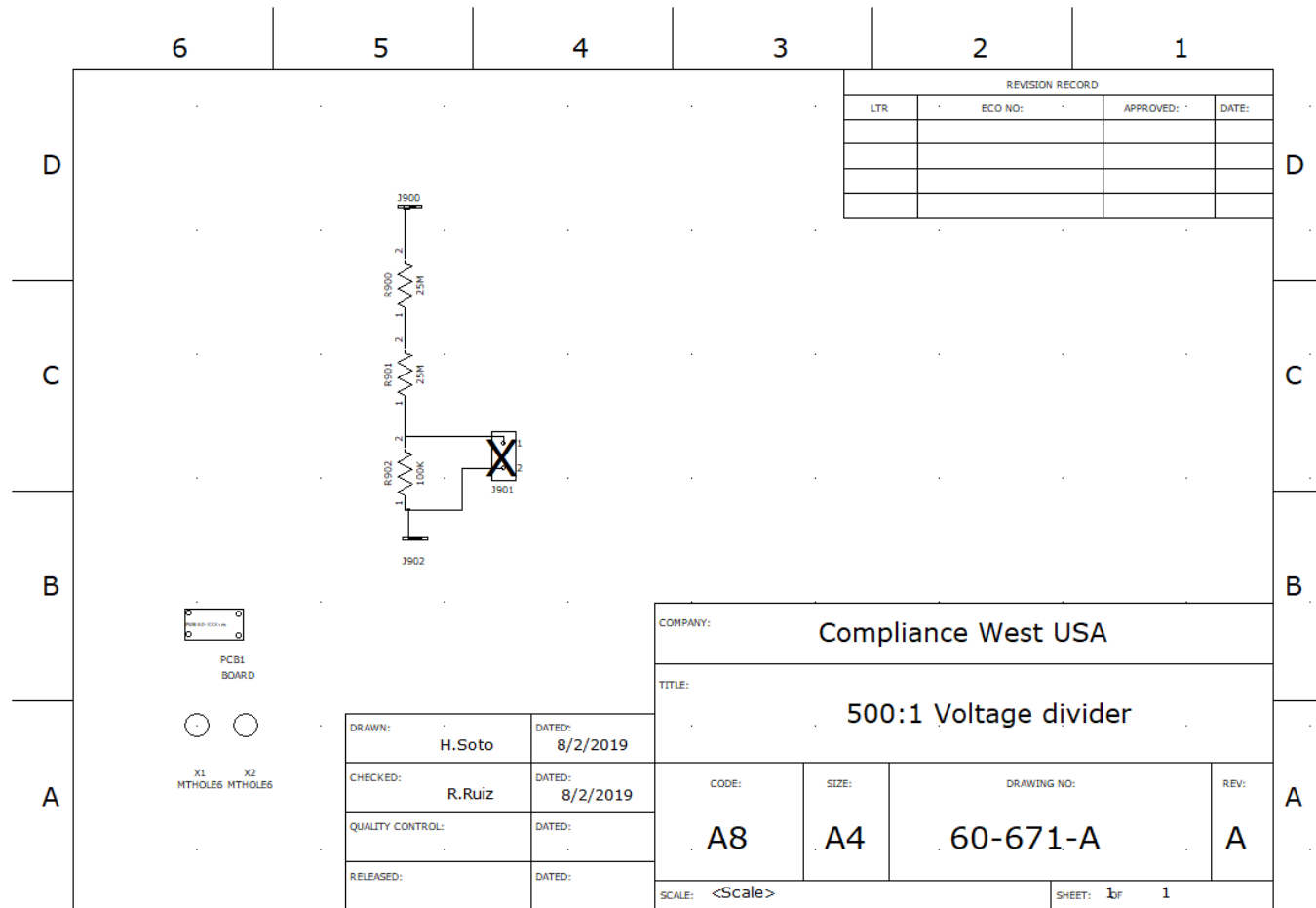


Figure 10 Defib-5PF-003 500:1 Voltage Divider

Appendix C

Defib-5PF-003 Bill of Materials

BOM for 60-739-A Defib-5PF-003 Bottom Board

Schematic: 60-739-A

Item	Reference	P/N	Description	Comments
1	PCB1	60-739-A	Defib-5PF-003 Bottom Board	
2	J1	60-132	Spade Lug, Male, .250	
3	J2	60-132	Spade Lug, Male, .250	
4	J3	60-132	Spade Lug, Male, .250	
5	J4	60-132	Spade Lug, Male, .250	
6	J5	60-132	Spade Lug, Male, .250	
7	J6	60-132	Spade Lug, Male, .250	
8	J7	60-132	Spade Lug, Male, .250	
9	J8	60-132	Spade Lug, Male, .250	
10	J9	60-132	Spade Lug, Male, .250	
11	L1	20-917	Inductor, air core, 500uH +/- 5%	
12	R1	20-373	Resistor, HV non-inductive HVR "C" series, 2.2 ohm, 5%, 4 watt	
13	R2	20-396	Resistor, HV non-inductive HVR "C" series, 2.2 ohm, 5%, 4 watt	
14	R8	20-276	25Mohm 1%, 1Watt	
15	R9	20-276	25Mohm 1%, 1Watt	
16	R10	20-379	Resistor, 16.5k, 1/4w, 1%	
17	R11	20-276	25Mohm 1%, 1Watt	
18	R12	20-276	25Mohm 1%, 1Watt	
19	R13	20-379	Resistor, 16.5k, 1/4w, 1%	
20	R14	20-483	Resistor, 390K 1/4w	

BOM for 60-671-A8 500:1 Voltage divider

Schematic: 60-671-A8

Item	Reference	P/N	Description	Comments
1	PCB1	60-671-A	Voltage divider board	
2	J900	60-132	Spade Lug, Male, .250	
3	J902	60-132	Spade Lug, Male, .250	
4	R900	20-276	25Mohm 1%, 1Watt	
5	R901	20-276	25Mohm 1%, 1Watt	
6	R902	20-207	Resistor, 100k ohm 1/4w	

BOM for 60-645-C5 Defib-5PF-003 Top Board

Schematic: 60-645-C5

Item	Reference	P/N	Description	Comments
1	PCB1	60-645-C	D5-PF Top Board	
2	J1	60-132	Spade Lug, Male, .250	
3	J2	60-132	Spade Lug, Male, .250	
4	J3	60-132	Spade Lug, Male, .250	
5	J5	60-132	Spade Lug, Male, .250	
6	J6	60-132	Spade Lug, Male, .250	
7	J8	60-132	Spade Lug, Male, .250	
8	J9	60-132	Spade Lug, Male, .250	
9	J10	60-132	Spade Lug, Male, .250	
10	J13	60-132	Spade Lug, Male, .250	
11	J14	60-132	Spade Lug, Male, .250	
12	J15	60-132	Spade Lug, Male, .250	
13	J16	60-132	Spade Lug, Male, .250	
14	MJMP1	Jumper	18 AWG HV on R15 & R20	If R from J3 to J10 is out spec, remove
15	MJMP2	Jumper	18 AWG HV on R10 & R9	If R from J6 to J8 is out spec, remove
16	R1	20-394	Resistor, 40 at 5600 jules	
17	R2	20-394	Resistor, 40 at 5600 jules	
18	R3	20-390	Resistor, 10 at 5600 jules	
19	R4	20-390	Resistor, 10 at 5600 jules	
20	R5	20-390	Resistor, 10 at 5600 jules	
21	R6	20-390	Resistor, 10 at 5600 jules	
22	R7	20-390	Resistor, 10 at 5600 jules	
23	R8	NONE	Resistor, 350 at 5600 jules	
24	R11	20-394	Resistor, 40 at 5600 jules	
25	R12	20-394	Resistor, 40 at 5600 jules	
26	R13	20-394	Resistor, 40 at 5600 jules	
27	R14	20-394	Resistor, 40 at 5600 jules	
28	R16	20-394	Resistor, 40 at 5600 jules	
29	R17	20-394	Resistor, 40 at 5600 jules	
30	R18	20-394	Resistor, 40 at 5600 jules	
31	R19	20-394	Resistor, 40 at 5600 jules	

BOM for 60-704-A2 6CH Mux Board

Schematic: 60-704-A2

Item	Reference	P/N	Description	Comments
1	PCB1	60-704-A	GE U-RE Mux board	
2	C1	20-706	Capacitor, .1 uf, monolithic	
3	C2	20-707	Capacitor, 47 uF 16V	
4	C3	20-706	Capacitor, .1 uf, monolithic	
5	C4	20-707	Capacitor, 47 uF 16V	
6	C5	20-706	Capacitor, .1 uf, monolithic	
7	C6	20-706	Capacitor, .1 uf, monolithic	
8	C7	20-775	Capacitors 18pF 50volts C0G 5% 2.5mm L/S	
9	C8	20-775	Capacitors 18pF 50volts C0G 5% 2.5mm L/S	
10	C9	20-706	Capacitor, .1 uf, monolithic	
11	D1	10-618	Diode, Shottky Rectifier, 1.1A	
12	D2	10-604	Diode, 1N4001	
13	D3	10-604	Diode, 1N4001	
14	D4	10-604	Diode, 1N4001	
15	D5	10-604	Diode, 1N4001	
16	D6	10-604	Diode, 1N4001	
17	D7	10-604	Diode, 1N4001	
18	J1	60-111	Header 3 pins	
19	J3	60-113	Header, .100 St. Fr. 4 pos.	
20	J4	60-111	Header, .156 St. Fr. 24 p/pin	
21	J5	60-111	Header, .156 St. Fr. 24 p/pin	
22	J7	60-111	Header, .156 St. Fr. 24 p/pin	
23	K1	40-101	Black Relay Aromat JW2SN	
24	K2	40-101	Black Relay Aromat JW2SN	
25	K3	40-101	Black Relay Aromat JW2SN	
26	K4	40-101	Black Relay Aromat JW2SN	
27	K5	40-101	Black Relay Aromat JW2SN	
28	K6	40-101	Black Relay Aromat JW2SN	
29	R1	20-223	Resistor, 47 1/4w 1%	
30	R2	20-259	Resistor, 1Meg 1/4w	
31	R3	10-951	Bead shield 68 ohm at 100MHz	
32	R4	10-951	Bead shield 68 ohm at 100MHz	
33	R5	20-223	Resistor, 47 1/4w 1%	
34	R6	20-203	Resistor, 1K 1/4w	
35	R7	20-203	Resistor, 1K 1/4w	
36	R8	20-203	Resistor, 1K 1/4w	
37	R9	20-203	Resistor, 1K 1/4w	
38	R10	20-203	Resistor, 1K 1/4w 1%	
39	R11	20-206	Resistor, 10K 1/4w 1%	
40	R12	20-223	Resistor, 47 1/4w 1%	

41	R13	20-223	Resistor, 47 1/4w 1%	
42	R14	20-223	Resistor, 47 1/4w 1%	
43	R15	20-223	Resistor, 47 1/4w 1%	
44	R24	20-217	Resistor, 0 ohm 1/4w	
45	R25	20-217	Resistor, 0 ohm 1/4w	
46	R26	20-217	Resistor, 0 ohm 1/4w	
47	R27	20-217	Resistor, 0 ohm 1/4w	
48	R28	20-217	Resistor, 0 ohm 1/4w	
49	R29	20-217	Resistor, 0 ohm 1/4w	
50	R30	20-217	Resistor, 0 ohm 1/4w	
51	R31	20-217	Resistor, 0 ohm 1/4w	
52	R41	20-217	Resistor, 0 ohm 1/4w	
53	U1	10-972	dsPIC 16 bit Digital Signal Controller	
54	U2	10-931	Driver, SN75468N	
55	Y1	10-971	Microprocessor Crystals 10.0 MHZ 18pF	