Trig-Tek™

620C
Article Protector
User Manual

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This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.

If this instrument is to be powered from the AC line (mains) through an autotransformer, ensure the common connector is connected to the neutral (earth pole) of the power supply.

Before operating the unit, ensure the conductor (green wire) is connected to the ground (earth) conductor of the power outlet. Do not use a two-conductor extension cord or a three-prong/two-prong adapter. This will defeat the protective feature of the third conductor in the power cord.

Maintenance and calibration procedures sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures and heed warnings to avoid “live” circuit points.

Before operating this instrument:

1. Ensure the proper fuse is in place for the power source to operate.
2. Ensure all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

If the instrument:

- fails to operate satisfactorily
- shows visible damage
- has been stored under unfavorable conditions
- has sustained stress

Do not operate until performance is checked by qualified personnel.

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DOCUMENT CHANGE HISTORY

Revision	Date	Description of Change
A	1/16/2014	Document Control release

Chapter 1
Introduction

The Trig-Tek™ 620C Article Protector (**Figures 1-1** and **1-2**) monitors the feedback from an accelerometer on a shaker, and provides rapid shutdown when preset limits for acceleration overtest, undertest, displacement overtravel, signal loss, or power interrupt is encountered. The shutdown is accomplished by an independent compressor circuit which provides a controlled shutdown. The time required for shutdown is the total of the detection time plus the compression time.

When in the SINE mode, the detection time is varied by the excitation frequency. It is approximately 100 milliseconds at 20 Hz and changes to about 5 milliseconds at 2000 Hz. Time after detection to full compression is about 3 milliseconds. When in the RANDOM mode, the detection time is preset for 330 milliseconds. The ACCEL input is Dual mode and will also operate with Differential accelerometers.

Figure 1-1, 620C Front View

Description

A built-in dual mode charge amplifier accommodates accelerometers with 0.1 to 120 pC-mV/g sensitivities, and also differential accelerometers. A built-in current source with an ON-OFF switch provides power to accelerometers with built-in electronics. An mV/g input can be used with the current OFF. The normalized acceleration signal is integrated to velocity and again to displacement, and the three parameters: Acceleration, Velocity, and Displacement are simultaneously brought out as normalized AC signals. A SINE-RANDOM switch selects RMS units at the INPUT for the RANDOM position, and PEAK units for the SINE position.

The acceleration test level is set by a MULTIPLIER and DECADE switch for levels between 0.1 to 100 g's. Once the test level is set, the OVERTEST +dB set and UNDERTEST –dB set switches can be set in any of six settings from 1 dB to 6 dB independently. In the Sine mode, a separate DISPLACEMENT OVERTRAVEL is provided that is responding to the Pk-Pk Displacement with up to 2990 MILS in 10-MIL steps. A DEVIATION meter provides a monitor to verify the test settings and observe the +/- deviation from the set position. Loss of signal detection is provided during the start-up mode, and when the –1dB REF point is passed, the unit switches to the OPERATE mode. If there is no feedback to the controller, the detector will do a controlled shutdown when the OVERTEST setting is reached.

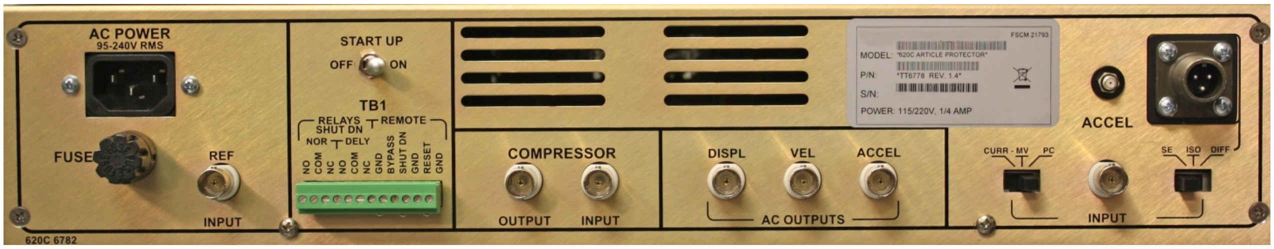

Figure 1-2, 620C Rear View

Specifications

Accel Input

Level (pC accel) (mV accel)	0.1 pC/g to 120 pC/g. 0.1 mV/g to 120 mV/g
Frequency	Range 2 Hz to 10 kHz
Impedance (pC accel) (mV accel) (Differential)	Greater than 10 meg Ohms Greater than 100 k Ohms. Constant current source for accelerometers with built-in charge converter (with ON-OFF switch) Greater than 10 meg Ohms
Connectors	Microdot and BNC for pC and mV, and three-pin for differential accelerometers

Ref Frequency Input

Level	0.1 to 20 V RMS
Impedance	Greater than 250 k Ohms
Frequency Range	2 Hz to 10 kHz
Wave Form	Any recurring waveform
Connector	BNC (isolated)

Compressor Input

Level	0 to 10 V RMS (Sine). 0 to 2 V RMS (Random)
Impedance	100 k Ohms
Gain	BNC (isolated)

Compressor Output

Level	0 to 10 V RMS (Sine). 0 to 2 V RMS (Random)
Impedance	Less than 50 Ohms (5 mA max)
Gain	0 dB ±1 dB (ZERO compression). -80 dB (FULL compression)

Accel Output

Level	Sine: 0 to 10V RMS Random: 0 to 2V RMS
Sensitivity	10 mV /g
Impedance	50 Ohms (5 mA max)
Frequency Range	2 Hz to 10 kHz
Amplitude vs. Frequency	±3% of reading ±0.5% FS
Dynamic Range	70 dB (minimum)
Connector	BNC (isolated)

Velocity Output

Level	Sine: 0 to 10V RMS Random: 0 to 2V RMS
Sensitivity	10 mV/IPS
Impedance	50 Ohms (5 mA max)
Frequency Range	5 Hz to 2000 Hz
Frequency Response	Follow a 6 dB/octave slope. 10 Hz to 1,000 Hz ±3% of reading ±1% FS 5 Hz to 2000 Hz ±5% of reading ±1% FS

Dynamic Range	50 dB (minimum)
Connector	BNC (isolated)

Displacement Output

Level	0 to 3 V RMS (RANDOM)
Sensitivity	.707 V/in.
Impedance	50 Ohms (5 mA max)
Frequency Range	5 Hz to 2,000 Hz
Frequency Response	Follows a 12 dB/octave slope. 10 Hz to 500 Hz ±4% of reading ±1% of FS 5 to 1000 Hz ±5% of reading ±1% of FS.
Dynamic Range	40 dB (minimum)
Connector	BNC (isolated)

Terminals

Shutdown NORMAL Relay	NO-COM-NC contacts, relay energizes when any set-in limit is exceeded, it remains energized until the condition is RESET.
Shutdown DELAY Relay	NO-COM-NC contacts, relay energizes approximately 500 milliseconds after the shutdown relay. It remains energized until the condition is RESET.
RESET-START	Normally Terminal at GND opens to RESET.
Shut down	Normally Terminal at GND opens to SHUT DOWN.
BYPASS	Normally Terminal at GND opens to BYPASS.

Controls

POWER Switch	Turns power ON.
INPUT Switch (RP)	Selects either pC/g, mV/g or mV/g CURR.

Sensitivity Switch	Selects 0.1-1.2, 1-12, or 10-120 multiplier for the sensitivity thumb switch.
Sensitivity Thumb Switch	Four decade thumb switch sets the acceleration gain to accommodate the particular pickup being used. Switch covers 1 to 12 range and works in conjunction with the sensitivity multiplier switch to cover the range of 0.1-120 pC/g.
SE-ISO-DIFF Switch (RP)	Provides isolated or single-ended operation for pC, SE for pC/g, and DIFF for differential pickups.
SINE-RANDOM Burst Switch	Selects RMS units at the input when in the RANDOM position and PEAK units when in the SINE position.
OVERTEST +dB Set Thumb Switch	A six-position switch to set 1, 2, 3, 4, 5, or 6 dB, and 0 is OFF.
UNDERTEST –dB Set Thumb Switch	A six-position switch to set 1, 2, 3, 4, 5, or 6 dB, and 0 is OFF. If ON, it will initiate when the -1dB point is passed.
TEST LEVEL Set Thumb Pot	Used in conjunction with the ACCEL g's Switch. Calibrated from 1 to 12.
ACCEL g's Switch	Selects .1-1.99, 1-19.9, or 10-199 as the switch multiplier for the TEST LEVEL set thumb pot.
OPER(Operate)-BYPASS	OPER position is for normal operation. The BYPASS position connects the compressor input to the compressor output jack.
RESET-START Switch	When mometarily pressed, the RESET switch resets any fault condition (if the original Fault is removed) and sets up the START condition.
SET (Displacement) OVERTRAVEL (Thumb Switch)	Provides adjustment from 0.300 to 2.999 MILS for the displacement overtravel set points. 0000 disables the DISPLACEMENT OVERTRAVEL.
START UP OFF ON Switch	Provides a way to disable the REF input as part of the start-up sequence

Indicators

Deviation/Level Set Meter	3-1/2 digit digital voltmeter to display the monitor input level.

Feedback LED	Normally illunimates green. If Feedback signal is not detected in the start time interval, the LED turns red and indicates a fault.
SIG Loss	Illuminates (RED), turns GRN if FEEDBACK is detected before timer expires.
Oper LED	Illuminates (RED) and turns GRN when the g level reaches 90%.
Under Test LED	Illuminates (RED) when the –dB SET setting is exceeded. It remains lit until the RESET-START switch is depressed.
Over Test LED	Illuminates (RED) when the +dB SET setting is exceeded. It remains lit until the RESET-START switch is pressed.
Displ (Displacement) OV (Over) Travel LED	Illuminates (RED) when the overtest set level has been exceeded. It remains lit until the RESET-START switch is pressed. (Setting “0000” on the SET OVERTRAVEL thumb switch disables the function.)
Bypass LED	Illuminates (RED) when BYPASS on the OPER-BYPASS switch is selected.
Power Interupt LED	Illuminates (RED) if the Power is interrupted. It stays lit until the RESET-START switch is pressed.
Fault LED	Illuminates (RED) if any fault occurs or if a signal is present at the compressor input when the RESET-START button is pressed.

Dimensions

3-1/2 inches high, 9 inches deep, 19 inches wide

Power Requirement

90 to 230 V RMS, 50 to 400 Hz, approx 25 W

Chapter 2
Operation

The 620C Article Protector is designed to provide a means of monitoring a Vibration Test System, using a controlled vibration exciter. This device's purpose is to protect the test article and the shaker. The unit monitors the level of vibration in both the Displacement and Acceleration parameters, and does an automatic shutdown should any of the preset limits be exceeded.

This chapter provides a start-up sequence and then describes each control and provides a method to best achieve the means of protection for the device being monitored. A simplified system block diagram is shown in **Figure 2-1**.

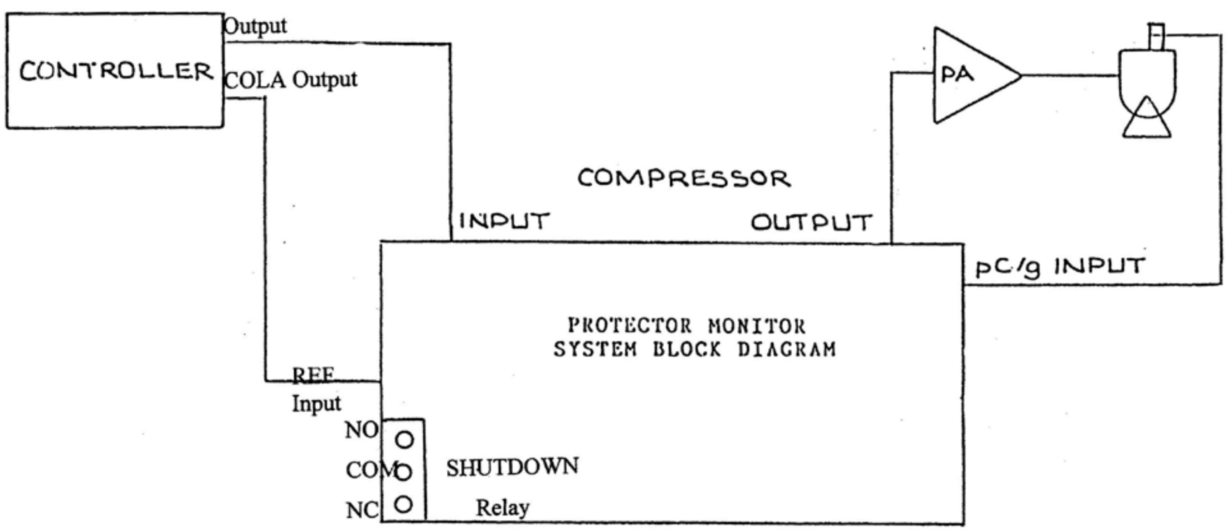

Figure 2-1, Simplified System Block Diagram

Start-Up Procedure

Refer to **Figures 1-1** and **1-2** for the location of the various switches, controls, and indicators.

Initial Instrument Setup

When a test is ready and all the instruments are ON, the 620C RESET-START push button switch should be depressed. This resets any fault and places the unit in the start-up condition.

CAUTION

If the REF input is not used, set the START UP switch (on the rear panel) to OFF.

NOTE

Before RESET the ACCEL and REF inputs must be zero (no signal).

Sine Mode

When the RESET-START switch is depressed, all LEDs should be GREEN except the OPER LED which will be RED. The start-up sequence will go through the following steps.

1. The SET (Displacement) OVERTRAVEL, UNDERTEST, and OVERTEST should be set as appropriate for the test. (To turn off the OVERTRAVEL, set switch to 0000.)
2. If the INPUT signal doesn't pass the -30 dB detector (after the REF input is detected), the FEEDBACK LED will turn RED and the FAULT LED illuminates and shuts the test down.
3. When the INPUT level passes the -1 dB detector, the OPER LED turns GREEN and the LEVEL holds at the 0 dB point. If it doesn't hold 0 dB, when the OVERTEST SET LEVEL is reached, the OVERTEST and FAULT LED turns RED and shuts the test down – indicating the wrong set g LEVEL or CONTROLLER setting.
4. When the OPER LED turns GREEN the DEVIATION meter should be at "0" deviation and all LEDs green. Minor adjustment of the ACCEL g's control may be needed to set a "0" deviation.
5. The UNDERTEST and SIGNAL LOSS is armed when the OPER LED is GREEN.
6. The SIGNAL LOSS and FAULT LEDs turn RED if the INPUT signal goes below -30 dB.

Random Mode

1. When the RESET-START is depressed, all LEDs except the OPER are GREEN.
2. When the FEEDBACK passes the -1 dB detection the OPER LED turns GREEN. This arms UNDERTEST and SIGNAL LOSS detection.
3. The DISPL OVERTRAVEL is OFF.
4. When a fault occurs, the detected fault and the FAULT LED turns RED, and the COMPRESSOR Shutdown and the SHUTDOWN relays are activated.

Burst Mode

1. When the FAULT-RESET is depressed, all LEDs are GREEN.
2. The UNDERTEST, SIGNAL LOSS, and DISPL OVERTRAVEL are OFF.
3. The OVERTEST is active.
4. When an OVERTEST FAULT occurs, the OVERTEST and FAULT LEDs turn RED and shutdown occurs.

Controls

FAULTS

When any of the preset limits are exceeded, the FAULT LED will blink RED and the system will shut down (go to FULL compression). Also the SHUTDOWN relays will energize. The time required to shutdown when a FAULT occurs is comprised of two parts, the detection time and the compressor attenuation time. The compressor attenuation time is fixed at three milliseconds. The detection time is controlled by frequency when in the SINE mode, and is fixed when in the random mode. Both the amount the limit is exceeded by, and the frequency will affect the shutdown time.

Table 2-1 shows the shutdown time for overtest dB and frequencies of 5, 50, 100, 500, 1K and 5K. Table 2-2 shows the Random Shutdown times.

Table 2-1, Sine 3dB Overtest

Frequency (Hz)	Shutdown Time (mS)
5	110
10	60
50	40
100	25
500	20
1000	20
5000	20

Table 2-2, Random (White Noise)

Overtest (dB)	Shutdown Time (mS)
1	60
3	250
6	1200

NOTE: *All FAULTS must be removed before RESET. The ACCEL and Compressor inputs must be ZERO.*

RESET-START Switch

This is a push button switch – when pressed, it resets any fault and sets the unit for start-up mode.

SHUTDOWN Switch

This is a push button switch that shuts the system down in 3 milliseconds after being mometarily pressed.

When the unit is turned on the switch should be tested to assure it is working. The FAULT LED should remain illuminated until reset.

MV-pC/g Switch and Sensitivity Thumb Switch

MV-pC/g Switch selects the sensitivity range of the Input sensor. The Sensitivity thumb switch sets the sensitivity in that range.

CURR-mV- pC Switch (Rear Panel)

The CURR-mV- pC switch provides a means of selecting pC or mV operation of the charge amplifier. The mV-CURR position turns the Current ON to operate integrated sensors. When this switch is placed in the pC position, the charge amplifier is configured to accept a charge input from a standard accelerometer with a picocoulomb output. The mV position provides the ability to use mV/g signals with no current at the input

SE-ISO-DIFF Switch (Rear Panel)

When the pC Input is selected by the CURR-mV- pC Switch, the charge amplifier input can be operated either in the SE (single-ended) mode, or in the ISO (isolated) mode. When in the ISO mode, the picocoulomb input to the charge amplifier is floating and is isolated from both chassis and signal ground. This position will be used when the pickup is grounded at the mounting point. If the pickup is not grounded, the SE position of the switch should be selected. When mV/g is selected the input is always SE. In the DIFF position the PC position of the CURR-mV- pC is selected and the input is via the three-pin connector, as the plus and minus inputs are being driven.

ACCEL g's Switch and GAIN SET LEVEL Thumb Switch

The GAIN SET Level Switch works in conjunction with the ACCEL g's switch to provide a means to set from .1 to 200 g's as the SET LEVEL. Set these switches for the g level that the test is to be run at.

OVERTEST and UNDERTEST dB Set Switches

Each of the switches have six positions to select 1 to 6dB as the OVERTEST or UNDERTEST level. The ZERO position turns the function OFF. The switch should be placed to the appropriate position as determined by the conditions of the test being run.

SET (Displacement) OVERTRAVEL Thumb Switch

The SET OVERTRAVEL monitors the displacement at the protector input. This SET OVERTRAVEL switch provides settings from 300 to 2990 MILS P-P. It should be set to a displacement below the travel of the shaker.

In the Random and Burst modes, the OVERTRAVEL is disabled.

SINE-BURST-RANDOM Switch

This instrument is designed to monitor and protect test systems that are being subjected either to SINE, BURST, or RANDOM excitation.

When the input to the unit is a sine wave, the switch should be in the SINE position.

When Random excitation is being used, placing this switch to RANDOM configures the system to a fixed shutdown detection time of approximately 330 milliseconds.

For a sine burst waveform, place the switch to BURST position.

Tables 2-2 and 2-3 list some of the shutdown times as they related to the overtest level and frequency. The last line shows the timing for random noise, when the SINE-BURST-RANDOM switch is placed to RANDOM

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Chapter 3
Performance Test

The procedure in this chapter provides a method of testing the 620C Article Protector for compliance to manufacturer specifications. In the event that a reading is out of tolerance the unit may require calibration (see Chapter 4). The unit should operate for more than 12 months without maintenance unless a component fails.

Test Equipment

Note: Equivalent equipment can be used.

Function Generator	Trig-Tek 346B
AC-DC Digital Voltmeter	Keithley 191

Switch Settings

Note: Refer to Figures 1-2 and 1-3 for switch and connector locations.

Place these switches in the following settings:

- mV-pC/g switch to 1-12
- SENSITIVITY switch to 10.00
- ACCEL g's switch to 10-120
- SET LEVEL switch to 100.0
- SE-ISO-DIFF switch (RP) to SE
- PC mV-CURR switch (RP) to mV
- SINE-BURST-RANDOM switch to SINE
- OPER-BYPASS switch to OPER
- POWER switch to ON

Performance Procedure

1. Connect the signal generator to the ACCEL INPUT jack. Set the generator for 61.4 ±0.2 Hz and 100.0 ±0.5 millivolts RMS.
2. Connect the AC Voltmeter to ACCEL AC OUTPUTS jack.
3. Observe an indication of 100 ±3 millivolts RMS on the AC Voltmeter.

4. Place the SENSITIVITY thumb switch to 01.00.
5. Observe an indication of 1000 ±30 millivolts RMS on the AC Voltmeter.
6. Connect the AC Voltmeter to the VELOCITY AC OUTPUTS jack.
7. Observe an indication of 1000 ±50 millivolts RMS on the AC voltmeter.
8. Change the generator frequency to 44.3 ±0.2 Hz.
9. Connect the AC Voltmeter to the DISPL AC OUTPUTS jack.
10. Observe an indication of 1000 ±50 millivolts RMS on the AC Voltmeter.
11. Return the SENSITIVITY switch to 10.00.
12. Set the generator frequency to 140 Hz and the level to 707 ±5 millivolts RMS.
13. Observe an indication of 0 ±0.25 dB on the DEVIATION meter.
14. Change the generator level to 1.41 V RMS.
15. Observe an indication of +6dB ±0.25 dB on the DEVIATION meter.

Chapter 4
Calibration Procedure

The 620C Article Protector's circuitry is packaged on a single circuit board. The adjustments are all accessible from the top when the instrument cover is removed. The locations of the various adjustments are marked on the PC board. The following procedure provides the method to make the adjustments.

Test Equipment

Note: Equivalent equipment can be used.

Function Generator	Trig-Tek 45EMD Calibrator
Voltage-to-Charge Converter	Trig-Tek 2030
AC-DC Digital Voltmeter	Keithley 191

Instrument Setup

Remove the top cover of the unit and connect the power cord to AC power between 90 and 230 Volts RMS.

Switch Settings

Note: Refer to Figures 1-2 and 1-3 for switch and connector locations. Refer to Figures 4-1 and 4-2 for variable resistor locations on the main motherboard and A3 daughter board.

Place these switches in the following settings:

- mV-pC/g switch to 1-12
- SENSITIVITY switch to 10.00
- ACCEL g's switch to 10-120
- SET LEVEL switch to 100.0
- SE-ISO-DIFF switch (rear panel) to ISO
- PC mV-CURR switch (real panel) to PC
- SINE-BURST-RANDOM switch to SINE

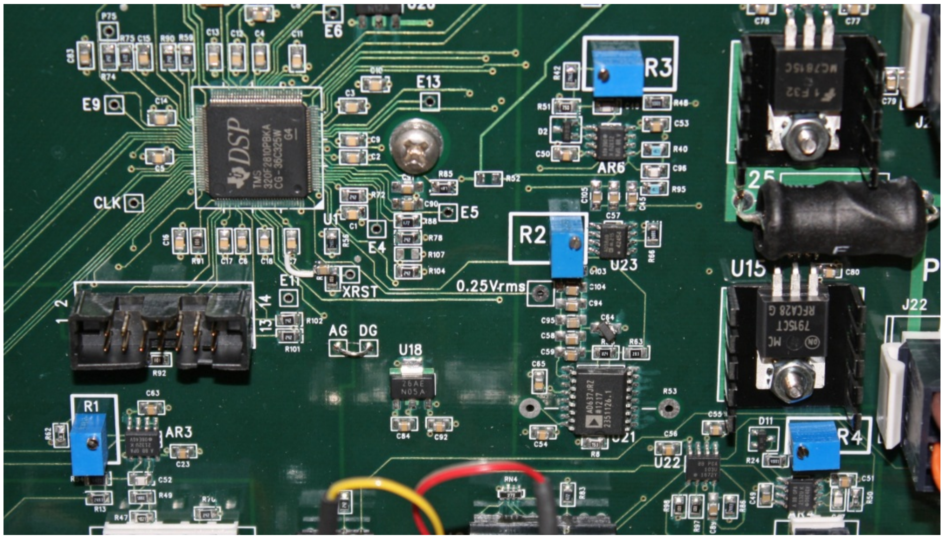

Figure 4-1, Main Board Variable Resistor Locations

Charge Amplifier Adjustment

1. Connect the signal generator to the ACCEL INPUT jack.
2. Set the rear panel SE-ISO-DIFF switch to SE, and the CURR-mV-pc switch to mV.
3. Set the generator for approximately 500 Hz and 707 ±4 millivolts RMS.
4. Connect the AC Voltmeter to the ACCEL AC OUTPUT jack.
5. Set the ACCEL FS ADJ R1 (**Figure 4-1**) for 707 ±5 mV RMS on the AC Voltmeter.

Velocity and Displacement Adjustments

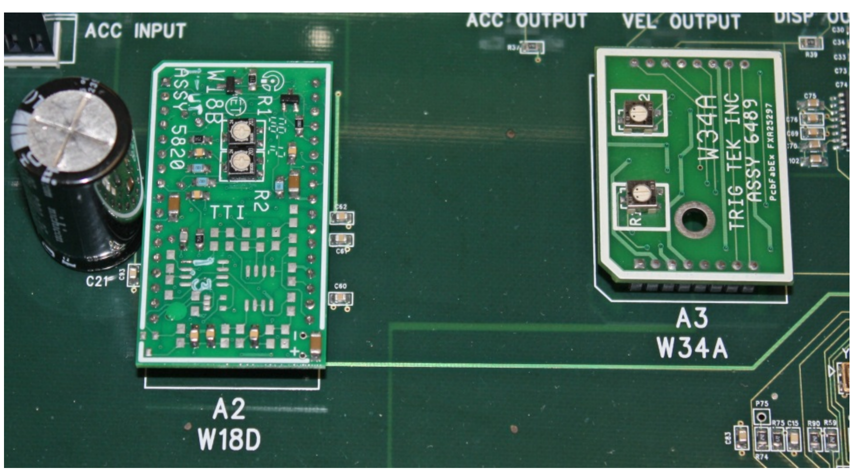

Figure 4-2, A3 Board Resistor Locations

1. Set the generator at the ACCEL INPUT for 61.4 ±0.1 Hz and 707 ±4 millivolts RMS.
2. Connect the AC Voltmeter to the VEL (Velocity) AC OUTPUT jack.
3. Set the VELOCITY ADJ R1 (**Figure 4-2**) on the A3 W34A Integrator Module, for a 1000 ±5 mV RMS indication on the AC Voltmeter.
4. Connect the AC Voltmeter to DISPL AC OUTPUT jack.
5. Set the generator frequency for 44.3 ±0.1 Hz.
6. Set the DISPL ADJ R2 (**Figure 4-2**) on A3 for a 707 ±5 millivolts RMS indication on the AC Voltmeter.

Deviation Meter Adjustments

1. Return the AC meter to the ACCEL AC OUTPUTS jack.
2. Set the generator at the ACCEL INPUT for approximately 500 Hz and 707 ±4 millivolts RMS.
3. Set the dB ADJ R2 (**Figure 4-1**) for a 0.0 ±0.1 dB indication on the DEVIATION Meter.
4. Change the generator level to 1414 ±10 millivolts RMS.
5. Adjust the DEV GAIN ADJ R3 (**Figure 4-1**) for a +6 ±0.1 dB indication on the DEVIATION Meter.
6. Change the generator level to 1000 ±10 millivolts RMS.
7. Move SINE-BURST-RANDOM switch on the front of the 620C to RANDOM.
8. The DEVIATION Meter on the front panel should show 0 ±0.2dB.

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