AMPTEC RESEARCH

AMPTEC 620ES IGNITER TESTER
OPERATION/MAINTENANCE MANUAL

Rev. G, April 2022

PHONE (512) 858-4045; FAX (512) 3858-4340;
website http://www.amptec.com

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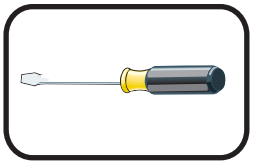


SECTION A - RECEIVING AND INITIAL INSPECTION

A-1. Introduction to the AMPTEC 620ES

The AMPTEC 630, 640 and now the 620 Series Igniter Testers/Failsafe Ohmmeters are becoming the standard in the Safety Igniter Circuit Test industry, and are designed to provide extremely safe and reliable resistance testing of explosive or volatile devices. Safety Approvals from various Safety Boards include, the U.S. Air Force (620A-4) for generic use on Non-Nuclear munitions and the US NAVAL ORDNANCE CENTER (620AN and other versions pending). Some of the devices the 620ES Igniter Tester may be used on include: fuses, squibs, igniters, explosive bolts, rocket motor squibs, automobile air-bag initiators and many others.

The AMPTEC 620ES is a 4-wire failsafe digital ohmmeter which has been designed to reliably use very low test currents for its resistance measurement. Failsafe Output Circuitry proprietary to AMPTEC RESEARCH ensures that test current levels do not exceed the specified "failsafe current" even in a worst-case component failure situation. The failsafe feature is tested in every instrument before shipment.

The newer 620 series represent the latest in ultra-safe Igniter Tester measurements. The 620ES uses the same main printed circuit board (PCB) as all of the AMPTEC 620A Igniter Testers. The 620ES has many features which make it useful in a variety of applications. Please check the last chapter of this manual for addendums that may apply to the 620ES.

Should the rechargeable batteries reach a low charge level a negative sign will apear on the display. The 620ES has a **battery monitoring** circuit that indicates it is time to plug in the battery charger.

A-2. Receiving, Unpacking, and Initial Inspection

Should the AMPTEC shipping box appear damaged upon arrival, request that the carrier's agent (i.e. UPS) be present when the unit is unpacked. If the 620ES appears damaged, the carrier's agent should authorize repairs before the unit is returned to the factory. Even if the instrument appears undamaged, it may have suffered internal damage in transit that may not be evident until the unit is operated or tested to verify conformance with its specifications.

If the unit fails to operate or fails to meet the performance specifications of Section B, notify the carrier's agent and the nearest AMPTEC Sales Office. Retain the shipping carton for the carrier's inspection. **DO NOT return equipment to AMPTEC RESEARCH** or any of its sales offices ***without first obtaining*** an (RMA) Return Material Authorization number. We need to know who to contact and how to contact (i.e. phone number and FAX number) in order to properly coordinate the return of the repaired AMPTEC product.

By calling AMPTEC RESEARCH first, prior to just returning the 620ES, we can often troubleshoot (based on the symptoms you describe) and identify the problem over the phone (i.e battery loose in the battery holder).

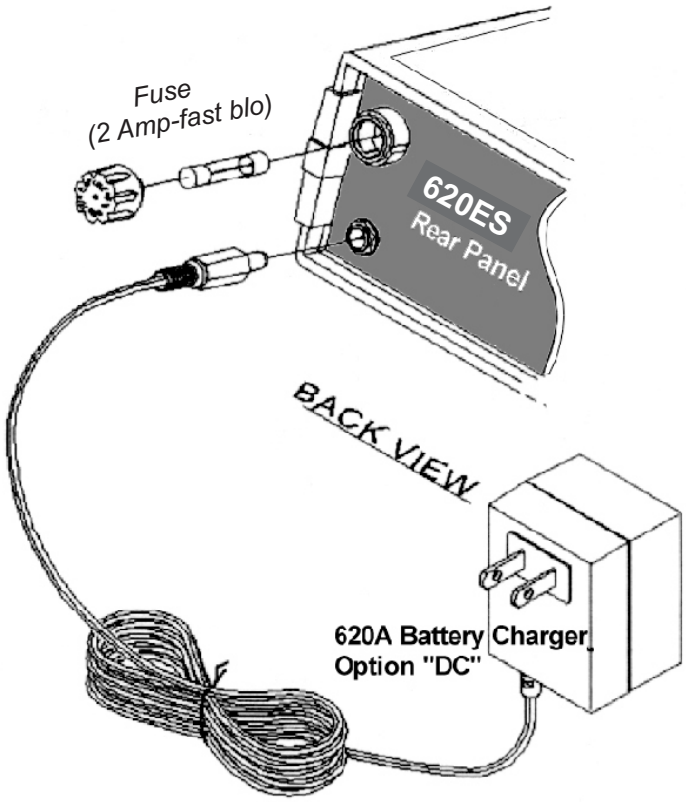
We may possibly be able to fix the problem over the phone and prevent you from having to return the unit to AMPTEC for repair.

A-3. AC/DC Battery Charger - Power Requirements

The AMPTEC 620ES is powered by an internal rechargeable heavy-duty nickel-cadmium battery pack (4 ea D cell - 5.0 AHr). Replacement batteries may be purchased, contact the sale department at AMPTEC RESEARCH.

The battery charger is an external AC/DC converter that plugs into a standard 115VAC receptacle. The AC powered battery charger provides 6VDC @ 250mA for charging the AMPTEC 620. The AMPTEC 620ES is designed so it is impossible to be powered (in operating - measurement mode) directly from the AC line battery charger. As an additional note, the 620ES main power switch ***must also be*** in the "***Off/Charging***" ***mode*** in order for the connected battery charger to recharge the 620ES's batteries.

For customers using 220VAC 50 HZ AC line power for running the battery charger, please inform AMPTEC's sales department at the time of your order and the appropriate adaptor will be included with the 620ES Failsafe Ohmmeter shipment for an additional fee.



A fully charged battery pack typically powers the 620ES for approximately 6 ~ 8 hours before requiring a recharge. AMPTEC installs a quality set of 4 each Heavy Duty (5000 mAHr) Ni-Cad batteries. The 620ES will also operate on a 4000 mAhr **D** cell Ni-Cads with a shortened operating time between charges. Recharge time is typically twice the "Power On" time. An "Overnight" charge
usually restores the 620ES to a "Fully Charged" ready to use state.

The main "Power" switch has two separate modes. The "ON" position supplies internal battery isolated power to operate the 620ES when they are charged. If you turn on the 620ES, and the display does not come on, it may indicate the batteries need charging. The "OFF/ CHARGING" power switch position is for use when the batteries need charging or the 620ES is not in use. As mentioned earlier of course the AC/DC Battery Charger must be plugged into the 620ES's rear panel charging jack/ connector to facilitate charging the batteries.

Located on left hand portion on the 620ES display is the "Low Battery" indicator box. Check for no "Low Battery" indication. If the LED display shows a negative (-) or minus sign in the indicator box the unit's batteries are low and need charging. The absence of the negative sign in the battery indicator box indicates the batteries are acceptably charged.

Although the batteries are fully charged prior to shipment, it may be desirable to refresh the charge for 24 hours before use. ***As a rule of thumb, the 620ES requires twice as much time to fully recharge as the amount of discharge time.*** For example, if the instrument was used continuously for 2 hours, the AC adapter must be connected for 4 hours in order to fully restore the charge. If you need a replacement AC/DC Battery Charger for the 620, contact the AMPTEC customer service department and request an option "620DC" Battery Charger.

When the 620ES is first turned on, the unit draws more internal power to heat up the unit's ovenized zener voltage reference. If the "Low Battery" Indicator only comes on for a few (i.e 10 to 15 seconds) seconds when the 620ES is first turned on then goes out, the battery levels are starting to indicate the charge level is getting low.

A-4. Setup and Use

The AMPTEC 620ES Igniter Tester may be setup to operate within minute(s) of power "turn on" (unless your in an extremely cold temperature - allow more time for warm-up - 15 minutes). A quick check for no sign of the "low battery indicator" and test lead integrity check and it should be ready to use.

Once the AMPTEC 620ES has had it's batteries charged for 12 to 24 hours it is ready for use. The 620ES consumes little power and generates virtually no heat. Consequently, it may be used in any area where the environment does not exceed the specifications of Table B-2.

Avoid exposing the 620ES to extremes of temperature which will affect accuracy and shorten battery life-span.

SECTION B – 620ES IGNITER TESTER SPECIFICATIONS

The below specifications apply to units that are purchased as a part of our 620ES standard offering with no additional options. For information on the specifications of units with additional options, please refer to the specific section per your unit's modification(s).

AMPTEC 620ES Range, Resolution, Accuracy, & Current Levels

Range	2 Ω	20 Ω	200 Ω	200 KΩ
Nominal Current	5 mA	5 mA	0.5 uA	0.5 uA
Failsafe Current	8 mA	8 mA	8 mA	8 mA
Resolution	100 uΩ	1 mΩ	10 mΩ	10 Ω
Accuracy	± .02% of reading & ± .05% of range	± .02% of reading & range	± .02% of reading & range	± .02% of reading & range

AMPTEC 620ES General Specifications

Display …… 4 ½ digit LED display

Input Voltage ……..…... 250 VDC maximum

Low Battery ……..……. Display reads"—"

Overload/Overrange ……...… Display flashes

Temperature Coefficient ….. ± 0.002% per 1º C

Temperature Limit (Storage) .….. -20º to 70º C

Weight (Standard Version) ……..…….. 3.5 lbs.

Dimensions ……..……..... 9.75" x 10" x 3.25"

Internal Voltage ……..... 4.8 VDC maximum

Open Circuit ……..…….... 1.6 VDC

Terminal ….....… Banana jack binding posts

Temperature Limit (Operating) …... 0º to 50º C

Update Rate ……..……. 3 readings per second

AMPTEC 620ES Power Specifications

Batteries ……..... 4ea 5000 mAh NICAD batteries

Battery Charger ……..……... AMPTEC 620-DC

Battery Charger Input ……... 90 – 264 VAC

Battery Charger Output ……..……..… 5.9V

Battery Charge Time …..... ~8 hrs. til full charge

Battery Charger Charging Current ..... 2A max

Battery Life ……..……. 1000 cycles or 3 years

OP-247 Optically Isolated Power Specifications

This option enables your unit to be ran via AC power, allowing for uninterrupted use. Unless otherwise noted in the table below, all other specifications match those listed in the general specifications section.

AC/DC adaptor ….……...… AMPTEC 247-DC

Adaptor output ……..……...…..…… 24 VDC

Adaptor input ……..……..…..……. 120VAC

Unit Weight ……...…..……..… 2.3 lbs

OP-232 RS232C Interface Specifications

This option enables your unit to connect to a computer and receive commands via RS232C.

Connection ……..…....…..... DE-9 connector

Rear terminal block .….. 4 Gold-Plated terminals

OP-519 Rack Mount Specifications

This option, OP-519S (for single units) and OP-519D (for dual units), allows your unit to be rack mounted. Unless otherwise noted in the table below, all other specifications match those listed in the general specifications section.

OP-519S (Single Unit)

Dimensions ……..….. 19" x 3.5" x 10"

Materials …… ABS plastic face, aluminum

Weight ……..…… 2.3 lbs (plus unit weight)

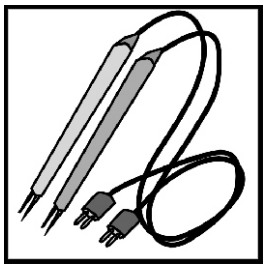
OP-519D (Dual Units)

Dimensions …….. 19" x 3.5" x 10"

Materials …….. ABS plastic face, aluminum

Weight ……..…. 2.1 lbs (plus unit weights)

SECTION C OPTIONAL ITEMS AND ACCESSORIES



C-1. Available Accessories and Options

Listed below are the options available for use with the AMPTEC 620A Series FailSafe Ohmmeters.

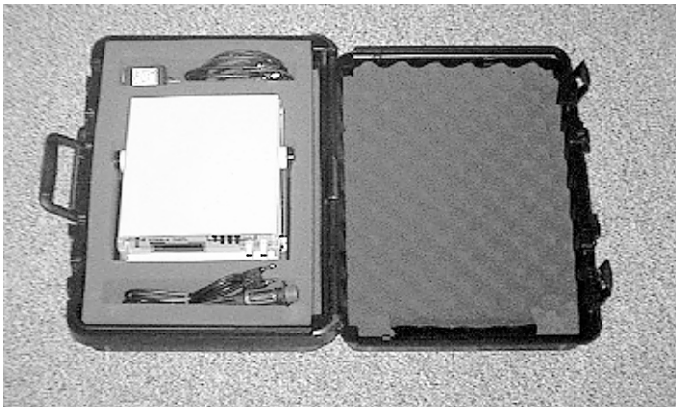
Option 620DC: Battery Charger

Option "DC" is an AC/DC converter that converts 115VAC line voltage to 6VDC at 300mA. One charger is provided as a standard accessory with every 620A. A 220 VAC 50 Hz powered Battery Charger adapter is also available.

Replacement Batteries

The rechargeable Nicad batteries installed in the 620A should provide years of trouble-free operation. Replacement, however, will eventually be necessary. The 620A uses four 1.2V cells (5.7 AHr recommended) installed in a reusable battery box. When ordering replacement batteries, please specify AMPTEC Stock #0E-10117, quantity four (4).

Option 100: Carrying Case



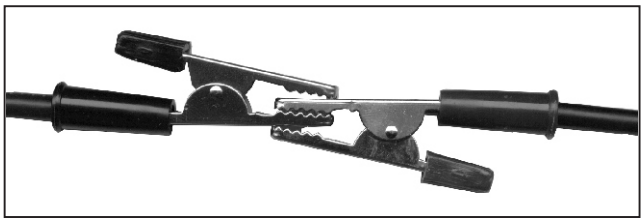
Option "100" is a hardshell (impact resistant plastic) shock absorbing foam lined meter and accessory carrying case for the 620A Ohmmeter with extra room for test leads, battery charger, Kelvin Clip Test Leads, Connector Adapters, single pointed probes and operator manual etc.

Option RACK: Rack Mount Adapter

Option "620RACK" includes an adapter tray that allows any AMPTEC 620 series tester to be flush panel mount installed in a standard 19" equipment rack.

C-2. Test Lead Sets and Probes

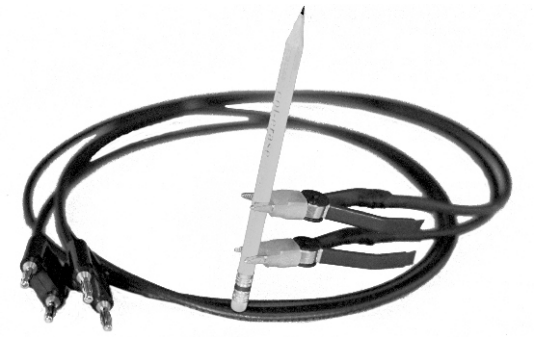
Option “290" Alligator Clip Lead Set



Option "290" is the recommended general purpose Alligator Clip test lead set (red and black) ***for models not having a 2.0 Ohm range*** (due to a small resistance “offset” at the tips - OK for 20 Ohm and higher range units) . Option “290" is supplied as a standard item with all 620A-4 (USAF version) ohmmeters as part of the accessory package. Option “290" is a 48" long cable set with dual banana plugs at one end. The other end is terminated with an alligator clip (red and black) . Some “Squib Resistance” test panel jacks have a plastic exterior with a conductive socket center. These alligator clips will measure (2 wire method) properly with either upper or lower jaw connected to the conductive socket center of plastic test panel jacks. Kelvin Clips see Option “300” (using the 4 wire method) *may have difficulty only if* both jaws (both upper and lower) do not make electrical contact with the conductive “resistance under test” center.

See next page for Kelvin Clips and other accessories.

Option 300: 4-Wire Gold Plated Kelvin Lead Set



Option "300" is a general purpose Gold Plated Kelvin four wire Leads for all AMPTEC 620 series Testers. Gold plated kelvin clips provide a low thermal EMF connection (minimizes the thermo-couple effect) with most connections. ***The Option "300" is the recommended test lead set for any AMPTEC Igniter Testers with a 2.0 Ohm range*** (i.e models 630ES and 620ES). The 4 wire Kelvin connection is ***important when measuring less than 1.0 ohm***, and also automatically ***eliminates test lead length offset*** and ***test lead contact resistance errors***. Option "300" is a shielded 48" lead set terminated in ½" opening gold plated Kelvin clips. The option "300" can clip easily to wires, pins, and medium size (up to ½" diameter conductors). The dual banana plug ends connect directly to the 620 tester's front panel input terminals. (see Option "320" for replacement Kelvin clip ends only)

Option 305: Banana-to-Banana Cable

Option "305" is a 48" shielded cable terminated in dual banana plugs at both ends.

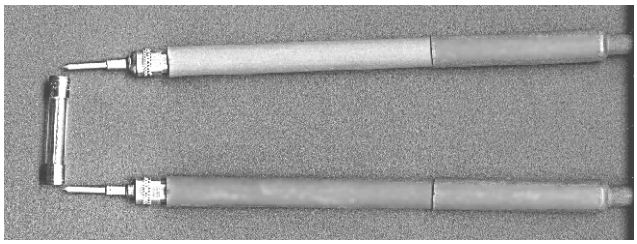
Option 320: Kelvin Clips

Option "320" are the gold plated kelvin clips used on the Option "300" cable set . These clips may be used when making custom cables or when repairing Option "300".

Option 360: Heavy-Duty Clips

Option "360" are Gold-plated jumper cable (large jaws) type clips used on the Option "350" cable. They are still Kelvin Clips because the insulated upper and lower jaw (jumper cable appearance) integrity is maintained. These may be used when making custom heavy duty cables that open to 1 1/2 " wide (i.e bolt heads)..

Option 401: Handheld Single Probe Leads



Option "401" is a 620 series compatible handheld probe (one black probe & one red probe) lead set terminated in ***single points***. The OP401 handheld probes allow for easy access to connector socket wiring (i.e. drone parachute squib sockets), recessed surfaces, and parts (i.e. flares) that alligator clip leads simply would not work well with.

Option "500" Optically Isolated Analog Output

This rear panel mounted isolated analog DC Voltage output signal is directly proportional to the 620 tester's ohm display measurement. (i.e. 1.2345 VDC for 12.345 ohms). It is used to track 620 tester measurements for datalogging purposes with an external device (i.e chart recorder, system DMM with GPIB). Isolation protection is rated @2000 volts peak to insure any instrument connected to "Option 500" has virtually no impact on the 620 series tester's safety.

Option "600" Optically Isolated Binary Coded Decimal (BCD) Data Output

For applications requiring data output the 620 series is available with "BCD"output. The measured resistance readings are output via a rear panel "BCD" talk only interface. A High- Go- Low BCD Dual Limit Comparator is presently under development and will be available Summer of 2001..

New Options and Custom Leads Available

Contact the sales department at AMPTEC RESEARCH (phone 1-800-350-5105) if you have need for **GPIB**, a special probe, adapter, lead set, or custom option not listed in this manual. AMPTEC'S experienced application engineers have helped supply many customers with special igniter tester accessory requirements.

CHAPTER D - OPERATION, FUNCTIONAL AND USE

D-1. General Operation

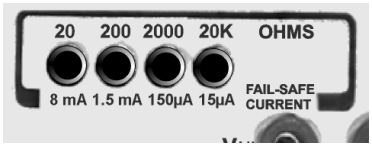
This section contains operating instructions for the AMPTEC 620ES Explosive Safety Igniter Tester.

D-2. Front Panel Features and Operation

Main Power Switch

When the front panel power switch is in the OFF /CHARGE position, all power is removed from the ohmmeter measurement circuitry, and the battery pack is connected to the rear panel charging circuit. When the main power switch is placed in the ON position, the unit's battery pack is disconnected from the charging circuit. The possibility of a common mode voltage between the device under test and AC Power ground is therefore completely eliminated. The operator need not be concerned if the battery charging adapter is plugged into the AMPTEC 620ES as it is disconnected during any resistance measurements.

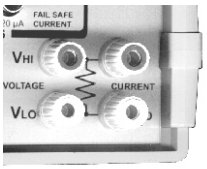
Range Switches



model 620A-4 shown

The AMPTEC 620 series ohms ranges are selected by pressing the desired range switch on the front panel. The range select pushbutton for the lowest resistance range (leftmost resistance range button) indicated above the range select buttons. When a given range is selected (pushed in) the other range switches "pop-out" and inform the user. It is obvious to the 620 user which resistance range has been selected, as it is the only range button pushed in. Also note that a resistance range should be selected after powering up the 620ES in order to place it in an operational mode. After turn "ON", a range should be selected. For new instrument users with a 200 Ohm range AMPTEC Igniter Tester, the unit will measure resistances up to 200 Ohms.

If the resistance being measured (including "Open Circuit/ Disconnected states") is a higher value than the selected range, the instrument's display will flash (blink) , which indicates "overrange" .



Gold Plated Five way Input Jacks

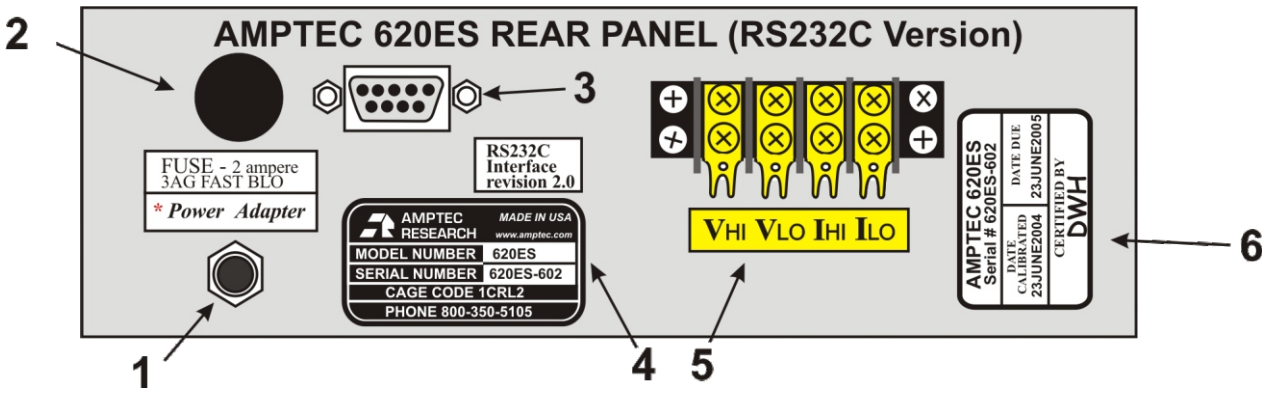
The AMPTEC 620 front panel input jacks are a gold plated variety that readily accept a number of user connection modalities. The unit's banana post input jacks may be unscrewed several turns to exposed a horizontal hole thru the gold plated post. The AMPTEC 620 user can directly connect a bare wire thru the banana post (horizontal hole). Once the wire is thru the banana post hole you can hand tighten the banana post to make a secure electrical connection. The AMPTEC 620 front panel input posts also accept wires with spade lugs, and or banana jacks. The 48” long dual banana Alligator Test Leads plug directly into the Voltage High and Voltage low , and Current high and Current low panel jacks. The spacing of the AMPTEC 620 panel jacks only allows horizontal connection of the dual banana jack test leads to prevent mis-connection.

Calibration Access Screws

Recessed in the four feet on the bottom of the AMPTEC 620ES you will note there are 4 screws (phillips head type) that are used for calibration access. These screws are meant to remain intact and should only be removed by authorized personnel (i.e. Calibration Lab staff).

Optional Functional Test Box with built-in milliammeter

An optional Functional Test Box (option FTB-620ES) for the AMPTEC 620ES contains an analog 10 mA full-scale milliammeter and a variety of test resistors is available from AMPTEC RESEARCH.



AMPTEC 620ES Rear Panel with RS232C I/O
The AMPTEC 620ES rear panel (shown above) contains many jacks, terminals, labels, and stickers.
* The AC to DC Adapter (item #1) must be left in the rear panel jack in order to continuously operate the unit, if fitted with option "247". If configured with NICAD batteries then this is the battery charger jack and the 620ES will only charge when the power switch is in the "OFF" position. (battery powered units only).

Item 2 is the fuse holder - replace with a 2 ampere 3 AG type fast blow fuse (rarely needs replacing).

RS232C Serial Interface - Item # 3 is the safety isolated RS232C serial I/O (9 pin D type Sub-min connector). This RS232C Interface provides the meter's resistance measurements to a PLC fitted with a serial port. The **RS232C protocal settings should be 9600 Baud, 8 Bits , No parity , 1 Stop Bit ,** *9 pin D Sub-min connection***.**

RS232C Command Set

(NOTE: All front panel range buttons must be de-selected (press in half way) **with all range pushbuttons out** in order to disable with local lockout and enable RS232C control. ***Note commands are case sensitive***.

C **Continuous Read Mode -** *RS232C I/O* outputs a data string every A to D conversion cycle, approx**.** 2.5 times per second.

S **Single Read Mode -** *RS232C I/O* outputs a single data string upon reception of a "R" command.

R **Read -** Commands *RS232C I/O* to output a single data string (1 resistance reading).

r0 De-Selects all Ranges
r1 Selects the 2.0 Ohm Range
r2 Selects the 20 Ohm Range
r3 Selects the 200 Ohm Range
r4 Selects the 200K Ohm Range
V Version **c**ommands board to output the firmware version string.

Data Format - The *RS232C I/O* outputs a data string with the following format:

1.2345E+3 The measurement is always in Ohms *(where E+3 = 10^{+3}scientific notation style)* . The Exponent is defined below. ***1.2345E+3 = 1.2345 KOhms*** (where $E^{+3}=10^{+3}$). ***1.3700E+1 = 13.700 Ohms*** (where $E^{+1}=10^{+1}$)

Range		Exponent
2.0	Ohm	E+0
20.0	Ohm	E+1
200.0	Ohm	E+2
2.0 K	Ohm	E+3
20 K	Ohm	E+4
200 K	Ohm	E+5

An overrange condition is indicated by 9.9999E*nn*..Where nn is the selected resistance range exponent. A Range Error is indicated by x.xxxxERR.

Item # 4 is the unit's serial number sticker.

Item # 5 is the gold plated 4 terminal rear terminal strip (they are wired in parallel with the front terminals). If a "2 wire ohms" connection is made then the **V** high and **I** high terminals should be shorted together, and the **V** low and **I** low terminals should be shorted. The 620ES Voltage High, Voltage low, Current high and Current low wires are permanently connected to the gold plated rear terminal strip (seel labeled gold plated terminal strip on rear panel).

Item #6 Calibration Sticker - If the calibration due date has expired (1 year) AMPTEC or a Cal. Lab can contacted to re-certify the AMPTEC 620ES Explosive Safety Ohmmeter/Igniter Tester. contact AMPTEC customer service see website www.amptec.com

The optional FTB-620ES's on-board milliammeter provides an independent verification of the AMPTEC 620ES's output current levels are less than 10 mA. The 620ES failsafe current circuitry limits the 620ES such that ***one should never see a current level*** of 15.0 mA or higher.

With one test lead (i.e. red ring tipped banana) plugged into the meter panel jack and the other test lead (i.e. black ring tipped banana jack) plugged into the common panel jack, the milliammeter will display the actual test current coming from the 620ES Igniter Tester, when the test leads are connected and the 620ES is in operation mode. The span of the DC milliammeter is 0 to 10 milliamperes full-scale. If the test leads are connected backwards to the 620ES DC milliammeter being DC based will not measure.

The test resistors of the FTB-620ES may also be used to verify general 620ES operation and functionality. Keep in mind the proper resistance range should be selected in order to measure a selected test resistor. You can't measure a 1000 ohm resistor on the 200 ohm range of the 620ES. With one test lead (i.e. red banana lead) plugged into the selected test resistor panel jack and the other test lead (i.e. black banana lead) plugged into the common panel jack, the 620ES Igniter Tester should display a resistance value close to the labeled value of the resistor. The 0.1 ohm resistor is commonly used to test the bottom or low end
(i.e. linearity) of a given 620ES resistance range. The 0.1 ohm resistor can be used to check the 620ES's zero offset.

Refer the AMPTEC 620ES to qualified service personnel (i.e Calibration Lab) if you suspect (i.e large error) the 620ES measurement display readings don't agree with the resistor values labeled on 620ES Function Test Section. Do not attempt to repair the 620ES unless you are qualified.

D-3. 4-Wire Resistance Measurement

The four-terminal configuration of the 620ES eliminates measurement errors normally caused by "**in series**" test lead resistance and "**contact**" resistance.

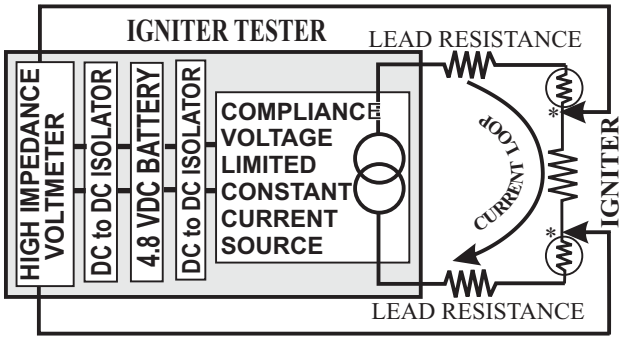


Figure D1 - Igniter Tester Kelvin Block Diagram

In many resistance measurement applications the contact resistance and can exceed the value of the test resistance by several orders of magnitude. The AMPTEC 620ES overcomes this potential error source by providing two terminals of constant current (**I** high and **I** low) and an additional two terminals for high impedance voltage measurement. The constant current source uses a variable compliance voltage circuit to overcome lead and contact resistance until the current loop is a constant level. The result is a fast, accurate resistance measurement of the test resistance, independent of the resistance of the current carrying leads.

Figure D-1 above illustrates the 4-wire principle eliminates lead, wire and contact resistances as potential error sources. The internal constant current source inherently overcomes all series resistance (within compliance voltage limits) and delivers a precise constant current. ***Separate DC to DC isolation circuitry provides independent circuit voltage supplies for both polarities of the constant current source circuit***. The internal high-impedance Digital Voltmeter (DVM) senses the voltage drop across the test resistance (i.e. squib or detonator). There is negligible contact and lead resistance error created by the voltage measurement because the high input impedance of the DVM limits current flow in the voltage (V_{hi} and V_{low}) leads.

D-4. Connections

Connections are made to the front panel terminals using a 4-wire configuration as described in section D-3.

Next connect the 4 wire Kelvin (Option "300") Clip Test Leads into the AMPTEC 620 Igniter Tester . The AMPTEC 620 front panel input jacks are spaced to only allow horizontal access (i.e. **V** high and **I** high) if using dual banana jacks. All AMPTEC 620ES Kelvin leads have the 4 wire current high, current low as well as the voltage sense high and voltage sense low routed to the end of the leads. The 4 wire Kelvin wires then terminate in a pair of gold plated clip jaws (upper and lower jaws). One Kelvin Clip for current and voltage high, and another Kelvin Clip for current and voltage low.

For 620 series test leads other than those terminated with banana plugs, RG-58 Shielded Coax Cabling is recommended. Customer built test wiring should maintaining the four wire Kelvin measurement if possible. Make the current conductor the largest conductor and keep the voltage sense input shielded or inside the current shield. The AMPTEC 620 series Igniter Tester's five way input jacks allow for customized wire connections, extended kelvin wiring (beyond 100 feet depending upon conductor gauge), cables terminated with spade lugs, and special banana jacks can all be used with the AMPTEC 620 Tester.

All AMPTEC ohmmeters use a high impedance voltmeter as part of the resistance measurement process. This voltmeter is a highly accurate and stable 4½ digit analog-to-digital converter (A to D). The high impedance DVM must receive a voltage drop in order to display the proper value. When the DVM is not receiving a definite input signal, the output reading from the Analog to Digital Convertor can appear random and wandering. The display may indicate a randomly wandering number or it may indicate an overrange (flashing) condition. This unpredictable display (No input to the DVM) condition is not a malfunction, in fact, just a characteristic of the high impedance voltmeter circuit and *should not be mistaken for a fault in the instrument* - As this condition is simply a state of an “open circuit” or “nothing connected” to the DVM circuitry. A flashing display (on and off usually all zeros) indicates an over-range condition whenever the test lead terminals are open, or the resistance under test is a higher value than the range selected on the AMPTEC 620 tester. ***Connecting V_{HI} to I_{HI} and V_{lo} to I_{lo} eliminates the wandering (open circuit) display condition***.

By using a 4-wire Kelvin type lead set or by shorting the $\mathbf{V}_{HI}$ and $\mathbf{I}_{HI}$ terminals together and $\mathbf{V}_{low}$ and $\mathbf{I}_{low}$ terminals together the instrument is in the 2 wire resistance mode.

Resistance Offset in 2 Wire mode

All wiring including harness wires from the two wire test connection out, are "**in series**" with the test squib resistance and become part of the actual two wire measurement (***another potential source of measurement error if not compensated for***) . Many Ordnance test procedures have the 620 series Igniter Tester user short their wiring harnesses at the very end (by the squib) and record the resistance value or offset. Then when the 620 series Igniter Tester leads, including the in-series harness wiring resistance, is connected to the test squib, the squib test resistance can be calculated (via subtraction of the 2 wire harness - test lead resistance offset).

That is the 2 wire lead length shorted offset resistance (without the squib resistance) can be subtracted for the total resistance (including the squib resistance) to determine the actual squib (test) resistance.

Identifying a Test Connection problem

A precision 1.0 Ohm test resistor is also located in the optional Functional Test Box (FTB-620ES) available from AMPTEC. The 1.0 Ohm test resistor can be used for testing mid-scale performance of the 2.0 Ohm range. Performing a similar Functional Test with the 620ES meter across the 1.0 Ohm test resistor should get a reading close to 1.00 Ohm (i.e. 0.9995 Ohms is OK). If the 620 Series Igniter Tester appears OK after checking the test resistors in the Functional Test Section then the connection problem must be outside of the 620 series meter (i.e your wiring harness or the actual device under test connection.) If the 620 series meter doesn’t agree with the test resistors in the Functional Test Box, then the meter or it’s test leads are most likely broken. If this case, please contact your local AMPTEC RESEARCH Service Office, or call 1-800-350-5105 or (512) 447-7456 (International Overseas) or FAX (512) 447-7455, email service@amptec.com

The AMPTEC 620 display should indicate a stable reading when the test leads are securely attached to the device under test. If the display appears to be erroneous when connected to the resistance under test, recheck the test leads for integrity and cleanliness. If all external items appear to be functioning properly, the next step in problem isolation and diagnosis envolves general trouble-shooting principles. If a measurement problem appears on the 2.0 Ohm range of the meter, test for a zero offset problem first. Plug the 620 with Kelvin test leads into a 0.10 test resistor (i.e. AMPTEC # FTB-620ES). If the meter doesn't display a value close to 0.1 Ohms adjust the zero (see calibration procedure chapter). The zero adjustment trimpot only has enough span to zero out the 620 series test leads. The meter's zero adjustment pot wasn't designed to zero out a 100 feet of 2 wire harness.

D-5. Failsafe Operation

The AMPTEC 620 Series of Igniter Testers or failsafe ohmmeters incorporate a constant current source design that renders them incapable of delivering excessive voltage or current to the device under test. The typical fail-safe current for each range is indicated with most AMPTEC models under the corresponding range switch on the 620 series meter front panel. Please refer to section E-6 for a technical description of the failsafe circuitry specifics.

As a further precaution the 620 Series Igniter Tester is isolated from the AC line whenever the POWER switch is in the ON position.
The 620 series igniter tester receives its power from an internal rechargeable battery pack (4 "D" Cell Ni-Cad batteries). The 620 series igniter tester "main power" switch (see item 12 of the Front Panel Diagram) must be in the OFF/CHARGING position in order to charge the batteries. Of course, the battery charger must also be plugged into the unit's rear panel jack. . The "main power switch" must be switched "OFF" to charge the batteries. In the "OFF" position, the main power switch disables all ohmmeter measurement circuitry and connects the internal battery pack to the charging jack (Safety Feature).

Constant Current Circuit Operation

Assume that terminals $\mathbf{I}_{hi}$ and $\mathbf{I}_{lo}$ of Figure E-3 are shorted, and 0.5 volt is applied to $\mathbf{E}_{in}$ so that $\mathbf{I}_{hi}$ is positive. To equalize the 0.5 volt applied to **E**in , the inputs of IC202, IC201 must be driven to zero. This condition occurs only when the voltage drops across R212 and R222 are equal to the drops across R213 and R221. For these voltage drops to be equal, the output of IC202 must be at +1.0 volt. Since the output of IC201 must be zero, the drop across R213 is 0.5 volts, making the inverting input 0.5 volts. The drops across R212, R221 and R222 will also be 0.5 volts. Since the inputs to IC201 are essentially equal, its output is zero (offset by the few microvolts required to drive IC202 to +1.0 volt). Under these conditions the sum of the voltages across R212, R213 , R221 and R222 equals the sum of $\mathbf{E}_{in}$ plus the output of IC202.

Consider now that the short is removed from the $\mathbf{I}_{hi}$ and $\mathbf{I}_{lo}$ terminals and a 100-ohm resistor (R_L) is connected in its place. The current through R_L increases the voltage at the input to IC201. A balanced condition will be reached when the output of IC201 is equal to the non-inverting input of IC202. Again, this condition occurs when the voltage drops across R212 and R222 are equal to the voltage drops across R213 and R221. At this time the output of IC202 is 1.0 V. The voltage drop across the range resistor is 1.0 V, just as it was when the output terminals were shorted. The current through R_L is 10 mA, just as it was through the jumper when the output terminals were shorted.

The 620ES Explosive Safety Igniter Tester measurement circuitry is failsafe current limited, even under worst case component failure.

For the 620ES Explosive Safety Tester the normal or typical operating current level is less than 10 mA, and <15 mA on 20 Ohm range as a Failsafe Level **.**

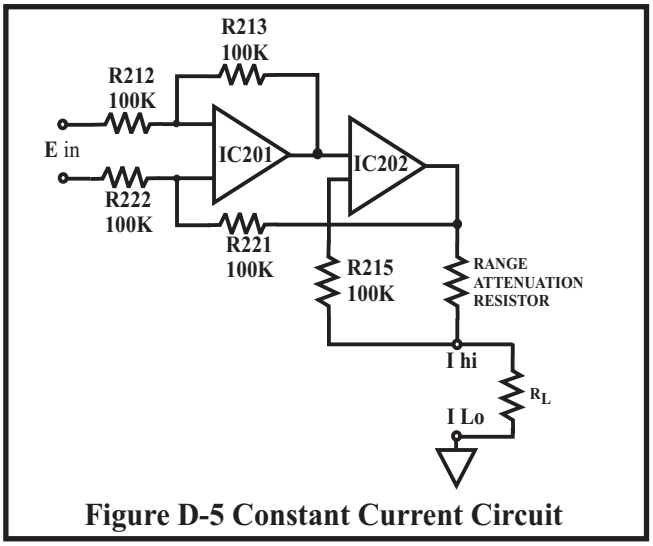
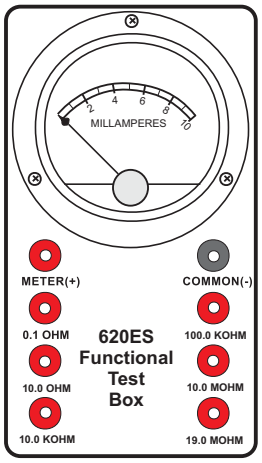


Figure D-5 Constant Current Circuit

A simple startup test procedure which also has the 620ES Explosive Safety Tester user perform a functional check using (optional FTB-620ES) with AMPTEC milliammeter would also detect any current level even getting close to the Failsafe level.



Functional Test Section - The optional 620ES Functional Test Box provides added measurement integrity using a milliammeter and test resistors to cross check the overall 620ES operation whenever desired. The test resistors are for cross checking 620ES basic operation and should not be used for calibration purposes.
Simpsontm **DC Milliammeter Range** - 0-10 mA fullscale, **Accuracy** ±3%
FTSR1 **01-23572** 0.1W 1.0 % Wirewound Resistor, **T**c- 25ppm/°C
FTSR2 **01-23575** 10.0W < 0.1% WirewoundResistor, **T**c- 10ppm/°C
FTSR3 **01-23577** 10.0 KW <0.1% Wirewound Resistor, **T**c- 10ppm/°C
FTSR4 **01-23583** 100 KW <0.1% Wirewound Resistor,**T**c- 10ppm/°C
FTSR5 **01-23587** 10.0 MW <1.0% Wirewound Resistor, **T**c- 20ppm/°C
FTSR6 **01-23589** 19.0 MW <1.0% Wirewound Resistor, **T**c- 50ppm/°C

Reference to the AMPTEC 620ES Igniter Tester schematic will show that the output of IC202-6 is actually applied to the base of transistor Q202, ***which acts as a current limiter***. ***The worst-case component failure that could occur in this circuit would be a Q202 short***, which would effectively connect the -5 volt supply directly across R218, D202, the range resistor and R_L.

D203, however, acts as a 1.6 volt zener diode, limiting the voltage that can appear across the current output terminals. Even if every component in the amplifier circuit shorted, the current through the igniter could not exceed safe limits, because the -5 volt and +5V supplies includes inherent current limiting. Because of the design of both supply isolation transformers T101 and T102, the ±5 volt supplies can only deliver 20 to 25 milliamperes before the DC/DC converter disengages, dropping the -5 volt output to zero.

620ES Failsafe Current Calculation - *Worst Case Component Failure*

Voltage limiting diode, D203, provides a 1.6 volts maximum across R227 (100W) and R223 (100W), which are 200 Ohms across the Igniter Testers output terminals.

(I*max*) *Current Maximum Calculation*

1.6V/110 ohms = 0.014 Amperes (15mA) max

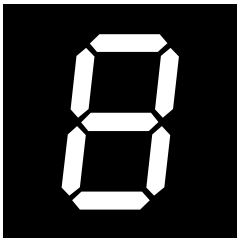
Please refer to Section E for a more detailed explanation of the failsafe current source.

D-6. Battery Monitoring Circuitry

The 620 series igniter tester display has a ± polarity display indicator preceding the unit's regular 4 ½ digit numeric display. The negative polarity display LED is used as a Low Battery indicator. If the low battery LED is illuminated, 620 Series Igniter Tester readings should not be trusted. An overnight recharge should be performed before using the 620 series igniter tester for critical testing. The batteries are fully charged prior to shipment, it may be desirable to refresh the charge for 24 hours before use. ***As a rule of thumb, the 620ES requires twice as much time to fully recharge as the amount of discharge time.***

Notice for Cal Lab: The variable trimpot RV3 is factory adjusted to have the *low battery indicator* come on at 4.50 VDC. To make this adjustment refer to the **Maintenance Section F** of this manual.

CHAPTER E GENERAL OPERATION AND DESIGN



E-1. General

The AMPTEC RESEARCH 620ES Explosive Safety Igniter Tester is shown in the block diagram (Figure E-1). All diagrams and information disclosed in this chapter is proprietary and is included in order to make troubleshooting to component level possible.

The AMPTEC 620 Series Igniter Tester uses modern solid-state semiconductors exclusively and digital CMOS circuits extensively to minimize power requirements and make battery operation useful and practical. AMPTEC also maintains a spare parts inventory of all components found in the 620ES Tester and it's customer service department can also provide additional assistance in the trouble shooting process.

E-2. Troubleshooting

Since the 620ES Tester is used to test potential deadly explosive force detonators and warheads of missiles etc., ***personnel that are not qualified to make such electrical repairs on the 620ES Tester should not even attempt to remove the calibration access screws or open the main panel or effect any repair whatsoever***.

Apparent 620ES Tester malfunctions can sometimes be the result of bad test lead/connection wiring, wrong connections, misinterpretation of specifications, low battery levels, and in rare cases due to an incomplete understanding of the instrument and how to use it. A thorough review of the operating instructions for this instrument is recommended prior to any component replacement. Check to be sure that cables and other test equipment are in good working order before attempting to troubleshoot the 620ES series igniter tester .

If you turn on the AMPTEC 620ES Explosive Safety Igniter Tester *and the* ***display does not come on***, ***it usually means the batteries are dead and need charging***, or fuse needs replacing.

If the 620ES exhibits problems that cannot be eliminated by reviewing Chapters B and D, the following guidelines have been established to help solve the problem.

E-2-1. Localizing the Problem

Chapter D-2 discusses how to use the ***Functional Test Box (FTB-620ES) with the*** 620ES Tester to help localize the problem. The key to successful troubleshooting is to localize the problem to a general electronic parameter as much as possible before trying to pin the problem down to a specific component. Certain questions should be asked such as "Does the problem occur on all ranges or on a specific range only?". If the 620ES Tester does not come on when powered up, did you check the rear panel fuse. The power supplies for both the current source and the digital voltmeter electronics are also one of the first things that should be tested. As it is not possible to anticipate all failure modes of the 620ES Explosive Safety Igniter Tester, servicing personnel should become familiar with this section to gain a complete understanding of the internal workings of the ohmmeter.

E-2-2. Component Replacement

If the malfunction is a faulty component, the accuracy of the 620 Series Igniter Tester can be maintained only if it is re-calibrated after a component replacement and the following precautions are taken:

Use only the specified component or its exact equivalent. Spare parts can be ordered from your nearest AMPTEC RESEARCH Service Center or directly from the factory by referring to the AMPTEC Stock Number listed in the Parts Lists section at the back of this manual.

The highest quality 63/37 grade rosin core electronic grade solder with a 50W or lower maximum power soldering iron should be used. Never use an acid core solder as corrosion of components leads and PCB etch loss can occur.

When soldering, heat the PCB pad and the lead of the component, not the solder. After several seconds of the component lead in contact with the hot soldering iron apply solder smoothly and evenly onto the PCB pad and component lead not the soldering iron. Do not touch or move the replacement part until the solder has cooled. Cold solder and bad solder joints can cause more problems.

Use the chassis ground (connect to the common terminal of the functional test section) connection - i.e. connect to an earth ground to avoid a static discharge to a static sensitive component. Handle all 620ES internal components as if they are static sensitive if you are not sure.

See Next Page for Start of 620 Circuit Descriptions and Functional Diagrams

E-3. Circuit Descriptions

The circuit descriptions which follow are referenced to Figures E-1, E-2, E-3 and the schematic diagrams at the back of this manual. In the following descriptions, references to integrated circuits are given in the form "IC201-1", which refers to Integrated Circuit 201, pin 1.

E-4. Analog to Digital Conversion

The A to D conversion is done with a ICL8068 /ICL71C03 chip set. The ICL8068 takes care of the analog part and the ICL71C03 takes care of the digital part of the 4 ½ digit 20,000 count dual slope conversion.

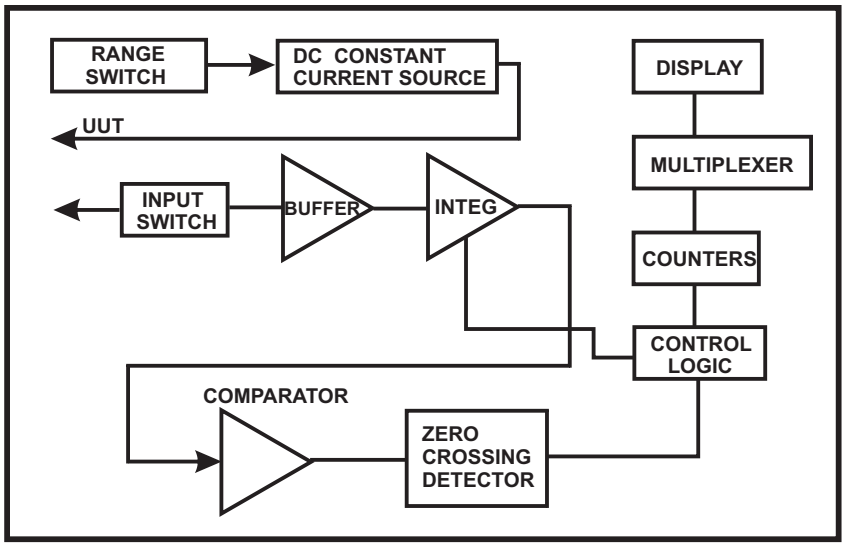


Figure E1 - **AMPTEC 620ES FUNCTIONAL BLOCK DIAGRAM**

COUNTS			
	PHASE I	PHASE II	PHASE III
4 ½ DIGIT	10.001	10.000	20.001

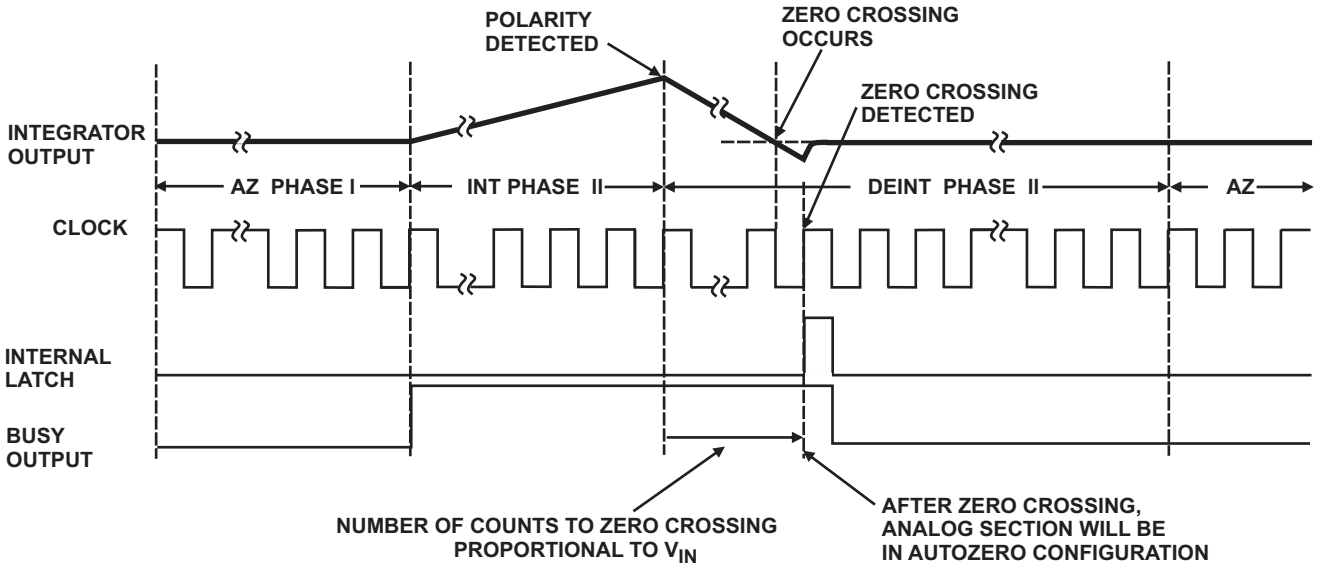


Figure E1B - **620 Conversion Timing Diagram**

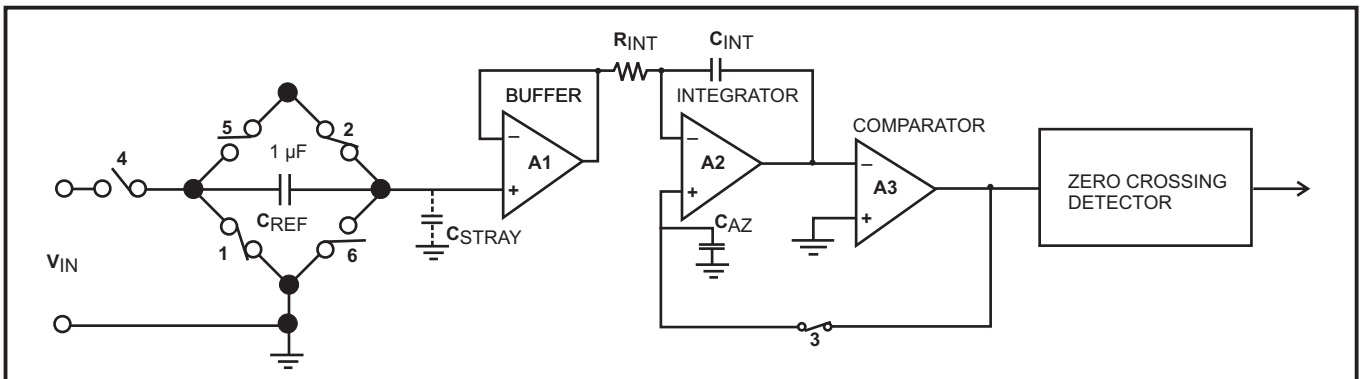


FIGURE E-2A. PHASE I AUTO-ZERO

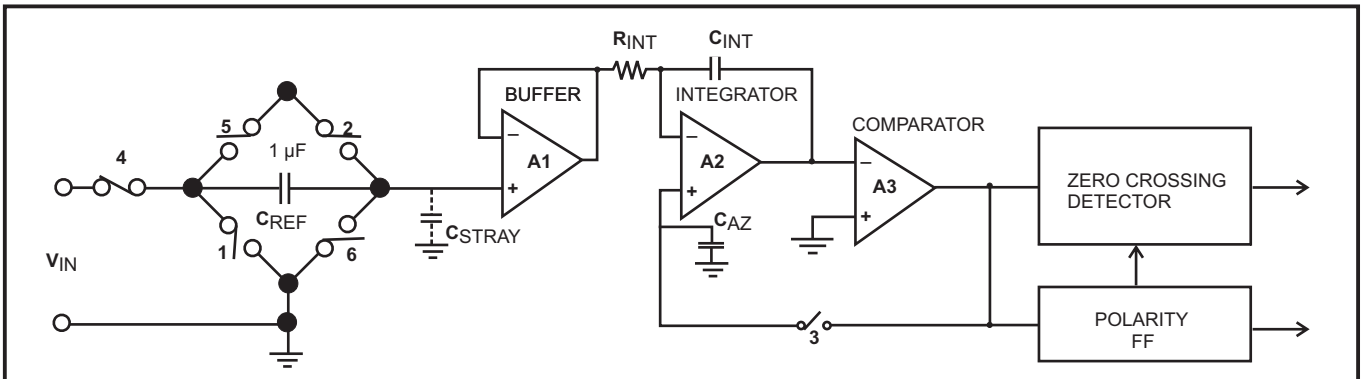


FIGURE E-2B. PHASE II INTEGRATE INPUT

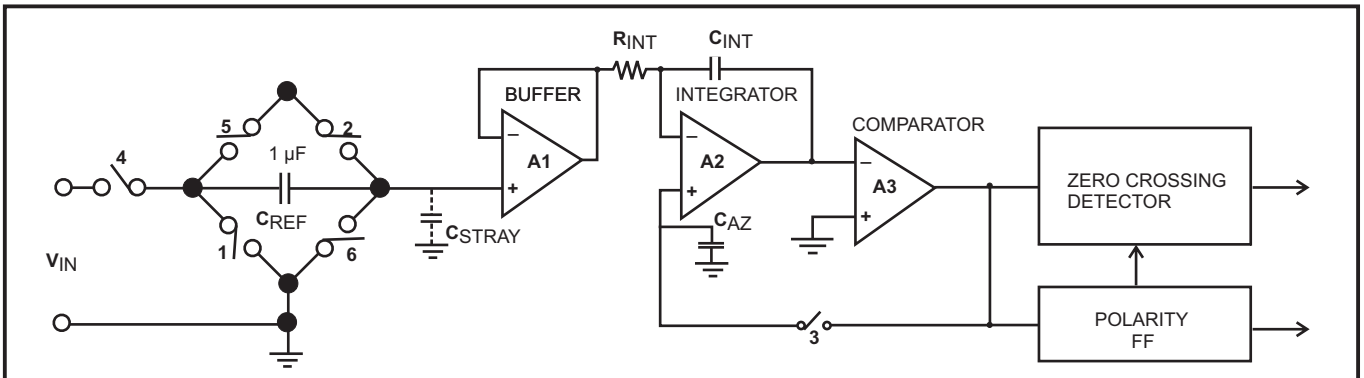


FIGURE E-2C. PHASE III AND DE-INTEGRATE

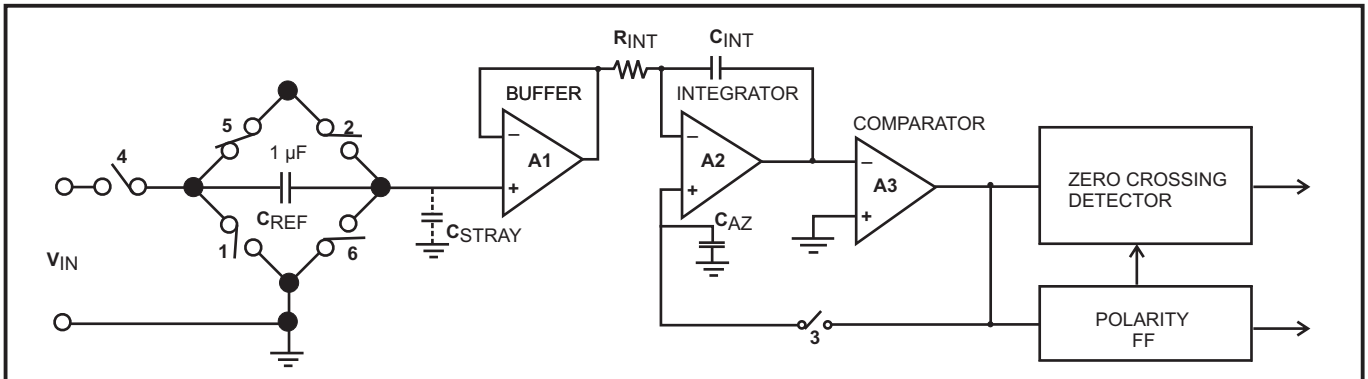


FIGURE E-2D. PHASE III AND DE-INTEGRATE

Figures E2. Main Analog Section of DVM Circuit - IC1 and IC2

Detailed Description

Analog Section

Figures E2 diagrams A thru D shows the equivalent circuit of the analog section in 3 different phases of operation. The system will perform conversions at a rate determined by the clock frequency 40,002 clock periods per cycle. (see Figure E1B shown earlier in this chapter for details of conversion timing).

Auto-Zero Phase I (Figure E2A)

During the Auto-Zero, the input of the buffer is connected to V REF through switch 2, and switch 3 closes a loop around the integrator and comparator, the purpose of which is to charge the Auto-Zero capacitor until the integrator output dose not change with time. Also, switches 1 and 2 recharge the reference capacitor to V REF.

Input Integrate Phase II (Figure E2B)

During Input Integrate the Auto-Zero loop is opened and the Analog Input is connected to the Buffer Input through switch 4 and C REF if the input signal is zero, the buffer, integrator and comparator will see the same voltage that existed in the previous state (Auto-Zero). Thus, the integrator output will not change but will remain stationary during the entire input integrate cycle. If V_{IN} is not equal to zero, and an umbalanced condition exists compared to the Auto-Zero Phase, the integrator will generate a ramp whose slope is proportional to V_{IN}.

Deintegrate Phase II (Figures E2C and Figures E2D)

During the Deintegrate phase, switch 5 is closed and a voltage which is V REF more positive than during Auto-Zero is impressed on the BUFFER INPUT. Thus the referance capacitor stores the equivalent voltage. This returns the output of the integrator to the zero crossing point established in Phase I. The time, or number of counts, required to do this is proportional to the input voltage.

E-4-1. Reference Voltage

The precision reference voltage required to do the A/D conversion is developed by IC201. The zener voltage is attenuated to approximately -0.5V . This voltage is applied to IC2-7 .

E-4-2. LED Display

The output format from IC2 is in Binary Coded Decimal (BCD) format. Each digit is scanned for 10 clock pulses. The scan sequence is D5 D4 D3 D2 D1. This drives Q1 thru Q5, which in turn drivers the seven segment displays. The BCD data is converted to seven segment format by IC4. When the 620ES electronics are in open circuit or over-range mode the display flashes "0000". IC5 is a 1 MHz oscillator which is divided by 10 by IC6. The 100 KHz clock output then goes to IC2.

E-5. Ohms-To-DC Converter

The ohms-to-DC converter generates a constant current which is passed through the device under test to develop the voltage measured by the A/D converter.

E-5-1. Constant Current Source

The constant current source is composed of IC201, IC202, Q202, D203 and their associated components. The input to the constant current source is approximately +1.05 volts, developed at IC201-7 and connected to IC201-13 through R209 and R210. The heart of the constant current source is the voltage-to-current converter. A simplified schematic of this circuit is shown in Figure E-4 and described in Section E-5-2. The amplifier of IC201-12 is an invertor, and its output is applied to IC201-9. The amplifier of IC201-8 has unity gain due to the feedback through R213 . Its output is applied to the inverting input of IC202-3. The output of IC202-6 provides feedback to the non-inverting input of IC201-10. This circuit operates to maintain the inverting input at IC202-3 and the non-inverting input at IC202-2 at the same potential.

E-5-2 Constant Current Circuit Operation

Assume that terminals I_{hi} and I_{lo} of Figure E-3 are shorted, and 1.0 volt is applied to $\mathbf{E}_{in}$ so that $\mathbf{I}_{hi}$ is positive. To equalize the 1.0 volt applied to $\mathbf{E}_{in}$, the inputs of IC202, IC201 must be driven to zero. This condition occurs only when the voltage drops across R212 and R222 are equal to the drops across R213 and R221. For these voltage drops to be equal, the output of IC202 must be at +1.0 volt. Since the output of IC201-8 must be zero, the drop across R213 is 0.5 volts, making the inverting input 0.5 volts. The drops across R212, R221 and R222 will also be 0.5 volts. Since the inputs to IC201 are essentially equal, its output is zero (offset by the few microvolts required to drive IC202 to +1.0 volt). Under these conditions the sum of the voltages across R212, R213 , R221 and R222 equals the sum of $\mathbf{E}_{in}$ plus the output of IC202.

Consider now that the short is removed from the $\mathbf{I}_{hi}$ and $\mathbf{I}_{lo}$ terminals and a 100-ohm resistor (R_L) is connected in its place. The current through R_L increases the voltage at the input to IC201. A balanced condition will be reached when the output of IC201 is equal to the non-inverting input of IC202. Again, this condition occurs when the voltage drops across R212 and R222 are equal to the voltage drops across R213 and R221. At this time the output of IC202 is 1.0 volts. The voltage drop across the range resistor is 1.0 volt, just as it was when the output terminals were shorted. The current through R_L is 5 milliamperes, just as it was through the jumper when the output terminals were shorted.

E-6. Failsafe Design

Reference to the AMPTEC 620ESTester Igniter Tester schematic will show that the output of IC202-6 is actually applied to the base of transistor Q202, ***which acts as a current limiter***. ***The worst-case component failure that could occur in this circuit would be a Q202 short***, which would effectively connect the -5 volt supply directly across R218, D202, the range resistor and R_L.

D203, however, acts as a 1.6 volt zener diode, limiting the voltage that can appear across these components. Even if every component in the amplifier circuit shorted, the current through the igniter could not exceed safe limits, because the -5 volt and +5V supplies includes inherent current limiting. Because of the design of both supply isolation transformers T101 and T102, the ±5 volt supplies can only deliver 20 to 25 milliamperes before the DC/DC converter disengages, dropping the -5 volt output to zero. See Section D.

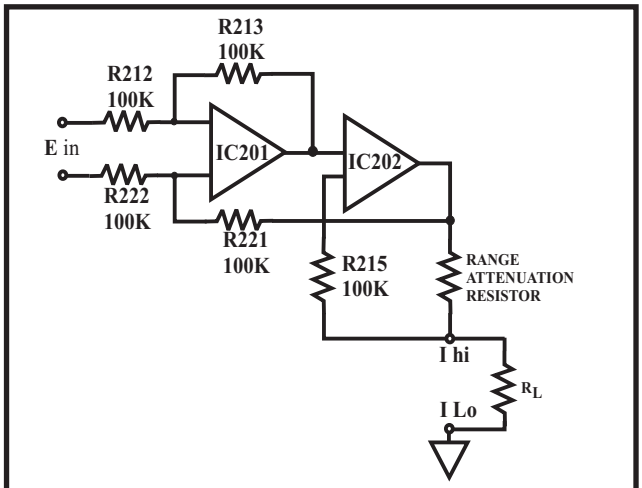


Figure E-3 Constant Current Circuit

620ES Failsafe Current Calculation - Worst case Component Failure

Voltage limiting diode, D203, provides a 1.6 volts maximum across R227 (10W) and R223 (100W), which are 110 Ohms across the Igniter Testers output terminals.

(I*max*) *Current Maximum Calculation*

1.6V/110 ohms = 0.014 Amperes
(15mA) max

The AMPTEC 620ES Tester is powered by a rechargeable internal battery pack and cannot be operated directly from the battery charging adapter. This is to ***eliminate the possibility*** of an electrical short to/from the AC line. ***Only when*** the 620 POWER switch is in the "***OFF/ CHARGING***" position are the batteries connected to rear panel charging jack. ***When the POWER switch is in the ON position***, the batteries are disconnected from the battery charger and connected to the internal circuits of the AMPTEC 620 Igniter Tester.

The 620ES Tester measurement circuitry is also failsafe current limited, even under worst case component failure. **A simple startup test procedure which also has the 620ES Tester user perform a functional check using the optional "FTB-620ES" Functional test box with milliammeter would also detect any current level even getting close to the Failsafe level.**

For the 620ES Tester the normal or typical operating current level is less than 10 mA, and <15mA on as a Failsafe Level **.**

E-7 . Ultra-Safe Power Supply Scheme

The +5 volt power supply is provided directly by the batteries (for driving the LED displays and digital logic). The ±5VD is used for driving IC8, the low battery detection circuit. The ±15V power supply is generated by IC7 for the digital voltmeter (DVM) chip set (IC1 and IC2).

The ±5 VA is developed by one DC to DC convertor circuitry: composed of Q103,Q104, T102, D103, D104, IC102 for the negative polarity. The other DC/DC convertor is composed is composed of Q101, Q102, T101, D101, D102 and IC101 for the positive polarity.

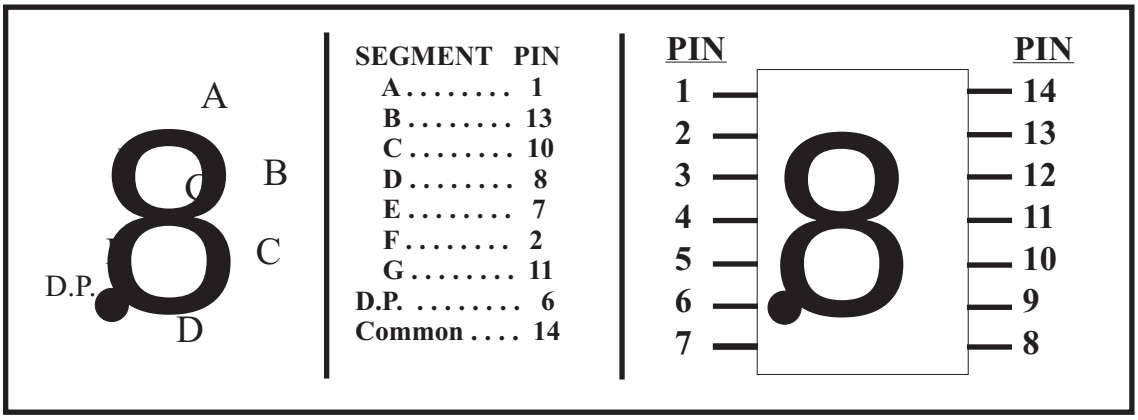
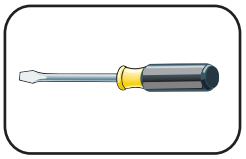


Figure E4 **- 620 series LED Display Pin Out Detail/Functions**

CHAPTER F CALIBRATION AND MAINTENANCE



F-1. General

This section of the manual contains routine maintenance information regarding the AMPTEC RESEARCH 620ES Igniter tester. Calibration should be performed on a regular basis to ensure continued instrument accuracy or following a main PCB electronic component repair/replacement. The recommended calibration interval is 1 year.

The AMPTEC 620ES igniter tester is a four wire Kelvin ohmmeter. ***The AMPTEC 620ES Igniter Tester must be calibrated using four wire Kelvin connections to the resistance standard*** in order to eliminate lead resistance and contact resistance errors. The Option "300" is Gold Plated 4 Wire Kelvin (or equivalent) Clip Test Lead Set that should be used to calibrate the AMPTEC 620ES Igniter Tester. The 4-wire configuration is maintained up to the point of the connection to the resistance standard.

F-2. Required Test Equipment

Following standard resistors are required to calibrate the 620ES Igniter Tester .

Precision Resistors:

0.001 ohm ± 0.01% Accuracy
0.1 ohm ± 0.01% Accuracy
1.0 ohms ± 0.005% Accuracy
10 ohms ± 0.005% Accuracy
100 ohms ± 0.005% Accuracy
100 KiloOhm ± 0.005% Accuracy

Test Leads:

4-wire Kelvin Test Lead set or
(AMPTEC Option "300")

F-3. Calibration Procedure

The AMPTEC 620ES should be calibrated with fully charged batteries **(NICAD)** and should be allowed to **warm-up** for a minimum of 15 **minutes** before beginning the calibration procedure. The calibration adjustments are accessed by removing the screws in the feet of the unit, then lifting off the lid to access the main PCB trimpots. The locations of the adjustments are shown on drawing number 620-600 at the back of this manual.

F-3-1. Zero Offset Adjustment (20 ohm and higher ranges)

1. Select the 20 ohm range. Connect the Kelvin leads to the 0.1 ohm standard resistor.

2. Adjust potentiometer RV2 for a display indication of 00.10 Ohms . ***Do not over adjust RV2 past a 0.00 reading***. A false or negative polarity 0.010 display reading offset error can be created. This calibration error has the display appearing normal (even though a negative 0.010 offset has been created) - the display doesn't indicate a negative sign).

F-3-2. Full Scale Adjustment (20 ohm and higher ranges)

1. Select the 200 ohm range. Connect the Kelvin leads to the 100 ohm standard resistor.
2. Adjust RV1 for a display reading of 100.00.

F-3-3 2.0 ohm range Zero adjustment

1. Select the 2 ohm range. Connect the 4 wire Kelvin leads to the 0.001 ohm standard resistor.

2. Adjust potentiometer RV5 for a display indication of 0.0010 Ohms . ***Do not over adjust RV5 past a 0.00 reading***. A false or negative polarity 0.0010 display reading offset error can be created. This calibration error (*mis-adjusted beyond zero*) has the display appearing normal (even though a negative 0.0010 offset has been created) - the display doesn't indicate a negative sign)

F-3-4. 2 ohm range Full Scale Adjustment

1. Select the 2 ohm range. Connect the Kelvin

leads to the 1.00 ohm standard resistor.
2. Adjust **RV6** for a display reading of 1.0000 Ohms.

3. Check the 200 KOhm range with the 100 Kohm Standard Resistor. All ranges must be within the specifications outlined in Chapter B. *There are no adjustments necessary for the 200 KOhm and 200 Kohm ranges.* Contact AMPTEC's customer service department if further technical support is necessary.

F-4. Battery Replacement Instructions

The rechargeable NICAD batteries (D cell 5.0 AHr each) used in the 620 series Igniter Tester are durable and should provide years of trouble-free operation. Some military maintenance procedures may require replacement of the 620ES NICAD batteries as part of the overall annual calibration plan, even if the batteries are working well every other year. As with all batteries, replacement will eventually be necessary.

Replacement batteries may be ordered from AMPTEC RESEARCH as stock #620-BAT which is a quantity of 1 complete set of 4 ea "D" cell Heavy Duty NICAD Batteries). The battery replacement process is :

1) Remove the 4 screws located in the feet of the unit. ***Carefully*** lift off the lid from the siderail grooves. Unscrew the perimeter screws that hold the main PCB in place, taking note of the PCB spacers which will have to be returned when completed. remove the old batteries. and replace with new batteries **Observe polarity!** in the same fashion.
Re-secure the main PCB with the spacers underneath as it was found. Return the lid in place into the front panel grooves and siderail grooves. Re-secure the lid screw in the feet.

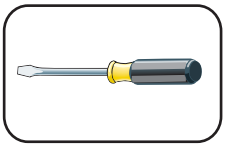
4) Secure the new batteries in place by re-connecting the battery retaining plate.
5) Replace the 620ES Igniter Tester front panel top plate and re-tighten the calibration access screws, taking care not to pinch any wiring.

Low Battery Indicator:

The variable potentiometer - trimpot RV3 is factory adjusted to have the low battery indicator come on at 4.50 VDC. To make this adjustment, **remove the fuse** from the fuseholder located **on the rear panel of the 620ES**. Remove the lid of the 620ES SAfety Igntier Tester(screws that secure the lid are located are in the feet of the unit).

With an adjustable DC power supply, set the power supply output to be 4.60 VDC. Observe power supply polarity. Connect the power supply to the wiring labeled "**MAIN**" + pos. and - neg. located in the rear section of the MAIN PCB. (i.e positive + power supply output to the anode side). Adjust trimpot RV3 to have the low battery indicator just come on (negative sign on display) with 4.60 VDC applied from the power supply. An increase in power supply voltage to 4.62 VDC should have the low battery indicator go out. The low battery indicator adjustment should now be complete.

Disconnect the power supply, and return the fuse to the fuse holder. Replace the lid, re-secure the screws through the feet of the AMPTEC 620ES Safety Igniter Tester.



620ES with OP-232

OP-232 is an optically isolated serial interface that allows the 620 series Igniter Tester to provide the resistance readings, overrange, and low battery status to be communicated via the RS232C interface to a PC (i.e. COM1 port). Range commands changes (i.e. from 20 ohm to 200 ohm) may be set via RS232C isolated interface to control which range is selected by the 620 series Safety Tester.

RS232C Command Set:

Note commands are case sensitive (send all CAPITAL CASE keys only from you PC keyboard) .

C Continuous Read Mode - RS232C I/O outputs a data string every A to D conversion cycle, approx. 2.5 times per second.

S Single Read Mode - RS232C I/O outputs a single data string upon reception of a "R" command.

R Read - Commands RS232C I/O to output a single data string (1 resistance reading).

r1 Selects the 2 Ohm Range

r2 Selects the 20 Ohm Range

r3 Selects the 200 Ohm Range

r4 Selects the 200K Ohm Range

V Version commands board to output the firmware version string.

Data Format - The RS232C I/O outputs a data string with the following format:

1.2345E+3 The measurement is always in Ohms (where E+3 = 10+3scientific notation style) . The Exponent is defined below. 1.2345E+3 = 1.2345KOhms (where E+3=10). 1.3700E+1 = 13.700Ohms (where E+1=10)

Range	**Exponent**
2.0 Ohm	E+0
20.0 Ohm	E+1
200.0 Ohm	E+2
2.0K Ohm	E+3
20K Ohm	E+4
200K Ohm	E+5

An overrange condition is indicated by 9.9999Enn where nn is the selected resistance range exponent. A Range Error is indicated by x.xxxxERR.