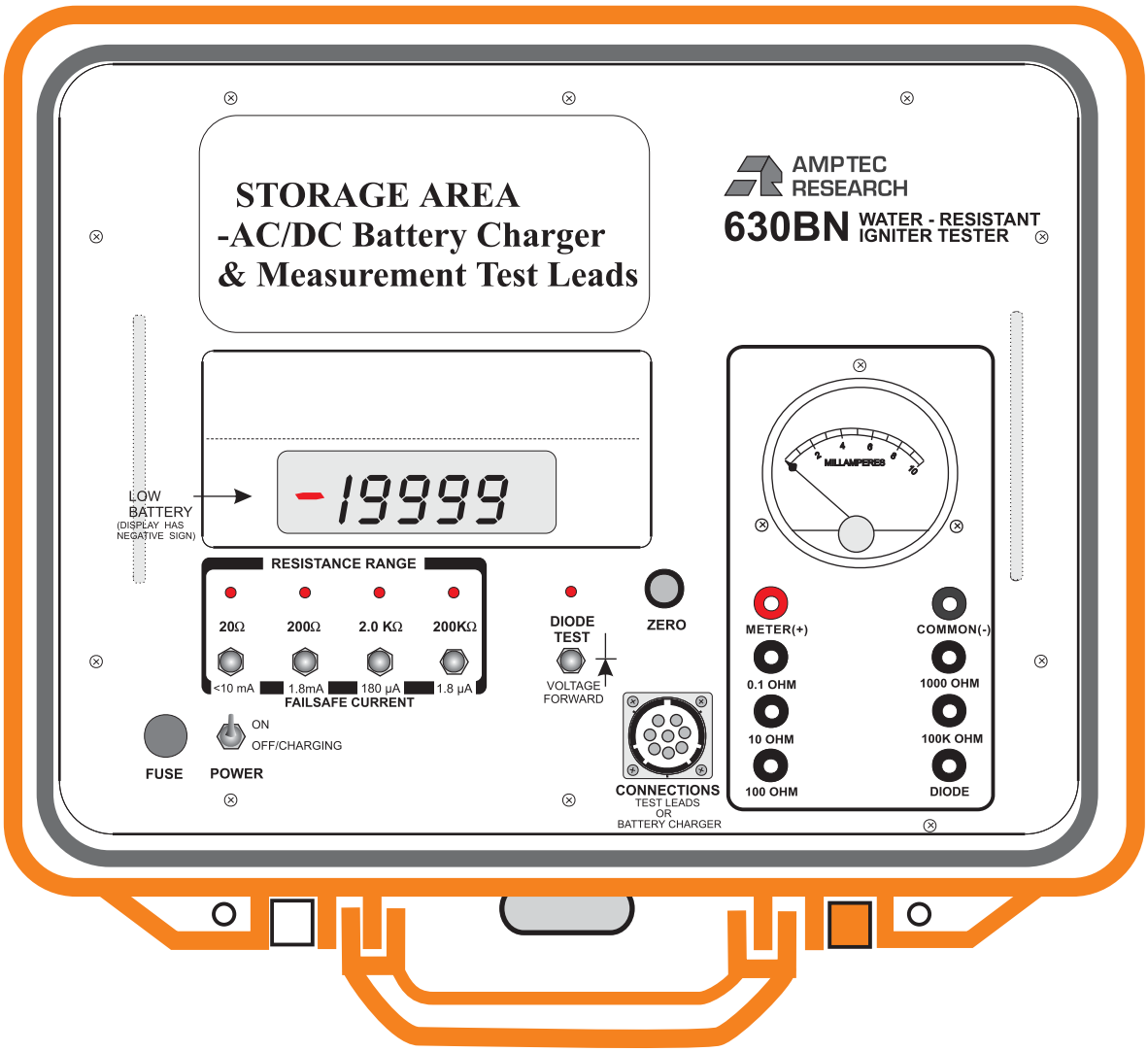
AMPTEC RESEARCH



MODEL 630BN
WATER-RESISTANT IGNITER TESTER

OPERATION/MAINTENANCE MANUAL

OFFICE 512-858-4045; FAX 512-858-4340; TOLL FREE IN USA 800-350-5105
website http://www.amptec.com

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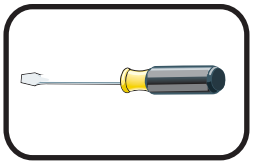
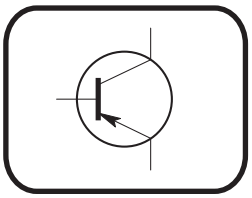
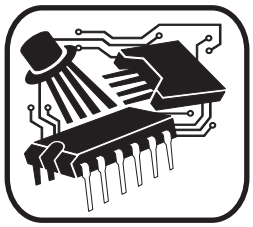
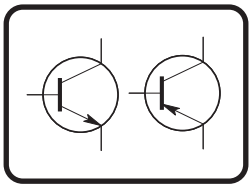








SECTION A - RECEIVING AND INITIAL INSPECTION

A-1. Introduction to the AMPTEC 640N

The AMPTEC 620A and now the 630 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 (630AN and other versions pending). Some of the devices the 630BN Failsafe Ohmmeter may be used on include: fuses, squibs, igniters, explosive bolts, rocket motor squibs, automobile air-bag initiators and many others.

The AMPTEC 630BN 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. An On board DC Milliammeter also lets the user verify actual 630BN current output levels, prior to connection to a squib or detonator.

The 620A and the newer 630 series represent the latest in ultra-safe Igniter Tester measurements. The 630BN uses the same main printed circuit board (PCB) as the AMPTEC 620A Igniter Tester. The 630BN has been made water-resistant and 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 new 630BNs and 630AN conversions.

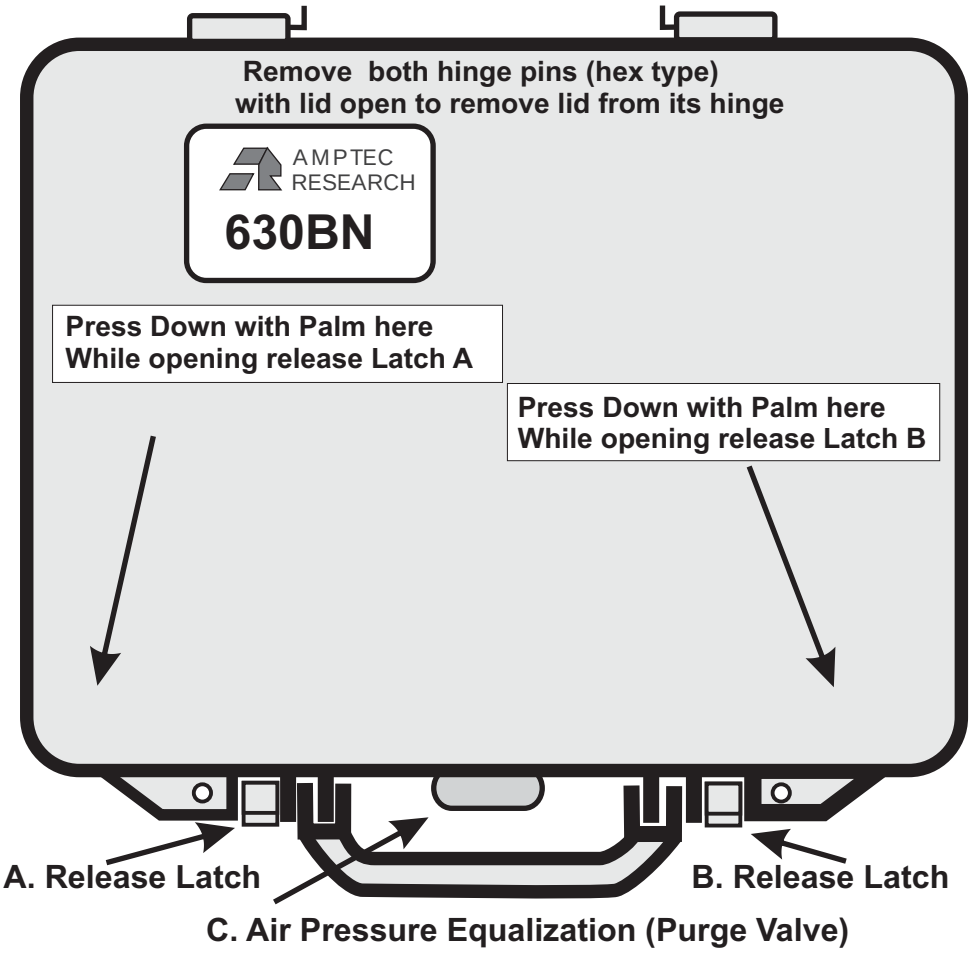
Should the rechargeable batteries reach a low charge level a negative sign will apear on the display. The 630BN has a **battery monitoring** circuit that indicates it is time to plug in the battery charger.

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 630BN 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. You may refer to the ***Functional Test section of Section D of this manual to help identify the problem*** (i.e Test leads etc.) The 630BN has a set of test resistors built-in the Functional Test Section that can quickly help the user figure out where the problem is most of the time. 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 630BN, 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. Opening the 630BN Igniter Tester and removal of the Lid

When closed, the 630BN Ohmmeter has two large O-rings that provide a very water resistant and on occasion even an air tight seal. By pressing down with your palm as diagramed above you compress the O-ring in the lid of the 630BN. This makes it easier to flip up the release latch. Repeat the palm press step on the other corner of the 630BN while flipping up the release latch. At this point the 630BN lid will normally be able to be raised, and placed in an open lid state.

If the 630BN doesn't open after flipping up the release latches, a change in atmospheric pressure since the unit was last closed may be the culprit. ***Turn the Air Pressure Equalization or "Purge Valve" counter-clockwise.*** Once air-pressure is equalized, the 630BN can be opened. If the Purge Valve was opened, return the valve to the closed state (tighten = clockwise) once the 630BN lid is open.

The ***630BN has a way to remove it's lid completely***, for example when used in an indoor laboratory environment. With the 630BN open, remove the units two hinge pins (hex type) by twisting them. The lid should come free at the hinge. Once the lid is removed replace the hinge pins in the hole they were pulled out of.

A-4. AC/DC Battery Charger - Power Requirements

The AMPTEC 630BN is powered by an internal rechargeable heavy-duty nickel-cadmium battery pack (4 ea D cell - 5.7 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 adapter provides 9VDC @ 1.1amperes. The AC Adapter Battery Charger is configured with a notched connector that plugs into the "mating" notched "J1" connector on the 630BN front panel.

For safety reasons, the battery charger's notched connector blocks access to the test lead connections that are also part of the 630BN notched connector. The main "J1" 630BN connector is a single access or one use at a time Safety Protection Device. ***In this way the 630BN user can not ever connect any test leads while the unit is charging***. The 630BN test leads have to use the same J1 notched connector. The 630BN is designed so it is impossible to be powered (in operating - measurement mode) directly from the AC line adapter. As an additional note, the 630BN main power switch ***must also be*** in the "***Off/Charging***" ***mode*** in order for the connected battery charger to recharge the 630BN'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 630BN Failsafe Ohmmeter shipment for an additional fee.

A fully charged battery pack typically powers the 630BN for approximately 8 hours before requiring a recharge. AMPTEC installs a quality set of 4 each Heavy Duty (5700 mAHr) Ni-Cad batteries. The 630BN 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 630BN to a "Fully Charged" ready to use state.

The "Power" switch has two separate modes. The "ON" position supplies internal battery isolated power to operate the 630BN when they are charged. If you turn on the 630BN, 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 630BN is not in use. As mentioned earlier of course the AC/DC Battery Charger must be plugged into the 630BN's notched connector to facilitate charging the batteries.

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 630BN 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 630, contact the AMPTEC customer service department and request an option "630DC" Battery Charger.

When the 630BN 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 630BN is first turned on then goes out, the battery levels are starting to indicate the charge level is low.

A-5. Setup and Use

The AMPTEC 630BN Igniter Tester may be setup to operate without the unit's lid intact. By removing the hinge pins the lid may be removed (i.e. for indoor lab bench use). Typically a test procedure will have the 630BN user test the 630BN with the units "Functional Test Section" to determine it is functioning properly and ready for use.

Once the AMPTEC 630BN has had it's batteries charged for 12 to 24 hours it is ready for use. The 630BN 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 630BN to extremes of temperature which will affect accuracy and shorten battery life-span.

CHAPTER B - 630BN IGNITER TESTER SPECIFICATIONS

630BN RESISTANCE RANGE/DISPLAY RESOLUTION TABLE

20Ω /1mΩ	200Ω /10mΩ	2000Ω /0.1Ω	200KΩ /10Ω
5mA/<10mA	0.5mA/1.8mA	50µA/180µA	0.5µA/1.8 µA

Diode Test (Voltage Forward) Test Current levels - 0.5mA/<25ma Fail-Safe
Actual fail-safe currents vary with each instrument and may be ±20% from the typical value.

Table B-2. Specifications

Accuracy: (for 1 year @25°C ± 10°C)
20Ω through 2000Ω ranges . . . . . ±0.02% of reading ±0.02% of range
200KΩ range . . . . . ±0.05% of reading ±0.05% of range

Temperature Range
Operating 0°C to 50°C
Storage -10°C to 70°C

Temperature Coefficient
20Ω through 20KΩ ranges ±0.002% per °C (from 0°C-15°C and 35°C-50°C)
200KΩ range and above not applicable

Instrument Display . . (20,000 count) 4½ digit Super Bright Light Emitting Diodes (LED)

Over-Range Indication . . . . . (select next higher range) 630BN Display flashes

Measurement Update Rate . . . . . Approximately 300ms

Voltage Protection - Maximum Input . . . . 250VDC or AC_{peak} without damage

Open Circuit Current Source Compliance Voltage . . . . . clamped at ~1.6 volts

Power . . . . (4 "D" 5.7AHr Heavy Duty) 1.2V rechargeable nickel-cadmium batteries

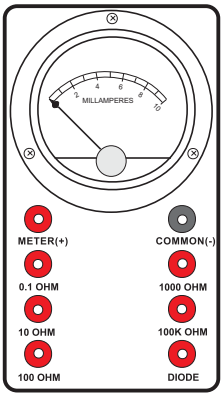
AC/DC Battery Charger (Option 630DC) provides 9VDC at 1.1A nominal

Dimensions . . . . . 13.5" (34.3cm) W x 12" (30.5cm) D x 6"(15.2cm) H

Water Resistance . . . . . To a 3 foot depth underwater - case closed with purge valve shut

Weight . . . . . 12 lbs net; 15 lbs shipping

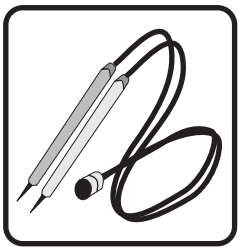
Functional Test Section - The 630BN Functional Test Section provides added measurement integrity using a milliammeter and test resistors to cross check the overall 630BN operation whenever desired. The test resistors are for cross checking 630BN basic operation and should not be used for calibration purposes.



Simpsontm **DC Milliammeter Range** - 0-10 mA fullscale, **Accuracy** ±3%

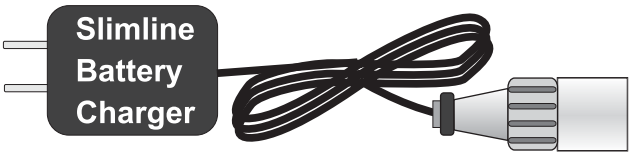
FTSR1	**01-23572**	0.1ohm	1.0 % Resistor, **T**c-50ppm/°C 1/4W
FTSR2	**01-23574**	10.0 ohm	1.0% Resistor, **T**c- 50ppm/°C 1/4W
FTSR3	**01-23576**	100.0 ohm	1.0% Resistor, **T**c- 50ppm/°C 1/4W
FTSR4	**01-23578**	1000 ohm	1.0% Resistor, **T**c- 50ppm/°C 1/4W
FTSR5	**01-23580**	100 Kohm	1.0% Resistor , **T**c- 50ppm/°C 1/4W
FTSR6	**01-23582**	190 Kohm	1.0% Resistor, **T**c- 50ppm/°C 1/4W
Diode	1N4001 Type	**Voltage Forward** 0.6 volts DC ± 0.1 volts DC	

CHAPTER C - REPLACEMENT, OPTIONAL AND ACCESSORY ITEMS



C-1. Available Accessories and Options

This manual does not list all possible accessories that AMPTEC RESEARCH is willing to provide as a support items for the 630BN Igniter Tester. Contact the sales department at AMPTEC if you have a request for an item that is not described here. Listed below are the options available for use with the AMPTEC 630BN Igniter Tester.



Option 630DC: Battery Charger

Option "630DC" is an AC/DC converter that converts 115VAC line voltage to 9VDC at 1.1A. The 630 Battery Charger is fitted with the mating plug that connects to the unit's J1 connector. One charger is provided as a standard accessory with every 630BN Ohmmeter.

Replacement Batteries

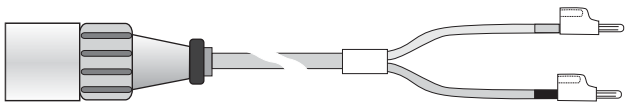
The rechargeable NICAD batteries installed in the 630BN should provide trouble-free operation. Replacement, however, will eventually be necessary. The 630BN uses four 1.2V cells (5.7 AHr recommended) installed in a reusable battery box. The batteries are held in place by a metal retaining plate. When ordering replacement batteries, please specify AMPTEC Stock #05-10117, quantity four (4).

Replacement AMPTEC 630BN NICAD batteries come with an inspection sticker that verifies each individual replacement battery voltage (charge level), inspector signature, along with the inspection date.

C-2. Test Lead and Connector Sets

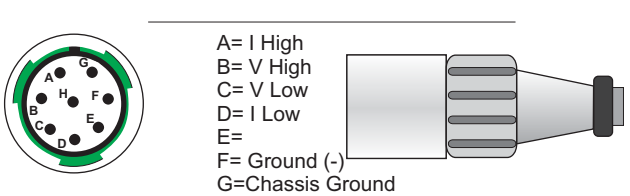
Option 630-400: 4 Wire Kelvin Lead Set

Option "630-400" is the recommended Kelvin four wire lead set for the 630 Series Igniter Testers (especially for versions that have a 2 Ohm range). Option 630-300 is a shielded 48" lead set terminating in ½" opening Kelvin clips. The option "630-400" can clip easily to wires, pins, and medium size (up to ½" diameter conductors). The notched connector end plugs directly into the 630's J1 main front panel connector labeled for "test leads".



Option 630-305: Separate/Twin Banana Plug (Red tipped and Black tipped) Cable Set

Option "630-305" is a 48" long replacement cable set normally supplied as part of the AMPTEC 630BN Ohmmeter package. The Option "640-305 has two single banana plugs (meter and common) terminated with the 630BN style notched connector. One banana plug is red (Voltage high and Current High) and one banana plug lead end is black (Voltage low and Current low) . ***The 4-wire configuration is maintained up to the point of the banana plug, eliminating most cable resistance effects***.



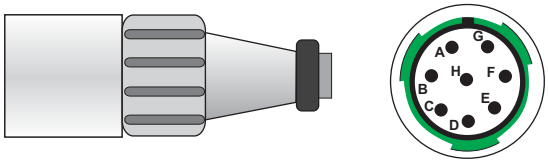
Option 630-Plug: For Custom Test Harnesses

Option "630-Plug" is the 630Test Lead Plug along with 8 gold pin/sockets for custom wiring/missile test harness applications.

Option 630-401: Single Probe Lead Set

Option "630-401" is a 4-wire lead set (up to the probe tip, 2 and 2 style) terminated with single handheld probe test points. The “630-401” also has the standard 630BN notched test lead plug that connects directly to the main 630BN J1 panel mount connector. The 4-wire configuration is maintained up to the point of the probe, eliminating most cable resistance effects.

Option “640-401” handheld probes may be used where a single probe tip is a must (i.e probing into ordnance connector sockets or difficult to connect to conductive test points).



Custom Leads Available

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

Check with our website which is ***http://www.amptec.com*** for latest AMPTEC RESEARCH contact (address and phone # changes) information.

CHAPTER D - OPERATION, FUNCTIONAL SELF- TEST AND USE

D-1. General Operation

A diagram and description of the front panel controls, connection instructions, and the theory behind resistance measurement is discussed in this section. This section of the manual contains complete operating instructions for the AMPTEC 630BN Igniter Tester.

D-2. Front Panel Features and Operation

Power Switch

When the front panel power switch is placed in the OFF/CHARGE position, all power is removed from the ohmmeter measurement pins of the J1 connector (see E-6), and the battery pack is connected to the charging circuit. When the switch is placed in the ON position, the battery pack is disconnected from the charging circuit. In addition the keyed connector on the 630BN front panel only allows either connecting a) the battery charger or connecting b) the test lead set but not both. The possibility of a common mode voltage between the device under test and AC Power ground is therefore completely eliminated. The operator can not be concerned if the battery charging adapter is plugged into the 630BN as it is then impossible to make any resistance measurements.

Range Switches

The AMPTEC 630BN input range is selected by depressing the desired range switch (protected with the given silicone rubber boot for water resistance) on the front panel. The pushbutton for the (20 Ohm) lowest resistance range is just below the display on the left, (see item 20 of the 630BN Front Panel Diagram.). When a given range is selected an indicator LED informs the user. Also note that a resistance range must be selected after powering up the 630BN in order to place it in an operational mode, that is when first turned on a range must first be selected.

Calibration Access Screws

Around the perimeter of the 630BN front panel you will note there are 10 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).

Function Test Section

The Function Test Section of the 630BN contains an analog 10 mA full-scale milliammeter and a variety of test resistors.

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 630BN Igniter Tester, when the test leads are connected and the 630BN 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 630BN DC milliammeter, the milliammeter will not measure any 630BN output, as the current polarity is reversed. For the 630BN with the 20 Ohm range selected, using the onboard milliammeter, a test current level less than 5 mA is normal. The 630BN failsafe current circuitry limits the 630BN such that ***one should never see a current level*** of 10 mA or higher.

The test resistors for the Function Test Section may also be used to verify general 630BN 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 20 ohm range of the 630BN. 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 630BN 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 630BN resistance range. The 0.1 ohm resistor can be used to check the 630BN's zero offset. The AMPTEC 630BN's zero adjust knob can be adjusted while the test leads are connected to the 0.1 ohm resistor. The 630BN zero knob can be adjusted until the 630BN display shows 0.1 ohms.

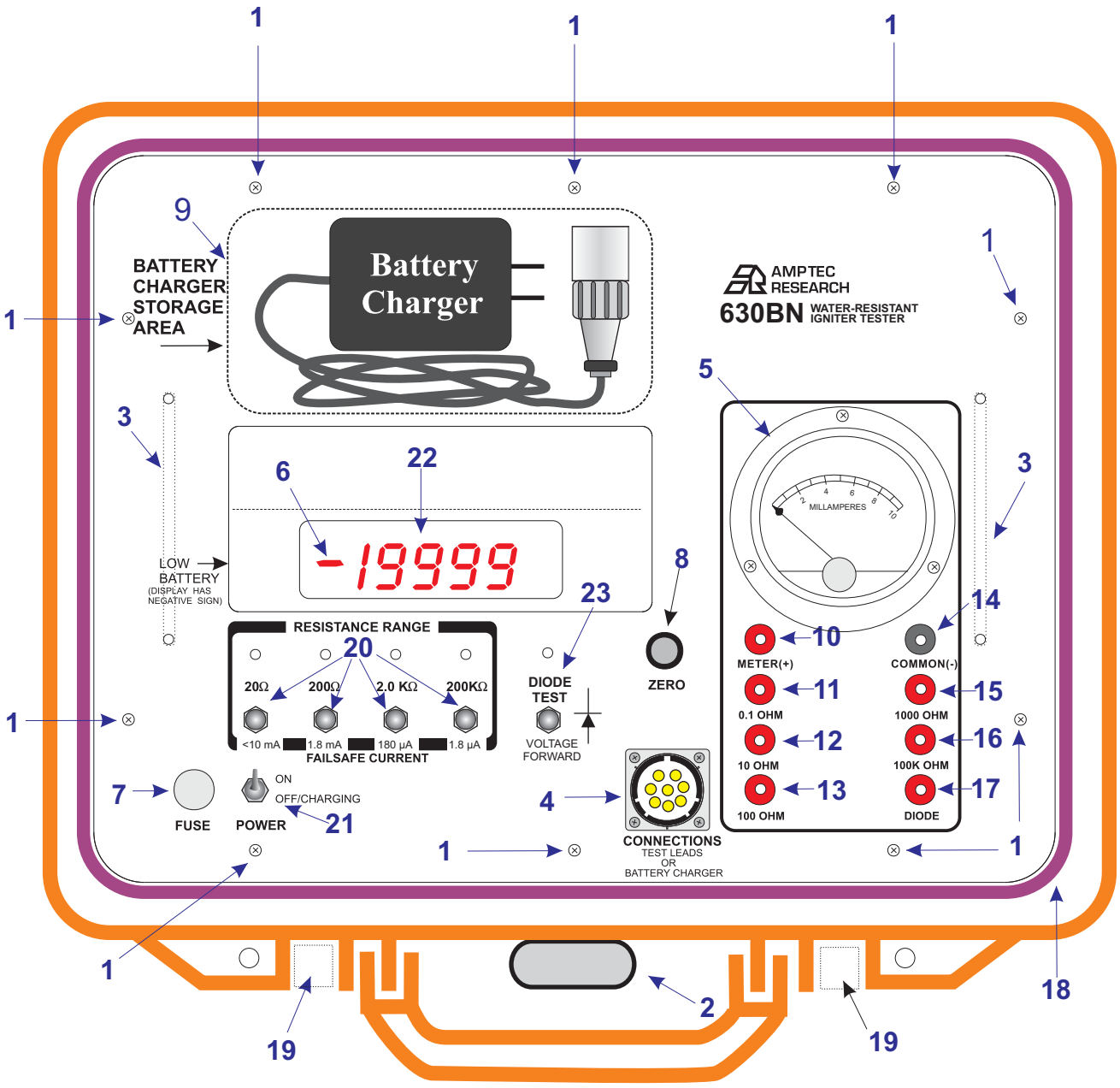
Refer the AMPTEC 630BN to qualified service personnel (i.e Calibration Lab) if you suspect (i.e large error) the 630BN measurement display readings don't agree with the resistor values labeled on 630BN Function Test Section. Do not attempt to repair the 630BN unless you are qualified.

D-3. AMPTEC 630BN Front Panel Diagram

1. Calibration/Maintenance access screws, also can be easily protected with a tamper proof calibration sticker or seal.

2. Purge Valve provides air pressure equalization to open the 630BN case after a transit involving an altitude change if unit will not easily open.

3. Handles for lifting front plate, once the access screws have been removed, for calibration access



4. Single Access Multi-purpose Notched Main Connector for either test lead hookup or connection to the battery charger. With only one connector to the outside world, it is physically impossible to do both at the same time. The power switch (item #21) must also be in the "Off/Charging" while the battery charger is connected to recharge the batteries.

5. Milliammeter for measuring test current coming from the AMPTEC 630BN Ohmmeter. Plug one lead into the panel jack labeled "meter" and the other into the common panel jack. The Analog Milliammeter (current meter) is for measuring actual 630BN test current (0 to 10 milliamperes fullscale). Use of the milliammeter (+) panel jack and Common panel jack (–) in the FUNCTION TEST SECTION with the 630BN test leads provides the analog milliammeter 630BN test current measurement connection.

6. Low Battery Indicator - Negative sign at the front of the digital display indicates "low battery level" time to recharge.

7. Fuse Access required for general operation - 2 ampere slow blow type.

8. Zero pot for adjusting the shorted resistance offset of the test lead wiring when in the 2 wire mode.

9. Battery Charger Storage Area -Press Battery Charger's Velcro$_{tm}$ against Velcro$_{tm}$ on the surface to attached/store the charger , cord and its mating connector. The 630 must also be powered "off" while charging the unit's batteries.

10. Input jack for connecting the 630BN Ohmmeter meter test lead (plug in the ***red*** banana jack) to the analog milliammeter.

11. Input jack of 0.1 ohm test resistor for checking the lower end or near zero accuracy of the 20 ohm range.

12. 10 ohm test resistor for checking the midscale functionality of the 20 ohm range.

13. 100 ohm test resistor for checking the midscale functionality of the 200 ohm range.

14. Common Test Lead Input jack for connecting to the 630BN Ohmmeter (plug in **black** banana jack). With the 630BN test leads (red lead into "meter" jack and black lead plugged into the common jack) connected, the milliammeter displays the output current level..

15. 1000 ohm test resistor for checking the functionality of the 200 ohm range.

16. 100K ohm test resistor for checking the functionality of the 200K ohm range.

17. TEST DIODE - Used to check the Diode Test Function (item #23), it should read approx. .2400 ± .03 if working OK.

18. Water Resistant O-ring seal(s) in lid and under the edge of the front plate.

19. Tight Squeeze Flip Latch Area - pro-vides a water resistant seal when closed. While pressing down with palm on corner of case, flip latch up to open.

20. Resistance Ranges 20 ohm, 200 ohm, 2000 ohm and 200 Kohm silicone rubber switch boots provide water resistance.

21. Power On or Off/Charging Switch

22. Beveled Display Hood with Super Bright LED s (five times brighter than normal LEDs).

23. Diode Check or Forward Voltage

D-4. Fuseholder and Charging System

Fuseholder

The fuseholder is mounted on the front panel and contains a 2 amp in-line fuse (see item #7 of the 630 Diagram.). The fuse protects internal batteries from excessive charging currents. Replace blown fuses with the same type and rating only!

The Charging System

The slimline AC to DC battery charger with connector is a notched connector that mates

with only two of the 8 pin/socket mating points on the main panel mount connector (see Main Connector J1 Section E6 for pinout definitions). The connection is made on the front panel (see item 4 of the 630 Series Igniter Tester Front Panel Diagram shown earlier).

The Single Access Multipurpose Notched Main Connector is for ***either*** test lead hookup ***o***r connection to the battery charger ***but not both at the same time***. With only one connector to the outside world, it is physically impossible to do both at the same time (charge and measure). The power switch (item #21) must also be in the "Off/Charging" mode while the battery charger is connected to recharge the batteries. The charging requirements supplied to the internal battery pack are internally stepped down from the 9VDC @1.1A supplied by the charger. The correct charging voltage is supplied by the adapter included with the instrument. Additional AC/DC Battery Chargers are available as Option "630DC". An overnight charge (16 hours) will provide about an 6 to 8 hour continuous powered up life for the 630BN. The 630BN has an internal ovenized voltage reference the draws a considerable amount of battery power when first turned on. If you know you will be using the 630BN again in 10 to 15 minutes, you actually ***conserve battery*** power ***by not turning it off***.

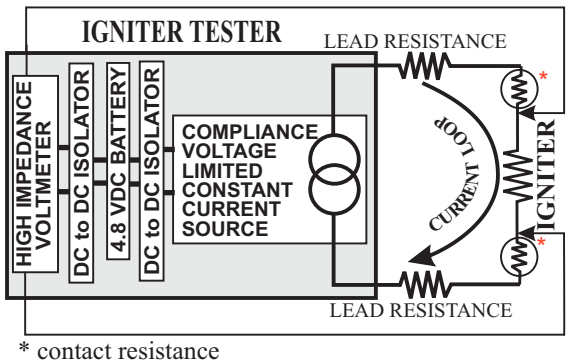


Figure D1 - Igniter Tester Kelvin Block Diagram

D-5. 4-Wire Resistance Measurement

The four-terminal configuration of the 630BN eliminates errors normally caused by in series test lead resistance and contact resistances. In many applications the contact resistance and can exceed the value of the test resistance by several orders of magnitude. The 630BN overcomes this potential error source by providing two terminals of constant current and an additional two terminals for high impedance voltage measurement. The result is a fast, accurate resistance measurement of the test resistance, independent of the resistance of the current carrying leads.

Figure D-1 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 (Vhi and Vlow) leads.

D-6. Connections

Connections are made to the front panel terminals using a 4-wire configuration as described in section D-5. Only use AMPTEC test leads supplied with the 630BN Failsafe Ohmmeter. When using AMPTEC test leads, the notched connector end plugs directly into the single access notched main connector (see J1 manual section E-6) of the 630BN. Next turn the connector clockwise until you feel the notch or click of the mating connector of the 630BN. All AMPTEC 630BN 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 single banana plugs. One banana plug (red) for current and voltage high, and another banana plug (black) for current and voltage low.

For 630BN leads other than those terminated with banana plugs, RG-58 Shielded Coax Cabling is used. Maintaining the four wire Kelvin measurement, the current is in the largest conductor and the voltage input is shielded.

In addition, the 630 series Igniter Tester notched test lead connector plug (640-plug) is optionally available for customized wiring connections , kelvin clips, cables terminated with spade lugs, and special banana jacks.

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 input signal or 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 may make it seem to appear that the instrument is experiencing some sort of malfunction. It 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 terminals are open, or the resistance under test is a higher value than the selected 640series Igniter Tester resistance range. By using a 4-wire Kelvin type lead set or by shorting the V_{HI} and I_{HI} terminals together and Vlow and Ilow terminals together the instrument is in the 2 wire resistance 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 630 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 630 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 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.

The 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 troubleshooting is to use the Function Test Section of the AMPTEC 630 series igniter tester. The Functional Test section contains test resistors of known value. If a measurement problem appears on the 20 Ohm range of the meter, test for a zero offset problem first. Plug the test leads into the 0.10 test resistor banana panel jack built into the Functional Test Section of the meter. If the meter doesn't display a value close to 0.1 Ohms adjust the zero knob on the front of the meter until it does. The zero adjustment knob only has enough span to zero out the 630 series test leads. The meter's zero adjustment knob wasn't designed to zero out a 100 feet of 2 wire harness.

The 10.0 Ohm test resistor is also located Functional Test Section of the meter. The 10.0 Ohm test resistor can be used for testing mid-scale performance of the 20 Ohm range. Performing a similar Functional Test with the meter across the 10.0 Ohm test resistor should get a reading close to 10.0 Ohms (i.e 9.995 Ohms is OK). If the 630 Series Igniter Tester appears OK after checking the test resistors in the Functional Test Section then the connect-ion problem must be outside of the 630 series meter (i.e your wiring harness or the actual device under test connection.) If the 630 series meter doesn't agree with the test resistors in the Functional Test Section, 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) 858-4045 (International Overseas) or FAX (512) 858-4340, e-mail service@amptec.com . Check with our website which is ***http://www.amptec.com*** for latest contact (address and phone # changes) info.

D-7. Failsafe Operation

The AMPTEC 630 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 under the corresponding range switch on the 630 series meter front panel. Please refer to section E-6 for a technical description of the failsafe circuitry specifics.

As a further precaution the 630 Series Igniter Tester is isolated from the AC line whenever the POWER switch is in the ON position.
The 630 series igniter tester receives its power from an internal rechargeable battery pack (4 "D" Cell Ni-Cad batteries). The 630 series igniter tester main power switch (see item 21 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 keyed single access connector. As mentioned earlier, the 630 tester's notched single access front panel connector allows ***either*** the slim-line battery charger to be connected or the test leads to be connected to the 630 tester but ***not both***. This "notched single access front panel connector" safety feature helps eliminate virtually any possibility of the operator measuring with the 630 series igniter tester test leads while also connected to an AC line powered battery charger.

D-8. Battery Monitoring Circuitry

The 630 series igniter tester display has a ± polarity display indicator preceding the unit's regular 4 ½ digit numeric display. The negative polarity display LED (see item 6 of the 630 series igniter tester Front Panel Diagram) is used as a Low Battery indicator.

If the low battery LED is illuminated, 630 Series Igniter Tester readings should not be trusted. An overnight recharge should be performed before using the 630 series igniter tester for critical testing.

It is possible for the user to receive a low battery indication on a single range only (particularly the 20 ohm range), while the 630 series igniter tester remains well within operating limits on other ranges. Unless the user observes a continuous low battery indication during measurement, readings are still valid.

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, first **remove the fuse** from the fuseholder. With an adjustable DC power supply, set the power supply output to be 4.50 VDC. Be sure to observe power supply polarity. Connect the power supply to the test points labeled "**MAIN**" + pos. and - neg. located in the rear section of the MAIN PCB. (i.e + power supply output to the anode side). Adjust trimpot RV3 so the low battery indicator just comes on (negative sign on display). An increase in power supply voltage to 4.52 VDC should have the low battery indicator go out. Finally, disconnect the power supply, and return the fuse to the fuse holder in the rear panel.

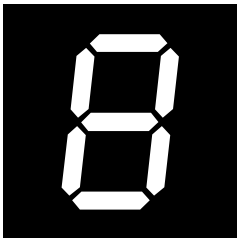
D-9. Zero Pot

The Zero Pot on the 630 Series Igniter Tester Front panel (see item #8 on 630 Igniter Tester Front Panel Diagram) is used to adjust linearity, which effectively adjusts the "zero" of the meter.

D-10. 630BN DIODE TEST

The diode test function of the 630BN Tester is for checking diodes. To do this, the voltage compliance output of the constant current supply is increased and the voltage sensitivity of the voltmeter section is decreased. When the Functional Test Section diode (item #17) is connected, the 630BN will read the voltage across it. The diode will have approximately 0.6 volts across it. This equals a reading of about .2400 ±.03 . A 14K Ohm resistor will have a reading of approx. 1.9800 on the display. If a 14Kohm resistor is tested with the diode test function, it will indicate a reading of 1.9800 ±100 counts on the 630BN display.

CHAPTER E GENERAL OPERATION AND DESIGN



E-1. General

The AMPTEC RESEARCH 630BN Igniter Tester is shown in block diagram form in 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 630 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 630 tester and it's customer service department can also provide additional assistance in the trouble shooting process.

E-2. Troubleshooting

Since the 630 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 630 Tester should not even attempt to remove the calibration access screws or open the main panel or effect any repair whatsoever***.

Apparent 630 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 630 series igniter tester .

If you turn on the AMPTEC 630BN, *and the* ***display does not come on***, it may indicate the batteries need charging, or fuse needs replacing.

If the 630BN 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 Section*** of the 630 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 630 Tester does not come on when powered up, did you check the front 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 630 series 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 630 series igniter tester can be maintained only if the 630 is re-calibrated following the 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 630 internal components as if they are static sensitive if you are not sure.

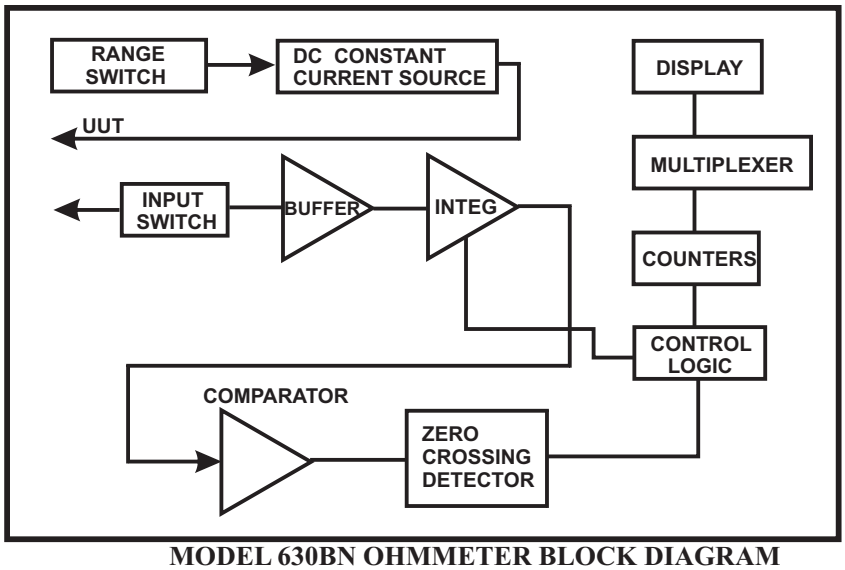
See Next Page for Start of 630 Circuit Descriptions and Functional Diagrams

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.



MODEL 630BN OHMMETER BLOCK DIAGRAM

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

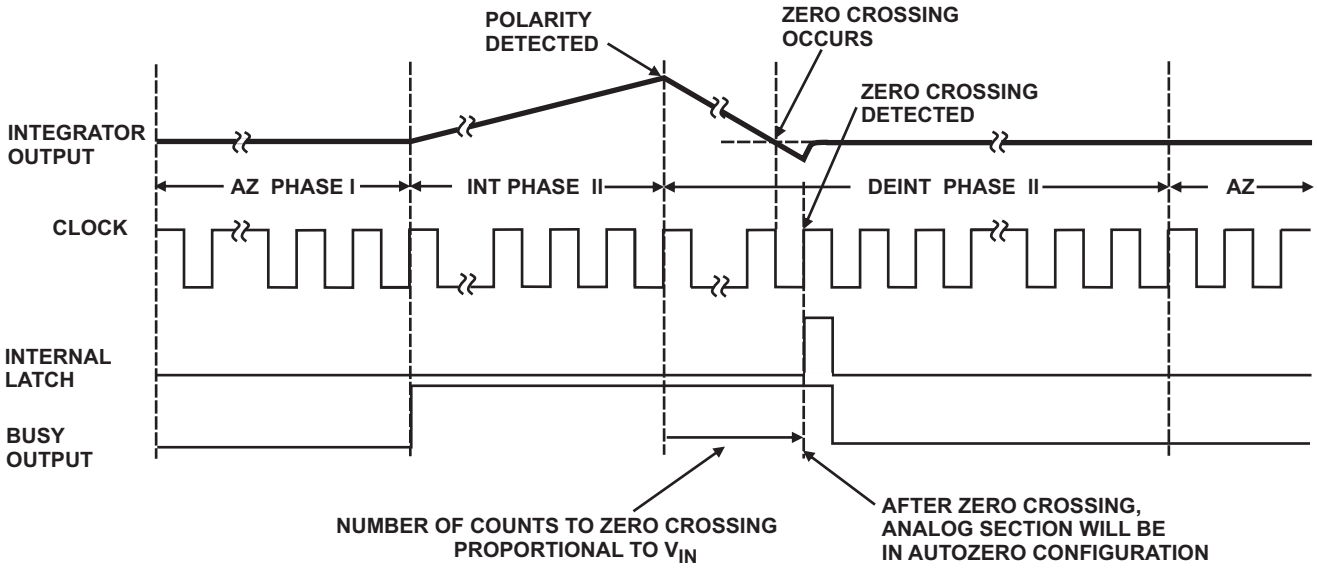


Figure E1 - 630 Conversion Timing Diagram

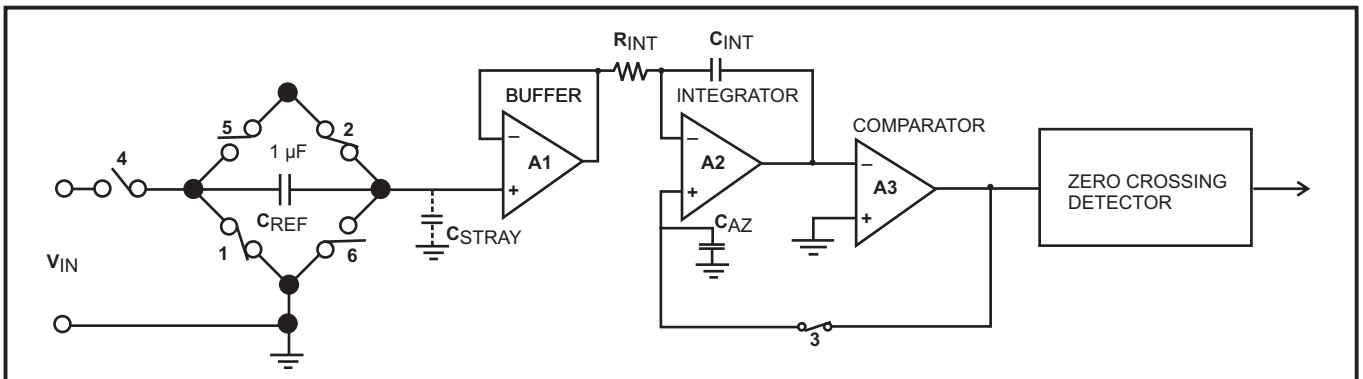


FIGURE E-2A. PHASE I AUTO-ZERO

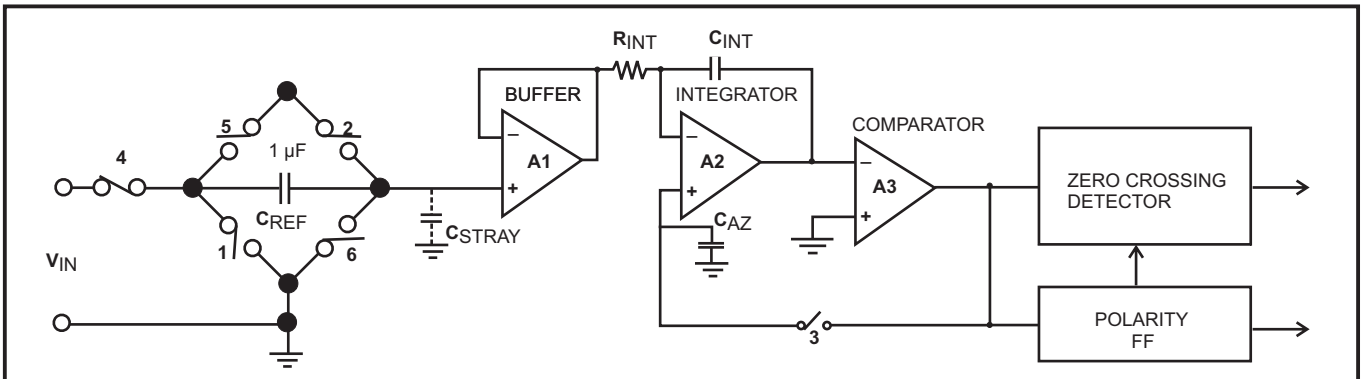


FIGURE E-2B. PHASE II INTEGRATE INPUT

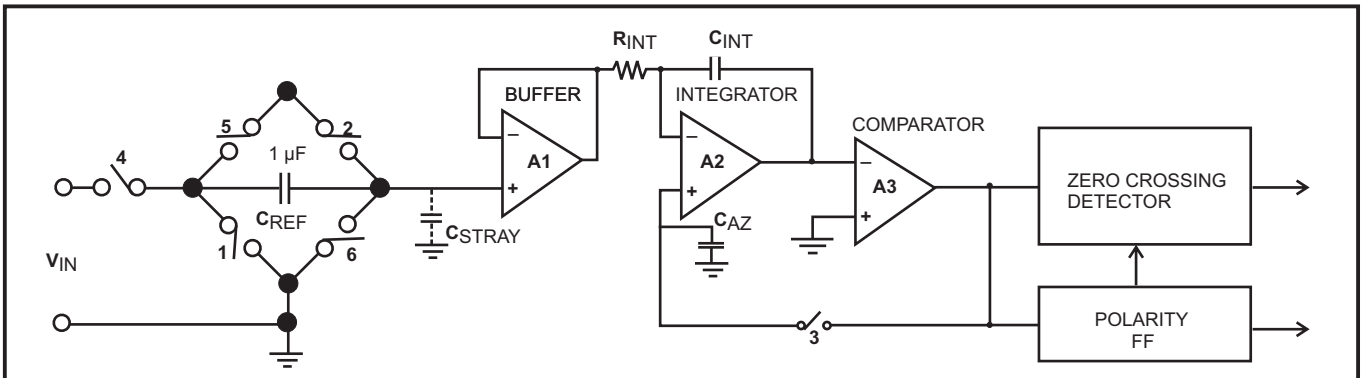


FIGURE E-2C. PHASE III AND DE-INTEGRATE

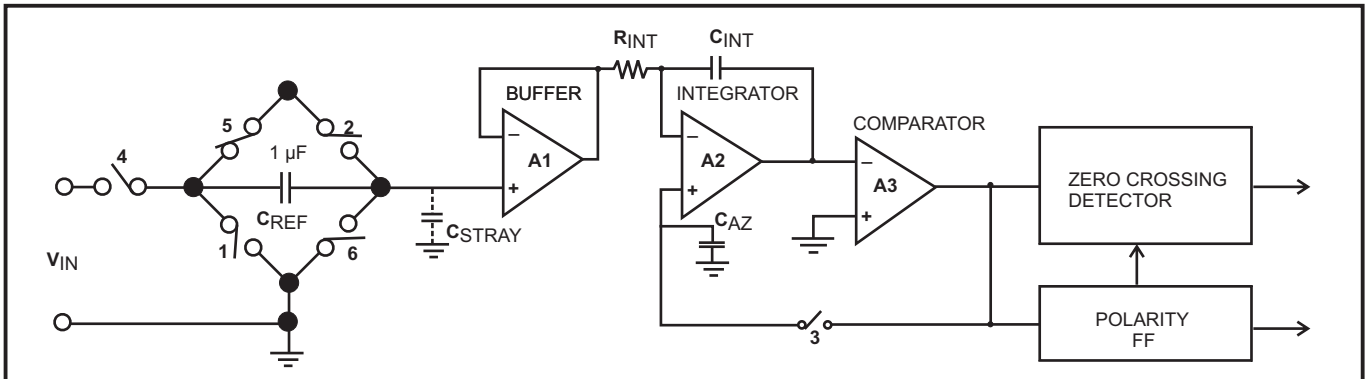


FIGURE E-2D. PHASE III AND DE-INTEGRATE

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 630BN 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 volt is applied to $\mathbf{E}_{in}$ so that $\mathbf{I}_{hi}$ is positive. To equalize the 1 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 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 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.

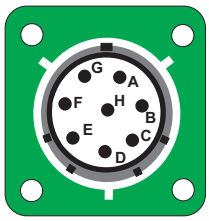
Consider now that the short is removed from the $\mathbf{I}_{hi}$ and $\mathbf{I}_{lo}$ terminals and a 100-ohm resistor (R_L) is connected in its place. The current through R_L increases the voltage at the input to IC201. A balanced condition will be reached when the output of IC201 is equal to the 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 1.1 volts. The voltage drop across the range resistor is 1 volt, just as it was when the output terminals were shorted. The current through R_L is 10 milliamperes, just as it was through the jumper when the output terminals were shorted.

E-6. Failsafe Design

Reference to the AMPTEC 630 Tester 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-7.

"J1" 630 Series Main Connection Jack



CONNECTIONS
TEST LEADS
OR
BATTERY CHARGER

A= I High
B= V High
C= V Low
D= I Low
E=
F= Ground (- neg Battery Charger)
G=Chassis Ground
H= +5 V (Battery Charger)

The AMPTEC 630 Testers are 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 630 POWER switch is in the "***OFF/ CHARGING***" position are the batteries are connected to only 2 of the possible 8 pin/socket contacts of the "Connections" panel mounted connector on the front panel to allow for recharge (see J1 Connections diagram in section E-6 of this manual). ***For safety reasons, none of the test lead connections (outside pins A thru D) can ever make the pin-socket contact with center Pin H*** . If for some reason, an abusive 630 Tester user tried physically jambing the test lead connection onto the J1 connector (i.e with a hammer) it is vitually ***physically impossible due to the inner and outer align ring and drop into sleeve construction of J1*** . So even if this impossible connection did some how occur, and make contact with pin H, remember all battery wiring is disconnected from the Main Connection Jack "**J1"** if the AMPTEC 630 Tester is turned ON. ***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 630 Igniter Tester.

The 630 Tester measurement circuitry is also failsafe current limited, even under worst case component failure. **A simple startup test procedure which also has the 630 Tester user perform a functional check using the milliammeter would also detect any current level even getting close to the Failsafe level.**

For the 630 Tester the normal or typical operating current level is less than 5 mA, and <10mA on most 20 ohm range versions 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.

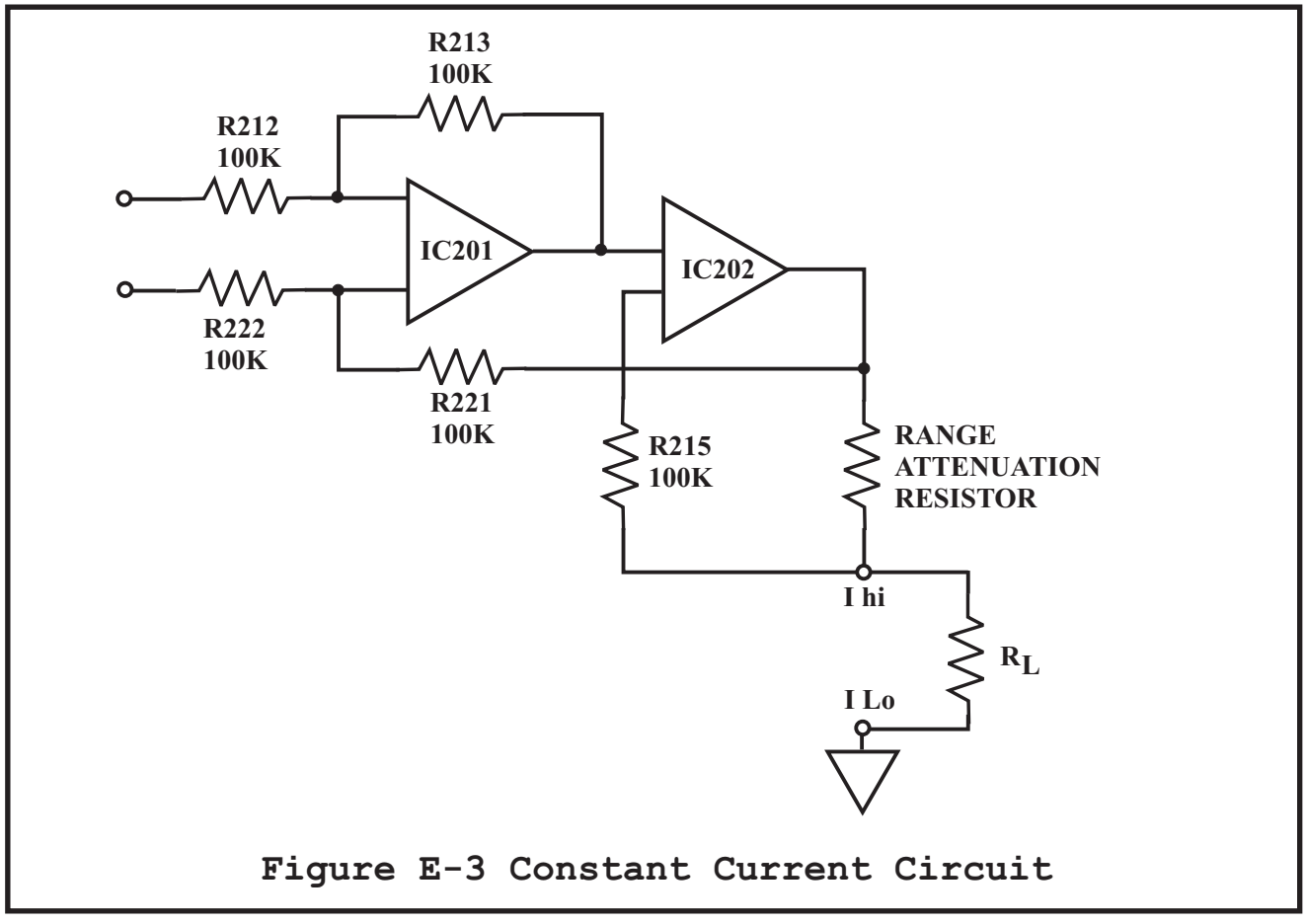


Figure E-3 Constant Current Circuit

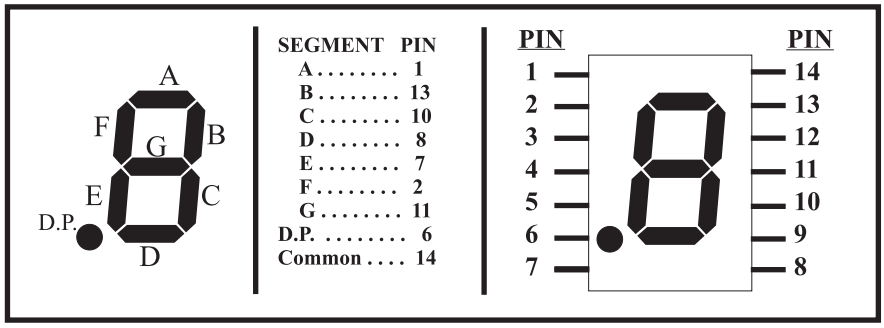
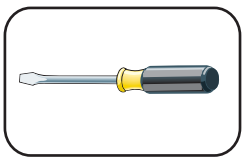


Figure E-4. LED Display Pin Functions

E-8. Relay Board General Operation

The internal 630BN PCB labeled “620-relay board” replaces the range switch S1 on the main board. IC-1 is actually a ribbon cable header that goes to the top panel and connects to the range push buttons (covered by silicone rubber boots) and their corresponding panel mount LEDS. IC-2 is a latch that will latch its output to the corresponding range push button input. Its output turns on the front panel LED (acts as an range mode indicator LED) and a corresponding relay that connects to the main PCB to select the range. RL1 is for the 20-Ohm range, RL2 is for the 200-Ohm range, RL3 is for the 2K Ohm range, and RL4 is for the 200K Ohm range. For 630 versions with the Diode Test (Forward Voltage) option, when the diode test is selected the relay board selects the 200-Ohm test current, and disconnects diode D203.

CHAPTER F CALIBRATION AND MAINTENANCE



F-1. General

This section of the manual contains routine maintenance information regarding the AMPTEC RESEARCH Model 630 series 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 630 series igniter tester is a four wire Kelvin ohmmeter. ***The 630 series 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 "640-305 has twin single banana plugs (meter and common) terminated with the 630 series igniter tester style keyed connector. One banana plug has a **red** ring at the tip(Voltage high and Current High) and one banana plug lead end has a **black** ring at the tip (Voltage low and Current low) . The 4-wire configuration is maintained up to the point of the banana plug, eliminating most cable resistance effects. Typically 2milliohms of in series resistance is associated with the AMPTEC "OP640-305" two single banana lead set.

Note: *Only for 630 versions with a 2 Ohm range:* the option "640-305" a 48" long replacement cable set normally supplied as part of the AMPTEC 630 package may have too much resistance offset for the actual calibration of 630 Igniter Testers versions fitted with a low 2.0 Ohm range. Contact AMPTEC for information on the "OP400-300" 48" long 4 wire Kelvin Calibration Lead Set all terminated with single banana jacks.

F-2. Required Test Equipment

Following standard resistors are required to calibrate the 630BN Igniter Tester .

Precision Resistors:

0.1 ohm ± 0.01% Accuracy
1 ohm ± 0.005% Accuracy
10 ohms ± 0.005% Accuracy
100 ohms ± 0.005% Accuracy
100000 ohms ± 0.005% Accuracy

Test Leads:

4-wire lead set or
(AMPTEC Option "640-305")

F-3. Calibration Procedure

The 630 series igniter tester should be calibrated with fully charged batteries and should be allowed to **warm-up** for a minimum of **5 minutes** before beginning the procedure. The calibration adjustments are accessed by removing the 10 calibration access screws around the perimeter of the 630 series igniter tester front panel, then lifting off the top plate by the handles. The locations of the adjustments are shown on drawing number 630BN-600 at the back of this manual.

F-3-1. Zero Offset Adjustment

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

2. Adjust potentiometer RV2 for a display indication of 0.100 .

F-3-2. Full Scale Adjustment

1. Select the 200 ohm range. Connect the Kelvin clips to the 100 ohm standard resistor.

2. Adjust RV1 for a display indication of 100.00.

3. Check the 2000 Ohm range with the 1000 Ohm Standard Resistor. Check the 200 KOhm range with 100 KOhm Standard Resistor. All ranges must be within the specifications outlined in Chapter B. There are no adjustments necessary for the 2000 Ohm and 200 KOhm ranges. Contact AMPTEC's customer service department if further technical support is necessary.

F-4. Battery Replacement Instructions

The rechargeable NICAD battery pack stock # 630BP (a plug/disconnect 4 unit NICAD cell 5.7 AHr each battery pack) used in the 630 series Tester are durable and provide years of trouble-free operation. Some military maintenance procedures may require replacement of the battery pack as part of the unit's 18 month calibration plan (as preventative maintenance) . The battery pack may be ordered from AMPTEC RESEARCH as stock # 630BP. The process of battery pack replacement is described below: The process of battery pack replacement is described below:

1) Remove the calibration access screws (10 of them) located around the perimeter of the 630 series igniter tester front panel. ***Carefully*** lift off the 630 series igniter tester front panel top plate by the handles. Note: Umbilical wire cabling connects the top plate electronics to the main PCB inside the bottom of the 630 series igniter tester case. Lift, rotate and tilt the top panel vertically to gain access to the main PCB, keeping the umbilical wiring intact.
2) ***Locate and remov***e the battery pack holder retaining ***cable ti***es down inside and ***around*** the 630 series igniter tester ***metal battery holder*** (next to the main PCB).
3) Unplug the disconnect clip and remove the old battery pack and replace with a new one.
4) Reconnect the polarized connector plug/clip and re-secure the new battery pack in place by replacing the cable ties that were cut earlier.
5) Replace the 630BN 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 next to the power switch on the 630 main operation top panel. Remove the 10 calibration access screws located around the perimeter of the 630 top panel, if the top panel has not already been lifted off or removed.

Use caution when lifting the 630 top panel off by the handles, as there is umbilical wiring and ribbon cabling that connects the top panel electronics to circuitry mounted inside the bottom of the 630 case. Lift, rotate the top panel vertically to gain access to the main PCB.

With an adjustable DC power supply, set the power supply output to be 4.50 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 4.50 VDC applied from the power supply. An increase in power supply voltage to 4.52 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 630 top panel to its original location. Return the calibration access screws to the perimeter of the 630 main top panel .

(see next page for Diode Test adjustment)

F-5 630BN DIODE TEST

The diode test function of the 630BN Tester is for checking diodes. To do this, the voltage compliance output of the constant current supply is increased and the voltage sensitivity of the voltmeter section is decreased. When the Functional Test Section diode (item #17) is connected, the 630BN will read the voltage across it. The diode will have approximately 0.6 volts across it. This equals a reading of about .2400 ±.03 . A 14K Ohm resistor will have a reading of approx. 1.9800 on the display. If a 14K ohm resistor is tested with the diode test function, it will indicate a reading of 1.9800 ±100 counts on the AMPTEC 630BN display.

Keeping the above information in mind, and with the AMPTEC 630BN in "Diode Test" mode, adjust trimpot RV4 until the display indicates 1.9800 on the display while connected to a precision 14.0 Kohm resistor (decade resistance box ok).