



# AMPTEC RESEARCH MODEL 620EXV OPERATION AND MAINTENANCE MANUAL



## A MESSAGE FROM PERMAC ELECTRONICS & AMPTEC RESEARCH



Permac Electronics Ltd. would like to thank you, our customer for selecting our Explosive Safety Armament Voltmeter.

Over the years our experienced engineering teaming partner Amptec Research has designed, manufactured, and supplied earlier versions similar to the 620EXV Explosive Safety Armament Voltmeter and 620UK Intrinsically Safe volt-ohmmeters to safely test the "ALCM - Air Launched Cruise Missile", "Tomahawk Cruise Missile", AIM-9 "Sidewinder" Missile, AIM-7 "Sparrow" and AIM-120 "AMRAAM" missile warhead detonators and rocket motor squib wiring. The 620EXV Explosive Safety Armament Voltmeter has the initials "EX" in the name, because it was originally designed to meet our United Kingdoms Ministry of Defense requirements for "EEX" Intrinsically Safe. The "V" designates voltage equipment use. We derived the AMPTEC 620EXV Armament Voltmeter initially from the AMPTEC 620UK Ohmmeter Intrinsically Safe EEX design. The 620UK Explosive Safety Ohmmeter is "EEX" ATEX certified as Intrinsically Safe for use in "Explosive and Volatile" environments and a similar "EEX ATEX" rating for the AMPTEC 620EXV" Armament Voltmeter is pending (June-July 2008). It fundamentally uses the 620UK product package - a similar display (better backlight), same exact all metal shielded/antistatic aluminum case, all metal front and rear panels, same all metal battery compartment (separated), same micro-processor but is optimized for it's voltage measurements, self-testing and voltage related parameters. We have improved the bezel (silicon rubber) to get it better than IP57 rated (dust and moisture). We hope you are satisfied with Permac Electronics/Amptec Research group, whether you are working with our products or our people. We value the trust our customers have placed with us, and are looking forward to supporting any requirement(s) you have.

Kerry Clark - President, AMPTEC RESEARCH (Design & Engineering Support)

Bob Lacy - President, Permac Electronics Ltd. (UK Mfg.)



### Certificate of Calibration to National and International Standards

Permac Electronics Ltd. certify this instrument has been completely tested, inspected, and found to meet published specifications as found in this manual on the date stated on the attached National Calibration Certificate. We further certify that its calibration measurements are traceable to the UK's National Standards which are also recognized internationally.



### 620EXV Explosive Safety Armament Voltmeter Warranty

Permission and a **return material authorization** (RMA) number must be obtained directly from Permac's customer service department (via phone, FAX, or e-mail [info@permac.co.uk](mailto:info@permac.co.uk) ) for repairs (warranty or otherwise). *We need to issue you an RMA number so we can keep track of the instrument and it's owner*, (who to contact? and where to return the repair?). The warranty period for this instrument is 1 year from it's original ship date. Permac Electronics will repair or replace the instrument during the warranty period provided it is returned to Permac Electronics, freight prepaid. No other warranty is expressed or implied. We are not liable for consequential damages. No liability will be accepted if returned without such permission. There are also many versions of the 620 Explosive Safety meters specifically developed to meet our customers safety requirements. The specifications, operation, and design characteristics discussed in this manual contain the unique detail that help define the AMPTEC 620EXV Voltmeter.

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## SECTION A - RECEIVING AND INITIAL INSPECTION



### A-1. Introduction - AMPTEC 620EXV "No-Volts" Meter

The 620EXV Armament Voltmeter is a portable battery powered (rechargeable) Intrinsically Safe AC-DC Voltmeter that measures from 0 to 30 Volts RMS. Once the unit's batteries are charged it is ready for self-test and use. Its microprocessor routine performs an internal self-test at power up all displayable parameters are briefly illuminated for observation by the user (even the "GO" and "NO-GO" LEDs). If a Mil-C-5015 compatible Test Lead cable is connected to the 620EXV a cable integrity test can also be performed (see operation section D for "PASS" or "FAIL" self-test details). The 620EXV Armament Voltmeter comes in its own padded carrying case and can even be used while in its carrying case. Having a strong all metal (aluminum) front, rear panels and chassis with protected bezel bumpers protects the 620EXV voltmeter from most accidental dropping damage. It also comes in a larger water resistant transit case that holds the meter, carrying case and battery charger. Since the units' battery charger is not "EEX" certified *the charger* should be stored and the 620EXV Armament Voltmeter should **only be charged** in a room free from any explosive or volatile atmospheres ("NO" Hazardous environment while charging).

### A-2. Unpacking and Inspection

Should the shipping box appear damaged upon arrival, notify the carrier immediately. If the 620EXV appears damaged, the carrier's agent should authorize repairs before the unit is returned to the factory. If the unit fails to operate or fails to meet the performance specifications of Section B, notify the carrier's agent and Permac Electronics Ltd. (see our website at <http://www.permac.co.uk> for contact info). Retain the shipping carton for the carrier's inspection. **DO NOT** return equipment to Permac Electronics Ltd. , Phone (44 UK country code) 01- 276 675714 or FAX 01276 675725 or any of it's sales offices *without first obtaining* an (RMA) Return Material Authorization number. We need to know who to contact regarding the shipping address, billing info, etc. in order to properly *coordinate the return of the repaired* AMPTEC 620EXV Armament Voltmeter. By calling Permac Electronics Ltd. service agent first, prior to returning the 620EXV, 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) and avoid an unnecessary repair and related delays.



### A-3. DC Battery Power Requirements

The AMPTEC 620EXV Explosive Safety Armament Voltmeter is completely powered by an internal rechargeable battery pack (four ea "AA" i.e. NiMH type) that is housed in a separate metal box that requires a special security screwdriver (for authorized personnel only) for removing the tamper resistant screws (see rear panel). Details on the use of the battery charger and the batteries are found on pages 4 and 11.

### A-4. Setup and Preparation for Use

Power "ON" - **Press and hold** the main front panel power switch power button **down for about one to two seconds**, then **release** to first turn the unit "ON". The full 1 second momentary "press and hold" time for the power switch is to **prevent** accidentally bumping the switch while closed in the case, turning the unit on and **draining the batteries**. The 620EXV Explosive Safety Armament Voltmeter may be setup to operate as soon as it "PASS"es it's self test **and** test lead integrity check (**section D**). After a quick check for no sign of the low battery indicator ("LO BAT") in the LCD display the 620EXV Armament Voltmeter is ready to use. Consequently, it may be used in any area where the environment does not exceed the specifications in section B. Avoid exposing the 620EXV Armament Voltmeter to extremes of temperature which can affect accuracy and shorten battery life-span.

**SECTION B - 620EXV "No-Volts" Explosive Safety Armament Voltmeter -**



**Table B-2. Specifications**

**Accuracy:** (for 1 year from 0°C to 40°C)  
**Digital Voltmeter Display (30 VRMS range)** . . . ± 10% of range DC or AC from 10Hz to 10 KHz.  
**"GO" (<60 mV) and "NO-GO" (>60mV) LED Comparator accuracy** is ± 10% (low limit is 54 mV to 66 mV DC or AC) .  
**Operating Temperature Range** . . . . . -20°C to +55°C at rated accuracy  
**Storage Temperature Range** . . . . . -40°C to +70°C  
**Temperature Coefficient** 30 V range . . . . . N/A at the operating temp range  
**Instrument Display** . . (9,999 counts) 4 digit Liquid Crystal Display (LCD) with a back light for viewing the 620EXV display in dim ambient light conditions (counts up to 30.00 V) with 10 mV LCD resolution.  
**Low Battery Indication** . . . . 620EXV LCD display shows " LO BAT "  
**Measurement Update Rate.** . . . . . Approximately 3 readings per second  
**Ingress Protection (weatherized) rating** **IP54**, rated at **IP67** in the transit case.  
**Power** . . Rechargeable Battery Pack inside separate chemical resistant battery compartment houses (4 ea "AA") 1.2 VDC NiMH batteries, Notice: **Observe battery polarity when replacing.** Do not mix different brands and **never replace a single battery**, replace all four.  
**Smart Battery Charger:** 220VAC 50 Hz input ~ 350 mA DC output, automatically "turns off" the 620EXV when the charger is plugged in the rear panel charging jack. (Use only in Non-Hazardous Environment)  
**Instrument Dimensions** . . . . . 7.5" W x 6" D x 2.75" H  
**Weight** . . . . . 5 lbs net; 7 lbs shipping  
**Calibration Access** . . . (adjustments are "30 V fullscale" (*leftmost*) and "60 mV trigger level" (closest to the edge) performed after removal of its rear panel *tamper resistant calibration sticker*.)

**For Authorized Personnel Only - Tamper resistant security screws normally protect the battery cover plate (rear panel). It is important to observe battery polarity when replacing the batteries !! Replace All 4 rechargeable "AA" batteries with same type at one time (NiMH).** Located in upper left hand portion on the LCD display is a low battery indicator area. The absence of the "LO BAT" LCD display indication signifies the internal batteries have acceptable power levels. If you try to turn on the 620EXV Voltmeter several times, and the LCD display does not come on, it may indicate the batteries are completely dead and either need charging and/or may need replacement if they can't hold a charge.

**Since the 620EXV "No-Volts" Voltmeter has been designed to only use rechargeable batteries. If you try to use any type of disposable alkaline battery substitute, they could explode, after a user plugs the battery charger in (not knowing the batteries aren't re-chargeable) causing a void in the warranty. To help prevent installing alkaline batteries, the battery compartment in the 620EXV Safety Voltmeter is protected with tamper resistant security screws.**



## SECTION C : OPERATION , FUNCTION, AND USE



### C-1 Operation and General Use Introduction

The AMPTEC 620EXV is a millivoltmeter designed to safely measure low to medium levels of AC or DC voltage (from 0 to 30.00 volts). The AMPTEC 620EXV uses internal solid state voltage reference(s) that permit the product to be used immediately after passing "Self-Test". If you flip the case lid flap completely open (almost inside out) and connect the lid buckle near the bottom of the carrying case to the unit's front buckle the 620EXV Armament Voltmeter can be carried hands free. Simply use the shoulder straps (placed over head and neck) to carry the meter in front. Your hands are now free to use a Mil-C-5015 compatible test lead cable. You can even look at the measured voltage or GO/NO-GO LEDs by glancing down at the display, while your hands are free. Carefully return the carrying case lid to its original protective position when done.

### C-2 620EXV "No-Volts" Safety Voltmeter Front Panel Features/Use



*Photo of AMPTEC 620EXV Explosive Safety Armament Voltmeter*

The AMPTEC 620EXV "NO-Volts" Voltmeter :

- A) Mil C-5015 Compatible Test Lead Connector with dust tight cap. The front panel socket contacts (inside the connector) mate with the pin contacts of the test lead cable (connector end). Align the slot of the mating connector with the "Test Lead" front panel connector and hand tighten the ringed collar (test lead outer shell) to a snug fit.
- B) 620EXV Chassis is all aluminum, including front and rear panels. It does have silicone rubber bumper trim to provide an IP57 dust and water tight seal as well as provide protection from falling onto concrete pavement (excellent mechanical impact resistance).
- C) 4 Digit (9999 count) LCD Display with "Low Battery" Indicator and power up Self-Test and System Test Display Indicator/Enunciators (Digits/counts and "OK" also shown as examples only).
- D) Momentary LCD Display Back-Light (silicone rubber boot switch cover protection). The display is back lit yellow to provide excellent higher contrast display readability/viewing in dim ambient lighting environments.
- E) Power On/Off switch (hold down for ~ two seconds for "Power on" - this "timing" prevents inadvertent power on in the case if the power switch is accidentally bumped. All the unit's switches are protected with silicone rubber covers (even has an o-ring under the machine nut) for added environmental resistance to dust and moisture.
- F) 3-Way Test Mode Switch - Immediately after powering up the unit internal "SELF-TEST" begins. 3 possible switch positions are: 1) toggle position "UP" to initiate "CABLE TEST" requires a Mil-C 5015C compatible input cable or test lead is connected. 2) The middle toggle test switch position is for either "STAND-BY" or "initial SELF TEST" mode. 3) "SYSTEM TEST" is in the toggle down switch position for testing a system such as "an Aircraft, Tank or Helicopter's armament related electrical system status" for safe voltage levels ("GO" is less than 60 mV) or possibly hazardous voltage levels ("NO-GO" is greater than 60 mV) are present on the armament system under test.

**G**) If the voltage being measured is less than 60 mV then the green "GO" LED is lit (*dimmer knob adjustable see item H*). If the voltage is greater than 60 mV (AC or DC) then the "NO-GO" red LED is lit. The "GO" and "NO-GO" LED indicators are the preferred (more accurate) indication to determine "60 mV" measurement status than the digital voltmeter which only has 10 millivolt resolution (60 millivolts on the 30.00 V voltmeter scale would only be 00.06) .

**H**) Both "GO" and "NO-GO" LEDs can have their brightness adjusted using the LED brightness knob. Note - The brightness is optimized for daylight viewing and may be dimmed for night viewing but may not go completely out in dark night viewing circumstances.

Hands free operation of the 620EXV while in the padded carrying case - If you flip the carrying case lid completely open (almost inside out) and connect the lid buckle around its back to near the bottom of the carrying case to the unit's front buckle the 620EXV Armament Voltmeter can be carried hands free. Simply use the shoulder straps (placed over head and neck) to carry the meter in front. Your hands are now free to use the meter's test lead cables to measure system voltage. You can look at the measured voltage level by glancing down at the display.



620EXV "No-Volts" Safety Voltmeter rear panel photo



**Battery Charger use** - The 620EXV charging jack is located on the unit's rear panel. Lift the spring loaded cover to gain access to the unit's charging jack. Rechargeable NiMH batteries need to be properly charged to avoid premature failures and/or shortening the battery life. Only the 620EXV charger (no substitute) that comes with the "No-Volts" meter should be used (*in a non hazardous area as well*). Plug the (220VAC 50 Hz input powered) charger into the unit's charging jack (cover lifted) for at least a four hour or longer period for optimal charge of the 620EXV NiMH batteries. The instrument will automatically be turned OFF when the charging jack is being used.

### C-3 Self-Test and Cable Test *(Overview - abbreviated description see page 9 for the full routine)*

After the 620EXV "No-Volts" Safety Voltmeter is powered up it will immediately perform a "SELF-TEST". With the initial power up self-test - the user should see the LCD display enunciate **all appropriate segments** and the "GO" and "NO-GO" LEDs will briefly light up. If you do not see the "GO" and "NO-GO" LEDs briefly light up reset power and re-initiate the start up "SELF-TEST". Next typically comes a cable integrity test (assuming no "LO BAT" display). A Mil-C-5015 compatible test lead should already be connected to the unit's "TEST LEADS" front panel connector. Notice there are four round sockets labeled A, B, C, and D inside the Mil-C-5015 test lead (front panel) connector. The 620EXV keyed single access connector also makes it extremely difficult if not virtually impossible during normal operation to mis-connect measurement leads to the 620EXV (see following pages for added pin out detail on the test lead cabling). Placing the 620EXV Voltmeter in "CABLE TEST" mode (3-way toggle switch position is "up") internally sends a very weak 1 volt signal into pin A of the input cable (at the unit's front panel connector). If the input cable is wired properly at the other end line A is shorted to line B. The signal path returns down line B to the meter and is then routed back into line C of the input cable. Since line C is shorted at the end to line D the signal path returns down line D to the meter.



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#### *SELF-TEST continued -*

The 620EXV "No-Volts" voltmeter then automatically determines if the "CABLE TEST" signal is present in the last return path wire (line D) of the input cable. A simple "PASS" or "FAIL" is displayed at the unit's front panel. Should the unit **FAIL** the "SELF-TEST" routine, it automatically shuts itself "OFF" and can not be operated until it passes the "SELF-TEST" routine. If a cable isn't connected to the 620EXV and the instrument is placed in "CABLE-TEST" mode it will obviously "FAIL" the cable test and turn itself off, since the unit requires a working cable must be connected to the unit's connector in order to "PASS" cable test.

In summary, immediately upon first powering up (*press and hold the power button down for approx. two seconds and release*) the 620EXV "No-Volts" voltmeter begins its "SELF-TEST". The unit's display symbols are then enunciated and the "GO" and "NO-GO" LEDs are also lit (may appear dim depending upon the adjustable LED brightness knob setting). The unit's LCD display then flashes the "SELF-TEST" message, to inform the user of the process the 620EXV is performing. **It is important** that the 620EXV "No-Volts" user observe the front panel during the initial power up self test to assure both the green "GO" and red "NO-GO" LEDs are briefly lit and the digital display segments all come on briefly as well.

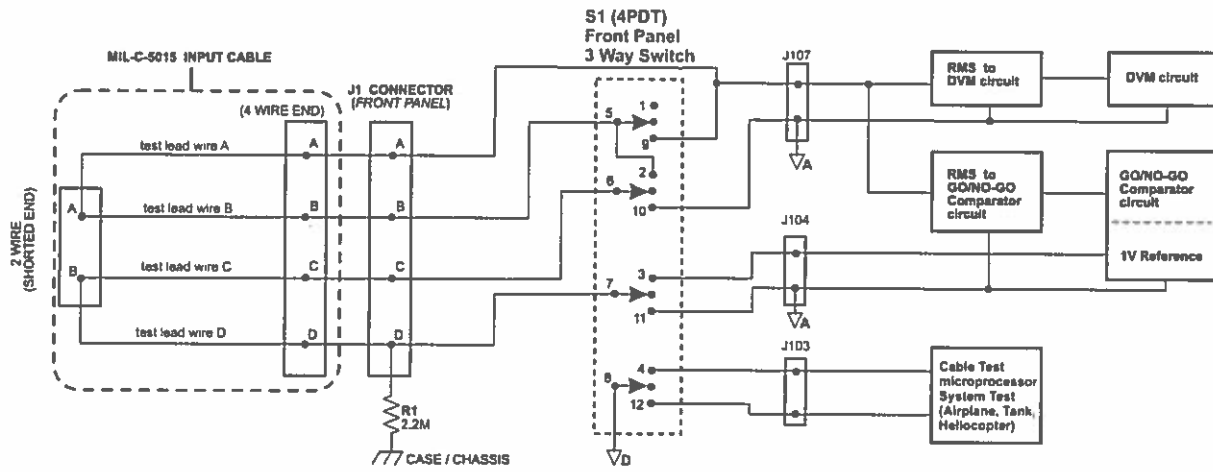
**What this means is the 620EXV will only "PASS" the SELF-TEST and become useable for a 'System Test' if**

- a) the unit's front panel self-test switch is in the "CABLE TEST" mode *and*
- b) the proper input cable or test lead is connected. The 620EXV will "FAIL" and turn itself off automatically for a number of reasons. **Primarily it will always "FAIL" the SELF-TEST if the front panel SELF-TEST switch setting is on "In Use" mode instead of "Cable Test" mode. If there is no test lead cable connected, or a faulty cable is connected it will also always fail the "SELF-TEST" routine.**

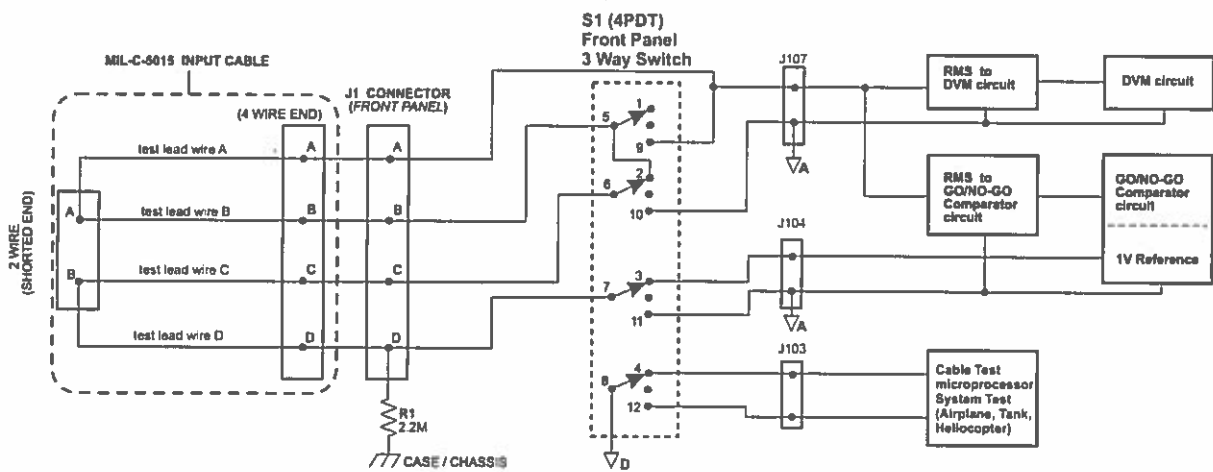


# C-3 Diagram of Self-Test Routine

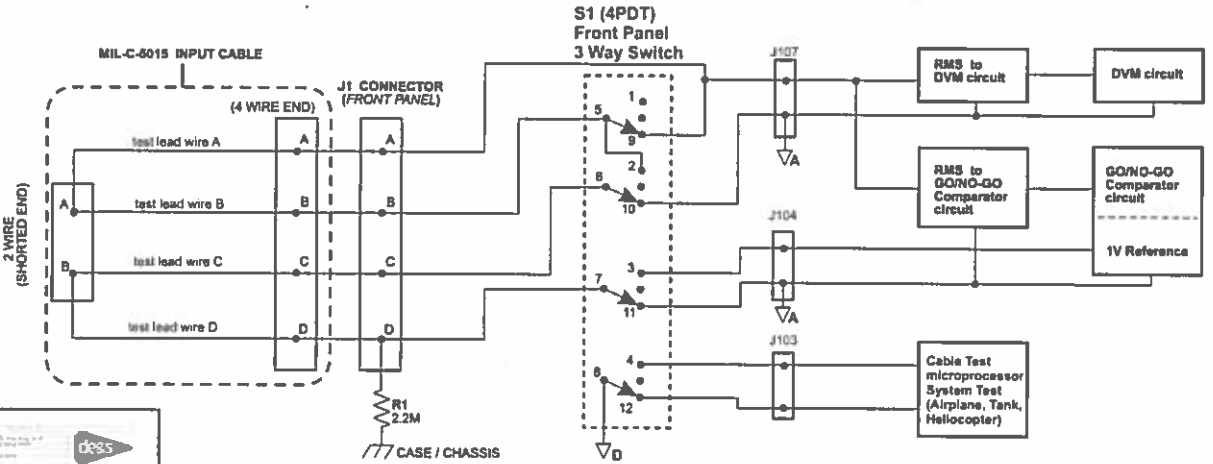
## 3-WAY switch (front panel) in Standby /Self-Test Position



## 3-WAY switch (front panel) in "CABLE TEST" Position



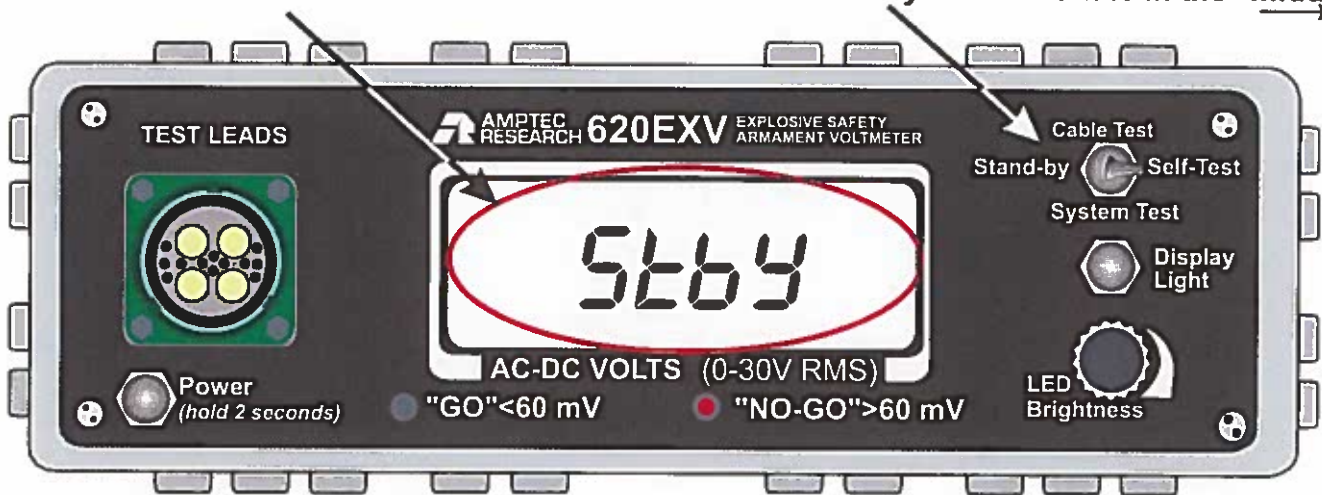
## 3-WAY switch (front panel) in "SYSTEM TEST" Position



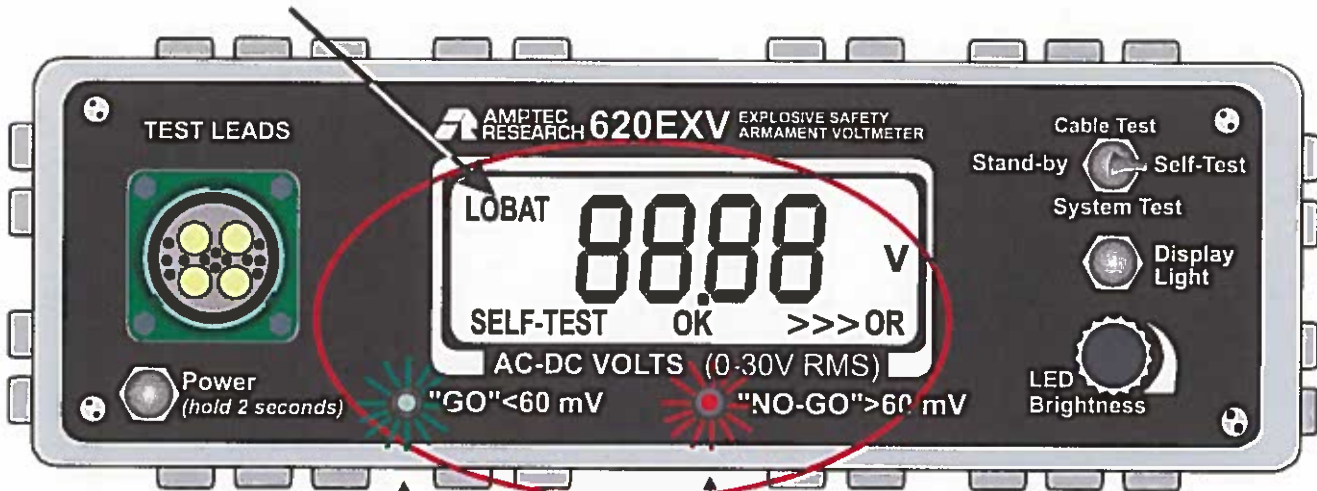
Preliminary Safety Board Approval for the 620EXV Electrical Schematics, others (ATEX, EMC etc) pending - The United Kingdom Defense Ordnance Safety Group for Defense Equipment and Support has given approval to the 620EXV "No Volts" Safety Armament Voltmeter electrical schematics.

## 620EXV Armament Voltmeter initial "turn-on" and "SELF-TEST"

1. Initial Power "On" display of "STANDBY" for about 2 seconds *When 3-way mode witch is in the "middle"*



2. The next 4 second portion of the initial SELF-TEST will turn-on all the LCD segments that can be displayed on the unit's LCD display. It also lights up both green "GO" and red "NO-GO" LEDs, and performs a microprocessor check, a digital voltmeter check and a "LO BAT" check. The user should observe that all display segments are lit as well as the both green "GO" and red "NO-GO" LEDs. (see sample below)



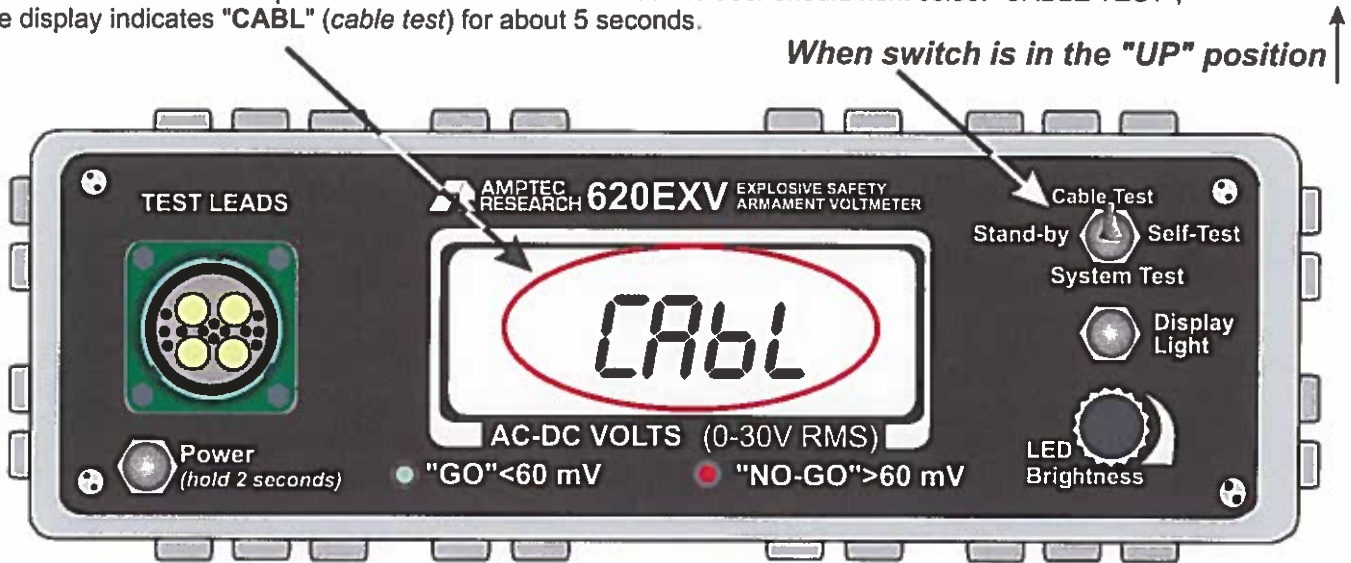
*You should observe that both green "GO" and red "NO-GO" LEDs and all display segments are lit*

3. If "Self-Test checks out alright, the display indicates "PASS" for about 3 seconds.

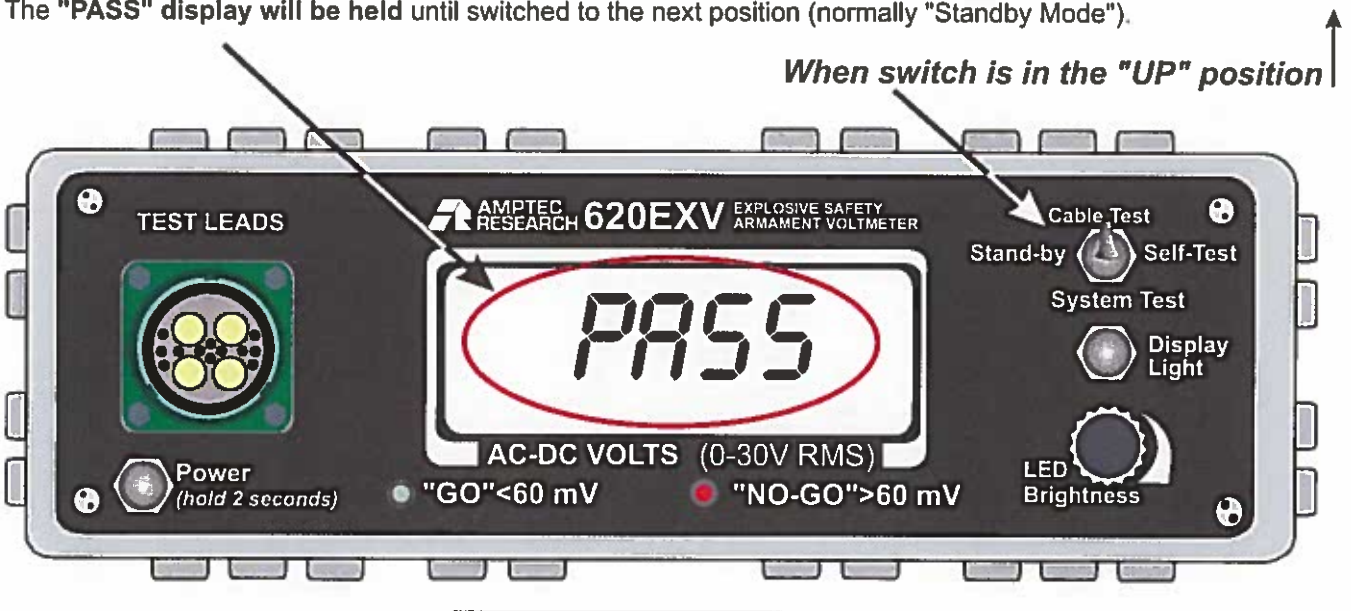




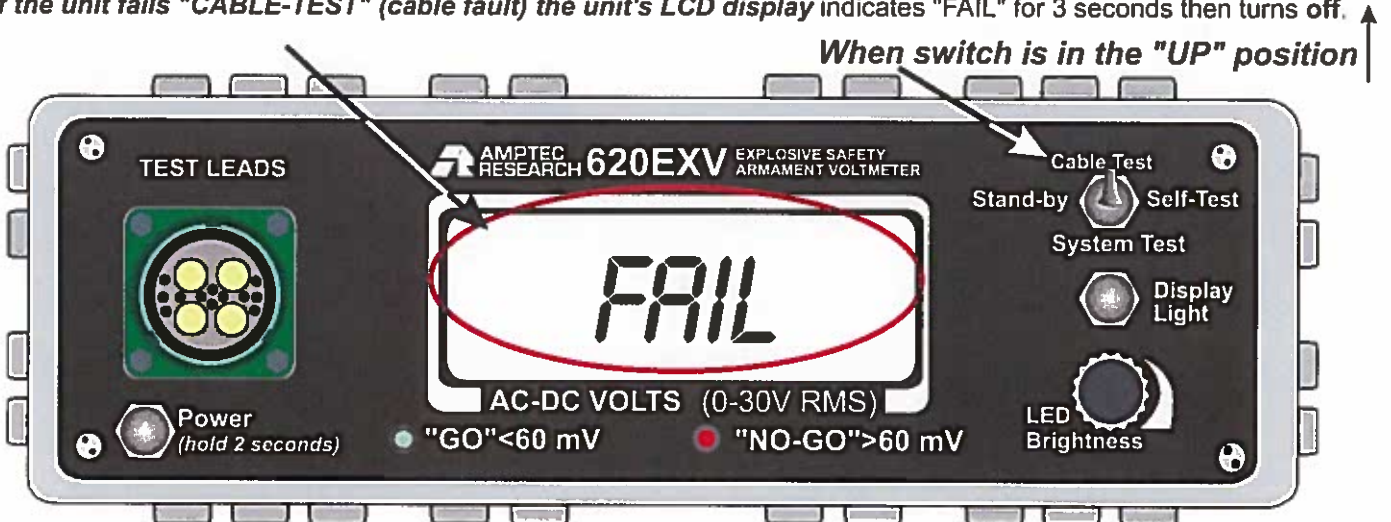
7. With a Mil-C-5015 compatible test lead cable connected the user should next select "CABLE TEST", the display indicates "CABL" (cable test) for about 5 seconds.



8. The next step in a "cable test" using a functional cable that is not broken the unit's display indicates "PASS". The "PASS" display will be held until switched to the next position (normally "Standby Mode").

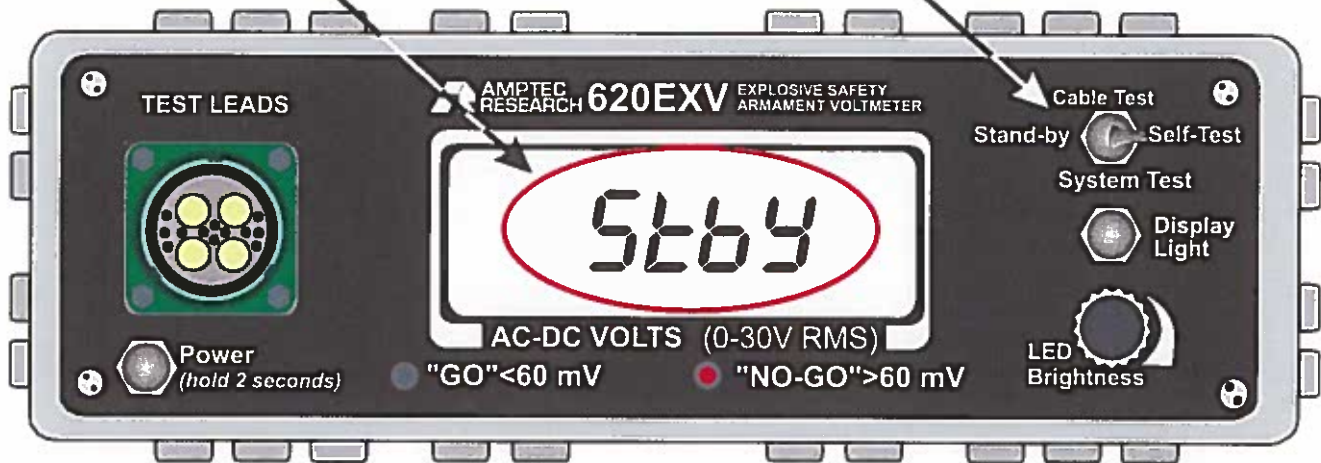


9. if the unit fails "CABLE-TEST" (cable fault) the unit's LCD display indicates "FAIL" for 3 seconds then turns off.



10. After successfully completing the "Cable Test" the user can return the unit into the "Stand-By" switch position. The display will then indicates "StbY" (display is held).

When switch is in the "middle" position →



### System Test Mode - Description

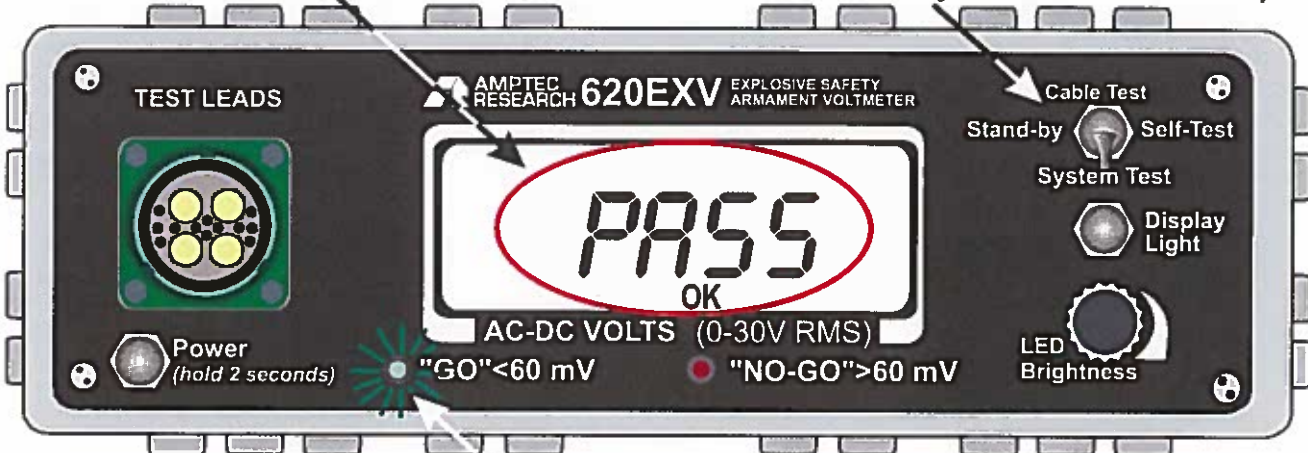
11. To begin to test an Aircraft, Tank, Missile etc. connect the cable to the device under test and the user selects the "System Test" switch position (flip 3 way toggle switch down). The display will then indicates "SYST" (for System) for 4 seconds.

When switch is in the "down" position ↓



12. If <60 mV is measured by the unit the display indicates "PASS" (this indication is held for 3 seconds) and the green "GO" <60 mV LED is actively lit for this low voltage level.

"System Test" mode when the 3 way switch is in the "down" position ↓



The green "GO" <60 mV LED is actively lit when <60 mV is present

*System Test mode continued*

13. If <60 mV is still being measured after displaying "PASS" the actual voltage is then displayed and the green "GO"<60 mV LED is actively indicated. (note: the GO and NO-GO circuit is more accurate than the 30 V range voltmeter at the 60 mV level)

*"System Test" mode when the 3 way switch is in the "down" position*



The green "GO" <60 mV LED is actively indicating when <60 mV is present.

The "OK" indicates the System PASSED the "System" Voltage GO/NO-GO 60 mV Test.

14. If >60 mV is being measured by the unit, the display indicates "FAIL" (held for only 3 seconds then goes right to step 15 below) and the red "NO-GO" >60 mV LED is lit.

*"System Test" mode when the 3 way switch is in the "down" position*

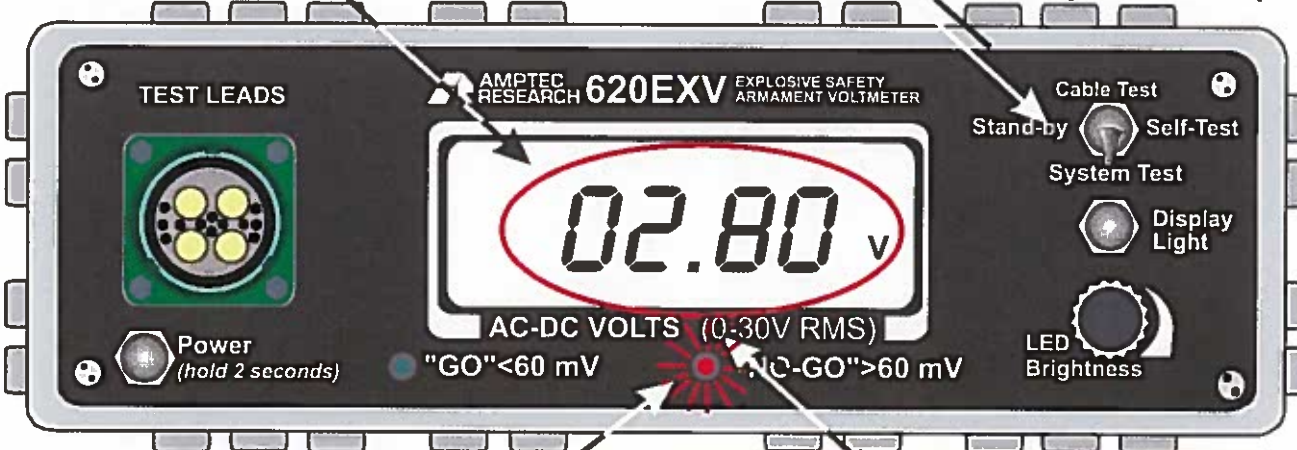


red "NO-GO" >60 mV LED is lit

*if System Test Fails*

15. Should a "System Test" fail (after displaying FAIL for 3 seconds) the actual voltage present on the test cable is displayed and the red "NO-GO" >60 mV LED circuitry is actively lit, if >60 mV is present (likewise the green "GO" LED if <60mV is present).

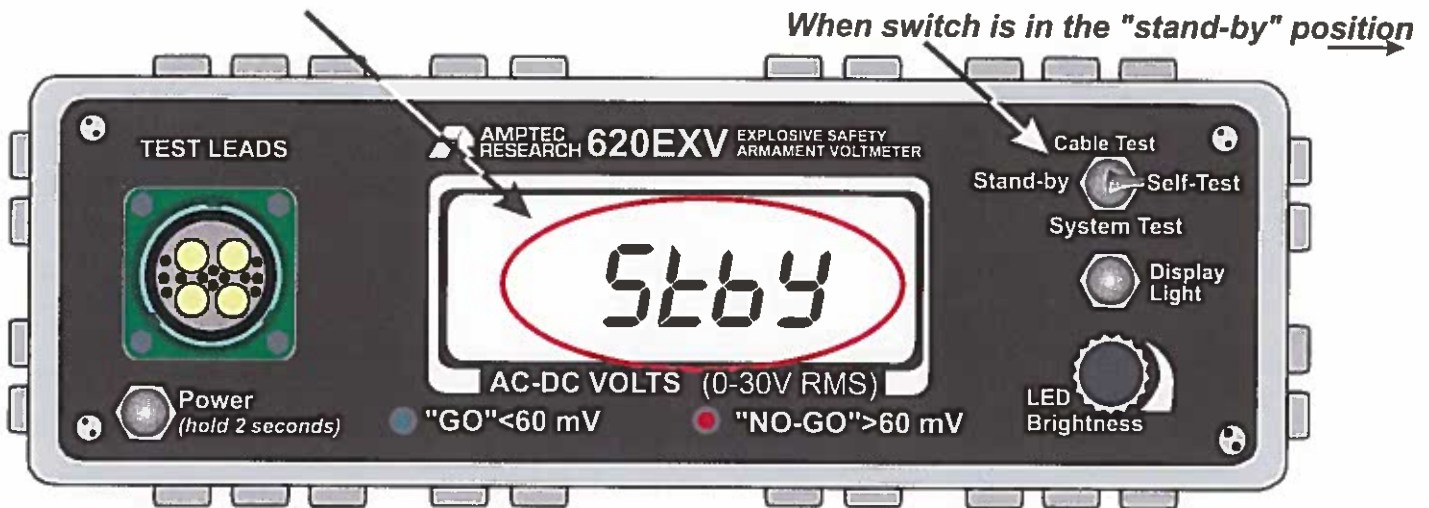
*When switch is in the "System Test" position*



The red "NO-GO" >60 mV LED is actively being indicated for this voltage condition

The "OK" indication is removed for a FAILING a System Test.

16. After completing a "System Test", when switched back to the middle "Stand-by" mode, all green "GO" <60 mV and red "NO-GO" LEDs are extinguished and the display indicates "StbY" for Stand-by mode.



17. Should an operator flip the 3 way test mode switch down to the "System Test" position (see item #11) a brand new System Test routine per item #11 (page 4) is initiated.

18. Should the operator flip the 3 way test mode switch up to the "Cable Test" position (see item #7) a brand new cable test routine per item #7 (page 3) is initiated.

**This completes the 620EXV Test Mode Screens and functions .**

#### C-7 620EXV METAL CHASSIS DESCRIPTION

The AMPTEC 620EXV Voltmeter case is black textured powder coated **aluminum 6063 alloy enclosure** that acts as a **Faraday cage surrounding the unit's internal electronics**. Internally the AMPTEC 620EXV Voltmeter chassis is wired to the aluminum rear panel, aluminum battery compartment, and front panel. Since the AMPTEC 620EXV Armament Voltmeter is portable and battery powered it may be floated (ungrounded) to make the "voltage " measurement.

The chassis is also fitted with tamper resistant screws to ensure that only authorized access is possible. A special screw-driver is required to gain access to the internal electronics and battery compartment. *Inquire with the customer service department at PERMAC ELECTRONICS LTD. for details.*

The AMPTEC 620EXV Voltmeter is supplied with a padded canvas-like carrying case that is made of a durable water resistant material. The carrying case is padded and the 620EXV "No-Volts" Safety Voltmeter has silicone rubber bumper bezel trim front and rear edges that provide excellent protection should the meter be dropped on any of its six sides.



## SECTION D : MAINTENANCE, REPAIR AND CALIBRATION

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### D-1. General

The 620EXV Armament Voltmeter is shown in PCB block diagram form (*see page 14*). The 620EXV primarily uses modern solid-state surface mount semiconductors and digital CMOS circuits extensively to minimize power requirements and make battery operation useful and practical. PERMAC Electronics Ltd. maintains a **620EXV spare PCB inventory** and it's customer service department can also provide additional assistance in the trouble shooting process.

#### **Board (PCB) Exchange in Lieu of Troubleshooting by Authorised Personnel Only**

Since the 620EXV Voltmeter is used to make measurements on a variety of explosive devices often in potentially explosive fuel air atmospheres, *personnel that aren't qualified to make such electrical repairs on the 620EXV Armament Voltmeter shouldn't attempt to remove the calibration sticker and make adjustments or open the main front panel or effect any repair whatsoever.* Considering the majority of components on the unit's main PCB are very small surface mount parts, troubleshooting for component replacement is not practical. Main PCB exchange is recommended.

Apparent 620EXV voltmeter problems may sometimes be the result of 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 main PCB replacement. *If you turn on the 620EXV, and the display doesn't come on,* it may indicate the batteries need charging, if the display is still non-functional after charging the batteries check both ends of the unit's display ribbon cable connector.

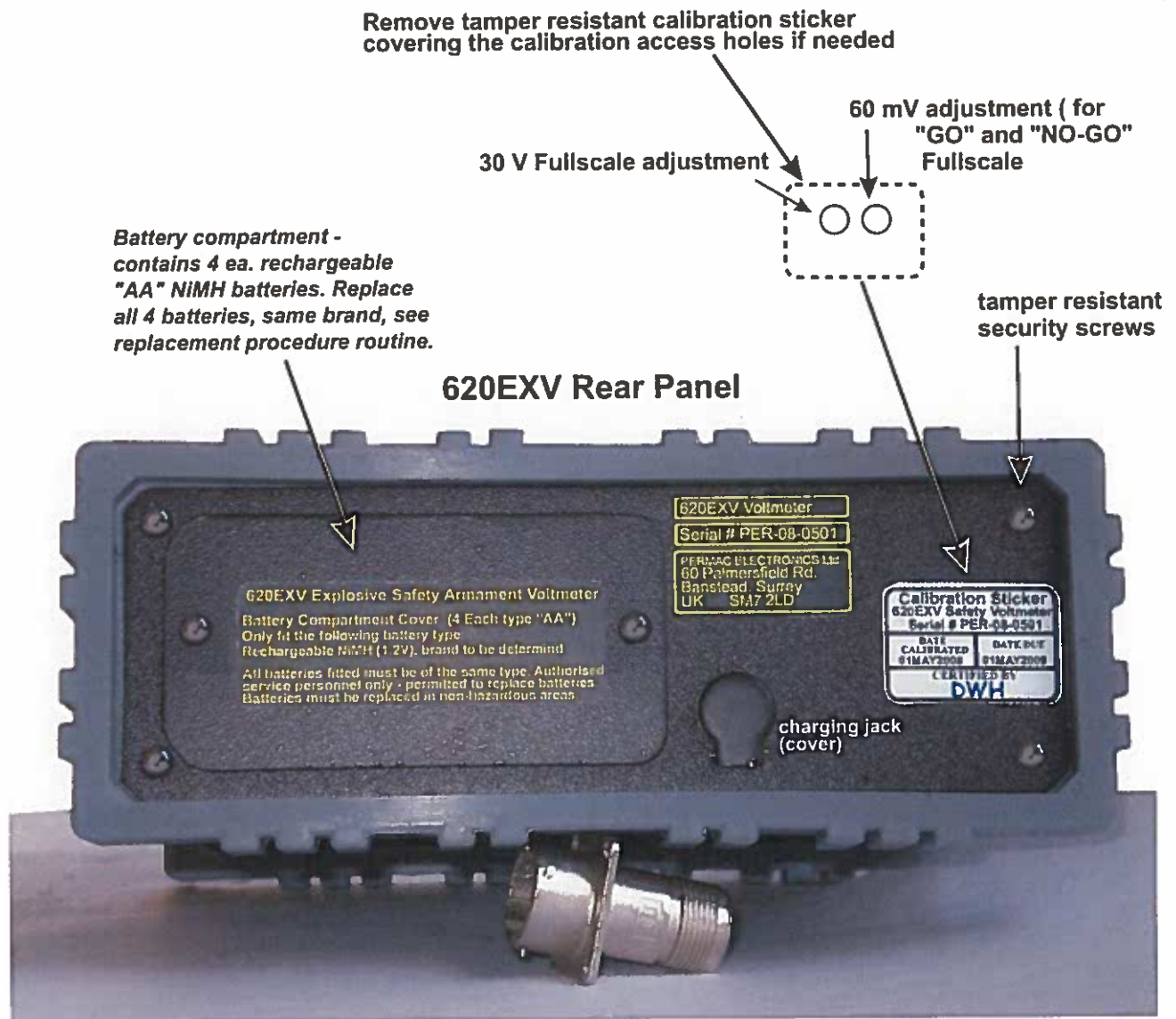
### D-2. Calibration Adjustments

There is only one internal main printed circuit board (PCB) that performs all the digital voltmeter "GO" and "NO-GO" voltage measurements. The 620EXV Explosive Safety Armament Voltmeter uses an "*intrinsically safe*" voltmeter circuit (EEX certification pending) with solid state voltage reference and is ready to calibrate once "SELF-TEST" is passed. The digital voltmeter PCB electronics provide a stable DC or AC voltage measurement for 00.01 volts to 30.00 volts (AC or DC). The digital voltmeter (DVM PCB) electronics uses a high input impedance voltage sense circuit. This circuit draws very little current while measuring any voltage from a "unit under test". The AMPTEC 620EXV DVM PCB slides in (a slot or groove) that also aligns the rear panel calibration access holes with the two trimpots (60 mV and 30.00 V fullscale adjustments) as show on the assembly/disassembly diagram on the next page.

--- see photo, details and 620EXV "No Volts" Meter adjustment procedure on next page ---



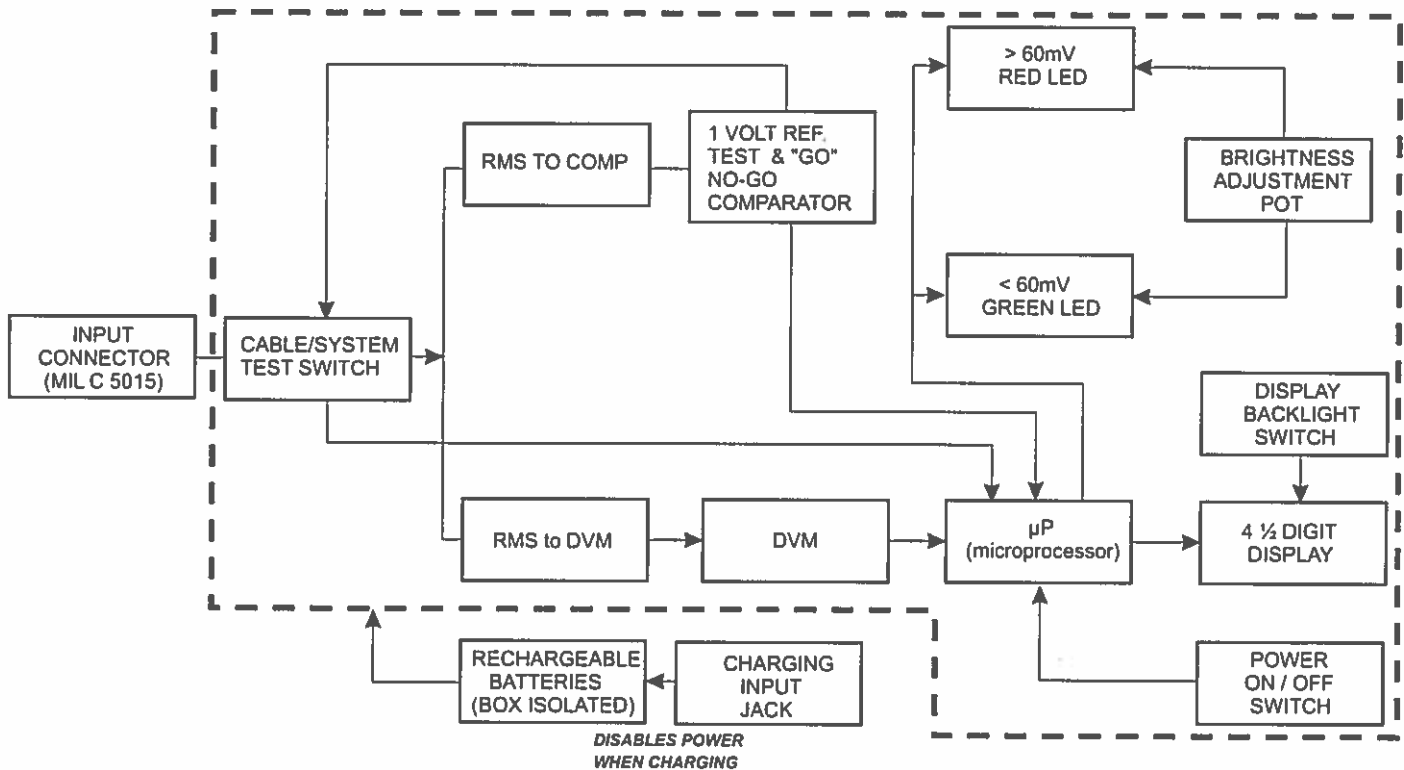
## D-2.1 620EXV rear panel calibration adjustment diagram



Following a successful 620EXV voltmeter "SELF-TEST" switch the unit to "In-Use" mode. If the 620EXV performance is verified to be well within specification then no adjustment is necessary. Only if the 620EXV voltmeter measurement accuracy is marginal or "out of specification" does it need adjustment. Assuming the instrument is at room temperature and there is no "LO-BAT" indication, it is now ready for calibration adjustments.

Use the following 620EXV Voltmeter Adjustment Procedure:

- 1.) Remove the rear panel tamper resistant calibration sticker covering the calibration access holes.
- 2.) Input 30.00 VDC from a precision DC Voltage Standard (0.01% or better accuracy) into the 620EXV voltmeter.
- 3.) Adjust the leftmost trimpot (through the rear panel calib. hole) for the 620EXV's display to indicate 30.00 V.
- 4.) Input 60.00 mV DC from a precision DC Voltage Standard (0.05 % or better accuracy). Adjust the rightmost trimpot (through the rear panel calib. access hole) until you observe the front panel red "NO-GO" LED just comes on. Now lower the input voltage level from the DC Standard to 59.00 mV DC and observe the green "GO" LED should just be lit. You should be able to adjust the sensitivity with the 60mV calibration trimpot, between the front panel "GO" and "NO-GO" LEDs . At a 59 mV input this should cause the green "GO" LED to come on and with 60 mV input the red "NO-GO" LED should come on (and the green "GO" LED is off).



**D-3 AMPTEC 620EXV Armament Voltmeter Block Diagram**

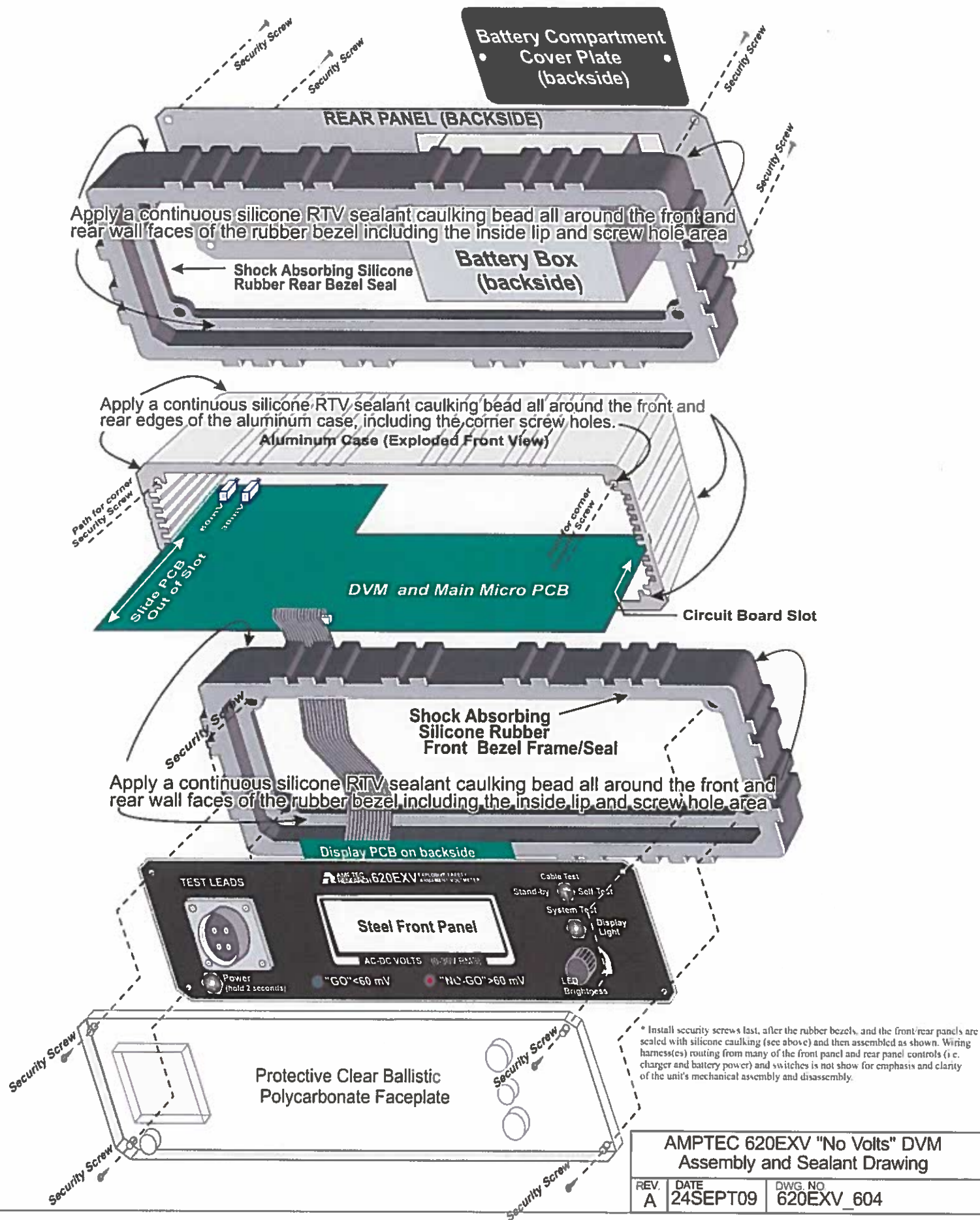
**D-4 Principle of Operation**

The AMPTEC 620EXV Safety Voltmeter fundamentally measures AC and DC voltage using a microprocessor to control an intrinsically safe digital voltmeter circuit. The 620EXV Voltmeter diagram above shows all the different functional blocks of the instrument. The RMS voltage measurement circuit has two primary functions. The RMS circuit routes the RMS level of input "voltage being tested" into the "GO"/ "NO-GO" voltage comparator circuit for the 60 mV determination. The RMS circuitry also routes the RMS level of the input voltage into the digital voltmeter circuitry. The unit's comparator circuitry is optimized for the proper activation of the unit's front panel green "GO" LED and red "NO-GO" LED indication. Use the "GO" and "NO-GO" LEDs to determine if 60 mV is present with the voltage level being tested, rather than the digital voltmeter. The digital voltmeter scale is set-up to indicate from 0.00 volts to 30.00 volts with only 10 mV resolution, so it is not near as accurate as the "GO"/ "NO-GO" comparator at the 60 mV level.

**D-5 PCB Exchange / Replacement**

If the malfunction is a component failure, the repair of the AMPTEC 620EXV Voltmeter can be maintained by replacing the PCB (Printed Circuit Board) that the faulty component is located on (99% of the components are on the unit's main PCB). There are no serviceable components on the 620EXV PCBs, it is a case of PCB exchange/replacement. PERMAC Electronics Ltd. ( AMPTEC's UK based manufacturer) provides a "No-Charge" PCB replacement while the 620EXV Voltmeter is under warranty (1 year) and also for "non-warranty" repairs on a case by case basis. PERMAC Electronics Ltd. customer service dept. should be contacted if it is determined that the unit needs repair. There is no fee for PERMAC Electronics Ltd. to evaluate any problem associated with the AMPTEC 620EXV Voltmeter, regardless of warranty status.

# AMPTEC 620EXV "No Volts" Safety Voltmeter Silicone Sealant Diagram



AMPTEC 620EXV "No Volts" DVM  
Assembly and Sealant Drawing

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### D-5 (continued) PCB removal from case -

Contact PERMAC Electronics Ltd.'s customer service department prior to any PCB removal as the procedure described below may be subject to change in the future.

A) Use a security tipped screwdriver to remove the voltmeter's four front panel security screws located in the corners. **Use caution when pulling the 620EXV front panel with gasket bezel and internal PCB from the aluminum case.** There are four wires (battery supply + positive and - negative, and two DVM sense wires red and black) and a single ribbon cable (going to display PCB) with cable plug that connects the front panel electronics to Main/DVM PCB circuitry located inside the 620EXV case. Slide the boards out (via front panel removal) to gain this PCB access.

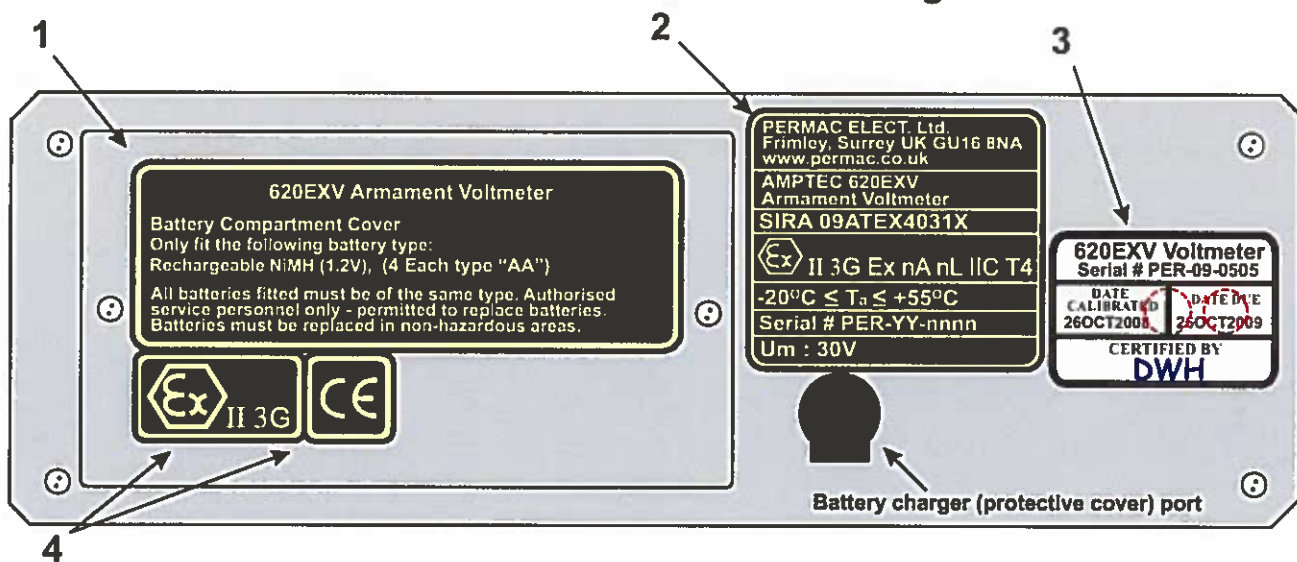
B) Pay careful attention to all wiring /PCB location and their polarity as found on the PCB connection. Disconnect all wires and cables that go to the faulty PCB at their PCB location/junction. Unplug the ribbon cable (that goes to the display PCB) from its PCB header.

C) Reinstall (solder) all wiring (proper polarity is important) and plug all ribbon cabling (back to their equivalent and proper location) on the new PCB.

D) After an accuracy verification/determination, an adjustment/calibration procedure is only necessary if the 620EXV is "out-of-tolerance" or "marginal" tolerance. Follow the calibration adjustment procedure (see previous page).

E) Slide the main PCB back into its slot along with the front panel and bezel assembly. Make sure the battery supply wiring is not pinched during this process and replace the front panel and bezel assembly and security screws in their corner location.

### 620EXV Rear Panel Sticker Drawing



1. **Battery compartment cover**, houses 4 ca. rechargeable "AA" NiMH batteries. It's sticker details type of batteries to be fitted, voltage rating, and size along with technician replacement instructions.

2. Name and address of **Manufacturer** (Permac Electronics Ltd.). **Apparatus name** / model number, certificate number Sira 09ATEX4031X, ATEX Code "Ex nA nL IIC T4", **Temperature** use range from  $-20^{\circ}\text{C} \leq T_a \leq +55^{\circ}\text{C}$  and serial number (year of mfg. incorporated), and maximum **voltage input rating**.

3. **Annual Calibration Sticker** - contains the present calibration date, calibration due date, technician initials and serial number of the meter. This sticker also covers two hole plugs that would provide access to the unit's main adjustment trimpots (30V fullscale and 60 mV adjustments) inside, *when removed*.

4. Sticker details the European Mark  $\text{Ex}$  II 3G, and carries the CE Mark.

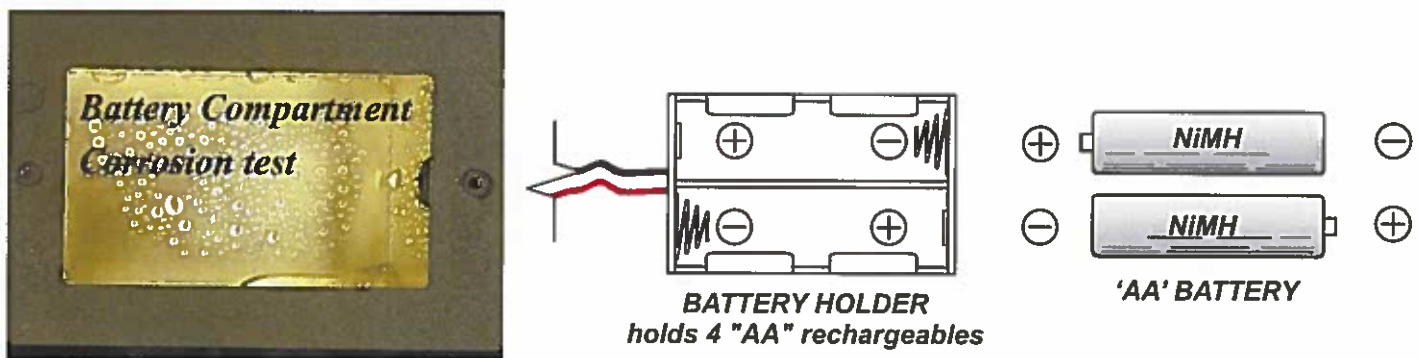
The unit's stickers (MARKs, Serial #, Code, Certification #, etc.) are made of vinyl sheet with an extremely tamper resistant adhesive backing. The colored ink is baked/fused onto the vinyl then several clear protective coatings of polyurethane (provides excellent weather/wear resistance) are added.

AMPTEC 620EXV "No Volts" DVM  
Rear Panel Sticker Assembly Drawing

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### D-7 Battery Compartment Design and Description

The metal battery compartment is coated to make it chemically resistant to battery leakage. The battery compartment cover is backed with a **rubber based compression gasket liner** that provides a water and chemical leak resistant seal when secured. The battery compartment battery holder houses four AA-size batteries. The supply wires connect the batteries to the Printed Circuit Boards inside the Voltmeter passing through a small rubber grommet lined hole in the side of the battery compartment. The battery supply wiring insulation is made of extra thick (>0.5 mm) teflon (much better than PVC insulation) to provide the 620EXV with excellent resistance to accidental cutting or wear and highly scorch resistant to a hot soldering iron. In order to remove or replace the batteries you must remove the two retaining screws securing the battery compartment cover plate. Removing the screws that secure the battery cover plate gives you access to the battery compartment. *Make sure to re-secure the new batteries via a plastic cable tie around the batteries and holder to prevent any battery from dislodging from the spring contacts of battery holder. Replace all four rechargeable NIMH "AA" batteries with new ones all same brand, 1.2 VDC ea. or equivalent as needed.* Using a plastic tie wrap in the battery compartment, wrap the plastic around the battery holder and secure. Cut excess plastic tie wrap ends.



### Def Std 66-31/2 Section 8.14 Alkaline Corrosion

The battery compartment used in the 620EXV has been shown to be chemically resistant to battery corrosion . The photo above shows (after 24 hours) a caustic alkaline solution of potassium hydroxide sprayed inside the battery compartment used in the 620EXV Armament Voltmeter. Per Defense Standard 66-31 / 2 Section 8.14 Alkaline Corrosion test, a 35% W/V solution of Potassium Hydroxide in distilled water was sprayed into the battery compartment in sufficient quantity to wet the entire surface. The compartment was closed and the equipment left in its normal operating attitude at room temperature for a period of 24 hours. At the end of this period there was no evidence of leakage from the compartment and no evidence of corrosion within it.

### D-8 Manual Updates and Safety Approvals

This area of the manual is reserved for abbreviated information on pending/future Safety Board Approvals (CE, ATEX EEX) , see AMPTEC's website ([www.amptec.com](http://www.amptec.com)) as updates become available. (website - [www.amptec.com/tech.htm](http://www.amptec.com/tech.htm) - e-mail for document access password - schematics etc. )



**AMPTEC 620EXV  
Explosive Safety  
"NO VOLTS" Armament Voltmeter**

**REAR COVER of MANUAL**