

ELECTRONICS INTERNATIONAL INC.

Volt/Amp  
Operating Instructions

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OI 041032

4/10/83  
Rev. A 2/26/87

There are two common methods of installing a VA-1 or VA-1-XX in the electrical system of your aircraft. Following are the operating characteristics of the VA units for each of these methods.

1. VA-1 or External Shunt Installed in the Battery Lead.

With this method, the VA unit will display the battery charging current during normal flight. If for any reason the alternator cannot supply the total electrical load a "Discharging" warning light over the display will come on warning the pilot that the battery is now supplying a portion or all of the load current and is discharging. The amount of discharging current will be shown in the display. When this happens, turn off any unnecessary electrical equipment. The lower you can get the discharging current, the longer the battery will last.

It is recommended to continuously monitor the battery amps in normal flight to detect any alternator or generator malfunction or a serious electrical overload before it can discharge the aircraft battery and render the aircraft's electrical equipment useless.

The electrical system load can be checked before the engine is started or at any time by switching the alternator off with a split master switch. This should only be done after you have turned off all your electrical equipment to avoid any possible damage due to over voltage spikes. The VA unit will display a discharging current representing the aircraft's electrical load. In this mode of operation any piece of electrical equipment can be checked for proper operation by performing the following steps:

1. Note the amps reading on the VA unit.
2. Turn off the piece of electrical equipment you wish to check.
3. If this piece of electrical equipment is working properly, you will see a decrease in load current that corresponds to the current that piece of equipment requires.

Using this method with the digital display of the VA unit, many important aircraft functions (strobes, retracts, radios, ,transponder, ADFs, DMES, pitot heat, etc.) can be checked from the pilot's seat. It would be worthwhile to note the load current for the entire system and for each piece of equipment when working properly. This would give you something to compare to when you wish to check for proper operation at a later date. You may also check the entire electrical system with one check by turning all the electrical equipment on and comparing this reading with your normal reading. If a improper reading is noted the VA unit may then be used to diagnose what piece of equipment has malfunctioned.

At any time the VA unit can be switched to monitor the battery or bus voltage. During normal flight, the battery voltage will read around 13.5 to 14.5 volts (27 to 29 volts for a 24 volt system). If this voltage goes above 15.6 volts you have a overvoltage condition and equipment or battery damage can occur. In a discharging condition monitoring battery voltage to .1 volts with the VA unit will display trend information. As you watch the battery discharging .1 volts at a time, it becomes relatively easy to judge the remaining time you have before the battery reaches a serious low condition. As the battery voltage approaches 9.5 volts (19 volts for a 24 volt system), the aircraft's electrical equipment will start to malfunction. The exact voltage at which each piece of equipment will start to malfunction depends on the design of that equipment. The VA unit will work accurately down to 7 volts. Far below where most electrical equipment starts to fail.

## 2. VA-1 or External Shunt Installed in the Alternator Lead.

With this method the VA unit will display the alternator output current which is the load current for the aircraft's electrical system. In this mode of operation the load current is displayed continuously. The battery charging current is part of this load current. The battery discharging current cannot be displayed. If for any reason the alternator cannot supply the total electrical load, the battery will start to discharge. This condition will not be displayed with the "Discharging" warning light. This light will only come on when the alternator is supplying absolutely no current. To determine if the battery is discharging, switch the VA unit to monitor battery voltage. When the battery voltage drops below 12 volts, the battery is discharging. As you watch the battery discharging .1 volts at a time, it becomes relatively easy to judge the remaining time you have before the battery reaches a serious low condition. As the battery voltage approaches 9.5 volts (19 volts for a 24 volt system), the aircraft's electrical equipment will start to malfunction. The exact voltage at which each piece of equipment will start to malfunction depends on the design of that equipment. The VA unit will work accurately down to 7 volts. Far below where most electrical equipment starts to fail.

Since the electrical system load is displayed continuously, any piece of electrical equipment can be checked for proper operation by performing the following steps:

1. Note the amps reading on the VA unit.
2. Turn off the piece of electrical equipment you wish to check.
3. If this piece of electrical equipment is working properly, you will see a decrease in load current that corresponds to the current that piece of equipment requires.

Using this method with the digital display of the VA unit, many important aircraft functions (strobes, retracts, radios, transponder, ADFs, DMEs, pitot heat, etc.) can be checked from the pilot's seat. It would be worthwhile to note the load current for the entire system and for each piece of equipment when working properly. This would give you something to compare to when you wish to check for proper operation at a later date. You may also check the entire electrical system with one check by turning all the electrical equipment on and comparing this reading with your normal reading. If a improper reading is noted the VA unit may then be used to diagnose what piece of equipment has malfunctioned. In this mode of operation the battery charging current is part of the load current and will be changing rapidly for the first few minutes (replenishing the current required to start the engine). Also, this test should be performed at an RPM above idle to insure the alternator is supplying all of the load.

Volt/Amp  
Installation Instructions  
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II 040934

4/9/83  
Rev. B 12/4/87

General Information: There are two types of volt/amp meters used in aircraft, internal shunt units and external shunt units.

**Internal Shunt Units** - Electronics International Inc. manufactures a VA-1 which is our only internal shunt unit. It has the shunt built into the unit, has two large lugs on the back of the unit and all of the electrical current passes through this gauge. Use this gauge if your aircraft is currently wired for an internal shunt unit or if you elect to route your main alternator or battery supply line up to the instrument panel. As with all internal shunt units, the current capability is limited. The VA-1 is capable of handling 100 amps continuous current. If your aircraft's electrical system is designed to draw more than 100 amps continuous current, you should use one of our external shunt units.

**External Shunt Units** - An external shunt is a strip of metal, usually mounted on a bakelite base. This metal is made of special alloys to produce a very small, precise signal when current passes through it and is not affected by temperature changes.

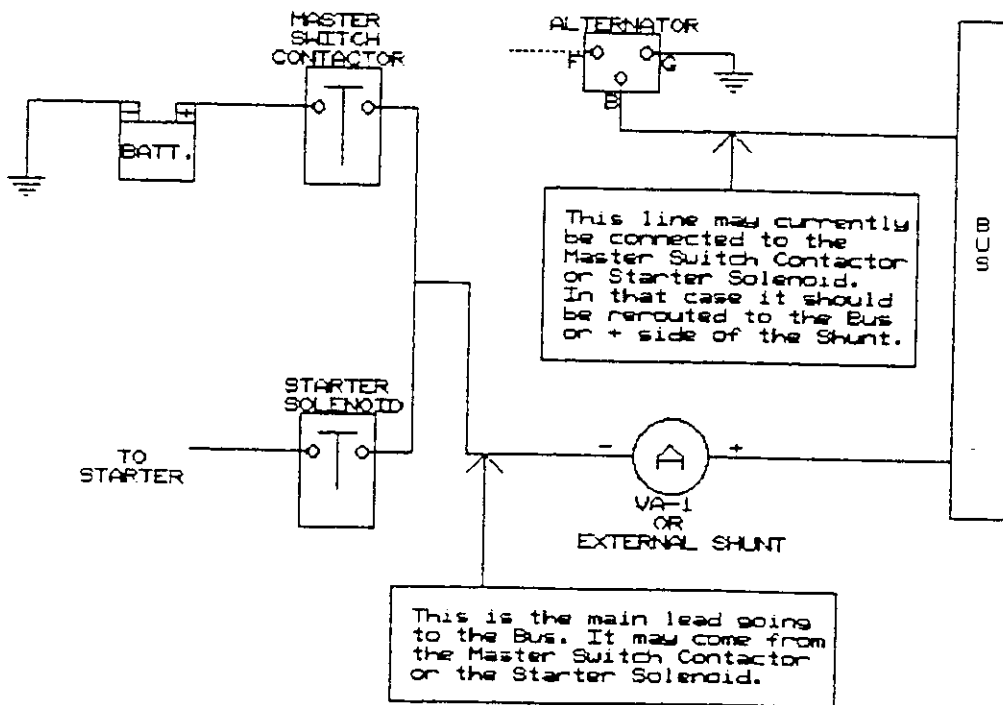
If your aircraft currently has an external shunt you should order a gauge to match that shunt. Electronics International manufactures a line of external shunt units (VA-1-XX, "XX" = shunt value in amps) that will match any shunt on the market. If your aircraft does not have an external shunt and you elect to install an external shunt, then order our VA-1-50 and S-50 shunt (100 amp capability) for aircrafts drawing less than 100 amps maximum, or our VA-1-300 and an S-300 shunt (300 amp shunt). Please note: All 50 amp units (100 amp capability) resolve to .1 amp and all units above 50 amps resolve to 1 amp. With our digital display, one amp resolution will still make an excellent electrical diagnostic tool since the current requirements for almost all pieces of equipment in an aircraft are more than one amp.

Step 1: Determine how the VA-1 or VA-1-XX will be installed in your aircraft's electrical system.

Obtain an electrical diagram of your aircraft's alternator/starter system from the service manual. There are two common ways an ammeter is installed in an aircraft. One method is with the ammeter in the generator or alternator lead. The other method is with the ammeter in the battery lead. The VA-1 or VA-1-XX may be installed using either method, but if it is installed in the battery lead you will be taking the greatest advantage of the unique features of this units. Following is a typical diagram of each installation. Read the Operating Instructions for details on the advantages and disadvantages of each method. Determine how the VA-1 or VA-1-XX will be installed in your aircraft.

FIGURE 1: VA-1 OR EXTERNAL SHUNT INSTALLED IN THE BATTERY LEAD.

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NOTE: THE VA-1 OR EXTERNAL SHUNT SHOULD NOT BE INSTALLED IN SERIES WITH THE STARTING CURRENT.

FIGURE 2: VA-1 OR EXTERNAL SHUNT INSTALLED IN THE ALTERNATOR LEAD.

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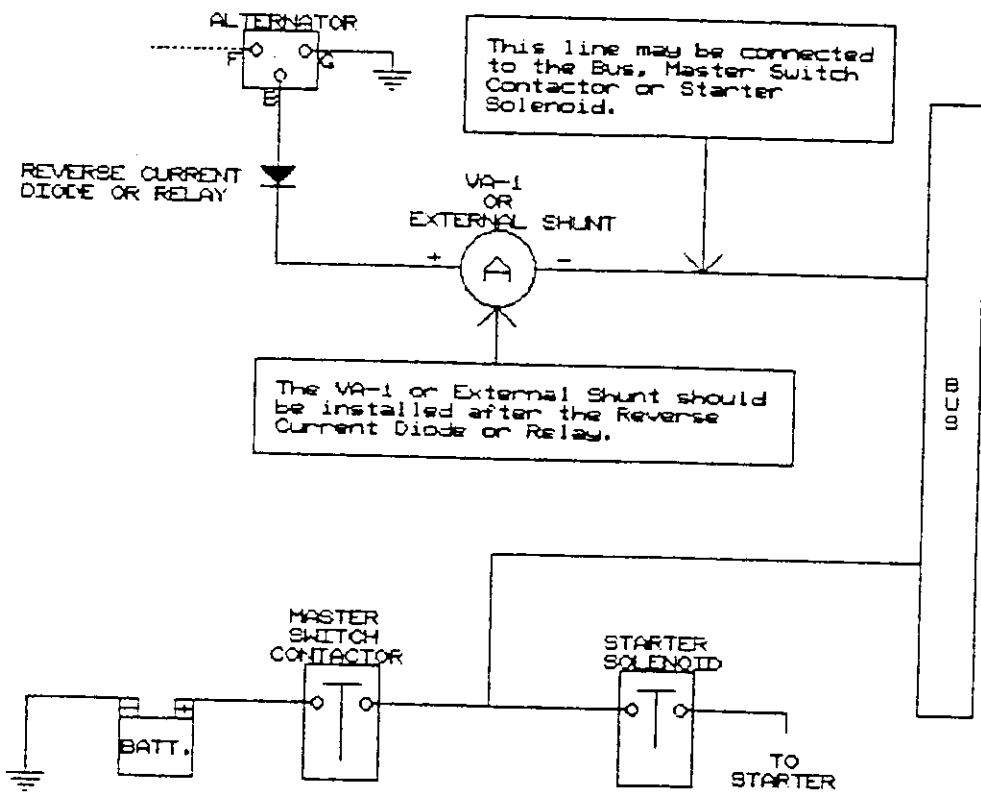
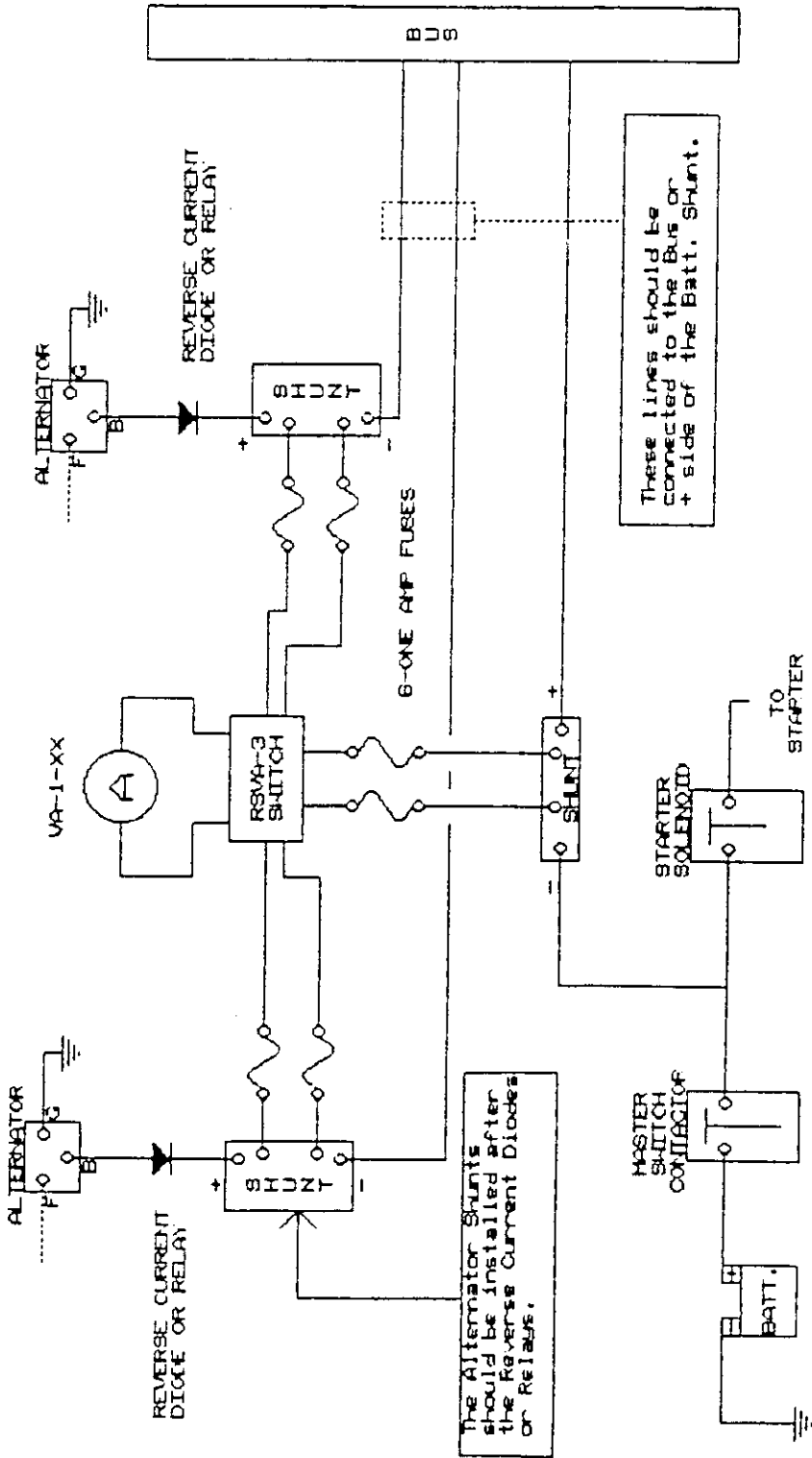


FIGURE 3: VA-1-XX AND RSV-3 INSTALLED IN A 1400 ENGINE AIRCRAFT.  
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NOTE: THE EXTERNAL SHUNTS SHOULD NOT BE INSTALLED IN SERIES WITH THE STARTING CURRENT.

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Step 2: Install the External Shunt, if Required.

The external shunt should be installed in an appropriate location that minimizes the routing of main cables. It should also be mounted in a location where inadvertent damage cannot occur. If the shunt can be easily accessed, it should be covered. When mounting the shunt, use self-locking or wired nuts.

Step 3: Connect Wires.

Route the appropriate bus, battery or alternator leads to the VA-1 mounting location or to the external shunt. Connect the black wire from the accessory kit to ground. Connect the white wire to the panel rheostat.

For a unit requiring an external shunt, install the red lead from the accessory kit (via a 1 amp fuse) to the power supply bus and install the brown and orange wires (via two 1 amp fuses) to the shunt. Tie wrap any loose wires as needed.

Step 4: Install the Instrument.

Connect the appropriate leads to your unit as outlined in the wiring diagram. Install the unit from behind the instrument panel using 6 x 32 screws. These screws should not be any longer than .4 inches. Tie wrap any loose wires as needed.

If you have any trouble with your installation or if we can help please call us at 503-640-9797 or 503-640-8384.

**WARRANTY:**

Electronics International Inc. warrants each of its CHT and TIT Temp units and system components to be free from defects in material and workmanship for a period of one year from the user invoice date. Electronics International Inc. will repair or replace any item under the terms of this Warranty provided the item is returned to the factory prepaid. This Warranty does not apply if the item has been damaged by misuse or incorrect installation. This Warranty is made only to the original user. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES OR OBLIGATIONS EXPRESS OR IMPLIED. MANUFACTURER EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. PURCHASER AGREES THAT IN NO EVENT SHALL MANUFACTURER BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS OR LOSS OF USE OR OTHER ECONOMIC LOSS. EXCEPT AS EXPRESSLY PROVIDED HEREIN, MANUFACTURER DISCLAIMS ALL OTHER LIABILITY TO PURCHASER OR ANY OTHER PERSON IN CONNECTION WITH THE USE OR PERFORMANCE OF MANUFACTURER'S PRODUCTS, INCLUDING SPECIFICALLY LIABILITY IN TORT.

## TROUBLESHOOTING

SYMPTOMPOSSIBLE PROBLEM

- |                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. No display.                                  | A. Check the ground connection.                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                 | B. Check the + and - terminals on a VA-1.                                                                                                                                                                                                                                                                                                                                                                              |
|                                                 | C. Check the Red lead and connections on a VA-1-XX.                                                                                                                                                                                                                                                                                                                                                                    |
| 2. Voltage or Current readings are not correct. | A. The VA-1 and VA-1-XX measures the voltage on the Shunt (not on the red power lead). The voltage on the Shunt should be the same as the bus voltage.                                                                                                                                                                                                                                                                 |
|                                                 | B. The VA-1 or External Shunt should be mounted after the Reverse Current Diode if the unit is installed in the alternator output lead. See figure 2.                                                                                                                                                                                                                                                                  |
|                                                 | C. If this unit is installed in the battery lead, check the connection location of the Alternator output. It should be connected to the bus or + side of the Shunt. See figure 1.                                                                                                                                                                                                                                      |
|                                                 | D. Check the Shunt connections, wires and fuses.                                                                                                                                                                                                                                                                                                                                                                       |
| 3. Reading jumps.                               | A. Check the Shunt connections, wires and fuses.                                                                                                                                                                                                                                                                                                                                                                       |
|                                                 | B. The VA units were designed to not respond to normal current or voltage fluctuations. However, large fluctuations will be displayed letting the pilot know there is a large varying load on the system (retracts, etc.) or there may be a potential problem in the aircraft system (faulty regulator, alternator, etc.) A hand-held digital voltmeter may be used on the bus to verify the operation of the VA unit. |

NOTE: If the problem cannot be found, contact the factory for assistance. If any item is returned for repair include a description of the symptoms with the item..



# WIRE CONNECTIONS

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## VA-1 (INTERNAL SHUNT)

<u>WIRE FROM UNIT:</u>	<u>CONNECTS TO:</u>
"+" TERMINAL	SEE FIGURE 1 OR 2 IN VA-1 INSTALLATION INSTRUCTIONS
"-" TERMINAL	
SOLID BLACK	GROUND
VIOLET/WHITE	12V PANEL LIGHTS
GRAY/WHITE	24V PANEL LIGHTS

## VA-1-xx (EXTERNAL SHUNT)

<u>WIRE FROM UNIT:</u>	<u>CONNECTS TO:</u>
SOLID ORANGE	"+" OUTPUT OF SHUNT
SOLID BROWN	"-" OUTPUT OF SHUNT
SOLID RED	12 or 24 VOLT BUS
SOLID BLACK	GROUND
VIOLET/WHITE	12V PANEL LIGHTS
GRAY/WHITE	24V PANEL LIGHTS

## RSVA-3 REMOTE SWITCH

<u>WIRE FROM UNIT:</u>	<u>CONNECTS TO:</u>
BROWN (male conn.)	"+" L. ALT. SHUNT
BROWN (female conn.)	"-" L. ALT. SHUNT
RED (male conn.)	"+" BATT. SHUNT
RED (female conn.)	"-" BATT. SHUNT
ORANGE (male conn.)	"+" R. ALT. SHUNT
ORANGE (female conn.)	"-" R. ALT. SHUNT
ORANGE/WHITE	ORANGE AND BROWN WIRES FROM THE UNIT.

Use brown and orange extension cables provided in the wire packet to connect from the switch to the shunts.



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