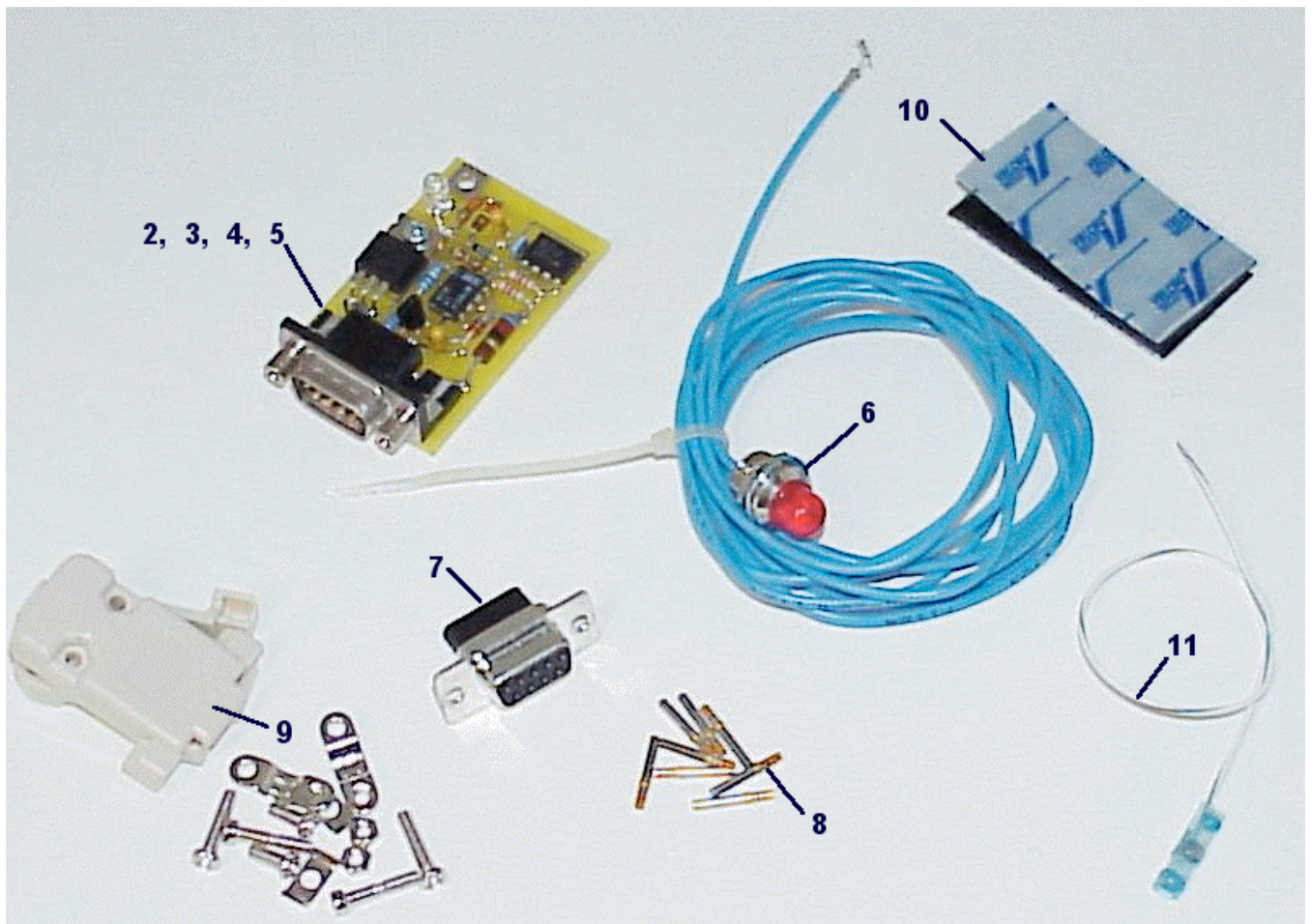




Bob Nuckolls  
6936 Bainbridge Road  
Wichita, Kansas 67226-1008  
Voice/Fax: 316-685-8617  
E-mail: <http://www.aeroelectric.com/bob.nuckolls>

## Installation and Operation Manual AEC9005 Series Low Voltage Warning and Auxiliary Battery Management Modules



# 1. INTRODUCTION

Most pilots suffering alternator failures are unaware of the event until the panel goes black. This is because contemporary electrical system instruments (voltmeter and ammeter) are among those gages that display exactly the same thing for hundreds of hours of operation and tend to be noticed less and less.

When the panel goes black, the battery has been carrying normal ship's electrical loads for some period of time. Once the battery is depleted, the pilot is out of options for judicious utilization of stored electrical energy. The AEC9005 Series Low Volts Warning and Auxiliary Battery Management modules detect and annunciate alternator failure within seconds of the event. Timely notification of alternator failure offers the pilot better options for en route utilization of a limited resource . . . battery capacity.

**Notice**

**The AEC9005 Series Low Voltage Warning/Aux Battery Management Modules are not FAA approved and not offered for use on any type certified aircraft.**

**Do not order this product with intent to install on a type certified aircraft before you contact the local offices of the FAA for guidance and a commitment to assist you with a field approval.**

Some AEC9005 series devices include an Auxiliary Battery Management function for automatic isolation of an auxiliary battery from the rest of ship's electrical system as soon as the alternator failure event is detected. This feature ties an auxiliary battery to the bus during normal alternator operation while assuring that auxiliary battery capacity is automatically reserved to power critical items should the alternator be shut down for any reason.

# 2. FEATURES

- 2.1 Low Bus Voltage Warning:** The AEC9005 series devices monitor ship's bus voltage and flashes a LOW VOLTS WARN annunciator any time the bus is below 13.0 (26.0) volts.
- 2.2 Auxiliary Battery Management:** The AEC9005-101/102 LV Warn/ABMM kits features an open-drain, power transistor rated at 2.0 amps and configured to automatically close an auxiliary battery contactor or relay whenever bus voltage is greater than 13.0 (26.0) volts.
- 2.3 LOW VOLTS WARN Annunciator:** The AEC9005-101/102 LV Warn/ABMM installation kits include a LOW VOLTS WARN annunciator lamp fixture featuring a light emitting diode suited for use with the warning module LED output driver.
- 2.4 LV Warn/ABMM Module:** All electronics for the AEC9005 series modules are mounted on an etched circuit board fitted with a 9-pin, D-subminiature connector. The module is calibrated at assembly using precision resistors and a precision voltage reference diode. No calibration is required over the service life of the product.
- 2.5 LV Warn Module – Open Drain Pull Down Option:** The AEC9005-201/202 LV Warn Modules rewire the power field effect transistor normally used for auxiliary battery management as a pull-to ground switch suitable for controlling incandescent lamps. This option is offered for designs where the builder wishes to annunciate LOW VOLTS on an incandescent lamp annunciator array. Auxiliary battery management is not offered on these models

2.6 LV Warn / Aux Battery Management Module Options				
Kit Part. No.	System Voltage	LED Annunciator Supplied	Pull Down Incandescent Output	Aux Battery Management
AEC9005-101	14	X		X
AEC9005-102	28	X		X
AEC9005-201	14		X	
AEC9005-202	28		X	

### 3. PARTS SUPPLIED

3.1 AEC9005 Series Installation Kits Contents						
		1	1		11	Solder Sleeve for Shield Pigtail
1	1	1	1		10	Self Adhesive Velcro Pair
1	1	1	1	D9H	9	Hood, 9-Pin D-sub
9	9	9	9	D20F	8	Socket, Machined, 20AWG D-sub
1	1	1	1	D9F	7	Connector, 9-Pin D-sub Female
		1	1	9005-200-1	6	Lamp Assembly, LED
1				9005-110-3	5	LV Warn Module, Incandescent Pull-Down, 28V
	1			9005-110-1	4	LV Warn Module, Incandescent Pull-Down, 14V
		1		9005-100-3	3	LV Warn / Aux Batt Management Module, LED, 28V
			1	9005-100-1	2	LV Warn / Aux Batt Management Module, LED, 14V
1	1	1	1	9005-701A	1	Manual, Instruction/Installation
				AEC9005-202		LV Warn Module, Pull-Down Incandescent, 28V (Kit)
				AEC9005-201		LV Warn Module, Pull-Down Incandescent, 14V (Kit)
				AEC9005-102		LV Warn / Aux Batt Management Module, LED, 28V (Kit)
				AEC9005-101		LV Warn / Aux Batt Management Module, LED, 14V (Kit)
-202	-201	-102	-101	Part No.	#	Description
Quantity/Assembly						

**3.2 Materials Not Supplied** Depending on the kit purchased, the installer may need to supply some additional installation materials as follows:

- 3.2.1 **-202 and -201 kits** do not include a LOW VOLTS annunciator fixture. This version of the LV Warn module is intended for use with user supplied incandescent lamp annunciator wherein one side of the lamp is tied to suitable bus supply and illuminates by grounding the annunciator signal lead.
- 3.2.2 **-102 and -101 kits** contain no hardware associated with the optional auxiliary battery management feature. The installer may have to supply an auxiliary battery, auxiliary battery contactor or relay, AUX BAT annunciator lamp, AUX BAT MASTER switch and inline fuse or fusible link for the AUX BAT annunciator circuit.. See wiring diagrams for exemplar parts suited to these tasks.
- 3.2.3 None of the kits will supply 22AWG lead wire recommended for connection the LV Warn / Aux Battery Management Module to ship's systems.

### 4. INSTALLATION TOOLS

**4.1** Aside from ordinary hand tools you will need a crimping tool (B&C Specialty Products RCT-3 or equivalent) to install the machined D-sub connector pins supplied with these kits. In case you put a pin into the wrong hole and need to remove it, you may also wish to purchase a rear-release extraction tool for these pins (B&C Catalog # DSE-1). D-sub connectors are widely use in many aviation products and these tools are good additions to your toolbox. If prefer you may substitute a solder type, 9-pin, female D-sub connector from a local supplier.

### 5. INSTALLATION INSTRUCTIONS

**5.1 Etched Circuit Board Assembly:** The ECB assembly (Items 2, 3, 4, 5) is supplied with a Velcro strip (10) installed on the underside surface. The primary reason is to provide nearly total coverage of the solder side of the ECB for protection from inadvertent contact with conductors. Bonding qualities of adhesive used for Velcro mounting is time dependent.

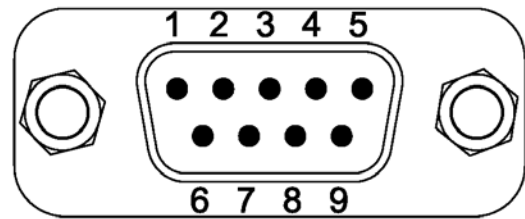
9005-701B  
9 February 2003

Clean the surface where the ECB is to be mounted using lacquer thinner or acetone to make sure it's grease free. Peel the protective backing from the mating Velcro strips and press firmly into place. You can press the ECB onto its mating Velcro strips right after they're installed but allow 24 hours for the adhesive to reach full strength before de-mating.

- 5.2** The ECB Assembly should be mounted inside the fuselage and not in the engine compartment. There are no field adjustments or controls on the ECB Assembly so it can be tucked away without regard to convenience of accessibility.
- 5.3 Low Voltage Warning Light (supplied with –101/-102 kits):** The light emitting diode warning light assembly (6) comes with a length of single conductor shielded wire already mounted to the light. The lamp's small size is favorable to a mounting location right in front of the pilot . . . even if the lamp needs to be tucked between existing panel hardware. Use spot-facer or Unibit to drill 13/32” mounting hole for lamp fixture. Install lamp fixture leads-first through the mounting hole and secure with nut from the back side. A large/long tie-wrap or piece of cable lace can be used to tie leadwire behind the panel to an adjacent instrument case so that inadvertent tugs on the lamp's leadwires don't break the fixture. Adjacent photos show how to terminate the warning light assembly to connector (7) using solder sleeve (11) and pins (8). The solder sleeve is installed using a heat gun.

**5.4 Wiring Diagrams:** Figures 7 and 8 show an exemplar power distribution diagram (black) in addition to wiring needed to install a 9005 Series device (red).

**5.5 Wiring –101/-102 Kits:** Wiring for these kits is illustrated in Figure 7. Installation of the auxiliary battery management feature is optional. 22AWG wire is recommended for all interconnections.

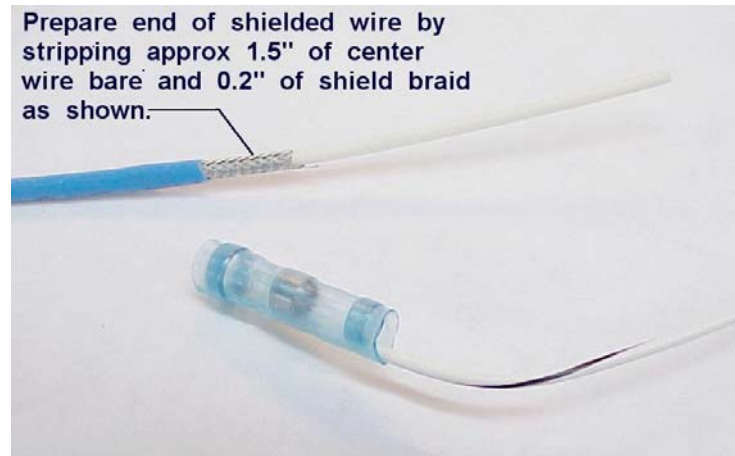


**PIN LOCATIONS LOOKING INTO REAR OF FEMALE CONNECTOR**

9005 Series Modules - Connector Pin-out List		
Pin #	9005-100-1/3 Modules	9005-110-1/3 Modules
1	Aux Battery Relay (-)	Incandescent LV Warn Annunciator (-)
2	LED LV Warn Annunciator (+)	LED LV Warn Annunciator (+)
4, 5, 9	(+) Bus Volts in/out	(+) Bus Volts in/out
3, 6, 7, 8	Ground	Ground

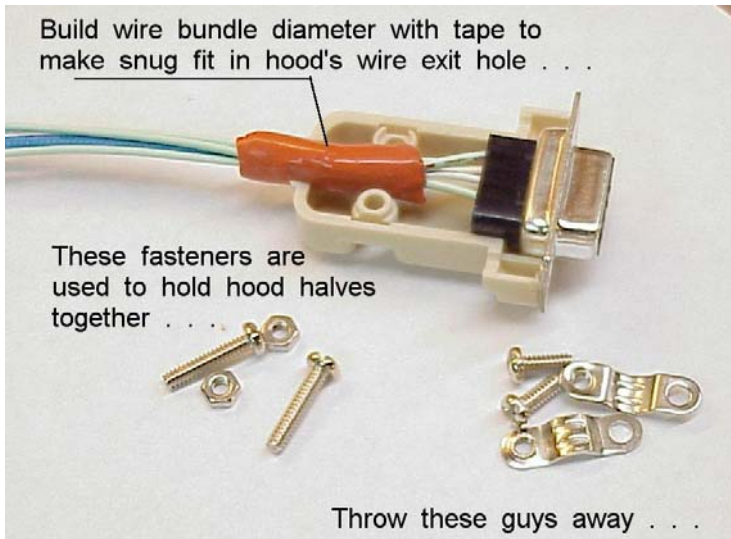
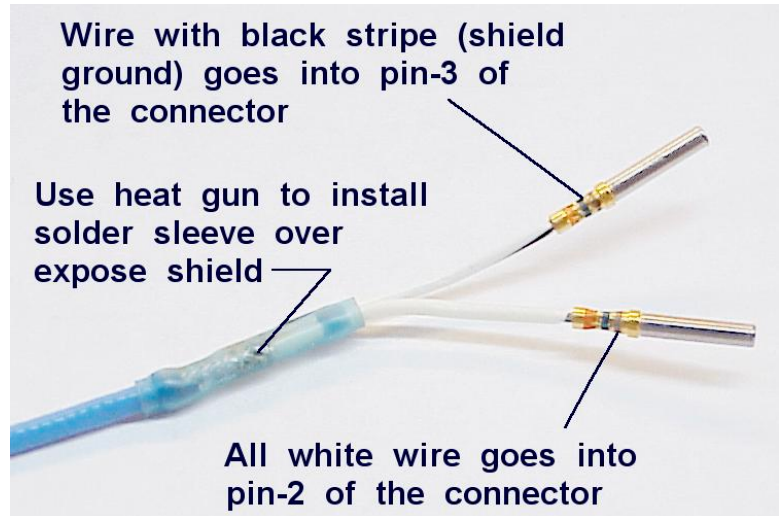
**5.6 Wiring –201/-202 Kits:** Wiring for these kits is illustrated in Figure 8. 22AWG wire is recommended for all interconnections.

**5.7 D-sub Connector:** All kits are supplied with a 9-pin, crimped pins style connector housing (7) and a quantity of female, machined pins (8). These pins can be installed on wires ranging from 20 to 24AWG using a 4-quadrant crimp tool as called out in Section 4.



**5.8** Pin numbers layout for the connector is illustrated in the adjacent figure.

- 5.9 When all wiring is installed in the connector, wrap the wire bundle with silicon or plastic tape to build its diameter to a snug fit in the cable exit hole on the connector hood (9).

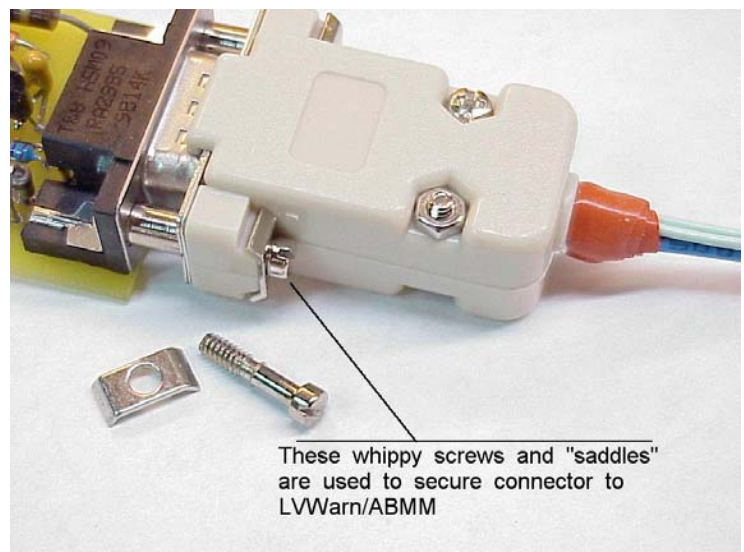


- 5.10 Assemble hood over connector as shown in adjacent photo.

- 5.11 Attach connector to LVWarn/ABMM using jackscrews as shown in adjacent photo.

## 6. OPERATIONAL CHECKOUT

- 6.1 Set DC PWR MASTER switch ON, bus voltage powered with battery only will be somewhere below 13.0 (26.0) volts.
- 6.2 The LOW VOLTS annunciator flashes.
- 6.3 Start engine and move DC PWR MASTER switch to BAT+ALT.
- 6.4 Bus voltage should be above 13.0 (26.0) volts. The LOW VOLTS warning lamp is dark.



- 6.5 If the Auxiliary Battery Management feature is installed, moving the AUX BAT MASTER switch to auto should close the auxiliary battery contactor and illuminate the AUX BAT annunciator lamp.
- 6.6 With the engine running, move DC PWR MASTER switch to BAT. Bus voltage drops showing alternator is off line. In a few seconds, the LOW VOLTS annunciator begins to flash. If the auxiliary battery management feature is installed – AND- the AUX BAT MASTER switch is in AUTO, the AUX BAT annunciator lamp will go dark indicating that the auxiliary battery contactor has opened

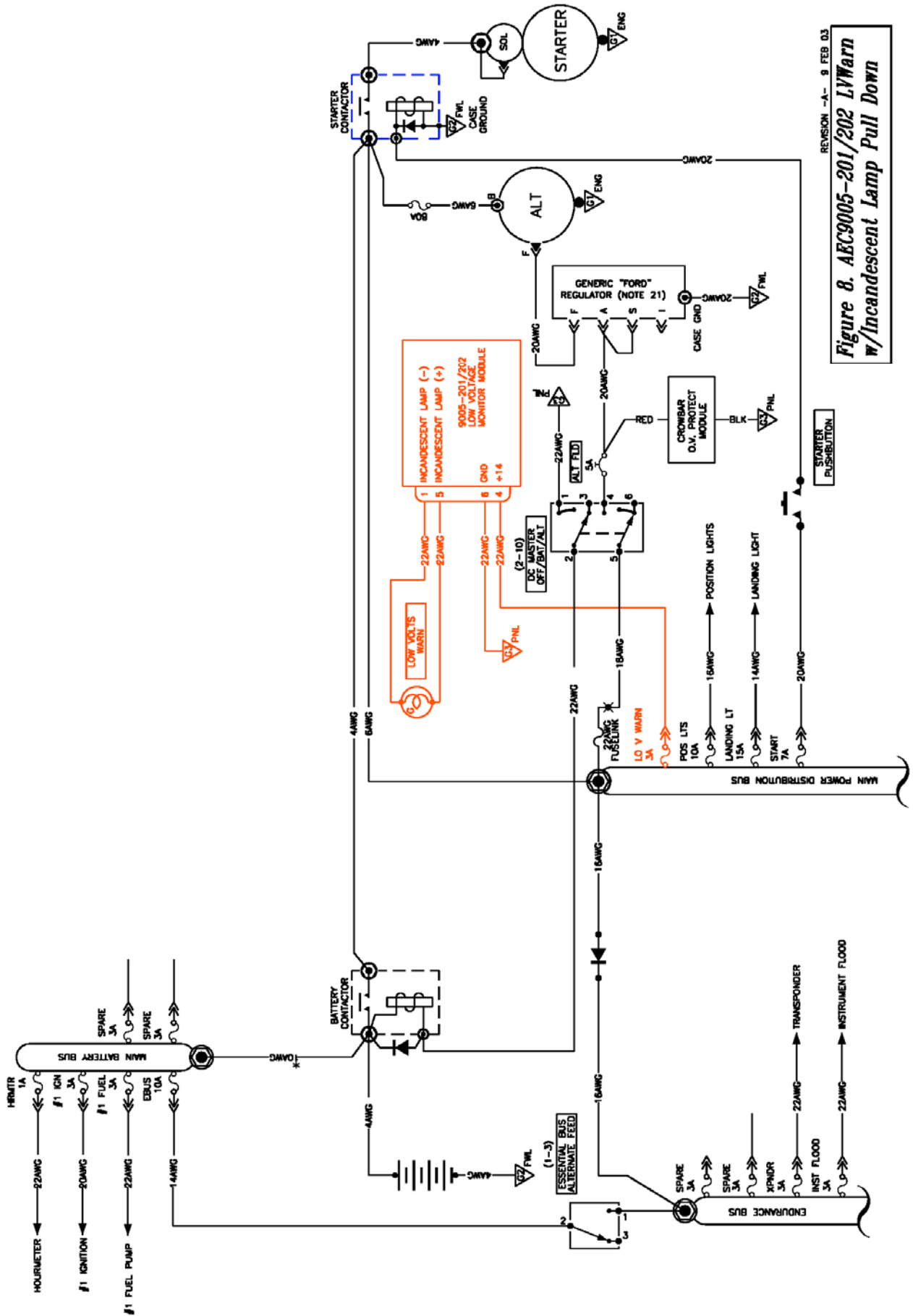
## 7 System operating instructions

- 7.1 The following information should be incorporated at appropriate places into your checklist, normal and abnormal operating procedures:
- 7.2 When the DC PWR MASTER switch is first turned on, the LOW VOLTS WARN light should be flashing.
- 7.3 If the optional auxiliary battery management feature is installed and the auxiliary battery is capable of aiding the main battery for engine starting, the AUX BAT MASTER switch should be ON during engine cranking.
- 7.4 If the optional auxiliary battery management feature is installed and the auxiliary battery is not rated for aiding the main battery for engine starting, the AUX BAT MASTER switch should be OFF during engine cranking.
- 7.5 When the engine is running and the alternator is on line, the LOW VOLTS WARN annunciator should be dark.
- 7.6 If the LOW VOLTS WARN light should illuminate in flight, steps should be taken to configure your system for alternator-out operations. Depending on your systems features, this may include setting the E-BUS ALT FEED switch to ON, setting DC PWR MASTER switch to OFF and setting AUX BAT MASTER switch to OFF for continued flight in the maximum endurance mode for battery only operations.

## 8 SYSTEM MAINTENANCE

All products installed with these instructions are free of any adjustments requiring periodic re-calibration. Components that control calibration of the LV Warn trip point are precision devices with very low drift and long service life. The system is well with every flight cycle so that abnormal behavior is readily detected. Therefore, no periodic or preventative maintenance activities are recommended for the AEC9005 series products.

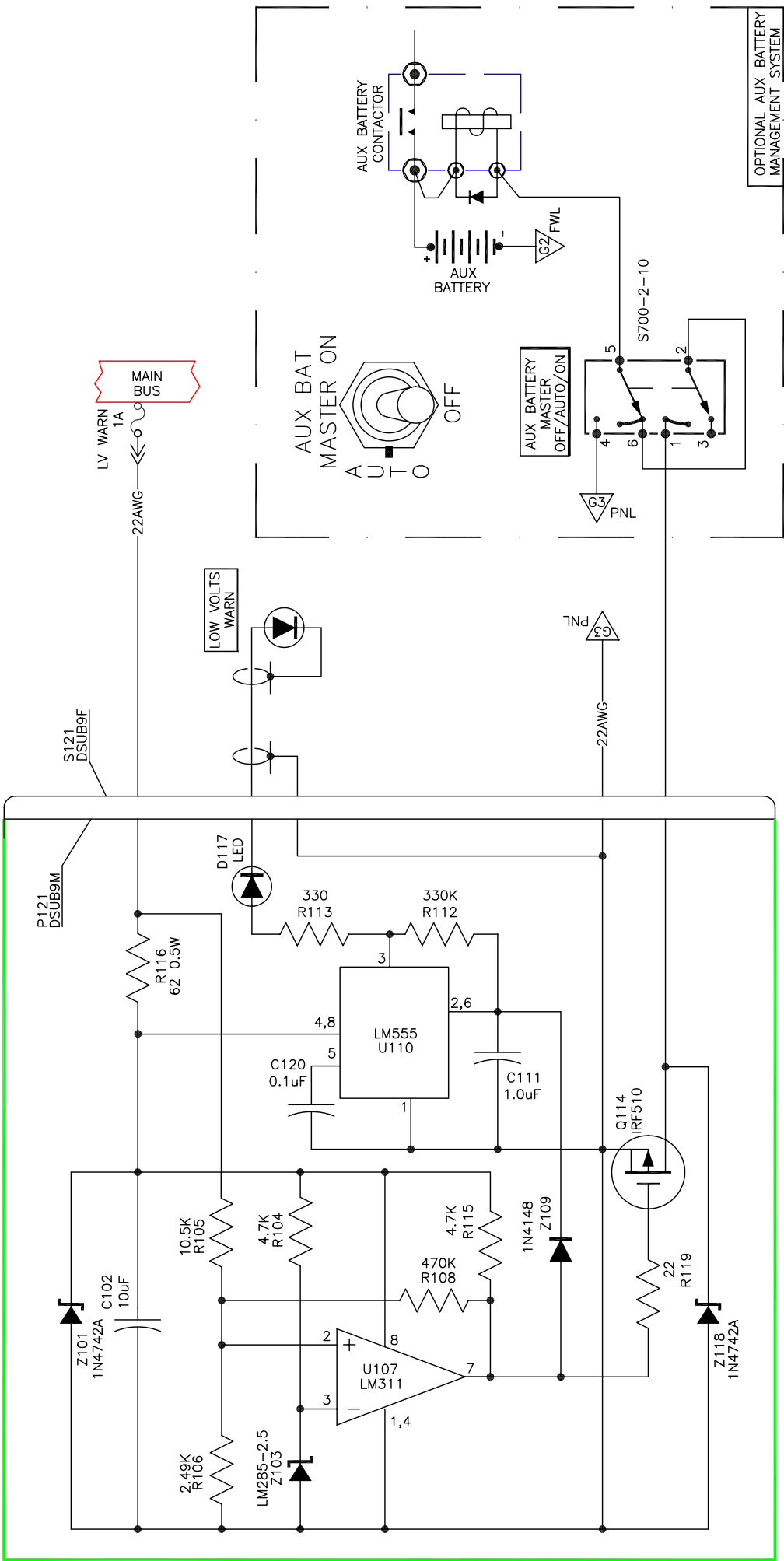




REVISION -A- 9 FEB 03

Figure 8. AEC9005-201/202 LVWarn w/Incandescent Lamp Pull Down





UNLESS OTHERWISE SPECIFIED		DATE	
DIMENSIONS ARE IN INCHES		9/14/2	
TOLERANCES ARE:		NUCKOLLS	
DECIMAL 0.XX = ±0.03		9/14/2	
DECIMAL 0.XXX = ±0.005		NUCKOLLS	
ANGLES = ±2 DEGREES		9/14/2	
DRAWN	CHECK	PROJECT	APPROVED
AeroElectric Connection www.aeroelectric.com		9021-620	
TITLE SCHEMATIC DIAGRAM - LOW VOLTAGE WARNING AND AUX BATT MANAGEMENT MODULE		DRAWING NO.	
		REVISION A	
		DATE 10/2/3	
		PAGE 1 OF 2	

BILL OF MATERIALS

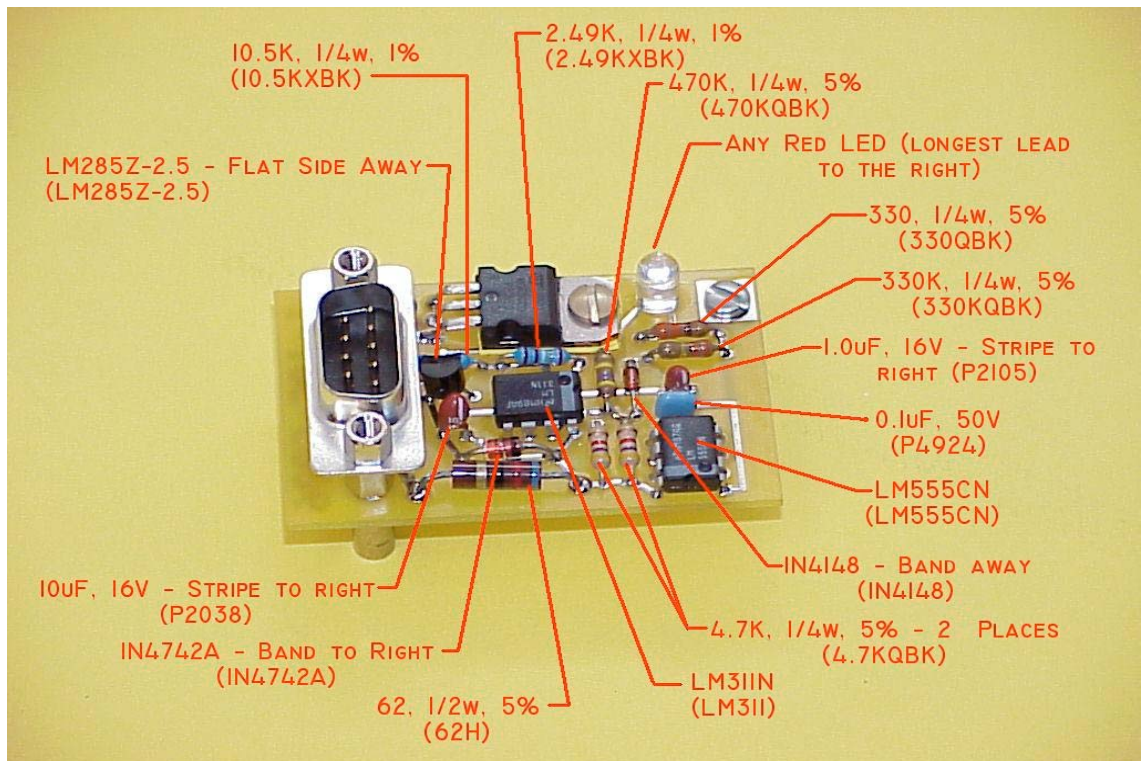
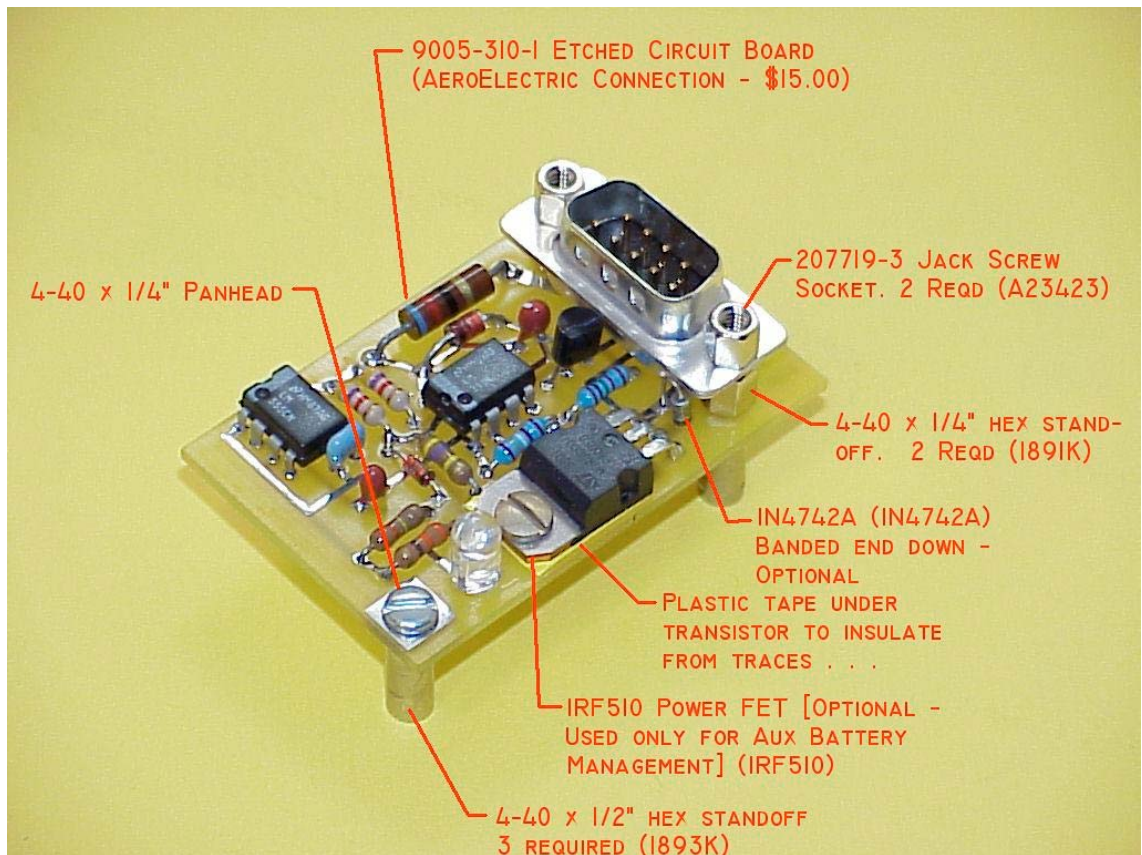
REF	P/N	DESCRIPTION	DIGIKEY CATALOG NUMBER
Z101	1N4742A	12V, 1W ZENER DIODE	1N4742AMSCT
C102		10uF, 16V TANTALUM CAP	P2038
Z103	LM285Z-2.5	2.5V REFERENCE DIODE	LM285Z-2.5
R104		4.7K, 1/4W, 5% RESISTOR	4.7KQBK
R105		10.5K, 1/4W, 1% RESISTOR	10.5KXBK
R106		2.49K, 1/4W, 1% RESISTOR	2.49KXBK
U107	LM311N	COMPARATOR, 8-DIP	LM311NNS
R107		470K, 1/4W, 5%	470KQBK
D109	1N4148	SMALL SWITCHING DIODE	1N4148DICT
U110	LM555	TIMER, 8-DIP	LM555CNNS
C111		1.0uF, 16V TANTALUM CAP	P2015
R112		330K, 1/4W, 5% RESISTOR	330KQBK
R113		330 OHM, 1/4W, 5% RESISTOR	330QBK
Q114	IRF510	N-CHANNEL, 100V, 5A PWRMOS	IRF510
R115		4.7K, 1/4W, 5% RESISTOR	4.7KQBK
R116		62 OHM, 1/2W, 5%, RESISTOR	62H
D117		HIGH BRIGHT LED	276-307 (RADIO SHACK)
Z118	1N4742A	12V, 1W, 5% ZENER DIODE	1N4742AMSCT
R119		22 OHM, 1/4W, 5% RESISTOR	22QBK
C120		0.1uF, 50V CERAMIC CAP	P4924
P121		9-PIN, DSUB MALE	A23139
S122	276-1428	9-PIN, DSUB FEMALE	276-1428 (RADIO SHACK)

NOTES:

(1) IF YOU DO NOT PLAN TO USE THE AUX BATTERY MANAGEMENT FEATURE, Q114, R119 AND Z118 CAN BE OMITTED FROM THE ASSEMBLY.

UNLESS OTHERWISE SPECIFIED		AeroElectric Connection www.aeroelectric.com	
DIMENSIONS ARE IN INCHES		TITLE SCHEMATIC DIAGRAM -	
TOLERANCES ARE:		LOW VOLTAGE WARNING AND	
DECIMAL 0.XX = ± 0.03		AUX BATT MANAGEMENT MODULE	
DECIMAL 0.XXX = ± 0.005		DRAWING NO.	9021-620
ANGLES = ± 2 DEGREES		REVISION	A
DRAWN	NAME	DATE	10/2/3
CHECK	NUCKOLLS	9/14/2	
PROJECT	NUCKOLLS		
APPROVED	SCALE	NOTED	JOB NO.
			PAGE 2 OF 2





22, 1/4W, 5% - OPTIONAL. USED  
ONLY ON AUX BATTERY MANAGEMET  
MODULE (22QBK)

4-4.0 x 1/4" PAN HEAD SCREW  
4-4.0 x 3/16" HEX NUT - OPTIONAL

