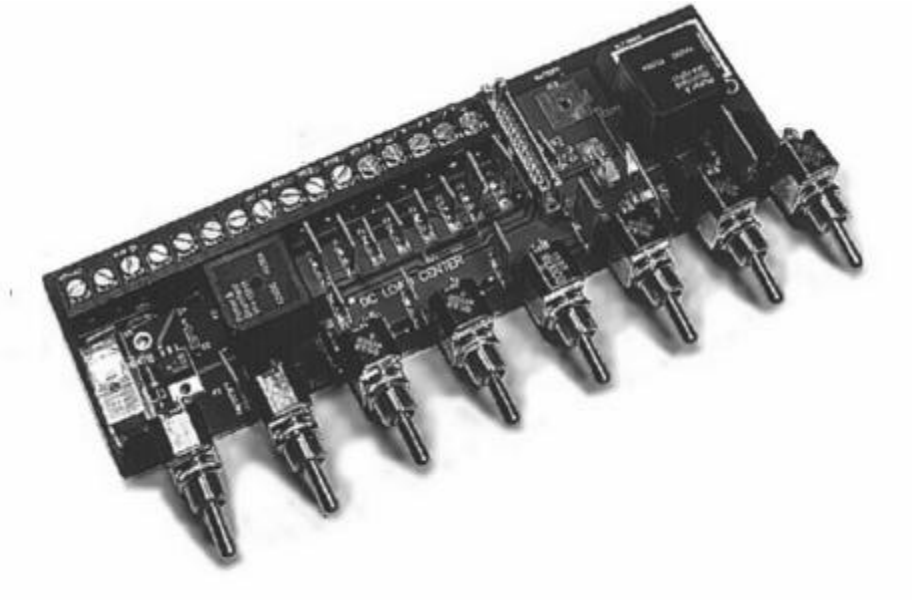
EXP BUS DC LOAD CENTER
INSTALLATION INSTRUCTIONS



OVERVIEW

The Exp-BUS DC Load Center replaces the master solenoid, all but one circuit breaker, the master switch function, and the avionics master switch function. The avionics output bus provides six overload protected, power output circuits. Switched outputs include the alternator field output, Beacon/Strobe output, nav light output, aux fuel pump output, and two LDG light outputs. All outputs are overload protected, eliminating the need for fuses or circuit breakers, and saving the labor of installing and wiring them up.

CIRCUIT OVERLOAD SYSTEM

The EXP Bus product uses solid state current limiting devices known as PTC current limiters, and commercially by the tradename POLYSWITCH®. These devices have unique advantages, and important differences when compared to fuses and circuit breakers. Like a fuse, the PTC device "blows" when too much current is drawn by an offending circuit, however, like a circuit breaker, the PTC can be reset, and does not need to be replaced after one use. Unlike a circuit breaker, there are no moving parts in the PTC, the device is totally solid state. Unlike either a fuse or a circuit breaker, the PTC resets automatically when the load is COMPLETELY removed.

In the past, one could obtain "self-resetting" thermal circuit breakers, however these were very undesirable for aircraft use. Old style self resetting breakers

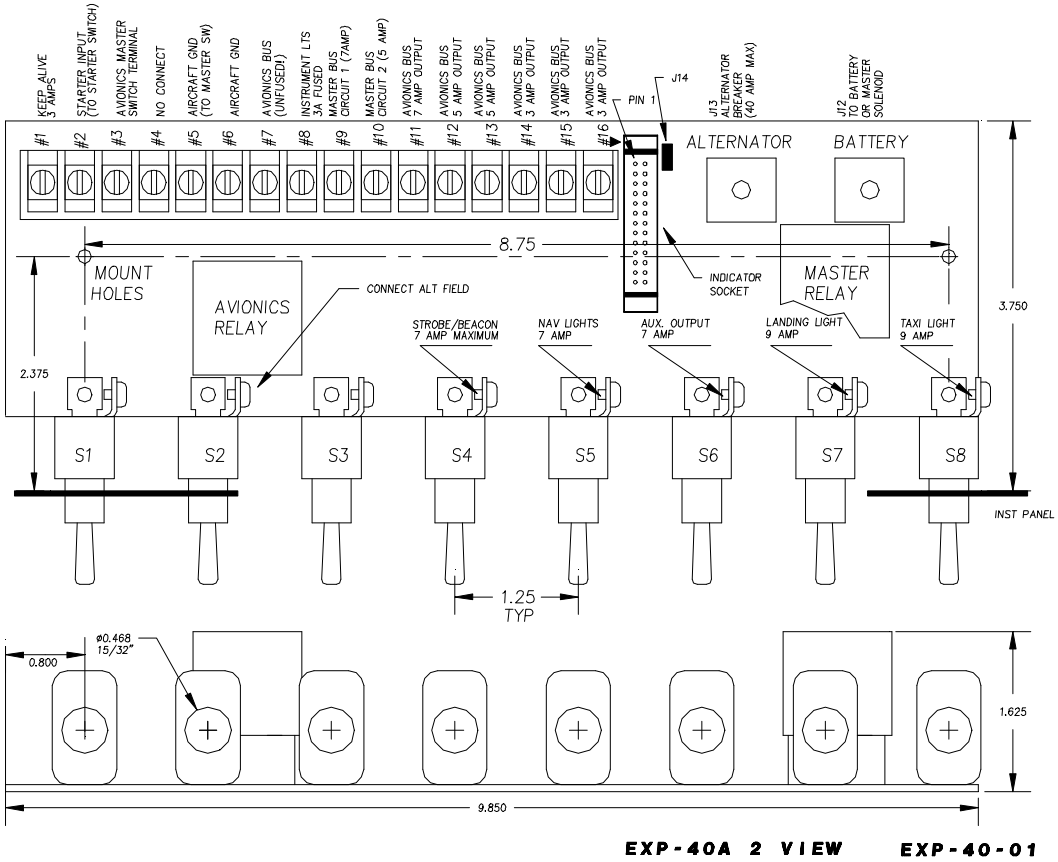
would reset themselves automatically after a short delay, even if the circuit were still overloaded. In the event of a serious electrical short, such as would be caused by a frayed or loose wire contacting chassis ground, this would likely cause a periodic arcing as the breaker reset and tripped. PTC breakers trip once, AND STAY TRIPPED, until the load is completely removed.

With a PTC breaker, a small, harmless amount of current "leaks" through when the devices are tripped. This current passing through the PTC device, keeps the breaker hot, thus keeping it tripped. The small current passed poses NO risk of fire or damage to the wiring or avionics, but only serves to keep the device from resetting. To reset the PTC, simply remove the entire load, by turning off the radio, light, or accessory being powered by the device. After about ten to fifteen seconds, the PTC will cool down, reset, and be ready for use again. The PTC can be tripped thousands of times without damaging the device.

If a circuit were to trip, there is no positive indication, other than the failure of the circuit in question. Many wise people feel quite strongly that if any system fails in flight, the first action to be taken is to land, then investigate the probem once safely on the ground. A companion piece of equipment to the EXP BUS Load Center is the INDICATOR module. This device is an annunciator panel that provides a warning light for each circuit in the system. When a circuit fails, the light illuminates. A dark panel indicates no problems. Call or write for more information on the indicator panel.

The PTC devices are an ideal fusing system for aviation, however the output is currently limited to 9 amps maximum. Some accessories, such as pitot heaters, hydralic power units, and large landing lights may exceed this amperage. Such accessories must be connected to a traditional bus bar, using external circuit breakers.

In the past, it has been traditional to use circuit breakers that are greatly oversized. For a radio that draws 4 amps, a 10 amp breaker is often used. This was generally done because we used just a few different sizes of breakers. One, three, five and ten amps were the steps. Thus, anything that might draw just over 5 amps, would generall be used with a 10 amp breaker. PTC's can be applied more precisely. 100W landing lights draw about 7.5 amps of current at 14Volts. These devices are generally fused with 20 amp breakers. On the EXP BUS, we use 9 amp PTC's for these lamps. When determining the requirements of your equipment, check the current draw. Connect the equipment to a PTC protected circuit that is rated for at least that much current drain.



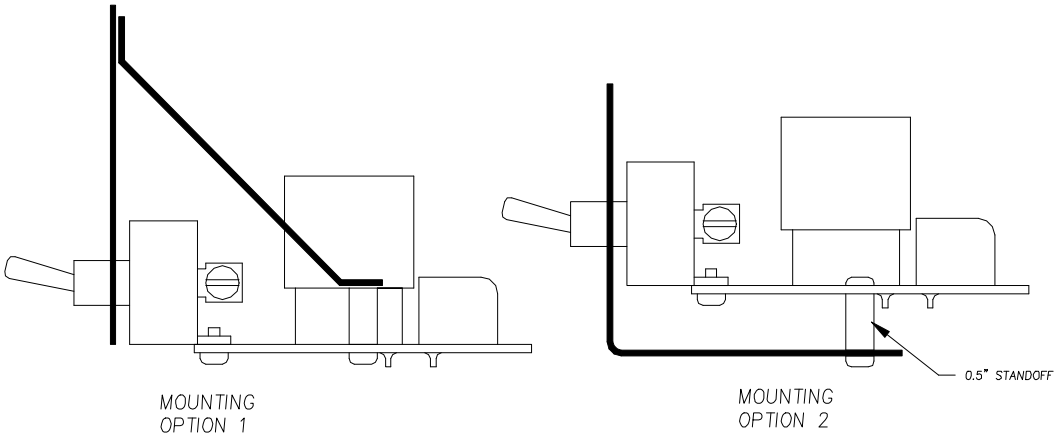
EXP-40A 2 VIEW **EXP-40-01**

MOUNTING AND INSTALLATION

The above illustration, drawing EXP-40-01 shows a 2 view drawing of the EXP-BUS PC Board. The switches and terminals are numbered and described.

The EXP PC board offers many flexible mounting and wiring options to the homebuilder. The switches provided are simply mounted to the PC board using screws. The unit may be installed with the supplied switches, or with user supplied switches. The aircraft may either have a master solenoid, or use the onboard master relay. The board may even be mounted with the components facing down, and the switches on the top of the pcb. In an extremely crowded panel, or in an airframe with unusually high vibration levels, the switches may be panel mounted, and wired to the PC board which may be remotely mounted in any convenient location. There is a 26 pin connector on the board to connect to the optional panel mounted INDICATOR board, allowing over and undervoltage annunciators, as well as a positive indication of each breaker on the PC board.

Drawing EXP-40-02 (next page) shows the mounting options for the PC board, should it be used with the switches attached. In this configuration, it is critical to support the PC board, to provide protection against vibration induced fatigue failures. An unsupported PC board will almost certainly result in rapid failure of the switches.



EXP BUS PC BOARD MUST BE MOUNTED AND SUPPORTED
TO PROTECT THE ASSEMBLY AGAINST VIBRATION.
OPTION 1 ILLUSTRATES MOUNTING THE PC BOARD USING OVERHEAD SUPPORT
OPTION 2 ILLUSTRATES SUPPORT FROM THE INSTRUMENT PANEL SILL.
ANOTHER OPTION – REMOTE MOUNT THE PC BOARD IN A HANDY LOCATION,
THEN MOUNT THE SWITCHES IN ANY LOCATION DESIRED

EXP-40A MOUNTING DIAGRAM
EXP-40-02

BOARD CONNECTIONS

SWICH OUTPUTS:

S1 MASTER	This serves as the master electrical switch for the entire system. When used with the onboard master relay, this switch removes power from all outputs except terminal #1, the keep alive output. When using an external solenoid, (grounding type) connect the terminal J10 to the solenoid input terminal.
S2 ALT FIELD	Connect this output to the power wire for the voltage regulator. If using an alternator/regulator that has no field input, this may be used for any 5 amp accessory desired.
S3 AVIONICS MASTER	This switch enables the avionics bus through the avionics relay. This switch should connect ONLY to the PC Board terminals.
S4 BEACON	7 amp output for the rotating beacon or strobes.
S5 NAV LIGHTS	7 amp output for the nav or position lights
S6 AUX PUMP	7 amp output for an AUX pump or other accessory
S7 LDG 1	9 amp landing light output with a soft start circuit. Use with 100Watt lamp maximum at 14Volts
S8 LDG 2	9 amp landing light output with a soft start circuit. Use with 100Watt lamp maximum at 14Volts

MAIN TERMINAL STRIP

For pin numbers, refer to drawing EXP-40-01

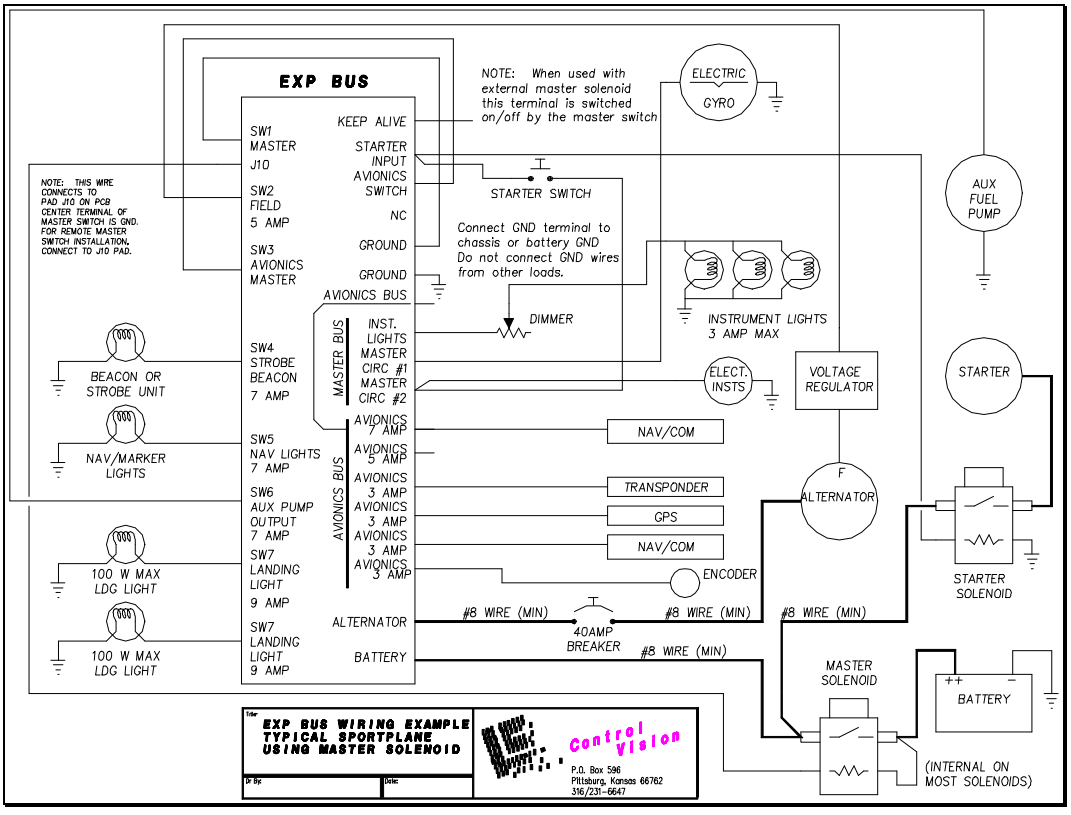
1 **KEEP ALIVE** ***output***	Use to power accessories such as a clock that needs power even when the master switch is off. When the unit is installed with an external solenoid, this terminal is switched off when the master is off, but when using the onboard master relay, this terminal is always "ON".
2 **STARTER** ***input***	Connect to the starter switch. When power is applied to this terminal, the avionics bus is shut down, even if the avionics master switch is "ON". This can prevent damaging radios with power surges during engine start.
3 **AVX SW** ***Special use***	This terminal should connect directly to the center terminal on the avionics master switch (S3). No other connection should be made to this terminal.
4	NO CONNECTION. *It may be convenient to connect this terminal to the J10 terminal with a soldered wire. If using an external master solenoid, this modification would allow the solenoid to connect to this terminal strip, instead of the switch it'self.*
5 **GROUND** ***Special Use***	This terminal should connect to the center terminal of the MASTER SWITCH, S1.
6 **GROUND** ***Input***	This terminal should be attached to the aircraft chassis, battery (-), or ground block in the aircraft. This terminal provides ground to the EXP PC board, and is not intended to be used as a grounding point for other accessories (lights, pumps, avionics, etc) in the aircraft.
7 **AV-BUS** ***Output***	Unfused output switched on with the avionics bus master switch. Up to 15 amps of additional current may be drawn from this terminal, and fused externally for additional circuitry.
8 **INST LTS** ***Output***	INST LTS: This terminal provides up to 3 amps of power output, always on when the MASTER SWITCH is on. When using an INDICATOR MODULE, The wire connecting the two pads of J14 should be cut. The indicator module then provides a variable voltage output to this terminal, adjustable with the lamp dimmer circuit. If not using the INDICATOR module, be sure that the two pads of J14 are connected. This terminal will then provide up to 3 amps at 14 or 28 volts, switched on with the master.
9 **MSTR1 *output***	7 amp output, on with the master, unswitched
10 **MSTR2 *output***	5 amp ouptut, on with the master, unswitched
11 **AV Bus *output***	AV12 - 7 amp output, switched on when the avionics bus is on.
12 **AV Bus *output***	AV11 - 5 amp output, switched on when the avionics bus in on.
13 **AV Bus *output***	AV10 - 5 amp output, switched on when the avionics bus in on.
14 **AV Bus *output***	AV9 - 3 amp output, switched on when the avionics bus in on.
15 **AV Bus *output***	AV8 - 3 amp output, switched on when the avionics bus in on.
16 **AV Bus *output***	AV7 - 3 amp output, switched on when the avionics bus in on.

BATTERY/ALTERNATOR TERMINALS

J13 **ALTERNATOR** ***Input***	Large square terminal labeled ALTERNATOR. The alternator output cable should connect to this terminal. This cable provides all charging to the electrical system. One should always place a circuit breaker between this terminal and the alternator. For a 40 amp alternator, use a 40 amp breaker, and #8 wire. It is a good idea to use a pullable type circuit breaker, to allow one to isolate the EXP BUS from the alternator, if this should prove necessary.
J12 **BATTERY** ***Input***	This pad is for connecting the battery to the system. Run at least a #8 wire from the battery to this terminal on the PC Board. If using an external solenoid, connect this terminal to the switched side of the master solenoid

ELECTRICAL CONFIGURATIONS

Drawings EXP-40-03 and -04 are typical wiring diagrams for a light sportplane, both with and without the master solenoid. There are several advantages to both configurations. In general, it is a good idea to use the master solenoid on larger, more complex aircraft, while on light VFR only aircraft, the onboard relay should be adequate.



Typical wiring schematic using external master solenoid

CONNECTION WITH MASTER SOLENOID

You may wish to use a master solenoid in your project if:

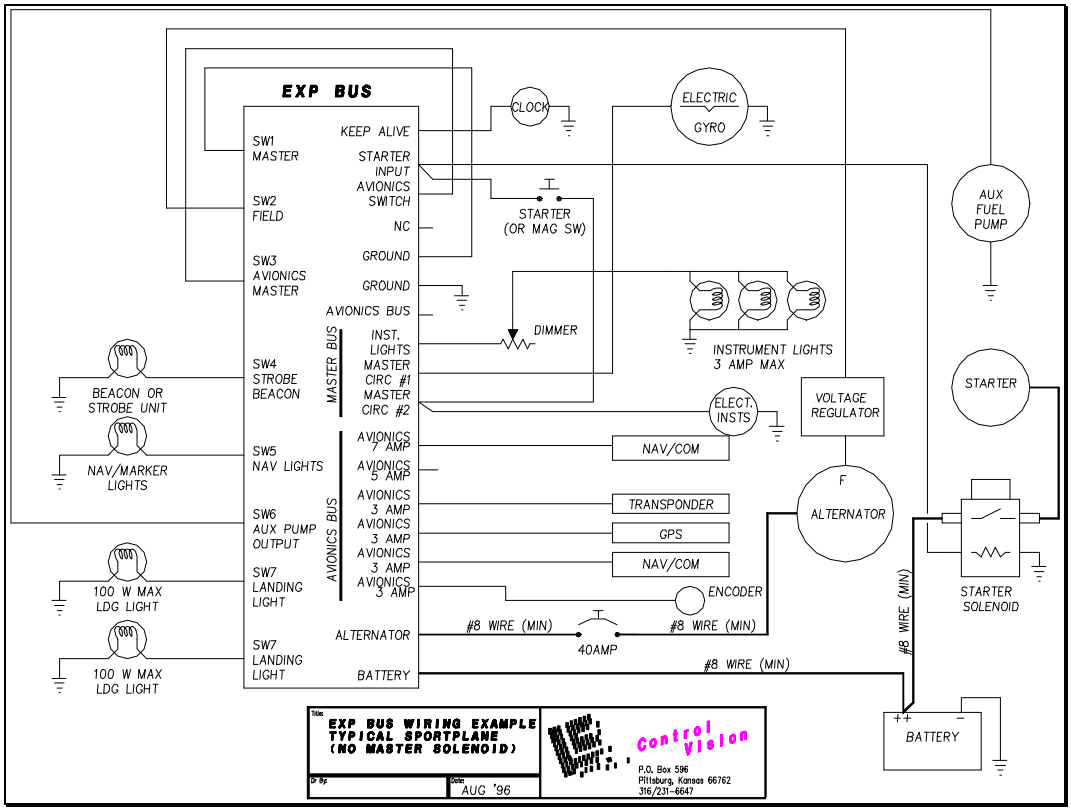
- The battery is more than three feet from the EXP BUS board; or
- The alternator puts out more than 40 amps; or
- Heavy IFR use is anticipated; or
- The aircraft will be cruised at high speeds, and/or very high altitudes.

The chief advantage of a master solenoid is the fact that it is generally located very close to the battery. This minimizes the length of the un-switched lead. This is a valuable safety consideration. Also, the on board master relay is only adequate for up to 40 amps of current, while the actual PC board is capable of over 60 amps of current flow. For installaions with a 50 or 60 amp relay, or in the case of IFR equipped projects, the external master solenoid is recommended. If the External master solenoid is to be used, the square pads of the relay K1, located near the battery connector should be connected together using a short piece of at least #12 solid wire. These should be soldered with a high wattage soldering iron. Having both the relay and the solenoid in circuit would work fine, however, two elements in series is not wise from a reliability point of view. Also, since the onboard relay is only rated for up to 40 amps of current, it would be unsafe to use this with a 50 or 60 amp alternator. When using a master solenoid, the coil terminal of the solenoid should be connected to terminal J10, on the EXP board. This is the terminal that connects the master switch to the PC board. Remove the screw, and connect the wire and switch to this terminal on the PC board. When the master switch is ON, this terminal is connected to GND. This will pull in the master solenoid. The switched power side of the solenoid, should be connected to terminal J12 BATTERY on the EXP bus. When connected in this configuraion, the KEEP ALIVE output is switched on and off with the master switch.

CONNECTION WITHOUT MASTER SOLENOID

You may not wish to use an external master if:

- Your alternator output is less than 40 amps; and
- Your project is intended primarily for VFR use; and
- Your battery is located within 3 feet of the PC board.



Typical wiring schematic using master relay

In simple VFR aircraft, with less than a 40 amp alternator, it is possible to wire the aircraft without using a master solenoid. The EXP 40 amp model has a master relay located onboard, good for switching up to 40 amps of load. In many applications, this is adequate for the electrical demands of the machine. The chief advantage of this configuration is ease of installation. The battery is connected directly to terminal J12 ("BATTERY"), and the alternator is connected to terminal J13, through a suitably sized circuit breaker.

RECOMMENDED WIRING PROCEDURES

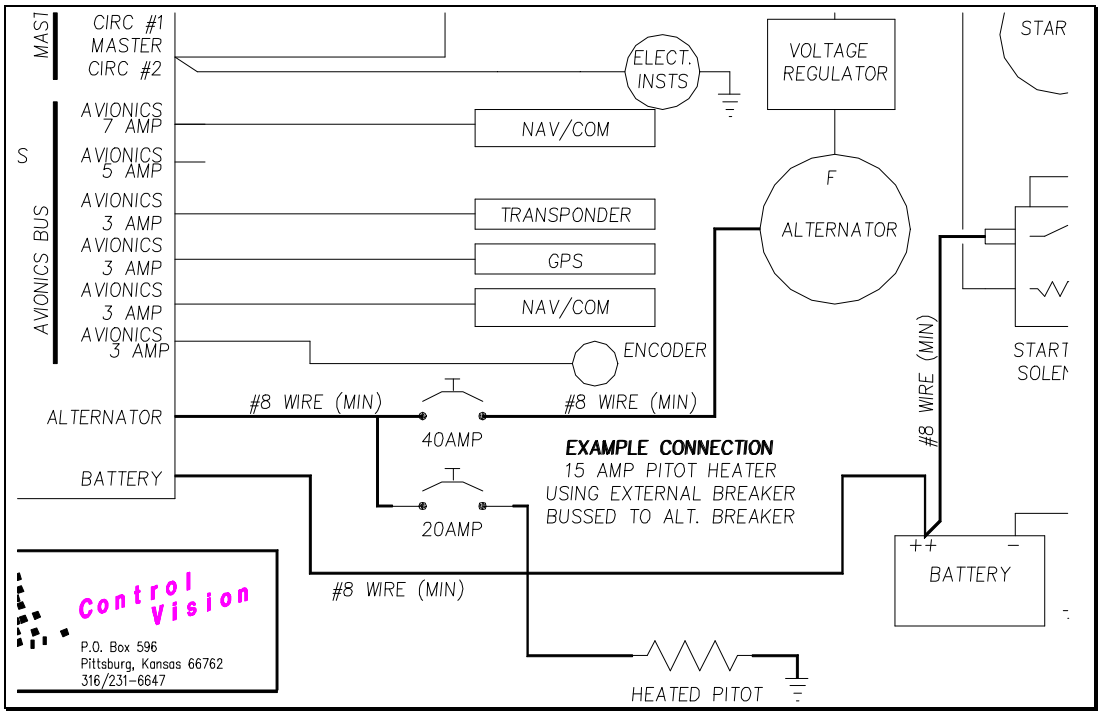
- ***Starter Connections:***
  The starter should be connected to an external starter solenoid, which is connected directly to either the battery, the master solenoid, or the battery terminal on the EXP-BUS circuit board. Starters typcially draw more than 60 amps of current, and under no circumstance should the starter draw power from the PC board. The external starter solenoid can handle the current load of the starter. Most starter solenoids are switched on with a positive voltage, from either a mag switch or a starter pushbutton. In either case, if a wire is connected from the starter switch to the EXP terminal strip #2, the avionics bus will automatically shut down if the starter is engaged. If not using this feature, leave the terminal unconnected.

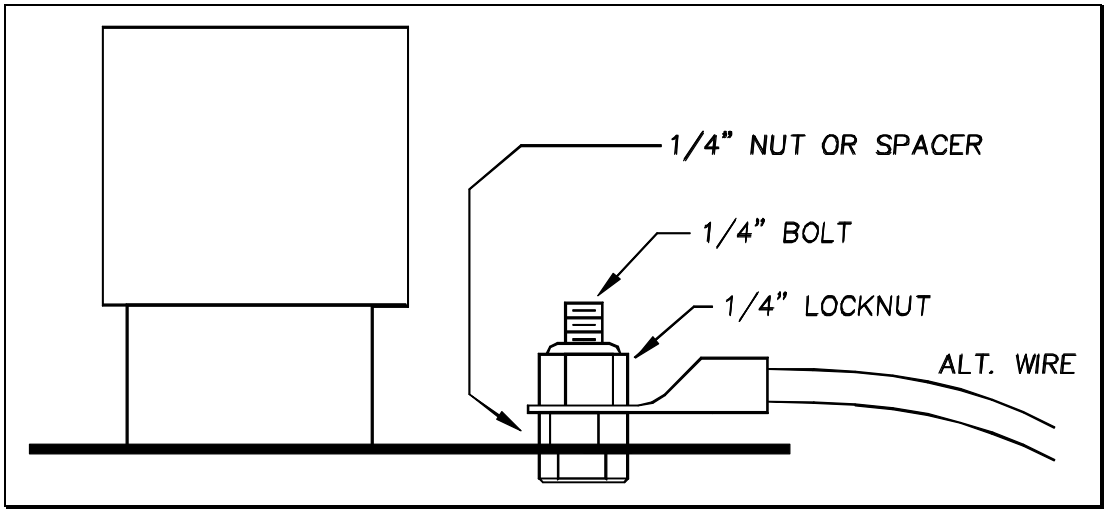
- ***Master bus connections:***
  Connect all accessories that are to be on whenever the master switch is on to terminals 9 and 10 of the PC board. Generally, one would use one of these terminals to power a turn coordinator, and the other to run electronic instruments, and/or the starter solenoid.

- ***Avoinics Bus Connections:***
  Connect all avionics power leads to terminals 11-16 on the terminal strip. All avoinics grounds (returns) should be chassis grounded, or connected to a grounding block in non-conductive airframes.

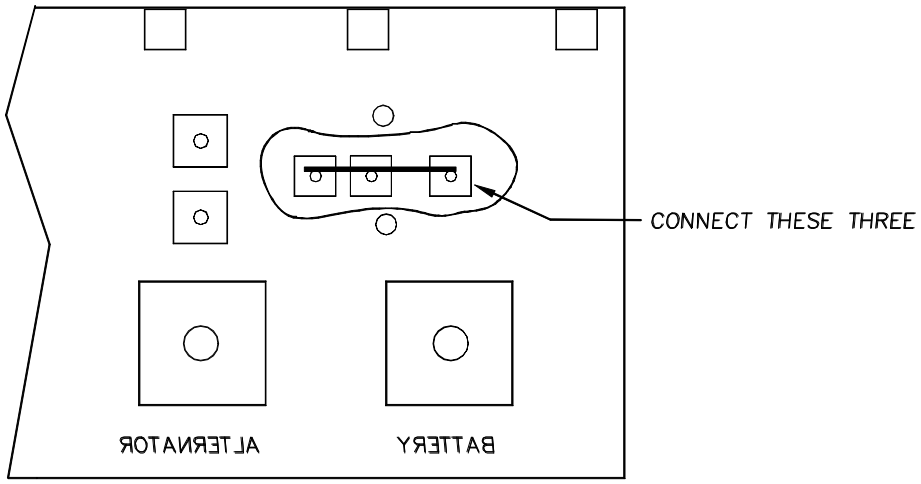
- ***Instrument Lights***
  Terminal 8 provides a 3 amp protected output that stays on whenever the master switch is on. If an indicator board is installed, this terminal is connected to the light dimming controller that allows for light dimming. If not using an indicator module, an external rheostat could be connected to this terminal for light dimming purposes.

- ***High current Accessories***
  High current accessories should be connected to a separate bus, using conventional breakers. These may be bussed together with the alternator breaker, which is on the master bus.





- ***Alternator/Battery Wire Connections***
  Install the main battery and alternator cables to the large square pads J12 and J13 using a 1/4" bolt and vibration resistant nut. You may wish to double nut the bolt, placing the ring terminal between the two nuts. Be sure to insulate the barrel of the ring terminal with heat shrink tubing, or a plastic sleeve. It is also a very good idea to secure these wires off the board so that they cannot loosen under vibration and come in contact.



BOTTOM VIEW OF PC BOARD

- ***Bypassing main relay***
  When using an external solenoid, it is a good practice to bypass the main relay. In this configuration, the main relay serves no purpose. EXP PC Boards may be ordered from the factory with the relay bypassed by ordering an EXP-60, instead of an EXP-40. The bypassing operation may be done in the field by shorting the three small square pads, under the main relay socket together with a fairly heavy piece of wire. A short piece of #12 solid copper wire works fine for this application. The wire should be soldered to each terminal with a high wattage soldering iron.

IMPORTANT PRECAUTIONS

Important -- read carefully and call our tech support line toll free if you have any questions at 800/292-1160 in the US, 001-316-231-6647 worldwide

- ◊ Remember to only use vibration resistant hardware when mounting the wires to the pc board terminals.
- ◊ Secure all wires so that they cannot work against each other even if the connections do loosen.
- ◊ Insulate all crimp on terminals to insure that a loose terminal cannot short to a nearby terminal. These two precautions are very important matter on the heavy alternator and battery cables, on J12 and J13.
- ◊ Be sure to use a circuit breaker in series with the alternator. Do not connect the alternator directly to terminal J13.
- ◊ Be sure to support the pc board properly. See drawing -02 for recommended mounting practices. If your aircraft vibrates severely, it is a good practice to support the front of the PC board with additional standoffs. There are two additional mounting holes, one in the center of the board, and one located between the battery and alternator holes. If using the mounting hole between the alternator and battery terminals, be certain to use nylon hardware, as this hole is connected to the battery bus, and is always powered up. It could cause a short and fire if this pad is connected directly to the grounded chassis of a metal airframe!
- ◊ It is also permissable to add mounting holes near the switches. The best locations for these would be between the master (J10) and the ALT FLD (J2) switches, as well as between J4 and J5, and J7 and J8. In the case of the latter 2 pads, it would be necessary to use non conductive hardware on a metal aircraft, as the holes would have to be drilled through the master bus copper on the PC board, and metal bolts and standoffs could be connected electrically to the bus.
- ◊ If you are planning to use electronic ignition modules requiring battery power, or if you are using an automotive engine requiring battery power, remember that **it is essential to connect these devices directly to the battery**, and to provide a back up power source in the form of a second battery. **Be sure to wire your aircraft so that the engine will continue to run even with the master switch OFF! Engine ignition power should not come from the EXP bus board under any circumstance.**
- ◊ **If you have any questions concerning the use of this product, call toll free 1-800-292-1160, central time zone and ask for technical assistance. The international number is 001-316-231-6647. Our fax is 316-2311-5816.**