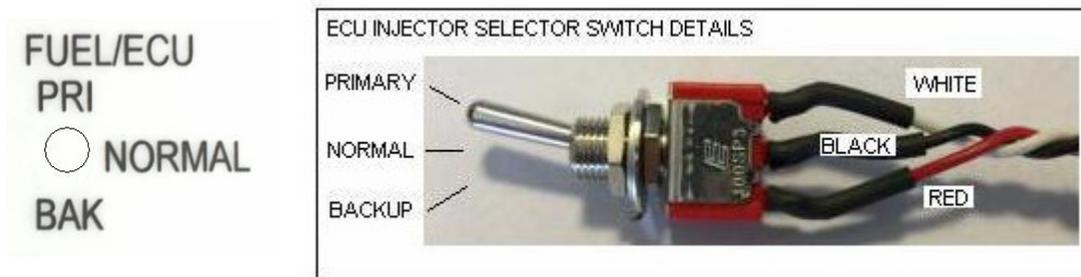


## SDS EM-5 6 Cylinder Dual ECU Supplement Jun 16/21

This supplement outlines some of the wiring, sensor and operational differences between dual ECU 6 cylinder systems, and other SDS aviation systems.

### Task Sharing- Injector Outputs/ ECU Selector Switch

The 6 cylinder dual system has a 3 position ECU selector switch to switch fuel injector control between each ecu board or to both ecu boards.



The 3 switch positions operate in the following ways:

**NORMAL position:** The Primary and Backup ecu are each controlling 3 injector outputs. This provides the ability to trim fuel mixture in each cylinder using the SDS programmer trim screens.

**PRIMARY position:** Makes the injector relay box switch all 6 injectors over to the Primary ecu board. This disconnects the Backup ecu fuel injector outputs from the injectors.

**BACKUP position:** Makes the injector relay box switch all 6 injectors over to the Backup ecu board. This disconnects the Primary ecu fuel injector outputs from the injectors.

In the PRIMARY or BACKUP position, each working ECU will continue to fire one set of plugs and all 6 injectors in pairs (1-4, 2-5 and 3-6), rather than individually as they do with the switch in the BOTH position.

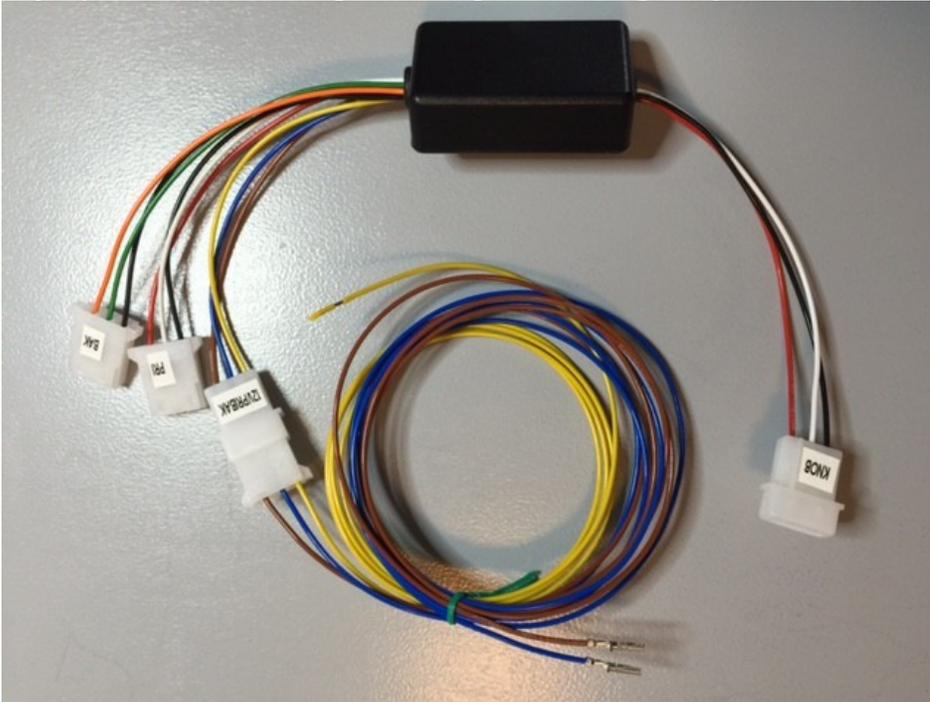
In the event you have a rough running engine or suspect an ecu or sensor problem move the switch to Primary or Backup to see if the engine runs smoother. This would indicate there is a problem with one ecu or its sensors.

Note that this switch does NOT control which ignition coil pack is running since both coil packs run all the time. Coil packs can only be controlled or shut off via their 12 volt power source.

If running in Primary or Backup positions its best to switch OFF your LOP(Lean of Peak) switch. Also depending on Cyl trim settings you may need to richen the mixture with the mixture knob, since trim settings from cylinders would be applied to other cylinders due to pairing of injector outputs.

## Sensor Pairings, Sharing and Mixture Knob

Since each ECU board is controlling only part of the ignition and fuel components, we also have a separate intake air temp (IAT) sensor and CHT sensor for each ECU so that each ECU is correcting the AFR for starting, warmup and IAT equally. Unlike 4 cylinder systems, we also share the TPS signal with both ECUs. As such, if you lose power or ground on the primary ECU, you will also lose the TPS function on the backup since they only share the signal wires, not power and ground wires. The TPS is non-critical for flight, you'll just have slightly slower throttle response to rapid throttle opening.



The single mixture knob affects either or both ECUs via a special relay box as shown in the photos below. The knob plugs into the connector on the right side of the photo (knob). Primary and backup ECU knob harnesses plug into the two left most connectors. You must connect the long yellow wire to switched 12V. The blue and brown wires connect as shown to the right injector relay box connector as shown in Fig. 2



Fig. 2

**Blue and brown wires from mixture knob box snap into pins 7 and 8 (upper right)**

Be aware that if you lose one ECU, you must manually switch the ECU Selector Switch over to the functioning Primary or Backup ECU to have proper running on all 6 injectors and to have mixture knob control. When on the Primary or Backup ECU, only one set of spark plugs will be firing.

The single orange wire on the backup main harness should be connected to the TPS signal wire (white, pin 3). You can crimp a short piece of wire into the TPS signal pin and make another connection which can be more easily disconnected with the white connectors and pins provided.

### **Cylinder Trim Differences**

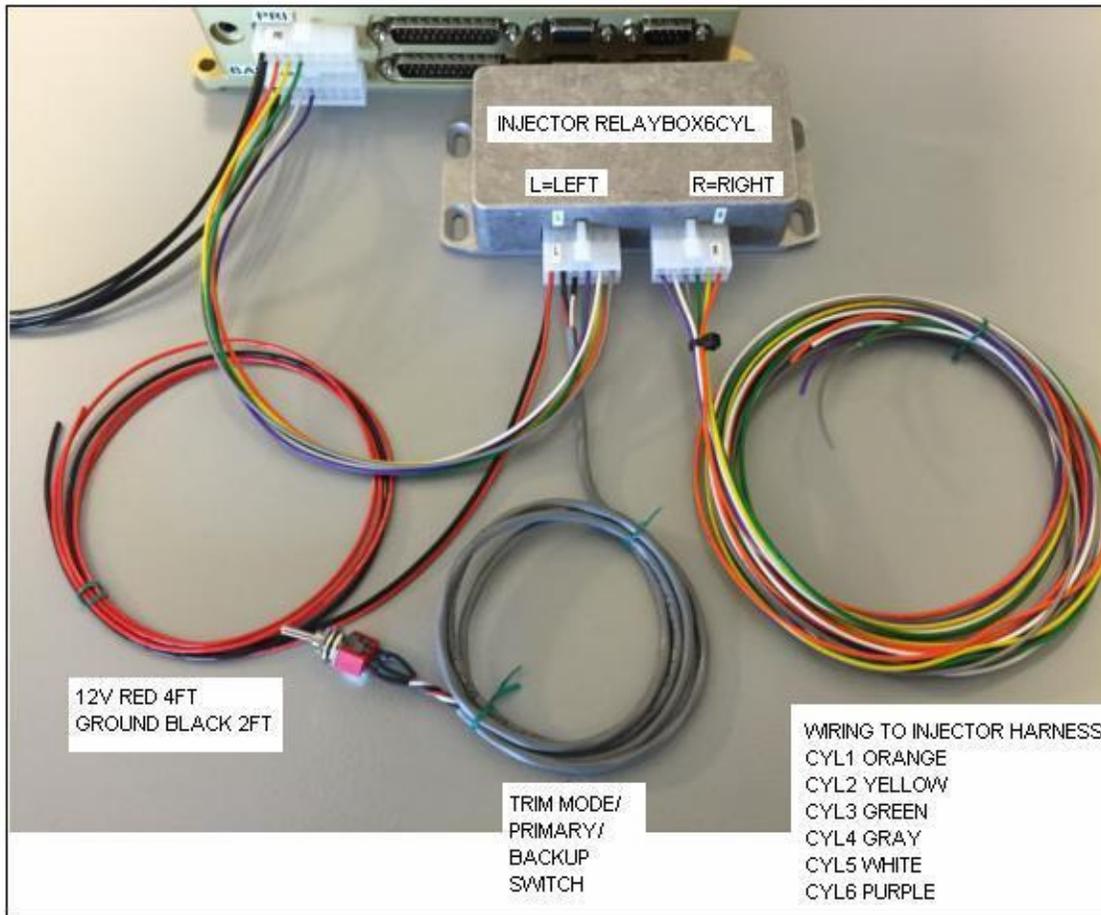
On 4 cylinder dual systems, each board runs the injectors and one set of spark plugs. Individual fuel trim is usually only done on the primary ECU. On dual 6 cylinder systems, to trim cylinders, you must toggle between ECUs with the programmer select switch, trimming cylinders 1, 2 and 3 with the primary ECU and cylinders 4,5 and 6 with the backup ECU. When Programming the trim values, be sure to have the ECU selector switch in the BOTH position.

### **Testing ECUs and Normal Running**

You can test the function of each ECU on the ground by running the engine at idle and running the ECU select switch from its middle position(call it Normal or Trim) to PRIMARY to BACKUP and then back to middle again. All normal running in flight should be with the ECU switch in the middle position. We don't recommend you switch the ECUs to Primary or Backup in flight unless the engine stops or runs rough.

## Injector Relay Wiring

See the photos below for the relay box and ECU selection switch wiring. Figs. 3 and 4



### Aircraft with single power buss

For aircraft with a single power buss the relaybox red wire will need to connect to a fuse/breaker rated at 2-5 amps.

**For Aircraft with Dual power busses read on below.**

## Aircraft with Dual power busses, both active all the time.

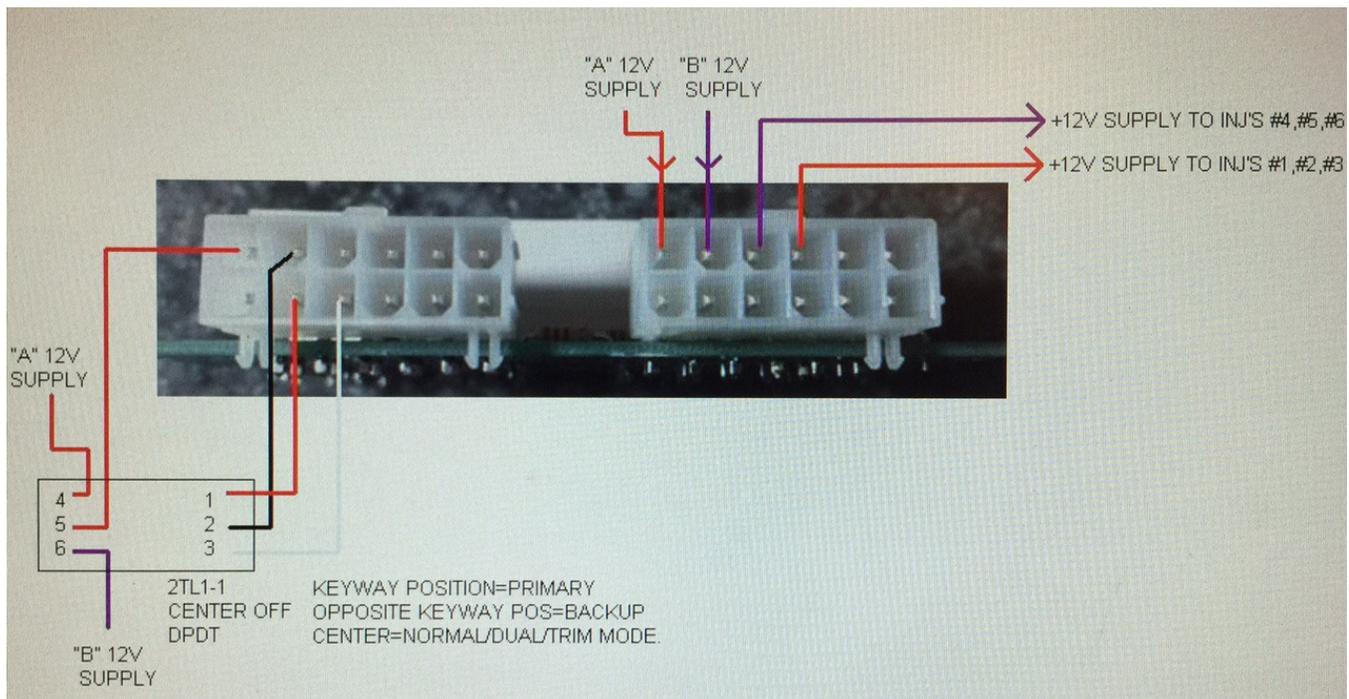
In dual power buss applications, the V4 relaybox has two additional relay circuits to switch injector power source between each active power buss. We use red and purple wires on the right side connector to make these connections. You would want two 15 amp breakers before sending power to the relaybox "A" and "B" supply purple and red wires. If you want breakers for each individual injector then these breakers will need to be connected inline with the relaybox red and purple output wires, however you could just run with the two breakers feeding to the relaybox, depends on your comfort level with chosen breakers.

Also the relaybox activation switch needs to be double pole type which allows the relaybox to get power from either power buss depending on switch position. With the switch in the middle(normal) position, the relaybox does not draw any current. If substituting a different brand of switch make sure it is a center-off type switch. If substituting the switch be very careful with switch wiring not to get it backwards because the system will not work as intended. Once running, test the function of this switch by shutting down each power buss completely and make sure the engine will still run on all 6 cyl's from the working buss.

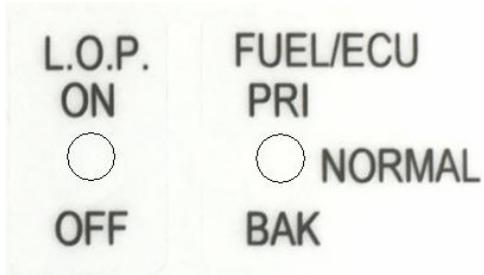
Note that both power busses must be active all the time when the engine is running. If one power buss does fail completely (0 volts), then the engine would then be running on 3 cylinders, you would need to manually switch the PRI/BAK/ switch to either PRI or BAK positions to get all 6 cylinders running again. There is no automatic switching.

Note that relayboxes without V4 tags cannot do this additional power switching, but they can be updated to do the switching by adding a small circuit board inside. Contact us if this is needed.

Photo showing Double Pole switch and purple and red injector power source wires. Left Purple to "B" buss breaker, Left Red to "A" buss breaker. Purple and Red on right go out to supply the injectors with +12v power. Red needs to be connected to injectors 1,2,3. Purple needs to be connected to injectors 4,5,6.



## Switch Functions



It's very important to understand the function of the 3 SDS toggle switches:

**LOP switch-** This activates the preset leaning amount and ignition advance feature.

**Programmer Select Switch-** This allows you to access either ECU for programming, viewing Gauge modes or trimming fuel. It DOES NOT switch ECU function.

**Fuel ECU Select Switch-** This switches control of the fuel injectors ONLY. It does not switch the ignition systems in any way.

Changes:

V4 add Dual power buss info and photo of relaybox purple and red wires. June 16, 2021.