texasturbines.com

Service Bulletin TTC-SB-DHC3-03-REV-A

Date: October 1, 2006

Title: Parallel/Series Start System Modification

Effectivity: All DHC-3 Otter aircraft modified with Texas Turbine Conversions, Inc. STC SA09866SC or Canadian STC SA02-15, turbine engine conversion modified prior to October 1, 2005.

Reason: Texas Turbine Conversions, Inc. has designed a parallel/series start system for the DHC-3 Otter aircraft modified by TTC, Inc.'s STC SA09866SC or STC SA02-15. The start system provides a reduced start time for the operator and is especially beneficial to those operations on water. The system reduces the start time by as much as 20 seconds and the start temperature by as much as 100C by increasing the battery voltage to the starter from 24V to 48V during the start sequence only.

Description: This service bulletin provides the requirements and installation instructions for the parallel/series start system using Service Kit TTC-SK-DHC3-01.

Compliance: Optional

Accomplishment Instructions:

1. Remove both side cowlings and lower cowlings to allow easy access for installation.
2. Remove cover and both batteries from battery box.
3. Disassemble both Elcon connectors to allow wire removal.
4. Remove electrical junction box (j-box) cover.
5. Remove the Eaton start relay and upper Eaton battery master relay (see figure 1). Remove the 125 amp current limiter, and the mount screws. Rotate the current limiter mount vertical and mark and re-drill the holes with a #10 drill and de-burr.
6. Install 6 AN470AD6-3 rivets in the holes where the Eaton relays, and the current limiter mount were removed. Re-install current limiter mount base and current limiter.
7. On the bench, install the 500 amp current limiter (ANL-500) between the normally closed relay (29.331.11.914) terminal (1 or 88) and the start relay (29.311.12) terminal (2 or 88a). Temporarily tighten the relay nuts to hold the current limiter in place.
8. Hold the current limiter/relay assembly up to the junction box in the mounting location depicted in the photo (approx. ¼" from previous horizontal 125 amp current limiter mounting base position) and mark the four holes to mount the relays in the j-box (see figure 2). Drill the four holes in the junction box using a #10 drill. De-burr the holes.

Standard Parallel System Electrical Junction Box

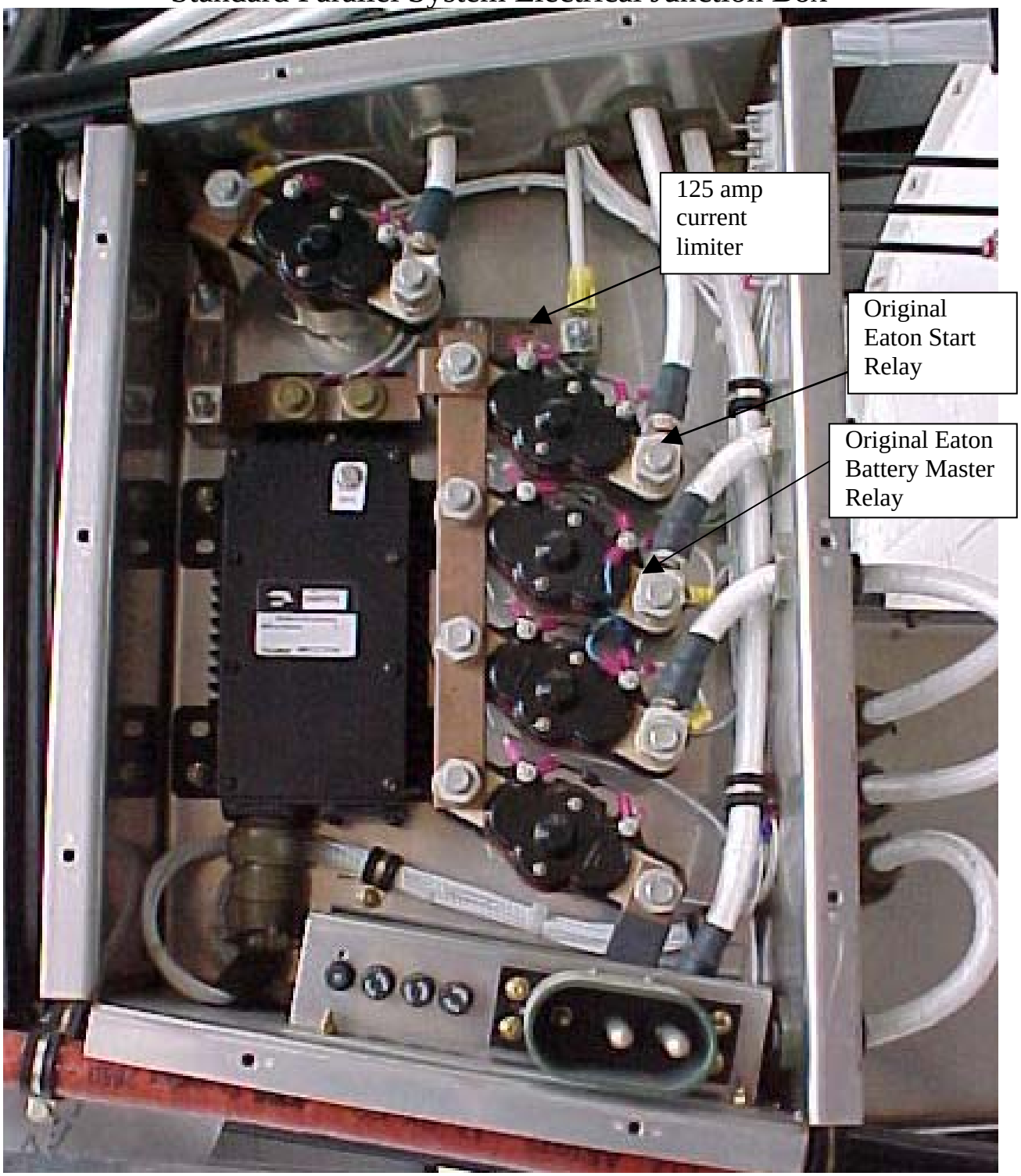

Figure 1

Parallel/Series System Electrical Junction Box

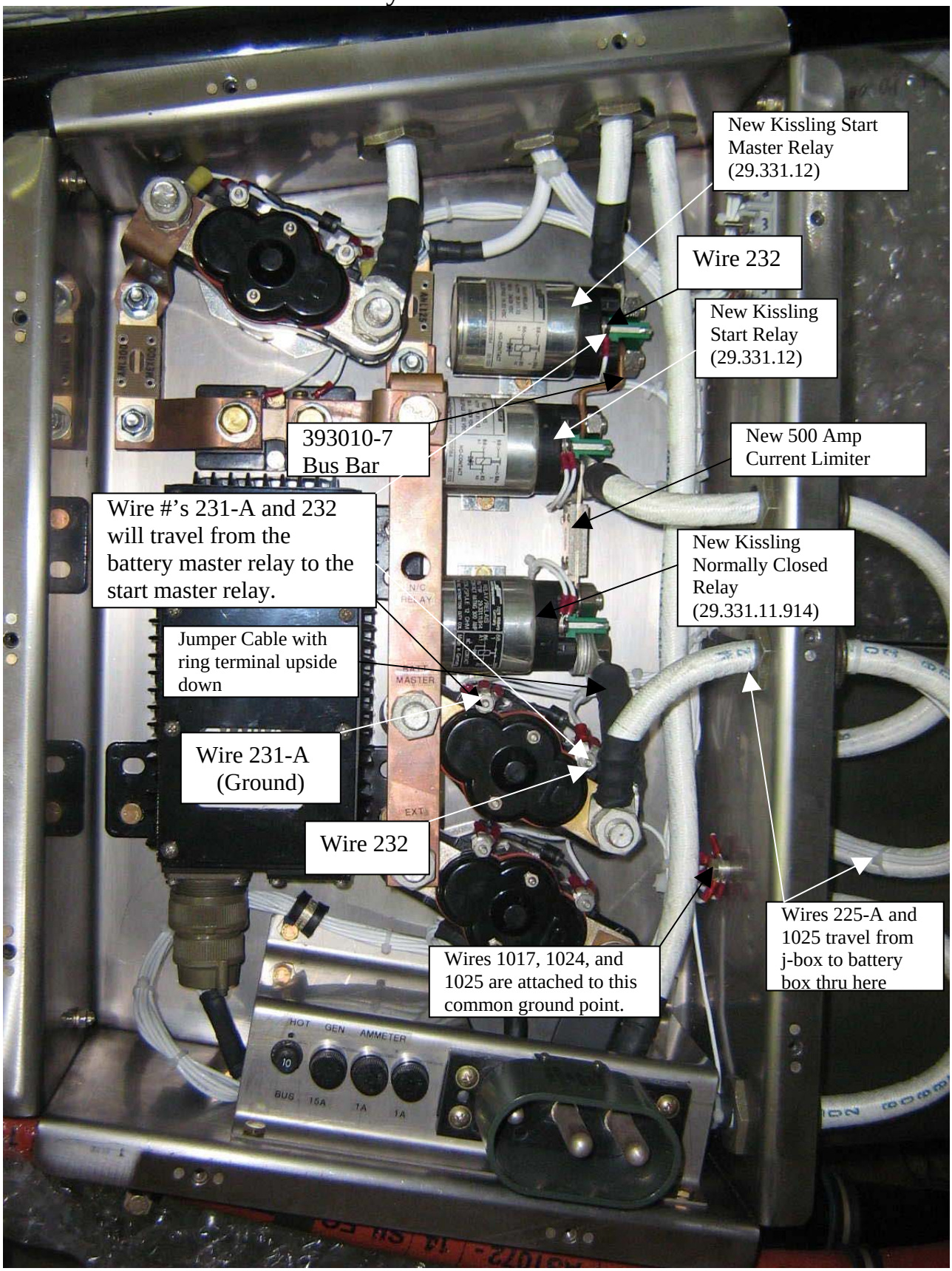

Figure 2

New Battery Box Wiring Installation

(viewed from firewall)

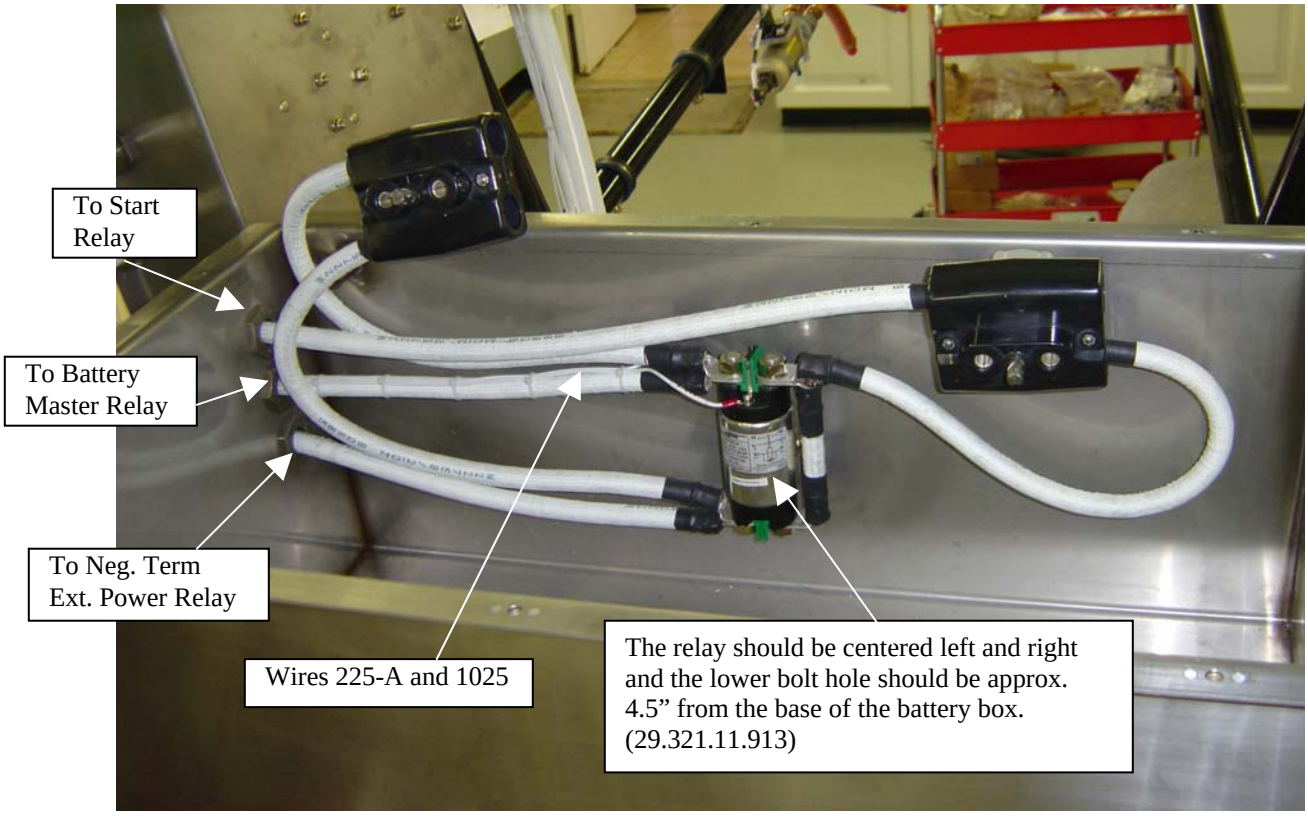

Figure 3

9. Before final mounting of the relay assembly, install the two ground wires (1017 & 1024) on the appropriate A1 terminal of each relay. Wire 1017 is existing and wire 1024 must be fabricated using MS22759/8-18-9 wire.

10. Install the relay assembly in the electrical junction box using 4 bolts (AN3-4A), 4 washers (AN960-10), and 4 steel lock nuts (AN363-1032). Then using the 393010-7 Bus bar for alignment, Match drill the start master relay(29.311.12) to J-box , (as depicted in fig. 2) and de-bur.

11. (Fabricate Wires 231-A and 232 with MS22759/8-18-9 wire) Install wire 231-A (ground) to start master relay (29.311.12) terminal A1 or 86. Attach wire 232 to terminal A2 or 85 on the start master relay (29.311.12).Mount to J-Box with 2 bolts (AN3-4A), 2 washers (AN960-10), and 2 steel lock nuts (AN363-1032). Attach wire 231-A to the same post of the relay that wire 231 is mounted (terminal X1), and wire 232 to terminal X2 of battery master relay.

12. Install the parallel/series transfer relay (29.321.11.913) in the battery box as depicted in figure 3 using two (AN3-4A) bolts, two (AN960-10) washers, and two (AN363-1032) nuts in diagonally opposing holes.

13. Route and cut existing wires from old start relay (235 and 235A) to the appropriate length to install them on the A2 terminal of the new start relay. Crimp the supplied #8 ring terminals on both wires and install them on the A2 terminal.

14. Attach existing wire 225 and a new wire 225-A (MS22759/8-18-9) to the terminal A2 of the normally closed relay. Route wire 225-A from normally closed relay terminal A2 out the strain relief clamp for the battery relay in the j-box and go in the middle strain relief of the battery box to the A2 terminal on the parallel/series transfer relay using a #8 ring terminal (see figure 3).

CAUTION

To prevent shorting of wire, be careful not to over tighten the strain relief clamps on the wires.

15. Route the new ground wire 1025 (MS22759/8-18-9) from the common ground point in the j-box to the battery box following the same path as wire 225-A, except attach wire 1025 to the A1 terminal on the parallel/series transfer relay using a #8 ring terminal. Use tie wraps to secure wires 1025 and 225-A to the middle heavy gauge wire of the battery box (see figure 3).

16. Attach wires 1017, 1024, and 1025 to the common ground point using the #10 ring terminals provided.

17. Cut the starter cable to the appropriate length (remove ½" ring terminal) to attach to the (1 or 88) terminal of the new top start relay. Crimp a 3/8"70-10 ring terminal on the cable and install it on the relay. (see figure 2 for ring terminal clocking)

18. Fabricate jumper wire from hot side of battery master relay to the terminal (2 or 88a) of the normally closed relay using the MS22759/2-02-9 wire and one ½" 70-12 ring terminal (master relay) and one 3/8" 70-10 ring terminal (normally closed relay). Note that the ring terminal on the battery master must be installed upside down to allow installation of two ring terminals on one stud. Also, due to the short length of wire, ring terminal clocking and wire length are very critical.

NOTE

For all heavy gauge cables, be sure to use heat shrink on each end of the wire to prevent fraying of the braided shielding.

19. Cut the end of the heavy cable that runs from the top strain relief of the battery box to the j-box at the j-box end and remove the cable from both the j-box and battery box.

20. Install a new MS22759/2-02-9 cable from terminal (2 or 88a) on the start relay to the positive terminal on the Elcon connector for battery number 2 (the one further from the j-box) parallel/series transfer relay in the battery box as depicted in figures 2 & 3 using the same holes where the previous cable was removed. Use the 3/8" 70-10 ring terminals on both ends. Note ring terminal clocking prior to crimping terminals and verify that there is adequate length to connect to battery when installed.

21. Cut the heavy gauge wire coming thru the middle strain relief (from the battery master relay) of the battery box to the proper length to allow installation of the wire on the top (1 or 88) terminal of the parallel/series transfer relay (see figure 3). Crimp a 3/8" 70-10 ring terminal at the new cut length.

22. Loosen the bottom heavy gauge strain relief on the battery box for the negative cable and push the cable further into the box to attach to the bottom post (4 or 87a) of the parallel/series transfer relay as depicted in figure 3. The existing 3/8" 70-10 ring terminal might have to be cut off and a new one installed to allow for proper clocking of the ring terminal. If the cable is not long enough, a new cable must be fabricated from the external power plug to the parallel/series transfer relay using the cable and 3/8" 70-10 ring terminals supplied in the kit.

23. Fabricate the heavy gauge wire from the negative terminal on the Elcon connector for battery number 2 (the one further from the j-box) to the top terminal (2 or 88a) of the parallel series transfer relay using the MS22759/2-02-9 wire and 3/8" 70-10 ring terminals that were supplied with the kit.

24. Fabricate the heavy gauge jumper wire from the top terminal (2 or 88a) of the parallel-series transfer relay to the bottom terminal (3 or 87) using the MS22759/2-02-9 wire and the 3/8" 70-10 ring terminals that were supplied with the kit. Again, pay careful attention to ring terminal clocking. (see figure 3)

25. Fabricate the heavy gauge wire from the positive terminal on the Elcon connector for battery number 1 to the top terminal (1 or 88) of the parallel/series transfer relay using the MS22759/2-02-9 wire and 3/8" 70-10 ring terminals.

26. Fabricate the heavy gauge wire from the negative terminal on the Elcon connector for battery number 1 to the bottom terminal (4 or 87a) of the parallel/series transfer relay using the MS22759/2-02-9 wire and 3/8" 70-10 ring terminals.

27. Permanently tighten the nuts and screws on all the relays. Tighten all strain relief clamps that were loosened during installation. Be careful not to over-tighten the strain relief clamps or pinch the two 18 gauge wires that run from the battery box to the j-box.

THE FIREWALL FORWARD MODIFICATION IS COMPLETE

28. In the cockpit, remove the engine instrument panel to allow installation of the series start relay.

29. Install the series start relay (PN. KUP-5D55-24) on the left bulkhead as depicted in figure 4 using two MS27039-0808 screws, two AN960-08 washers, and two MS21083N08 nylon nuts.

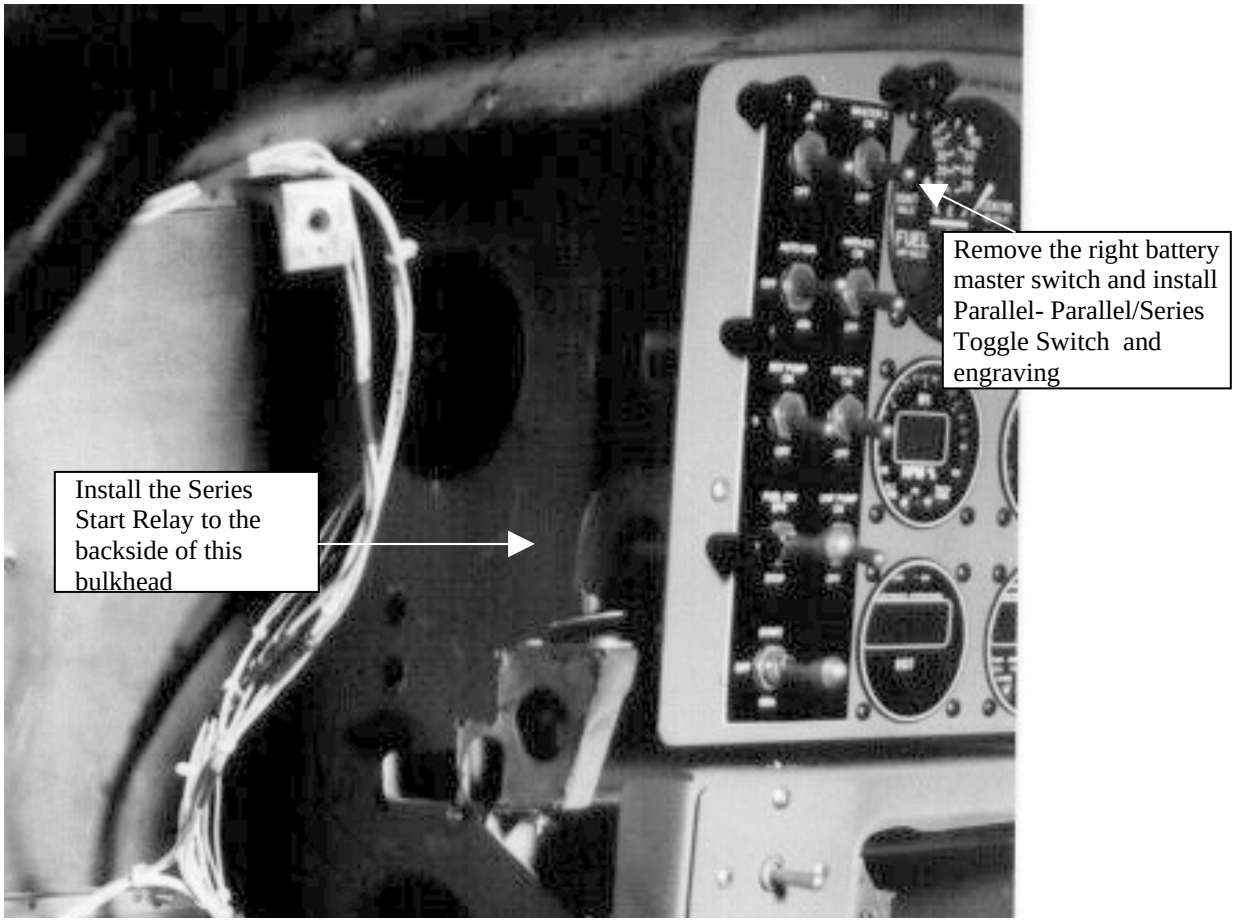
Remove the right battery master switch and install Parallel- Parallel/Series Toggle Switch and engraving
Install the Series Start Relay to the backside of this bulkhead

Figure 4

Simplified Schematic of Parallel/Series Start System

Figure 5

29. Remove the right battery master switch from the engine instrument panel and install the parallel/series switch 8501-K9 (provided with kit)

NOTE

If wire 325 and wire 1105 are on the left battery master switch, the left battery master must be removed and the right battery master should be moved to the left hole.

30. Remove wires 325 and 1105 from the battery master switch and cut the ring terminals off to facilitate removal from the engine instrument panel harness. Route the wires over to the Series Start Relay that was just installed. Connect wires 325 and 1105 to the appropriate marked wires of the series relay using the spade terminals provided in the kit (see figure 5).

31. Fabricate and install wire 600-A (MS22759/16-18-9) on the START/GEN switch on the same post as wire 407 using a #8 ring terminal. Route the wire along the existing harness to the Para/Series Toggle Switch and attach it to the appropriately marked terminal of the switch. (see fig. 5)

32. Fabricate and install wire 601-A (MS22759/16-18-9) on the FUEL ON/SPR switch on the same post as wire 404 using a #8 ring terminal. Route the wire along the existing harness to the Para/Series Toggle Switch and attach it to the appropriately marked terminal of the switch. (see fig. 5)

33. Fabricate wires 600 and 601 using wire(MS22759/16-18-9) and using #8 ring terminals, run them between the Para/Series Switch and the Series Start Relay and attach to appropriately marked leads or terminals.(see figure 5)

34. Permanently tighten all screws on the START/GEN switch and FUEL ON/SPR switch. If the battery master switches were flipped, check that the screws on the remaining battery master switch are not loose.

35. Open circuit breaker panel and remove the 10 amp Engine Controls circuit breaker and install the 15 amp circuit breaker (4200-001-15) supplied in its place. Close circuit breaker panel.

36. Secure all wires to the existing harnesses and re-install the engine instrument panel.

THE COCKPIT MODIFICATION IS COMPLETE

37. Re-install the two aircraft batteries in the battery box and secure. Connect the two Elcon connectors to the batteries and safety wire.

38. Pull the ignition circuit breaker and verify that the engine cranks using the normal motoring procedure.

NOTE

The start system should crank normally, because the system does not switch to series until the fuel is turned on.

39. If system cranks normally, install battery box and j-box covers and test run engine. If engine does not crank normally, verify that wiring is correct and repeat step 36.

40. Start engine using normal start procedures, at 12-15% (when the fuel is turned ON) the system will automatically switch to a series start (48 volt start as indicated by a more rapid acceleration) and will stay series until starter cutout at 55-60%. Verify that generator functions normally and that bus voltage is approx. 27 volts. Shut down engine.

NOTE

During the series phase of the start it may take substantially more fuel enrichment to keep the start temperature up at 675C, or you may not be able to reach 675C. This is normal.

THE PARALLEL/SERIES START SYSTEM MODIFICATION IS COMPLETE

Approval: This service bulletin is FAA approved.

Man-hours: The modification should take no more than 16 man-hours.

Material: The appropriate materials will be supplied in the service kit TTC-SK-DHC3-01.

Tooling: 00 wire crimpers will be necessary to fabricate the heavy gauge cables.

Weight and Balance: Add 5.3 pounds at station 42.0