

## ***Post-Paint>Fuselage>Install electrical wiring***

### **Objectives of this task:**

To install all of the electrical wiring in the aircraft and connect to the multi-pin plugs. Each wire will need to be cut from the supplied coils of aircraft grade wire. The length required will vary depending on how you choose to route the wire and so it is difficult to give any exact lengths, but generally you should allow a little extra length to be on the safe side. Study the photos in this task to see how we route our factory wiring before starting work.

### **Materials required:**

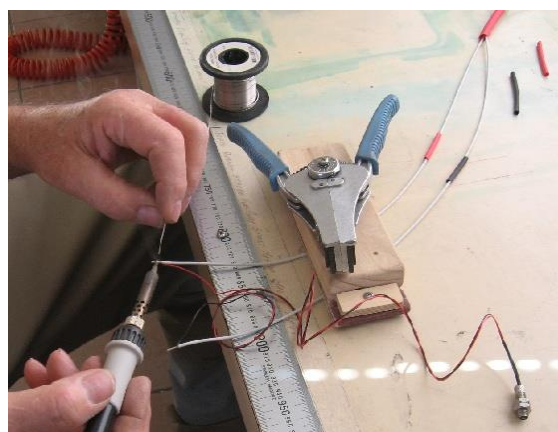
Wiring Kit, as well as both the *Electrical wiring diagrams* and *Assemble instrument panel* tasks for reference and for pin assignment for the multi pin connectors.

### **Preparation**

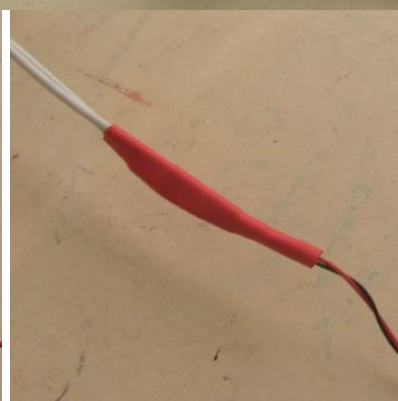
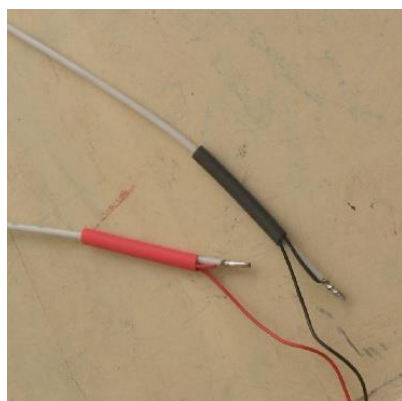
Before heading out to the aircraft there are a couple of things that need to be prepared:

The 2 tachometer (tacho) sender unit wires will need to be soldered to 2 x 700mm lengths of 16 gauge wire as shown at right.

Because soldering hardens the wire there is a risk of the wire breaking just beyond the solder joint, so the wires are joined by twisting the bare ends of the tacho wire around the bare ends of the 16g wire and soldering them together and then doubling the thinner wires back and covering each, and then both, wires with heat shrink tubing, all as shown below.



This method provides a much safer joint that allows the wire to flex without the danger of breaking near the solder joint. Label each white wire as being positive (red) or negative (black). The CHT sender plug halves can now be connected and then the connector halves can be fixed together with 2 zip ties as shown at right. Cut off the ends of the zip ties.



## Engine wiring

All wires will need to be long enough to route from the respective sources, around the engine in the manner shown, and either to a connection point on the firewall in some cases or through the firewall plus about 300mm for connection to a multi-pin plug for the majority of cases.

All wires to multi-pin plugs *must* be labeled (use masking tape) to avoid later confusion. Refer to the [Electrical wiring diagrams](#) task (found immediately before this task) to see where each wire will be connected to and plan the lengths accordingly.

Careful consideration must be given to the routing of wires around the engine. All wiring in the engine compartment must be kept well away from all hot and/or moving parts. The supplied white wire is all aircraft grade and has high temperature insulation but care must still be taken to route away from obvious heat sources such as the exhaust system.

## Wire the oil temperature and pressure senders

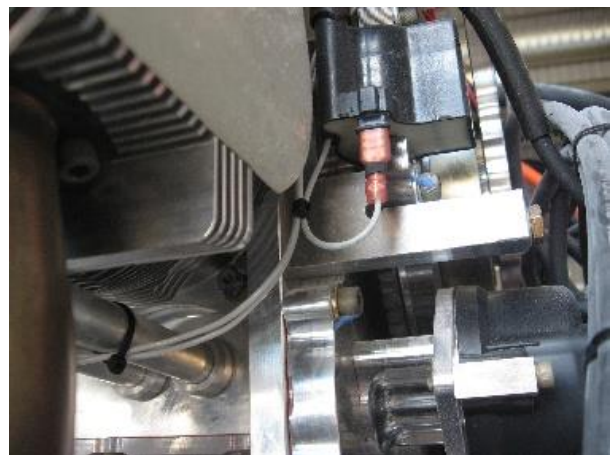
These senders are located on the left front of the engine and the single wire from each unit is routed back under the cylinders to the rear of the engine and zip tied to the pushrod tubes.

Strip 4mm of insulation from each wire and crimp a red female spade connector and a black heat shrink tag to each. You will need to cut the insulation from the oil temperature connector as shown at right to allow it to fit over the 'button' pin on the oil temperature sender. Note the black heat shrink tag – this sender unit measures the resistance to earth.



Connect to the oil temperature sender unit, which is located just above the drain plug on the sump. Crimp over the end of the connector when it has been fitted to prevent it from slipping off the sender unit. Label each wire.

Fit the other connector to the oil pressure sender unit, which is located above the oil filter. Note the black heat shrink tag – this sender unit also measures the resistance to earth.



Route both wires back under the cylinders and zip tie them to the pushrod tubes – you will need to bend the zip ties into a “U” shape first in order to fit them around the pushrod tubes. In the photos above you can see the 2 wires running back under the pushrod tubes and then up behind the rear cylinder. You can also see the earth wire from the left magneto (with a black tag again because it is used to earth the magneto to turn it off). These wires will all need to be long enough to be routed around the rear of the engine and 300mm into the cabin.

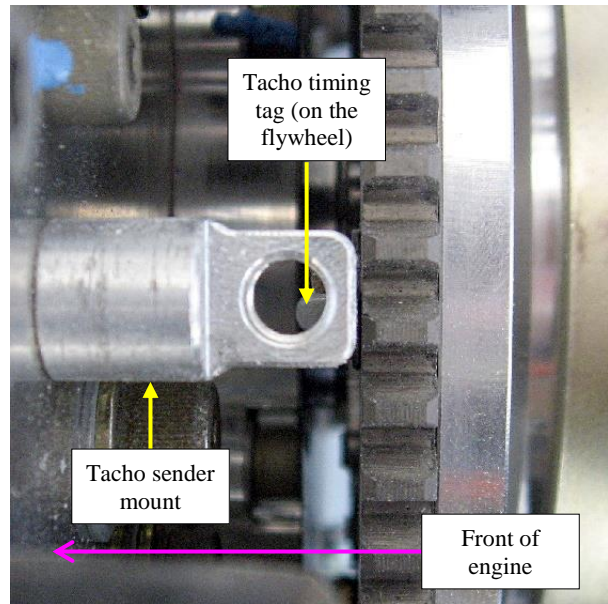
## Fit the tacho sender unit

For this step you will need to rotate the engine, which may cause 1 or 2 of the sealing plugs to pop off of the exhaust pipes and possibly some preserving oil may drip out, so place some rag under the engine until this step is complete. You will require a lever to turn the engine – in our factory we use a tool that fits onto the propeller flange.

Rotate the engine until a tacho timing tag can be seen under the tacho sender mount (the threaded fitting at the left rear of the engine) - refer to the photo at right for detail.

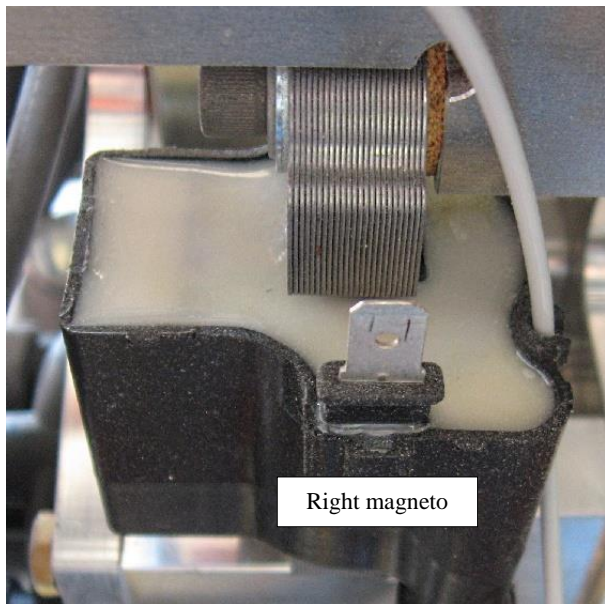
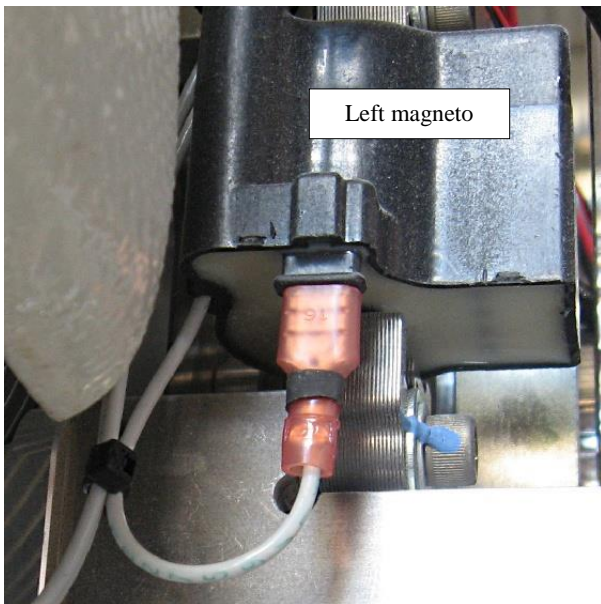
Remove one lock nut from the sender unit and screw it into the fitting, then carefully screw it down until it **just** touches the timing tag. Unscrew the sender unit one full turn and tighten the lock nut finger tight.

Now rotate the engine one half of a turn until the other timing tag is under the sender unit and screw the sender down until it **just** touches that tag, which should be one full turn. Back the sender unit out one half of one turn and firmly but carefully tighten the locking nut.



## Wire the magnetos

Feed a plain length of 16 gauge wire through the hole in the side of each magneto, strip 4mm of insulation off and crimp a red female spade connector to the wire with a black heat shrink tag. A black tag is used because the magneto wire is used to earth the magneto to turn it off.

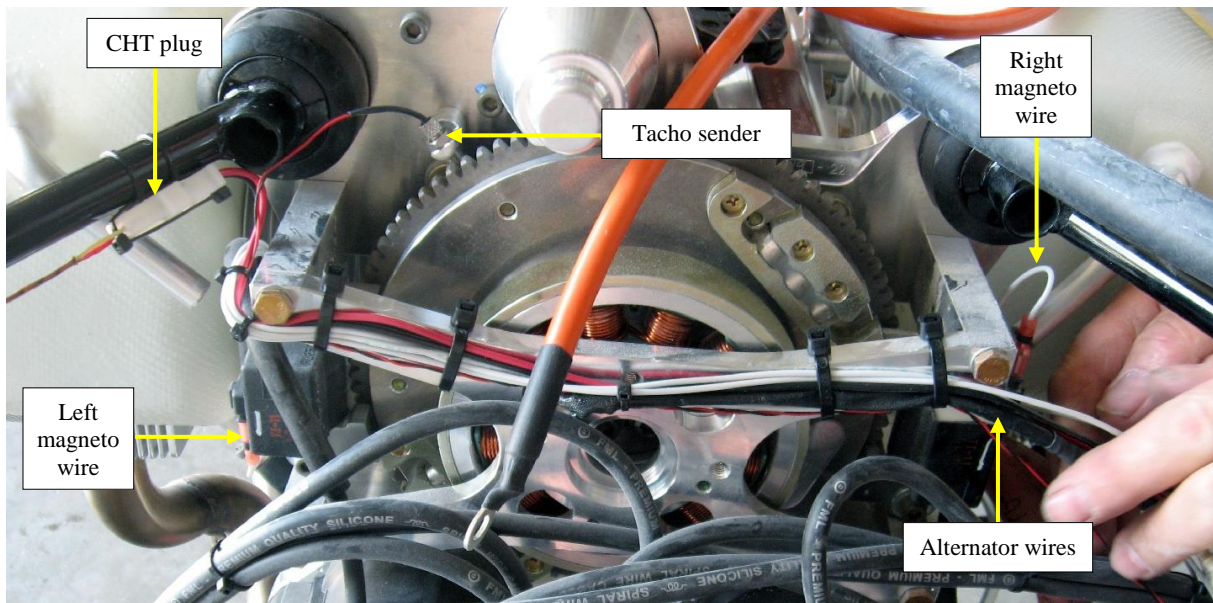
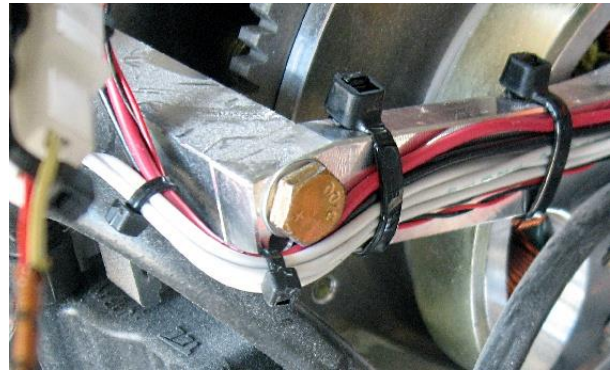


## Fit the CHT (Cylinder Head Temperature) plug and wiring

Zip tie the CHT connecting plug to the front of the left hand top engine mount with the high temperature wire facing back. The sensor will be fitted to the left rear spark plug later in this task. The main photo on the next page shows the CHT connecting plug fitted.

## Engine wiring routing

Cut the zip ties that hold the alternator wires to the engine and bend the wires to the right. At this stage you will have wires at the top left rear of the engine for oil pressure and temperature, left magneto, CHT and tacho. Group these wires and zip tie them as shown at right, so you will have 3 white 16 gauge wires (oil pressure, oil temperature, left magneto) and 2 pairs of red and black wires (CHT and tacho).



Now run the wires across the machined aluminum beam behind the flywheel as shown above. Add the alternator wire pair into the group as shown, but before you do, twist the wire pair several times so that there are no lengths where the wire pair is straight– the full length of the alternator wires should be twisted. This will help to minimize inducing noise into the wiring harness from the alternator.

From here the wiring bundle can be routed up to the top right engine mount and then back along the mount tube to the firewall. Include the right magneto wire in the wiring bundle at this point.

The 16 gauge wires for oil pressure, oil temperature, left and right magnetos, CHT and Tacho can all be passed through the right hand cable collar in the firewall and 300mm left free inside the cabin for later fitting to Connector **A**.

If you are using the optional fuel pressure sensor it can be connected at this time and the wires included in the wiring bundle for later fitting to Connector **B**.

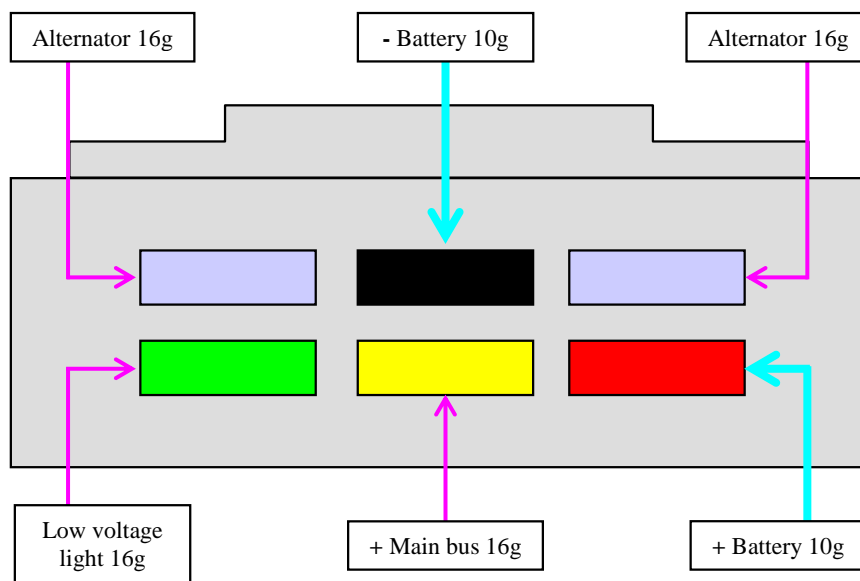
The 2 wires from the alternator can be routed along the firewall and down to the regulator plug for connection in the next step.

Don't zip tie the wiring bundle to the engine mount just yet - there are some more wires to be added to the bundle over the next few steps.

### Wire the regulator connector

Power from the alternator will go to the regulator through the regulator connector, and power from the regulator will go to the positive and negative sides of the battery as well as the power to the main bus and to the optional low voltage warning light, also through the regulator connector.

Crimp a male spade connector to each of 2 x 1m lengths of 16 gauge wire and plug them into the female connectors from the alternator. Cover each connector with heat shrink tubing. Route the wires into the wiring bundle that runs along the top right-hand engine mount, around the firewall and down to the regulator connector.



Wire the male half of a QK6 connector as shown above – note that the positive and negative wires to the battery are both 10 gauge (heavier) wire, shown above as light blue, while the rest are all 16 gauge (lighter) wire, shown above as purple.

The colour coding of the pins in the diagram above indicates the colour of the wires coming from the regulator to the connector.

Route the 10 gauge positive wire from the red pin to the front post on the starter solenoid.

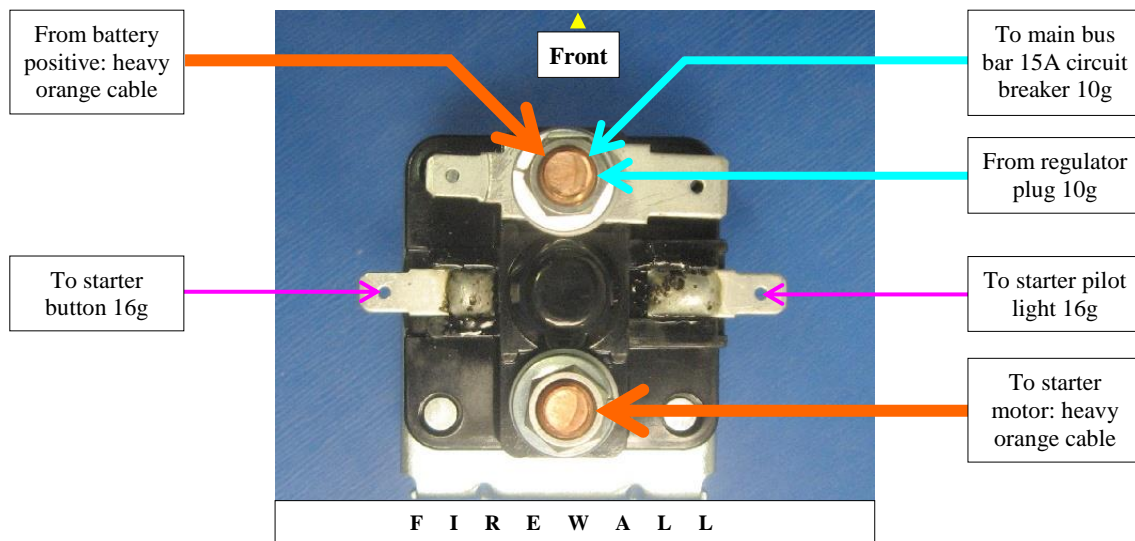
Route the 10 gauge negative wire from the black pin to the earth terminal on the firewall.

Route the 16 gauge wires from the yellow pin to the main bus and from the green pin to the optional low voltage warning light - pass both wires through the right hand cable collar in the firewall and leave 300mm free inside the cabin for later fitting to Connector **B**. Carefully label each wire with masking tape.

Once you have allowed enough wire length to enable routing in a tidy manner, strip 4mm from the end of each wire, carefully crimp a female spade connector to each wire, and then fit each connector carefully into the connector housing.

Refer to the [Engine bay wiring routing](#) step later in this task for an example of how to route the wires from the Regulator plug to the battery and the cable collar.

## Wire the starter solenoid



Route the short heavy orange cable from the positive side of the battery to the front post of the starter solenoid. Fit an 8mm yellow ring terminal and a red heat shrink tag to each of 2 lengths of 10 gauge wire (shown above as light blue) and route one wire to the red pin in the regulator plug and the other wire from the front post to the main bus 15A circuit breaker: pass the wire through the right hand cable collar in the firewall and leave 300mm free inside the cabin for fitting to Connector **C**.

Fit a red female spade connector and a red heat shrink tag to 2 x 1m lengths of 16 gauge wire (shown above as purple) and route one wire from the left-hand middle connector on the solenoid to the starter button and one wire from the right-hand middle connector to the starter pilot light - pass both wires through the right hand cable collar in the firewall and leave 300mm free inside the cabin for fitting to Connector **B**.

The large and small spade terminals on the front post of the starter solenoid are not used.

## Connect the starter motor

Earth the starter motor by fitting the long heavy orange cable under the top bolt that holds the front of the starter motor housing in place – this provides maximum current to the starter unit. Loosen both starter bolts slightly and then remove the top bolt and fit the cable under it. Apply a drop of Loctite and retighten both bolts firmly. Route both orange cables back along the top right engine mount strut.

The positive cable (the one that goes inside the starter motor) can be fitted to the rear post of the starter solenoid and the earth cable can be fitted to the negative side of the battery.

## Wire the firewall earth tag

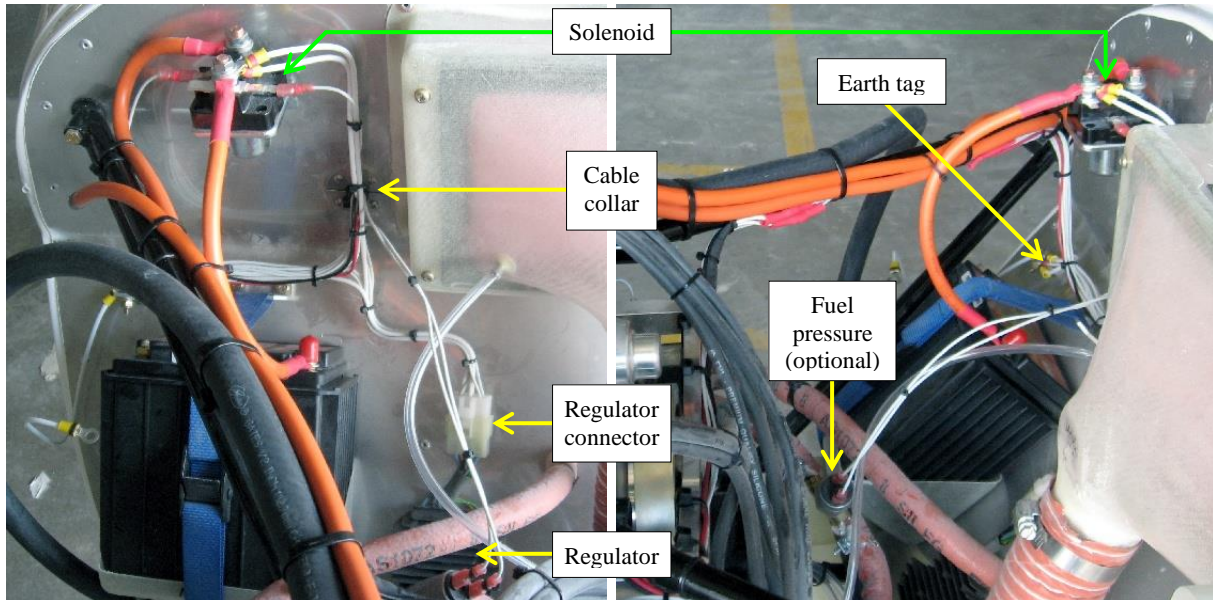
The following 3 x 10 gauge wires are fitted to yellow 6mm ring terminals with black heat shrink tags and connected to the firewall earth tag with a single AN3-5A bolt and Nyloc nut:

1. The negative wire from the black pin in the regulator plug;
2. The negative wire to the earth bus - pass this wire through the right hand cable collar in the firewall and leave 300mm free inside the cabin for later fitting to Connector **C**;

3. The negative wire to the negative post of the battery. Do **not** connect this wire to the battery at this time.

### Engine bay wiring routing

The engine wiring bundle can now be zip tied to the right top engine mount and then the starter cables and the breather tube can be zip tied over top of those wires. Take some time to route all of the wires neatly and zip tie any loose wires together. When all wires have been zip tied you can trim off the excess ends of the zip ties.



In the photos above you can see the general arrangement of the engine bay wiring.

### Wire the strobes (optional)

Fit the strobe unit to the left side step on the firewall and feed all of the strobe wiring through the left-hand cable collar in the firewall – this separates the high voltage strobe wiring from the low voltage signal wiring that passes through the right hand cable collar.

Connect the strobe power supply wiring to Connector E and connect the strobe output wiring to the strobe wires that were fitted in the [Pre-Paint>Fuselage>Fit control cables and lines](#) task. Fit the strobe unit to the top of the fin and connect the wiring.

Wingtip strobe units will be connected after the wings have been fitted to the fuselage.

### Seal the cable collars

Once all wiring has been routed through the 2 cable collars, each collar must be sealed with automotive exhaust sealer putty, which is available from any auto supply shop.

Push the putty into the cable collars from the firewall side until it can be seen inside the cabin and then smooth both sides off with your thumb. This will provide a fire resistant plug seal that will delay an engine fire from reaching the cabin through the cable collars.

### Connect the high-tension leads and CHT sensor

Remove the ram air ducts from the cylinder heads. Remove the left rear spark plug and fit the CHT sensor under the plug. Refit the spark plug.

The high-tension leads are zip tied in pairs and grouped for each side of the engine, and the lengths of the leads are such that each pair will only fit properly to one cylinder. Test fit the

leads with the ducts off, and then feed them through the rubber grommet in the rear of each duct and push the spark plug leads firmly onto the spark plugs. Replace the ram air ducts.

## Wire the fuel pump

Two fuel pump wires were fitted through the console to the fuel pump in the *Pre-Paint>Fuselage>Fit control cables and lines* task: one wire will be the positive and one wire will be the negative or earth to the fuel pump. Determine which wire will be the positive wire and which will be negative or earth wire and label each end of each wire with masking tape. The forward or firewall end of both wires will be fitted to Connector **D**.

Route the firewall end of both wires so that there is enough length for Connector **D** and then trim the rear ends of both wires so that they end beside the fuel pump.

Fit a red female spade connector and a red heat shrink tag to the positive wire and a red male spade connector and a red heat shrink tag to the red wire from the fuel pump. Connect the positive wire to the red wire from the fuel pump.

Crimp one 4mm ring terminal with a black heat shrink tag to each of the following wires:

1. The negative or earth wire from Connector **D**;
2. The black wire from the fuel pump;
3. A 100mm length of 16 gauge wire – this will earth the header tank quick drain;
4. 2 lengths of 16 gauge wire 100mm longer than the fuel lines – these wires will earth the wing tank quick drains. Crimp both wires into the one ring terminal.

Drill a 4mm hole through the floor near the fuel pump and fit a 4mm countersunk screw with a Tinnerman washer from under the fuselage, then place all 4 ring terminals over the screw and secure them with an M4 Nyloc nut and washer. Tighten firmly. This will ensure a secure fixed earth point for the entire fuel system that cannot accidentally become disconnected.

Feed the 100mm length of 16 gauge wire under the header tank, out of the quick drain hole and through a small hole in the side of the quick drain fairing, trim to length and fit a 4mm ring terminal with a black heat shrink tag and fix to the side of the quick drain fairing with a stainless steel self tapping screw as shown at right.



Run a length of twisted lock wire from the quick drain fitting to the same point, fit a 4mm ring terminal with a black heat shrink tag and connect it under the same self tapping screw as shown above. This will lock the quick drain fitting in place and also earth the header tank.

Run the wing tank earth wires along the outside of the protective sheath with the fuel lines to the wing tanks and zip tie the wires in place. These wires will be connected when the wings have been fitted. Label both wires [Earth] with masking tape.

## Wire the flaps and optional landing lights

Run a pair of 16 gauge wires from the firewall through the console, along the back of the front seats and up behind the door to the flap motor. Fit male and female spade connectors to connect to the flap motor.

Landing light wires follow the same path through the console and are then routed out through the floor and up inside the left hand wing strut.



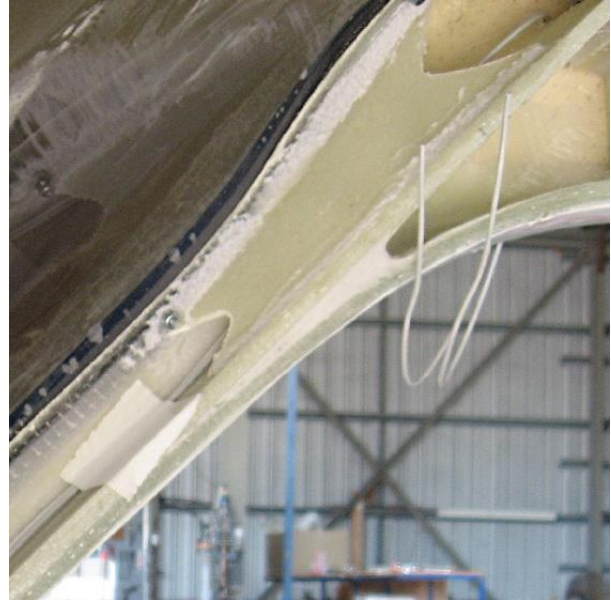
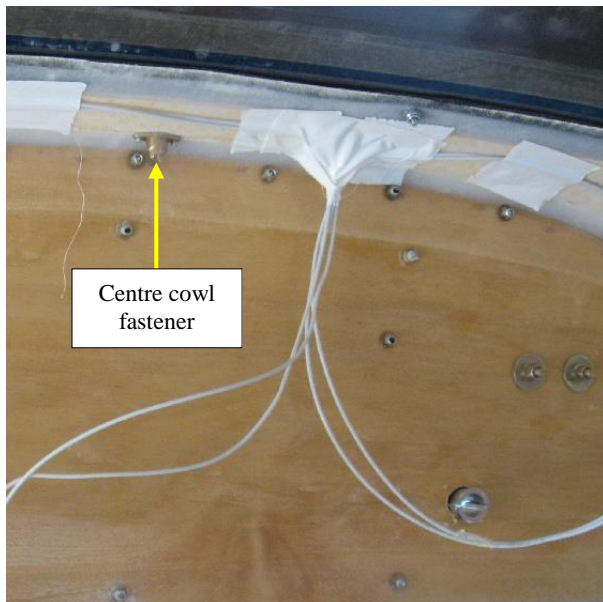
Label each pair of wires for later fitting to Connector **D**.

### Fuel gauge wiring from the wing tank fuel gauges

Before completing the upholstery around the windscreen the 2 wires from the wing tank fuel gauges must be routed down the windscreen pillars.



Drill a 5mm (arrowed above) hole slightly in front of the forward wing mounting lug on each side and feed 2 wires out of the hole and back towards the rear wing mounting lug as shown above and tape them to the fuselage.



Run the inside portion of the wires down the windscreen pillar, holding them in place with short lengths of cloth tape as shown above right. The wires from both sides need to meet slightly to the right of centre as shown above left. Leave the wires hanging down about 300mm and make sure that the wires from each side are clearly labeled [Left] and [Right] – use masking tape to label them. There is no polarity requirement for these wires. These wires will be fitted to Connector **E**. Note that these wires are quite separate from the wing tank earth wires that were fitted earlier.

The upholstery strips can now be glued into place to cover the wires – refer to the [Post-Paint>Fuselage>Upholstery 1](#) task for detail. In the factory we place these wires before the upholstery is fitted, which is shown in the photos above, however you could equally install all of the upholstery apart from the windscreen strips and then fit them once the wires have been placed.

The top ends of these wires will be connected to the wing tank fuel gauges when the wings have been fitted to the fuselage. Leave them taped to the fuselage until then.

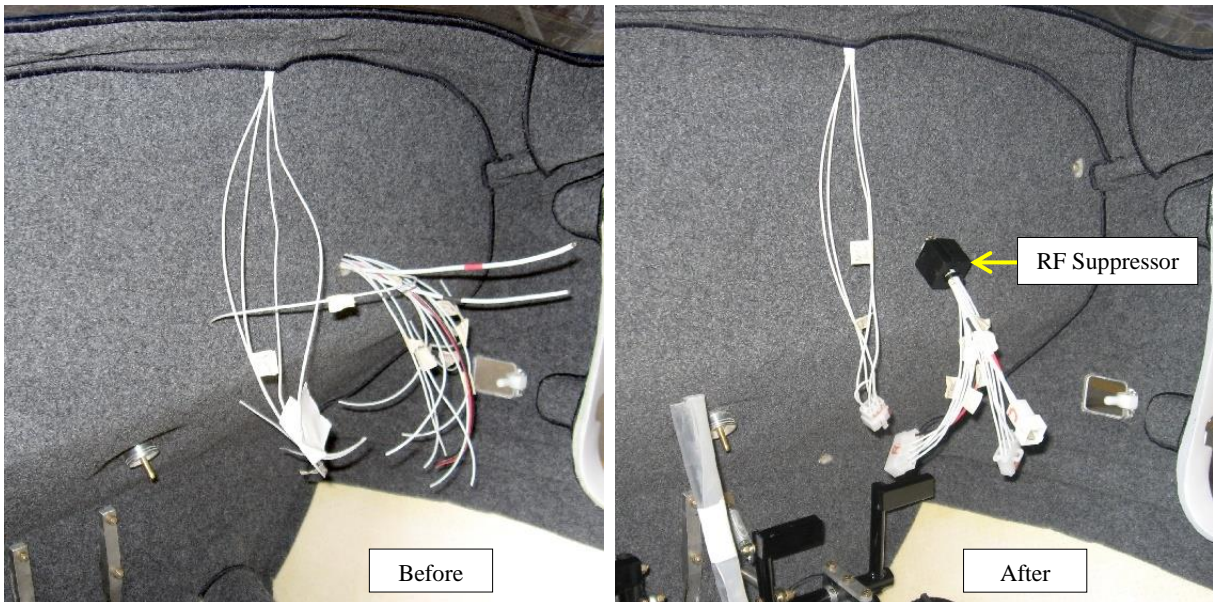
## Connect the multi pin connectors

Each wire inside the cabin has been labeled with masking tape as it was fitted in order to clearly identify where it came from. If any wires have not been labeled then use a circuit tester to trace the wire to its source and then label it clearly.

Use the multi pin connector diagrams from the *Assemble instrument panel* task to sort and group the wires for each connector together. Trim each group to an even length, then strip 4mm from the insulation of each wire and fit the appropriate connector type to each wire: *male* spade connectors for a *female* connector body and *female* spade connectors for a *male* connector body.

The connector bodies that will be used are the matching halves of the connectors that were used in the *Assemble instrument panel* task – these were store at the completion of that task. Use the connector diagrams and pin numbering assignments from the *Assemble instrument panel* task to very carefully fit each spade connector into the connector body until it clicks into place in the same manner as you did in the *Assemble instrument panel* task.

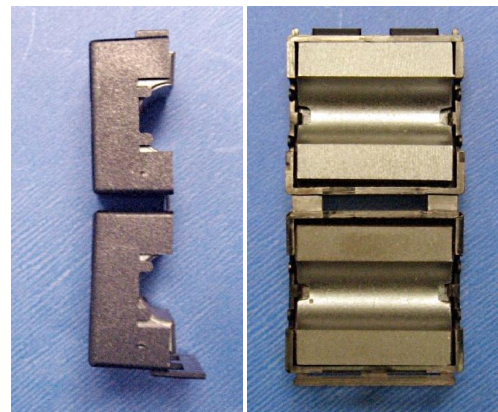
Take your time with this step – the wiring to each pin **must** be absolutely correct!



Notice the clear labeling of each connector in the photo above right.

Clip a ferrite RF Suppressor (shown opened at right) around each wiring bundle as it exits from the cable collar in the firewall, taking care not to crush any single wire when you clip it shut.

Use a zip tie around the wiring bundle to hold the RF Suppressor from sliding down the wires.



## Fit the VHF radio wiring harness

The Aircraft Harness pack includes the wiring harness and all of the necessary hardware: the Push To Talk (PTT) buttons for the control stick and the headset jacks for the top of the cross beam outboard of the seat backs. All wires are clearly labeled and the headset jacks are colour coded as well for ease of installation. The harness goes through the console and exits in 2 places: the PTT wires exit under the control stick and the headset wires exit each side of the console behind the seats. The multi-pin plug connects to the digital harness behind the panel so leave the plug about 400mm above the console. Note that in all cases the grey wires are the earth wires. Use a flexible rod inserted from the access hole behind the seats to draw these wires back through the console, then work through the access hole in the side of the console to feed the control stick PTT wires only around and out of the hole under control column as shown arrowed below right. Fit a rubber grommet to the hole first to prevent chafing of the wires.

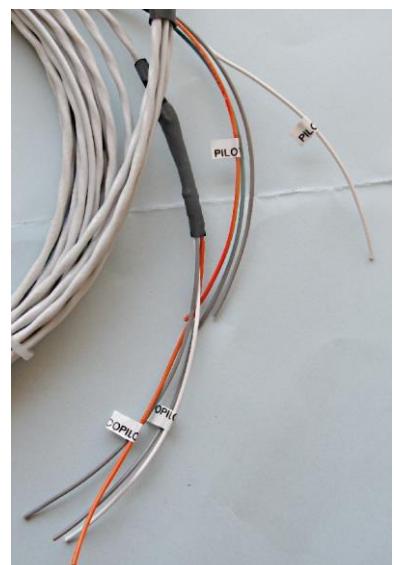


For a dual stick: feed both groups of PTT wires up and into the left underside of the control stick, taking the Pilot group up the left hand side and the Co-Pilot group up the right hand side. For a single stick: feed the Pilot group up and into the stick and route the Co-Pilot group into the right seat base. You will need to cut an access hole under the right-hand seat in this case. Both groups contain 2 pairs of wires: the blue and gray wires are for the PTT button while the green and gray wires are for the optional remote memory feature. Route the wires as shown in the photo at right, leaving enough room for full and free movement of the control stick.



Fit the wires to the PTT buttons and push the PTT buttons into the top of the control stick, or in the case of a single stick fit the Co-pilot's PTT into the front of the right seat base. Separate the pilot and co-pilot headset wires (both sets are labeled as shown at right) and route them out of holes in either side of the console across behind the seat back to the jack locations. Strip the ends of the wires and solder them to the tags on the jacks, (the jacks are colour coded to match the wiring) and then fit the jacks into place.

We suggest that you mount the jacks in the top of the beam between the seat back and the side of the fuselage. This tends to keep the headset wires out of the way in flight. Zip tie the wires up under the rear lip of the beam – drill 3 holes along the bottom of each seat back for the zip ties.



## Connect the VHF antenna cable

The VHF coaxial antenna cable was installed in the *Pre-Paint>Fuselage>Fit control cables and lines* task and connected to the VHF antenna in the *Pre-Paint>Fuselage>Empennage> Fit vertical tail fin* task. Trim the cable off level with the top of the firewall and fit the BNC connector that is supplied with the wiring kit (fitting instructions are included).

## Fit the transponder encoder, antenna and cable

Start by mounting the encoder unit to the firewall with the connecting plugs end facing downwards – the encoder unit attaches to a base (both shown at right) with a thumbscrew so the base can be mounted to the firewall with 3 stainless steel self-tapping screws and then the box is fitted into it. Make sure that the encoder will mount above the throttle shaft and not foul the back of any instruments when the panel is fitted.



The static line up from the console will need to be branched with a “T” piece to

connect to the encoder before connecting to the other static instruments.

Fit the supplied wiring harness plug to the encoder unit, tighten the plug retaining screws by hand and leave the other end free for later connection to the transponder unit when the instrument panel is fitted.

Mount the transponder antenna under the fuselage (shown fitted below right)– you will need to drill a 22mm hole through the floor of the aircraft on the centerline 415mm back from the base of the firewall. The antenna must be mounted facing down with the ground plane (the large round plate) fitted against the fuselage and held in place with the antenna flange. Smear the top of the ground plane with white silicone sealer before fitting to seal it to the fuselage.

The retaining nut and washer can then be fitted from inside the fuselage – you will have to work inside the front section of the console for this step.

Tighten the retaining nut firmly: do not over-tighten, then wipe away any excess silicone sealer that may have squeezed out from around the ground plane.



Connect the supplied coaxial antenna cable

to the back of the antenna and route the cable out of the console and up the firewall for later connection to the transponder unit when the instrument panel is fitted. Route the coaxial cable so that all bends are gentle and take care to avoid crushing the coaxial cable in any way.

This completes the *Post-Paint>Fuselage>Install electrical wiring* task.