Post-Paint>Fuselage>Assemble instrument panel

Objectives of this task:

To fit all instruments into the instrument panel, fit all of the electrical wiring and terminate to multi-pin connectors ready for installation into the instrument panel housing.
There are 5 panel options as well as builder variations and so this task will address the fitting of hardware and both analogue and digital instrumentation in general terms and will use photos of Standard (analogue) and Jumbo (digital) panels to illustrate various aspects of the task. Refer also to the *Post-Paint>Fuselage>Electrical wiring diagrams* task.
Fitting of the hardware and instrumentation to the panel is not particularly difficult but the actual wiring is a task that requires *considerable* care and attention to detail.
A kit builder *can* do the wiring provided that he or she is careful and methodical. If you are not experienced at electrical wiring and the reading of electrical wiring diagrams then you may wish to consider having the wiring of the panel done by a specialist technician, or possibly a friend or acquaintance may have the necessary skills.

Materials and tools required:

Card # OPT1INST *'Hardware for Options A,B and C.'*
Card #16J or 16T "*Electric Flaps*" specifically the flap actuating switch and flap switch handle
Wire stripping and crimping tools

Prepare the work area

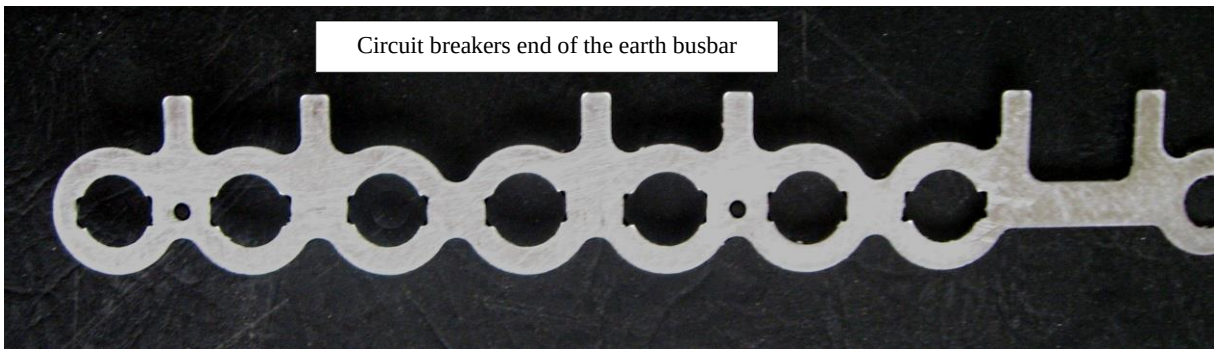
You will need a clean well lit workbench and a piece of foam about the same size as the panel so that the panel can be placed face down without any risk of scratches to the front face of the panel or the faces of the instruments.
All electrical connectors should be close at hand and your heat gun will be needed to shrink the coloured tags onto the wiring. All tools should be within easy reach.
There will be a lot of packing waste so empty your rubbish bin before starting.

Unpack the hardware and fittings

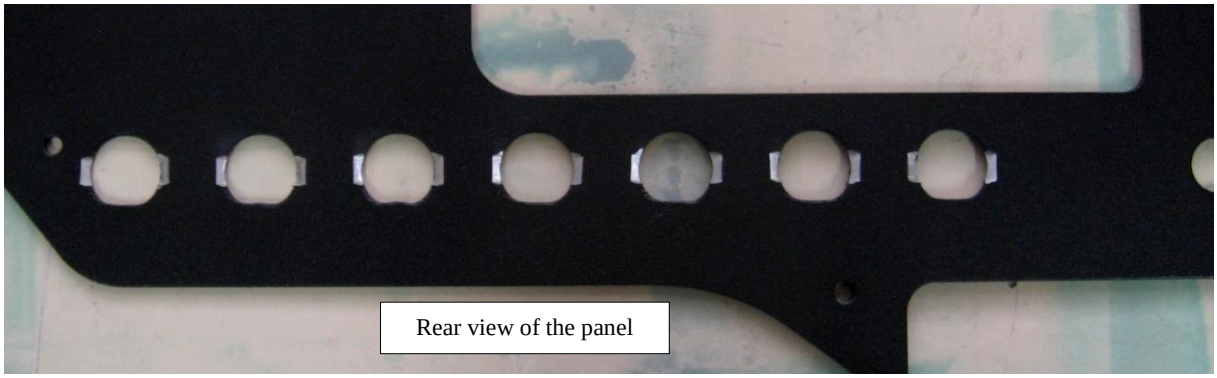
Strip all of the hardware and fittings from the Cards – use a knife to cut *around* each item and then peel the plastic shrink-wrap back and *away* from the item. Be very careful when cutting the noise suppression filter out of the wrap: do not cut near or through the wires.
Sort all of the items into groups: switches, circuit breakers, wiring, lights, etc.
Empty the bag of electrical connectors onto your bench top and sort the items into groups: note that the red female spade connectors are for single wires and the blue ones are for 2 wires. Do the same with the screws and fittings bag: select the black screws (2 lengths) and nuts, the silver screws and Nyloc nuts (M3 and M4) and the gold anodised captive nuts. The remaining items should be put aside for later use when installing the panel into the aircraft.
The M3 silver screws and Nyloc nuts will be used for busbar to circuit breaker connections, the M4 silver screws and Nyloc nuts will be used to fix hardware to the panel, while the black screws will be used to mount instruments to the panel. The gold anodized captive nuts will be clipped into the analogue instruments as each instrument is being fitted.
On factory built aircraft we sandblast and paint the heads of the M4 silver screws satin black so that they blend into the panel. You may wish to do the same before assembling your panel.

Fit the hardware to the panel

The panel assembly sequence is: prepare and fit the circuit breakers, then the switches and panel lights, then the instruments, radio(s), intercom and transponder.
The Standard panels have a single long earth busbar while Jumbo panels have 3 earth busbars, 1 for the circuit breakers, 1 for the panel lights and 1 for general use.



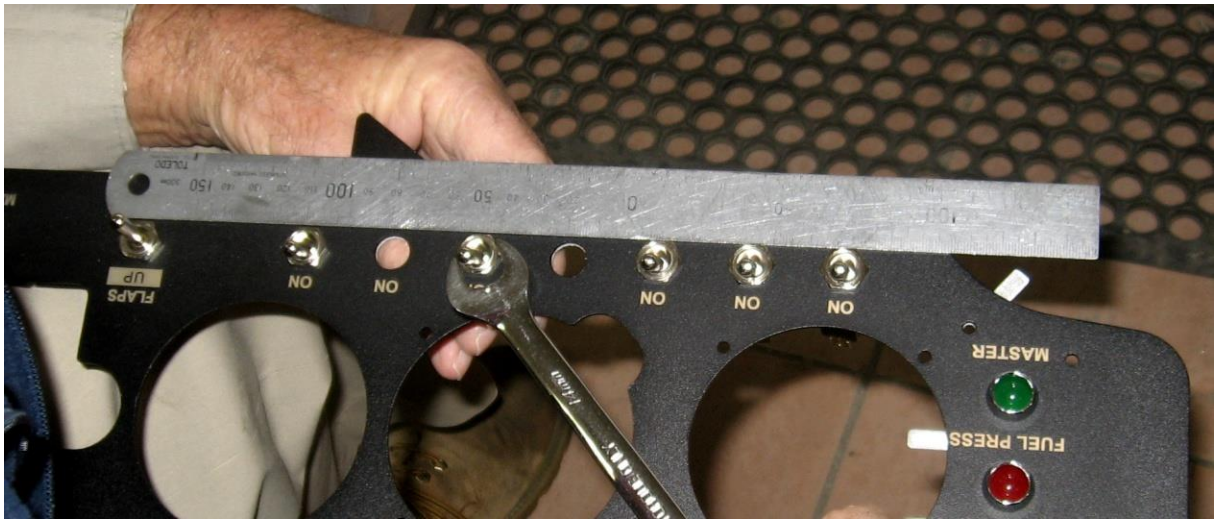
Prepare the circuit breakers and switches earth busbar by filing a 6mm notch on each side of each circuit breaker hole in order to clear the circuit breaker attachment clips as shown above.



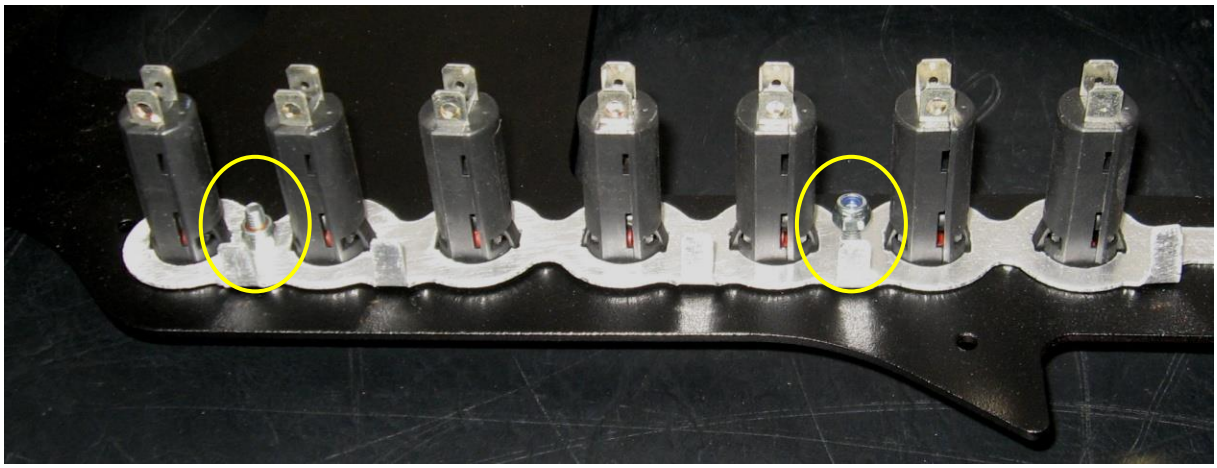
Prepare the panel for the circuit breakers by very carefully filing a 6mm wide 45° recess on the **back** of the panel at each side of each circuit breaker hole as shown above – this allows the circuit breaker attachment clips to seat firmly into the holes. Work carefully and take care not to mark the front of the panel. File the recess on all circuit breaker holes, even spares.
Prepare the 5 and 10 amp circuit breakers only by carefully drilling out the hole in each bottom spade connector to 3.3mm. This allows the main busbar to be bolted to the connectors. Support the connectors while drilling by placing a piece of plywood between them.

Fit the circuit breakers to the panel from the front – check the etched labels on the panel and the circuit diagram and fit the correct value circuit breaker to each hole. Press each circuit breaker in until the attachment clips click into place. Standard panel shown above.

Lay the panel face down on a soft surface and fit the earth busbar over the back of the circuit breakers. Fit the switches though the earth busbar and though the panel. Each switch has 2 retaining nuts: one nut will remain behind the panel and be used to tighten the switch in place and the other nut will be fitted to the front of the switch on the panel face.
Each 2-way switch is labelled on one side with the direction of the OFF and ON positions.
All 2-way switches follow the convention of UP = ON and DOWN = OFF which means that for most switches the machined groove in the threaded barrel of the switches will face downwards. The Magneto switches will be the opposite, where the DOWN position will connect the magneto to earth while the UP position will remove the earth and make the magnetos live. Accordingly the magneto switches will have the groove facing upwards.
The 3-way flap switch should be fitted with the groove facing downwards.
Place all the switches into the panel and tighten the front nuts finger tight, then check that each nut is flush with the end of the threaded barrel. Adjust the rear nuts to suit.

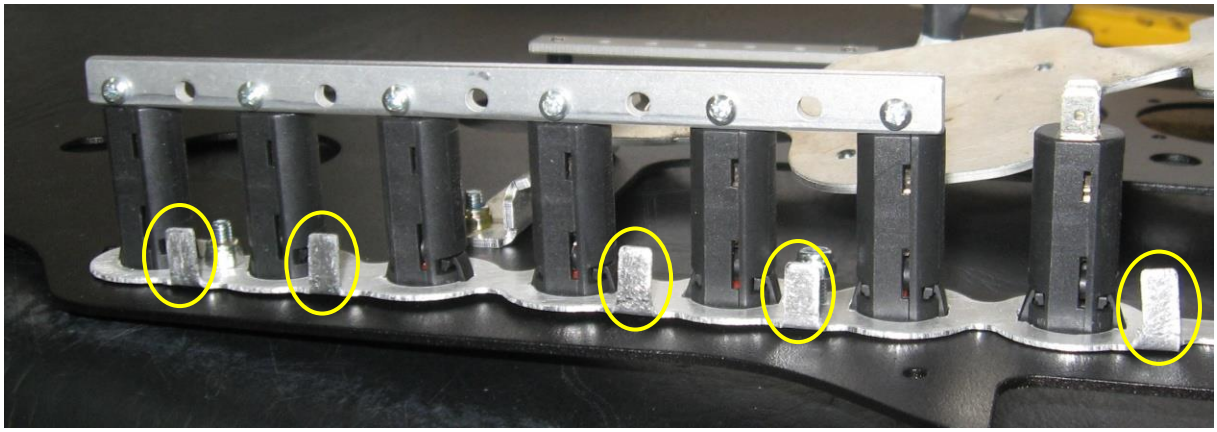


Lay a metal ruler along the bottom flats of the front retaining nuts as shown above and gently adjust each nut until all the flats are in line, then use a spanner to tighten the rear nuts firmly. Recheck each switch for alignment and make any final adjustments that may be needed.

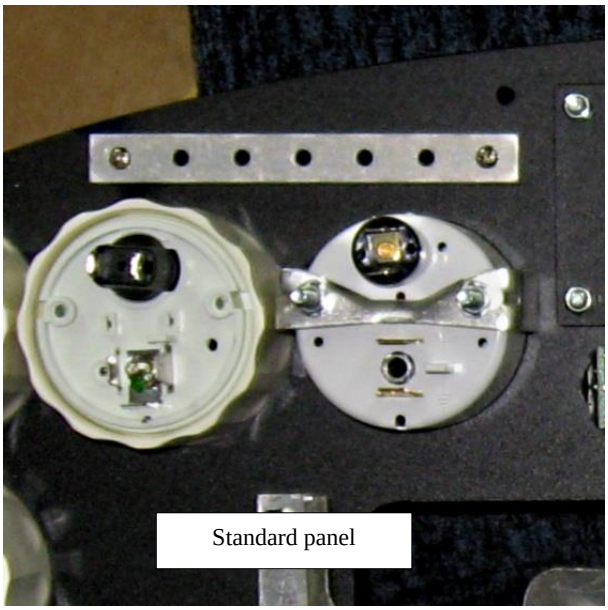


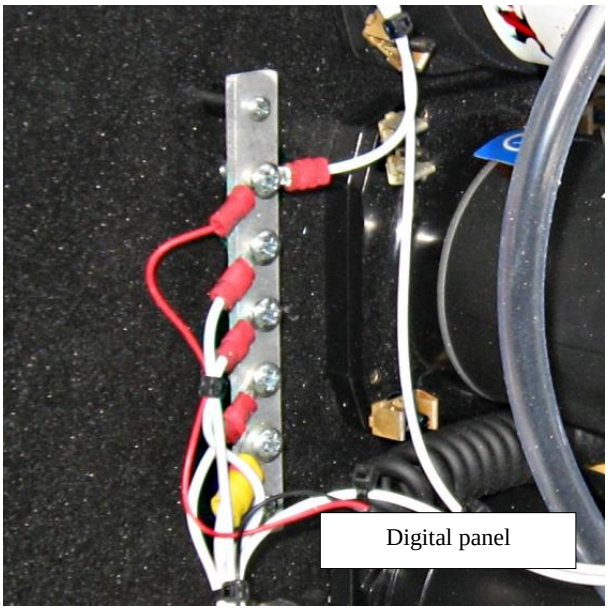
Drill through the 2 mounting holes in the earth busbar between the circuit breakers and bolt the busbar to the panel with 2 M4 screws and Nyloc nuts (shown circled above). Don't tighten the nut closest to the centre of the panel just yet (shown as the right hand nut above); the master earth will fit under this later during the wiring process.

Fit the LED lights through to the panel and busbar. The green light is the Master light; the rest will be red lights. The connectors are labelled [**+**] and [-] – align all the [**+**] connectors to face in the same direction. Tighten the retaining nuts firmly. Fit the Electric Turn Coordinator (ETC) OFF/ON switch near the instrument.
Fit the Starter button and the keyed Master switch if using one, tighten using pliers.
The earth busbar(s) have earthing tags that must now be bent up 90° - use a screwdriver and pliers to bend each tag up, circled in photo below. These tags will be used as earth terminals.



Bolt the main busbar across the lower side of the bottom contacts on the 5 and 10 amp circuit breakers only using the M3 silver screws and Nyloc nuts as shown above. Tighten firmly only: these screws and nuts are very small so take care not to over-tighten them.
Note that the main busbar does **not** connect to the *Master* 15 amp circuit breaker.
Fit the black "U" shaped safety bracket between the Mag switches.
Now the Avionics busbar can be fitted.

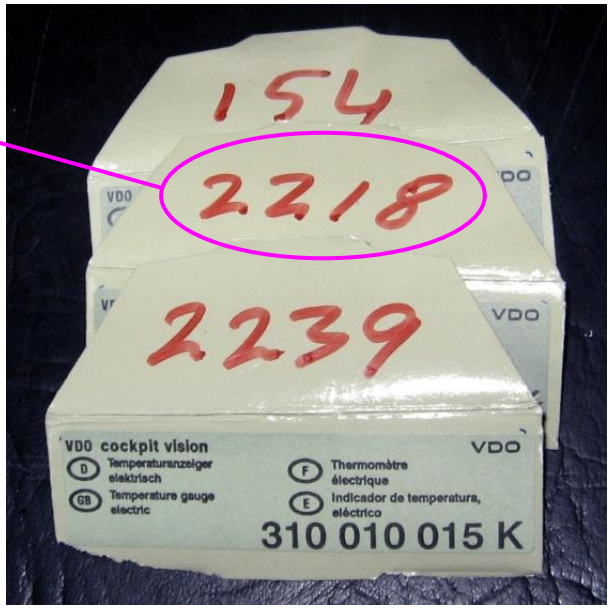




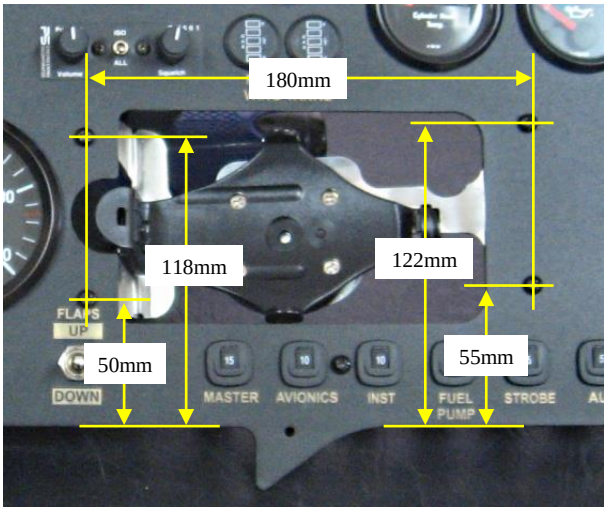
For a Standard panel the avionics busbar is located behind the "No Smoking" label above the engine instrumentation, see photo at left above – hold the busbar against the front of the panel and carefully mark and drill through the hole in each end of the busbar, first positioning the busbar so that the screw holes will not obscure the labelling.
For a Jumbo panel the avionics busbar will be located vertically to the right of the analogue instruments as shown in the photo above right.

There are 2 nylon standoffs in the hardware pack – these must be used to isolate the avionics busbar from the panel itself, as the panel will be earthed. It will be necessary to countersink the screw holes at each end of the busbar to allow the screws to thread into the nylon standoff.
Mount the avionics busbar to the panel and tighten the mounting screws firmly.

Unpack the instruments and radios



Each instrument box will have a Jabiru stock number written on the top in marker pen. Take each instrument out of its box, cut the tagged end of the box off and discard the box. Write the Jabiru stock number on the tagged end and put it aside – this information along with all other instrument serial numbers will be entered on the *Aircraft Identification* form in this Manual.
Discard any "O" rings from around the instruments: these will not be required.
The *Microair* VHF radio and Transponder can be removed from their boxes at this time. Each unit is wrapped in a silver electrostatic bag. Do **not** cut the bag open at the end, but rather cut the bag open along the **side** of the bag and remove the unit. Cutting across the end of the silver bag risks cutting into the face of the unit and must be avoided at all costs.
Unpack the *Microair* VHF radio/intercom and Transponder wiring harnesses.
If fitting a GPS unit you will need the appropriate mounting bracket and wiring harness.
If the GPS is a *Garmin* product the mounting bracket must be removed from the end of the clamp assembly and screwed to the Jabiru panel mount bracket as shown at right.
To mount the *Garmin* 296/495 in a Standard panel, refer to the photo at right for drilling dimensions:
If the GPS is an *AvMap* unit the supplied panel mount bracket will be used.
If the GPS is any other brand or model refer to the manufacturers literature for mounting instructions.



Fit analogue instrumentation

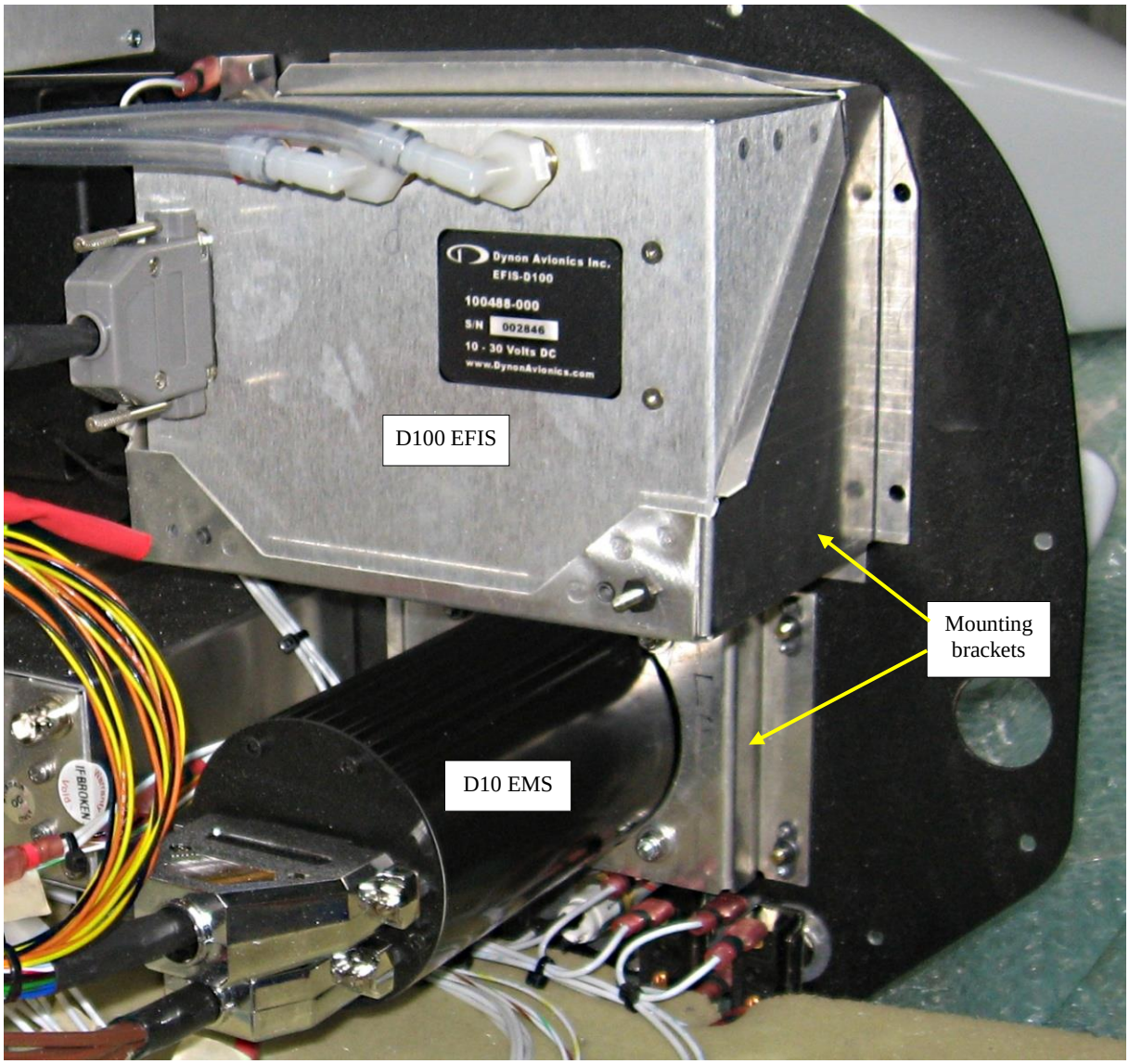
Analogue instrumentation (ASI, ALT, VSI, ETC, engine instruments) will require each individual wire to be connected to the back of each instrument. There are 3 methods of fitting analogue instruments: screws though the panel and into the instrument (flight instrumentation), or retaining brackets or retaining screw rings (engine instrumentation).

The photo above shows the analogue instrumentation for a Standard panel. Note the *Garmin* GPS bracket above the circuit breakers. The angle of the bracket faces the GPS unit towards the pilot: in the photo above the bracket has been bent to face the GPS slightly upwards too.
When fitting the flight instruments the gold anodized captive nuts are first inserted into the rear of the screw holes in the instrument and then held in place with a finger while the screw is fitted from the front, through the panel and the instrument, and tightened.
There is not a lot of room around the instruments so the order of fitting is important.
Generally the approach is to start from the centre of the panel with the engine instruments: CHT, Oil pressure and temperature and Voltmeter, and then move to the Tacho and then the VSI and ETC.

At this time the 2 points at the bottom of the panel should be placed on a known level surface and the balance ball (circled above) should be checked to see if it is in the centre.
If it is not, remove the instrument and enlarge the mounting holes slightly (to about 3/16”) then refit the instrument and rotate it until the balance ball sits correctly when the panel is held level then tighten the screws.
Now the Altimeter and ASI can be fitted along with the wing tank fuel level digital gauges.

Fit digital instrumentation

Digital instrumentation (EFIS, EMS, radio(s), transponder, intercom, GPS) will usually have a pre-wired harness and a multi-pin connector fitting at the rear of the instrument.
The *Dynon* brand EFIS displays are supplied with mounting hardware and the fitting method is to fit the instrument through the panel and lay the panel face down, then place the mounting bracket over the instrument and carefully mark the position of the mounting holes on the panel with a sharp drill. Remove the instrument, drill the holes through and fix the mounting bracket into place with M4 screws and Nyloc nuts and then fit the instrument into the mount.



The photo above shows a *Dynon* D100 EFIS (top) and a D10 EMS (bottom) fitted to a Jumbo panel. Note the mounting brackets (arrowed) that attach each instrument to the panel.

Finishing

For both the Standard and Jumbo panels you can now fit the intercom unit and faceplate or sticker, the VHF radio(s) and the transponder to the panel. Each unit is retained by screws that are supplied with the unit.
Any blank spaces remaining in the panel can be covered with the supplied plate(s) or plugs.

Wiring standards

Before you start wiring the panel we suggest that you follow a few wiring standards:

- All wires and connectors will be identified by a colour coded heat-shrink tag or label,
- Wiring insulation will be stripped back 4mm for all connectors,
- All wires will be crimped into the appropriate connectors using a crimping tool,
- No more than 2 wires will be crimped into any one connector.

Heat shrink tubing should be cut into short lengths (about 2 or 3mm) and used for tagging each electrical connector or wire in the following manner:

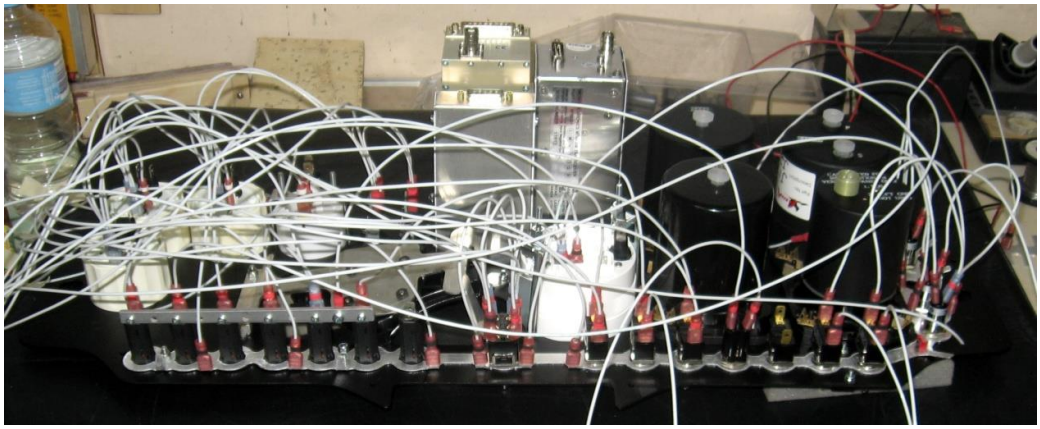
- Red = positive
- Black = negative (earth)
- White = signal

Cut about 20 of each colour to start with and cut more as needed.
Put a strip of masking tape along the bottom rear of the panel under the switches and circuit breakers and label each one – this will save you having to keep lifting the panel to read the labels on the front and that will make the wiring a little bit easier.

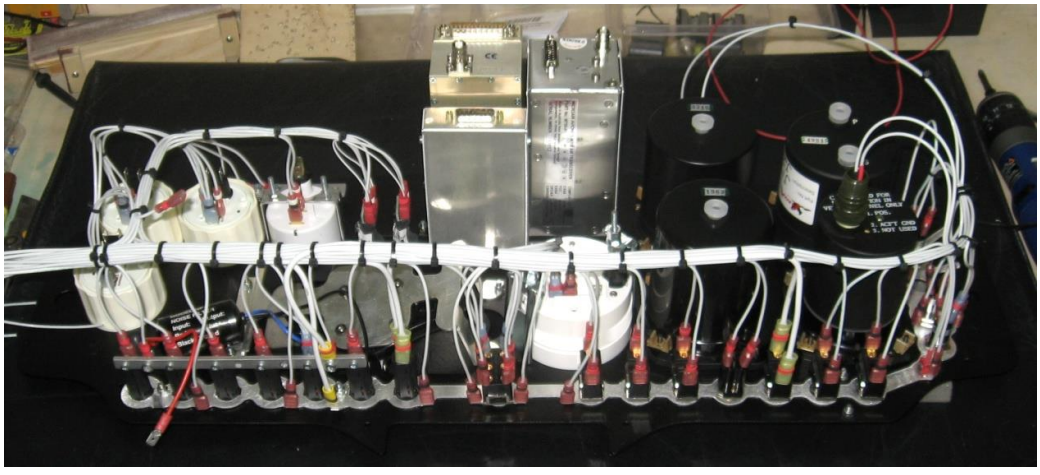
Wiring the panel

This is a one-wire-at-a-time process that cannot be rushed.
The objective is to use lengths of wire that can later be zip-tied together to form a tidy wiring loom. The *before* and *after* photos below show how factory wiring is arranged into a loom:

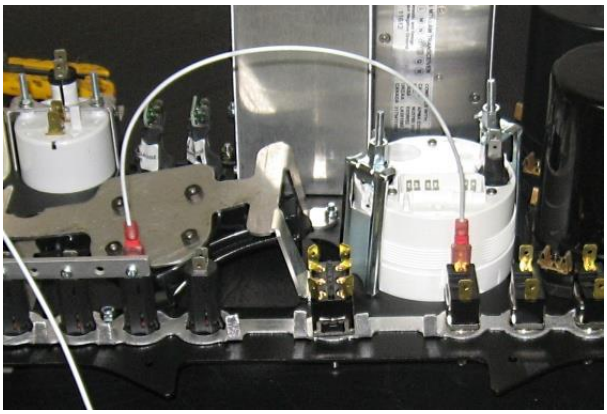
From this:
(We use pre-cut wire lengths for our standard panel layouts)



To this:



The process is to put one wire on at a time, so if you were to start with the wire from the Avionics circuit breaker to the Avionics switch you would strip 4mm of insulation off one end of the wire and crimp a red female spade connector to it then heat shrink a red tag to the connector. Push that connector onto the circuit breaker terminal and measure out enough wire to reach the Avionics switch while allowing a bit of height above the panel as shown in the photo at right. Cut the wire, strip 4mm of insulation off, slip another red tag on and crimp another red female spade connector in place and heat shrink the tag on.



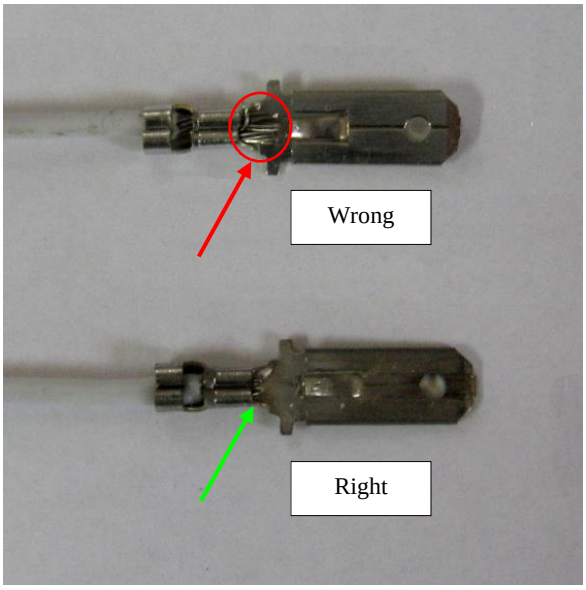
With that wire fitted in place you can then square off the wire by bending it and then fit the next wire so that it would end up being the same height above the panel and then keep adding one wire at a time until the panel is fully wired, then you can use zip ties to tidy up the wiring into a loom as shown in the bottom photo on the previous page.

Note that there are 2 main wire sizes: 16 gauge, which is used for most of the wiring; and 10 gauge, which is used for the main battery wiring, all shown on the electrical wiring diagrams. Some wires will be common, such as the power supply to the engine instruments. In these cases the suggested approach is to loop from instrument to instrument by crimping 2 wires into each blue connector. Do not crimp more than 2 wires into a single connector or you run the risk of having some of the wires pull out of the connector, so stay with 2 wires maximum.

Quite a lot of wires will go to other parts of the aircraft, and these wires are terminated into one of five multi-pin connectors for ease of installation and maintenance. If one end of a wire will go to a multi-pin plug then you must label that end clearly (use masking tape for the label) before going to the next wire. If you do *not* label it you risk having a real problem later.

Multi-pin connectors are supplied in 2, 4, 6 and 8 pin types depending on the instrumentation options that you have ordered with your kit. In all cases the pins are standard male and female spade connectors, just the same as the normal wiring connectors except without the insulation, and each connector will be crimped on to the wire in the same manner. The connectors will then be pushed into the respective half of a connector body until they click into place.

With the *male* spade connectors (that fit into the *female* connector body) care must be taken that the stripped end of the wire does **not** extend beyond the end of the crimp area of the connector, otherwise the connector will not be able to clip into place in the connector body. The photo at right shows the wrong way and the right way to crimp a wire into a male spade connector. Note that in the “Wrong” example the bare wire has been pushed too far into the crimp area of the connector, as indicated by the red arrow, while in the “Right” example the



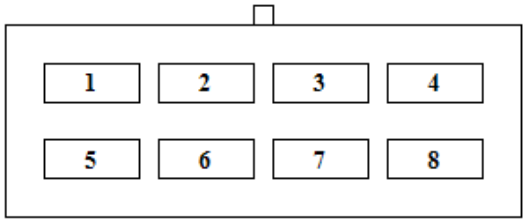
wire stops at the end of the crimp area of the connector, as indicated by the green arrow.

Fitting the multi-pin connectors

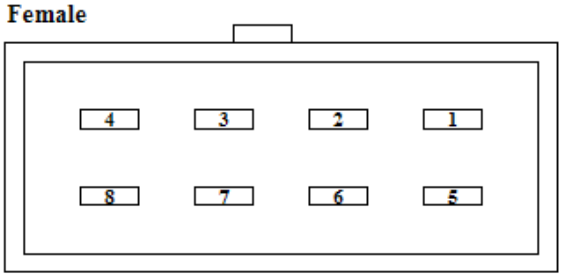
What follows is the pin layout that is used in our factories. Some pins may not be used on your particular panel in which case simply leave that pin unwired, and the connector layout here will be referred to again in the *Post-Paint>Fuselage>Install electrical wiring* task.
Each connector is assigned a group of wires that go to a similar physical location.
The connector pairs should be marked from A, B, C, D or E as shown on the next page, and a mark should be made on the corner beside pin #1 for each connector. If you have more than 1 QK6 connector you should plan to fit 1 male and 1 female QK6 connector to the panel to lessen the possibility of plugging the wrong pair of QK6's together.
The diagram below shows the pin numbering convention for each of the 4 connector types:

QK8

Male

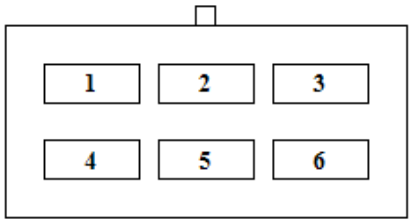


Female

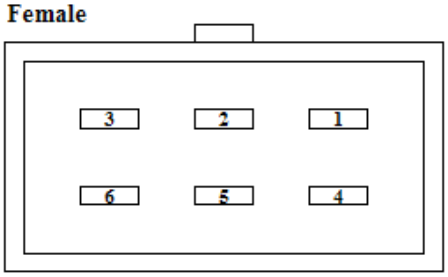


QK6

Male

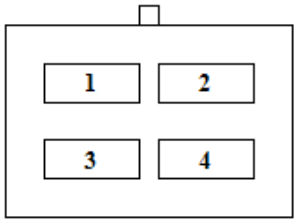


Female

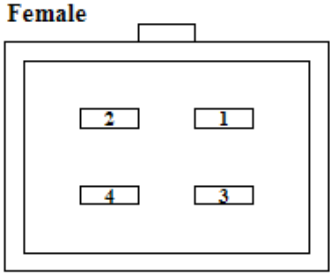


QK4

Male

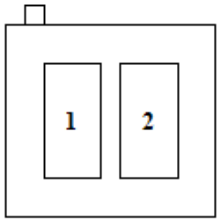


Female

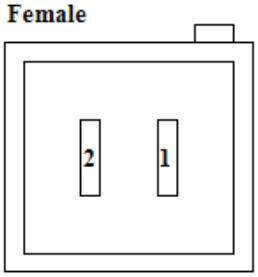


QL2

Male



Female



Group the wires for each plug together and 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. References to *male* or *female* will mean the connector body.
Hold the connector body in the correct orientation and insert each spade connector from the rear of the connector body: push into place until a solid click is felt – this indicates that the spade connector is correctly seated in the connector body.
If a spade connector is not seated correctly it may be forced back and out of the connector body when the 2 halves are joined, so double check that each spade connector is fully seated.
The connector pin assignment shown below will be referred to again when the other side of each connector is fitted in the *Post-Paint>Fuselage>Install electrical wiring* task:

Connector A: Engine instrumentation, QK8 connector, 16 gauge wire

1 CHT positive
2 Tacho positive
3 Left MAG
4 Oil temperature
5 CHT negative
6 Tacho negative
7 Right MAG
8 Oil pressure

Connector B: Electrical, QK6, 16 gauge wire

1 Starter
2 Starter pilot light
3 Charge pilot light
4 Regulator to main busbar
5 EFIS negative
6 Fuel pressure

Connector C: Main power, QL2 connector, 10 gauge wire

Note the use of the heavier 10 gauge wire to this connector.

1 BATTERY POSITIVE
2 BATTERY NEGATIVE (EARTH)

Connector D: Wings 1, QK6 (or QK4 if no landing light) connector, 16 gauge wire

1 Fuel pump positive
2 Flaps UP
3 Landing light positive
4 Fuel pump negative (earth)
5 Flaps DOWN
6 Landing light negative

Connector E: Wings 2, QK6 connector, 16 gauge wire

1 Strobe positive
2 Right wing fuel gauge positive
3 Left wing fuel gauge positive
4 Strobe negative
5 Right wing fuel gauge negative
6 Left wing fuel gauge negative

YOU WILL HAVE USED ONE HALF OF EACH CONNECTOR BY NOW. BECAUSE YOU WILL NOT BE USING THE OTHER HALVES UNTIL THE *POST-PAINT>FUSELAGE>INSTALL ELECTRICAL WIRING* TASK, STORE THE REMAINING CONNECTOR PARTS IN THE PLASTIC BOXES THAT THEY CAME IN UNTIL YOU NEED THEM. THIS SIMPLE ACTION WILL MAKE YOUR LIFE MUCH EASIER WHEN WIRING THE REST OF THE AIRCRAFT SO DO IT NOW: PUT ALL THE BOXES INTO A PLASTIC BAG, LABEL IT CLEARLY AND PUT IT ASIDE WHERE YOU CAN EASILY FIND IT LATER.

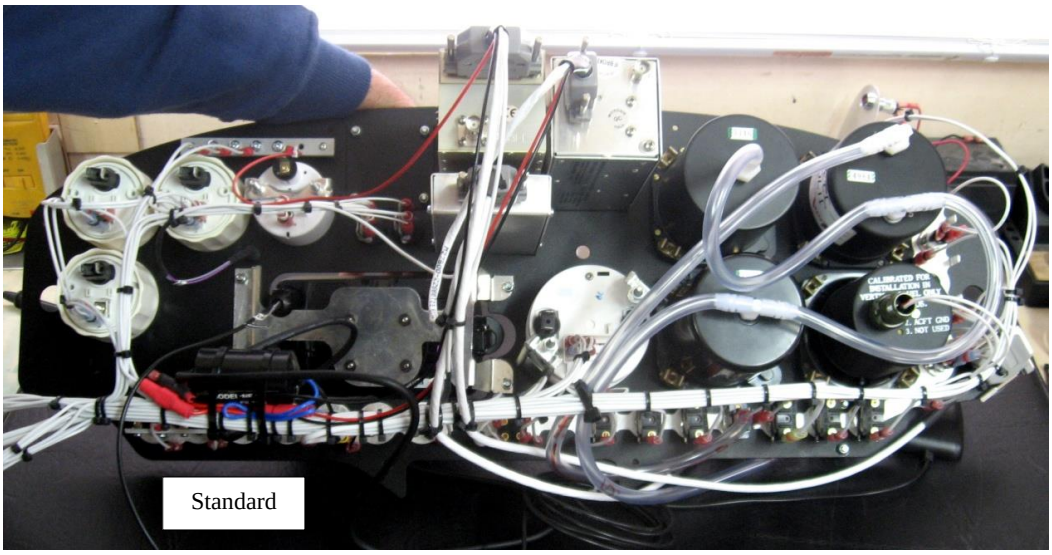
Fit the noise suppression filter into the power wire from the Avionics busbar to the VHF radio (use male and female spade connectors) and zip tie the filter to the loom.

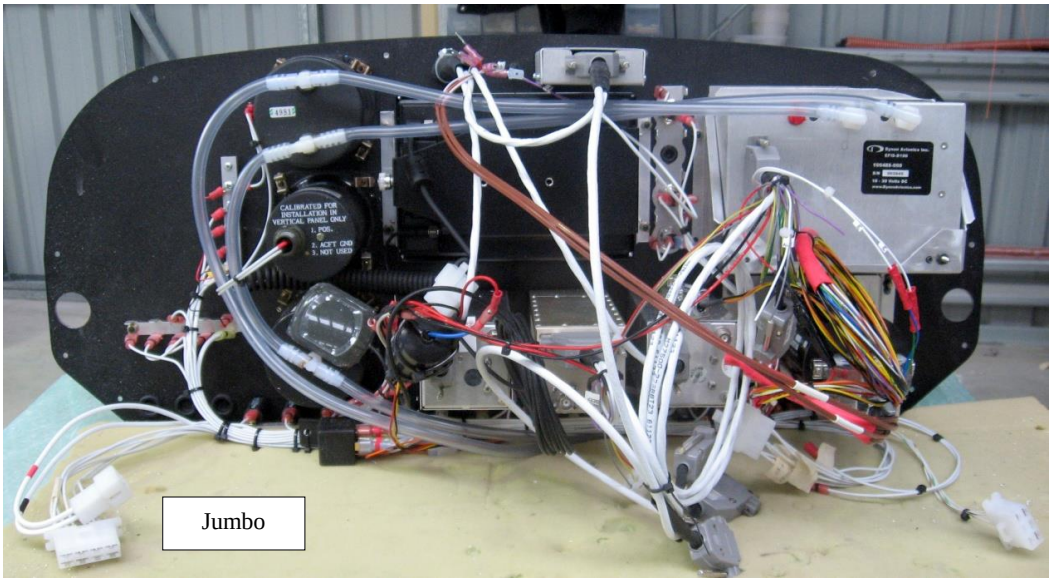
Fit digital wiring harnesses

The digital wiring harnesses can now be fitted to the plugs at the rear of the digital instruments and the VHF radio, transponder and intercom. Tighten the plug screws by hand. There is an MP3 player input socket on the intercom harness and this may now be fitted to the panel if desired. Select a location on the panel where the cable to the MP3 player will not obscure any instruments and drill a 6mm hole through the panel and mount the socket.
Use zip ties to hold the digital harnesses to the wiring loom.

Tube up to the pressure instruments

Fit the nylon fittings to the rear of the pressure instruments – decide first where the static tubing will run and use elbows and tees to suit. Take care not to cross-thread the nylon fittings. Run the static tubing as required and leave it about 200mm below the bottom of the panel. Run the pitot tubing from the ASI and trim to the same length. Mark the pitot tubing clearly so that it will not be mistaken for the static line.
Zip tie the pressure tubes lightly (do not crush them) to the wiring loom.


Standard


Jumbo

This completes the *Post-Paint>Fuselage>Assemble instrument panel* task.