
STANDARD MINOR MODIFICATION – AUXILIARY POWER SOCKET
INSTALLATIONS

1. Introduction

Many pilots find it useful to have auxiliary power sockets in their cockpit for powering, for example, portable communication/navigation equipment, or heated clothing.

This leaflet covers the fitment of 1 or 2 auxiliary power sockets to both flexwing and 3-axis microlight aircraft. Note that there must be no more than 2 auxiliary power sockets on the aircraft in total, post modification. To avoid complex electrical analysis, load testing of the installation and re-weighing of the aircraft, this TIL only covers simple, low-power, low-mass auxiliary power socket installations. A power socket with multiple ports (for example: Charge2 or Charge4 USB power sockets) would still be considered as 1 individual auxiliary power socket.

Aircraft operators requiring a more complex solution should refer to other BMAA TILs for guidance and apply for the modification using form BMAA/AW/002. A full list of TILs is contained in TIL 001. This leaflet is not intended to be used for approving the supply of power to equipment that is permanently, or semi-permanently, attached to the aircraft; the BMAA recommend that such modifications are approved as a one-off modification, or as one of the other standard minor modifications available. It is important to note that if the auxiliary power sockets **are** used to power equipment attached to the aircraft, the attachment of said equipment must also be approved (but that cannot be achieved with this leaflet).

2. Deciding on the rating of your power socket(s)

2.1 Limits within which you must remain:

For each auxiliary power socket both a maximum continuous current draw and a fuse rating must be chosen. The fuse rating must be between 1.5 and 2 times the maximum continuous current draw.

The maximum continuous current draw for each auxiliary power supply must be no greater than 4 amps. If two auxiliary power sockets are fitted to the aircraft then the sum of the maximum continuous current draw must be no greater than 6 amps.

A power sockets maximum continuous current draw is usually what the maximum current the power socket is rated by the manufacturer to draw. It is possible to install a power socket which has a maximum current draw capability that is greater than 4 amps, however, it must **not** be used to draw more than 4 amps and adequate fusing must be installed as specified above to ensure excessive current draw does not occur. That being said, it is recommended for peace of mind and simplicity of operation that an installed auxiliary power socket current draw capability should not exceed 4 amps.

2.2 Limits imposed by your aircraft's electrical system:

The aircraft's electrical system must fall into one of the following four generic configurations:

1. Aircraft with electric start;
2. Aircraft with battery / without electric start;
3. Aircraft without battery / with master switch;
4. Aircraft without battery / without master switch.

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These configurations are detailed in figures 1 to 4 respectively at the back of this leaflet. If the aircraft's electrical system differs significantly from the appropriate diagram – in particular, if the electrical system is 'missing' any switches or fuses – then contact the BMAA for advice.

The maximum continuous current draw on the whole system (without auxiliary power sockets) must be calculated or measured. The sum of the maximum continuous current draw on the system plus the maximum continuous current draw of the auxiliary power sockets must not exceed 60% of the maximum current available from the aircraft's generator.

When calculating the current draw on the system, in the absence of any other source of information, the typical maximum current values in table 1 may be used for common load types. Maximum electrical power outputs of common engine types are listed in table 2.

Note: Fuji-Robin documentation does not quote the maximum current, but maximum current at 5500 RPM. For these engines the maximum continuous current draw of the auxiliary power sockets must not exceed 75% of the 5500 RPM value.

2.3 An example calculation:

Auxiliary power socket for 22 W heated gloves.

Current 1.833 A at 12 V (nominal) (using the equation Power [W] = Voltage [V] x Current [A]).

Maximum continuous current draw chosen to be 2 A.

Fuse rating chosen to be 3 A (between 1.5 and 2 times maximum continuous current draw).

10 A rated switch (greater than 2 times fuse rating).

All other hardware used rated 5 A or greater (greater than fuse rating).

1.5 A existing current draw on system (1 A transceiver plus 0.5 A GPS).

3.5 A current draw on system post modification (existing 1.5 A plus 2 A aux power socket).

Aircraft powered by Rotax 582 therefore modification acceptable

(3.5 A is less than 60% of 14 A).

3. Detail design issues

3.1 Overload protection (fuses) and switches

Each auxiliary power socket must be individually fused with a fuse equal to the socket's fuse rating (see section 2.1).

Each auxiliary power socket must be able to be easily switched off in flight by the pilot in case of fire. This requirement can either be met by a separate auxiliary power socket switch and/or by supplying the power socket via the master switch. For aircraft of configuration 4 – no battery or master switch – no switch is necessary as long as the plug can be easily pulled out of the socket by the pilot in flight.

Note that under no circumstance must the ignition circuit(s) be affected when making this modification.

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3.2 Individual component ratings

All components (socket, cables, fuse holder etc) must be rated in excess of the fuse rating of the auxiliary power socket. In addition, only multi-strand cable should be used; solid-core cable is unacceptable. If a separate auxiliary power socket switch is fitted, it must have a current rating at least 2 times the fuse rating of the auxiliary power socket.

3.3 Placards

Each auxiliary power socket must be placarded as an auxiliary power socket (for example 'aux') with its nominal voltage (for example '12V') and its maximum continuous current draw (for example '3A max'). The fuse rating can either be included on the auxiliary power socket placard or placarded on, or adjacent to, the socket's fuse holder.

Switches must be clearly placarded as to their sense and function, and must be orientated down for off. In the case of multiple individually switched auxiliary power sockets, there must be no room for confusion as to which switch applies to which socket.

When installing a power socket that has a current draw capability greater than 4 amps, the power socket placard must state that the max allowable current draw is 4 amps, or indeed less than 4 amps if the aircraft owner chosen a lower max continuous current draw value.

4. Safety issues

4.1 Total installation weight

The total combined weight of the hardware being fitted (sockets, cables, fuses etc) should not cause a significant alteration to the aircraft's pre-installation weight and CG, therefore negating the need to prepare a new weight and CG report for the aircraft post installation. A significant alteration would be a weight change greater than 0.5% of the aircraft's pre-installation weight and CG position change greater than 5mm from the aircraft's pre-installation empty CG position.

4.2 Other safety issues

Each auxiliary power socket must be of a non-locking type; the plug must come out of the socket under force alone.

Each auxiliary power socket must be of a non-reversible type; it must not be possible to insert the plug in more than one way around. This is to ensure that the polarity of the supply cannot be inadvertently reversed.

With a plug and lead inserted, the positioning of the auxiliary power socket should not restrict any of the controls of the aircraft, or impede entry and exit from the aircraft.

Note that carbon-fibre instrument panels may conduct electricity.

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5. Installation notes

Cables must be securely attached to the airframe at intervals of 150 mm (6 inches) or less. Any cables bridging de-riggable parts of the aircraft must have quick release fasteners at the join.

Holes and cuts may be made in the aircraft's instrument panel as long as this is not a stressed item (part of the aircraft's primary structure). No other holes or cuts are permissible. The maximum allowable hole diameter is 30 mm.

6. Post-installation testing

After installation the auxiliary power socket(s) must be tested: firstly for correct functioning and polarity, and secondly under electrical load. The load test involves ground running the aircraft for at least a minute with all of the aircraft's electrical equipment turned on and a load plugged into each auxiliary power socket that will draw a current close to the socket's maximum continuous current draw. If the aircraft has two auxiliary power sockets then both sockets must be loaded for the entire duration of the test! Ensure that no fuses blow and no parts of the installation overheat.

7. What to do once you have fitted your auxiliary power socket(s)

In conjunction with your inspector, fill in the form on pages 4 and 5 of this TIL, and return it to the BMAA. The BMAA will return this form to you, with the full modification approval number shown at the bottom of the page. This mod number must then be entered in the aircraft logbook.

It is acceptable to send in the form with your permit renewal form.

Aircraft must be wholly owned by BMAA members. A BMAA Ownership Trustee Grid should be submitted with this form for syndicate, group and company owned aircraft.

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Approved for Issue:

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BMAA – STANDARD MINOR MODIFICATION CHECKLIST: TIL 107

Reg: G-	Aircraft type:	Serial No:
Owners name ¹ :		Owners BMAA No:
¹ BMAA Aircraft Ownership Trustee Grid required for syndicate/group/company owned aircraft		

Installation Details

	<u>Applicable</u>	<u>Max Cont Current Draw</u>	<u>Built in Overload Protection?</u>	<u>Fuse Rating (If Applicable)</u>	<u>Switched by Master Switch</u>	<u>Individually Switched</u>
Aux Power Socket 1	yes	A		A		
Aux Power Socket 2		A		A		
Aux Power Socket 1 – Make & Model:						
Aux Power Socket 2 – Make & Model (If Applicable):						

Max Continuous Current Draw (prior to installation)	A		Total Weight of Installation	g
Calculated or Measured?				
Max Continuous Current Draw (post installation)	A			
Aircraft Generator Max Current (Fuji-Robin: 5500 rpm value)	A		Aircraft Electrical System Configuration - enter 1, 2, 3 or 4 (see section 2.2)	

TIL Applicability Checks

<u>CHECK</u>	<u>ACTION</u>	<u>COMMENTS</u>	<u>INSPECTOR'S INITIALS</u>
<i>1 Applicability</i>			
1.1	Only 1 or 2 aux power sockets fitted to aircraft in total		
1.2	Fuse rating(s) between 1.5 and 2 times max continuous current draw		
1.3	Max continuous current draw not > 4 A		
1.4	Combined max cont current draw not > 6 A		
1.5	Total mass of installation < 100 g		
1.6	Individual component mass < 25 g		
1.7	Aircraft electrical system of approved configuration (see section 2.2)		

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Safety Checks

<u>CHECK</u>	<u>ACTION</u>	<u>COMMENTS</u>	<u>INSPECTOR'S INITIALS</u>
<i>2 Power Availability</i>			
2.1	Max continuous current draw not > 60% max current from aircraft generator (Fuji-Robin: not > 75% of 5500 rpm value)		
<i>3 Design</i>			
3.1	Aux power socket(s) non-locking and non-reversible		
3.2	With plug inserted, aircraft controls not restricted		
3.3	With plug inserted entry/exit of aircraft not impeded		
3.4	Aux power socket(s) can easily be turned off by pilot in flight (or unplugged if configuration 4)		
3.5	Aux power socket(s) individually fused		
3.6	Placard(s) includes function, voltage and max continuous current draw		
3.7	Fuse rating(s) placarded and correct fuses installed		
3.8	Switch(es) down for off and placarded as such		
3.9	Purpose of switch(es) clear - adjacent to socket or placarded		
3.10	No confusion possible if 2 sockets and 2 switches		

(Further Checks on Following Page)

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<u>CHECK</u>	<u>ACTION</u>	<u>COMMENTS</u>	<u>INSPECTOR'S INITIALS</u>
<i>4 Installation</i>			
4.1	Switch(es) rated > 2 times fuse rating		
4.2	All cables and components rated > fuse rating(s)		
4.3	Multi-strand cable used and adequate cable flexibility		
4.4	All cable terminations properly made - no exposed conductor		
4.5	Cables and other components properly secured		
4.6	Quick release connectors for cables bridging de-riggable parts		
4.7	Holes only in instrument panel - not load bearing		
4.8	No hole > 30 mm diameter		
4.9	Post-installation tests passed (see section 6)		

OWNER'S DECLARATION

I declare that the foregoing information is correct to the best of my knowledge and I will not change the installation design once approved.

Signed:	Name:	Date:
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INSPECTOR'S DECLARATION

I declare that the foregoing information is correct and the installation is fit to be flown.

Signed:	BMAA Inspector #: BMAA Member #:	Date:
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**This form must be sent with payment as per current fees in MF or www.bmaa.org,
and BMAA Aircraft Ownership Trustee Grid (if applicable) to*:- technical.office@bmaa.org**

BMAA Office Approval:	(signed)	(Name)
Mod No.: G-_____ / TIL107 / 20 __ / _____		(Date)

**Whilst waiting for this form to be returned by the BMAA the aircraft may be flown for upto one calendar month from the Inspection date above. Once this form is returned to you signed please enter the full modification approval number above in your aircraft logbook and retain this sheet with your aircraft records.*

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load type	maximum current [A]
digital engine instruments	1.0
GPS	0.5
transceiver (max 5W transmit)	1.0
transponder	2.5

Table 1 – typical maximum current values for common load types

engine	maximum power [W]	maximum current [A]
Fuji-Robin* EC34PM/EC44PM	75	6
Hirth 2706	250	21
HKS 700E	210	17
Jabiru 2200	120	10
Rotax 2-stroke (447 and larger)	170	14
Rotax 912/914	250	21
Verner 133M	160	13

Table 2 – maximum electrical power outputs of engines in common use

*Fuji-Robin engines @5500 RPM

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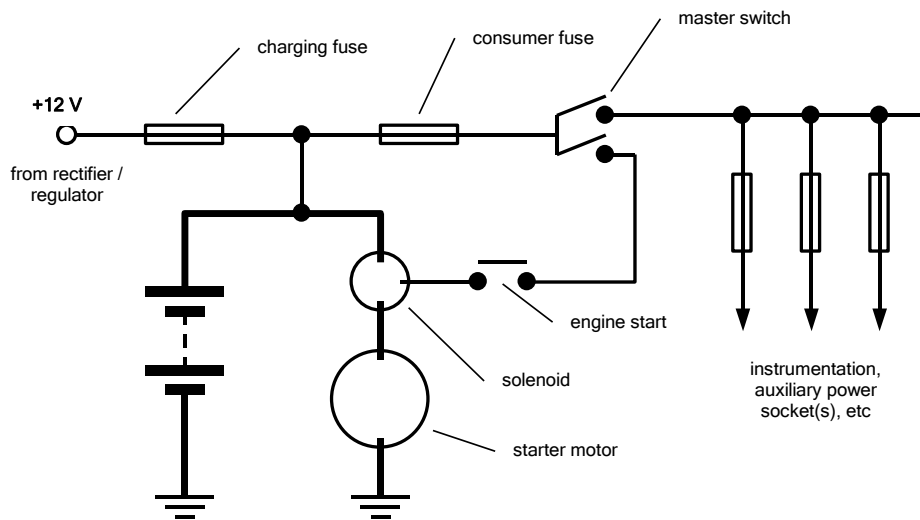


Figure 1 – configuration 1
aircraft with electric start

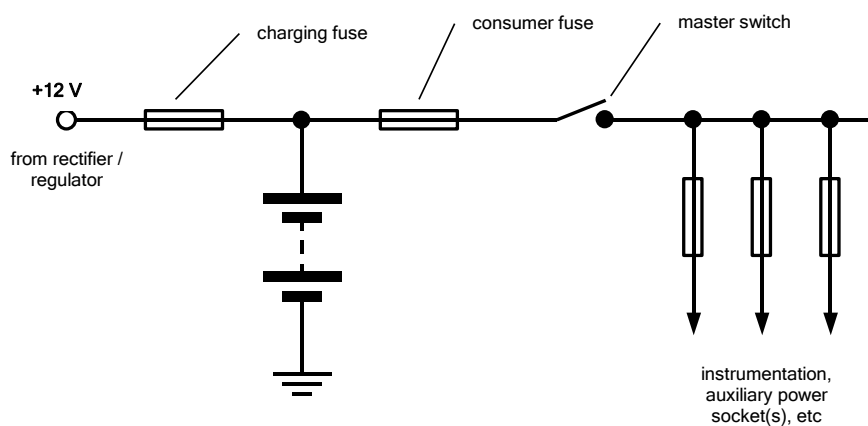


Figure 2 – configuration 2
aircraft with battery / without electric start

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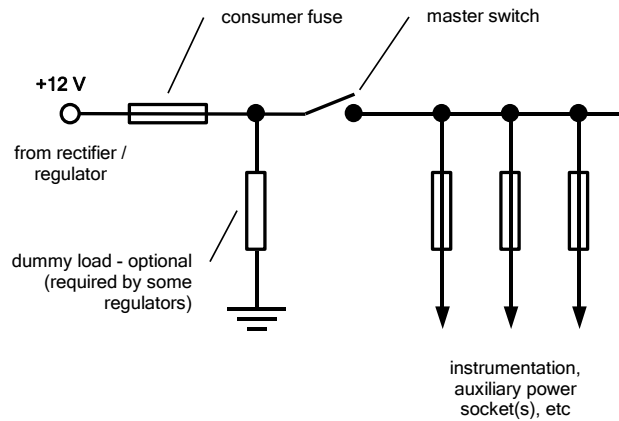


Figure 3 – configuration 3
aircraft without battery / with master switch
(optional dummy load may be fitted either side of master switch)

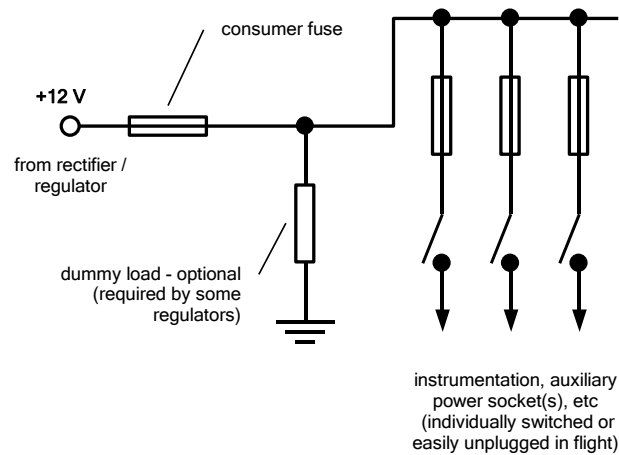


Figure 4 – configuration 4
aircraft without battery / without master switch