

P91

Hi-Load Twin Switch

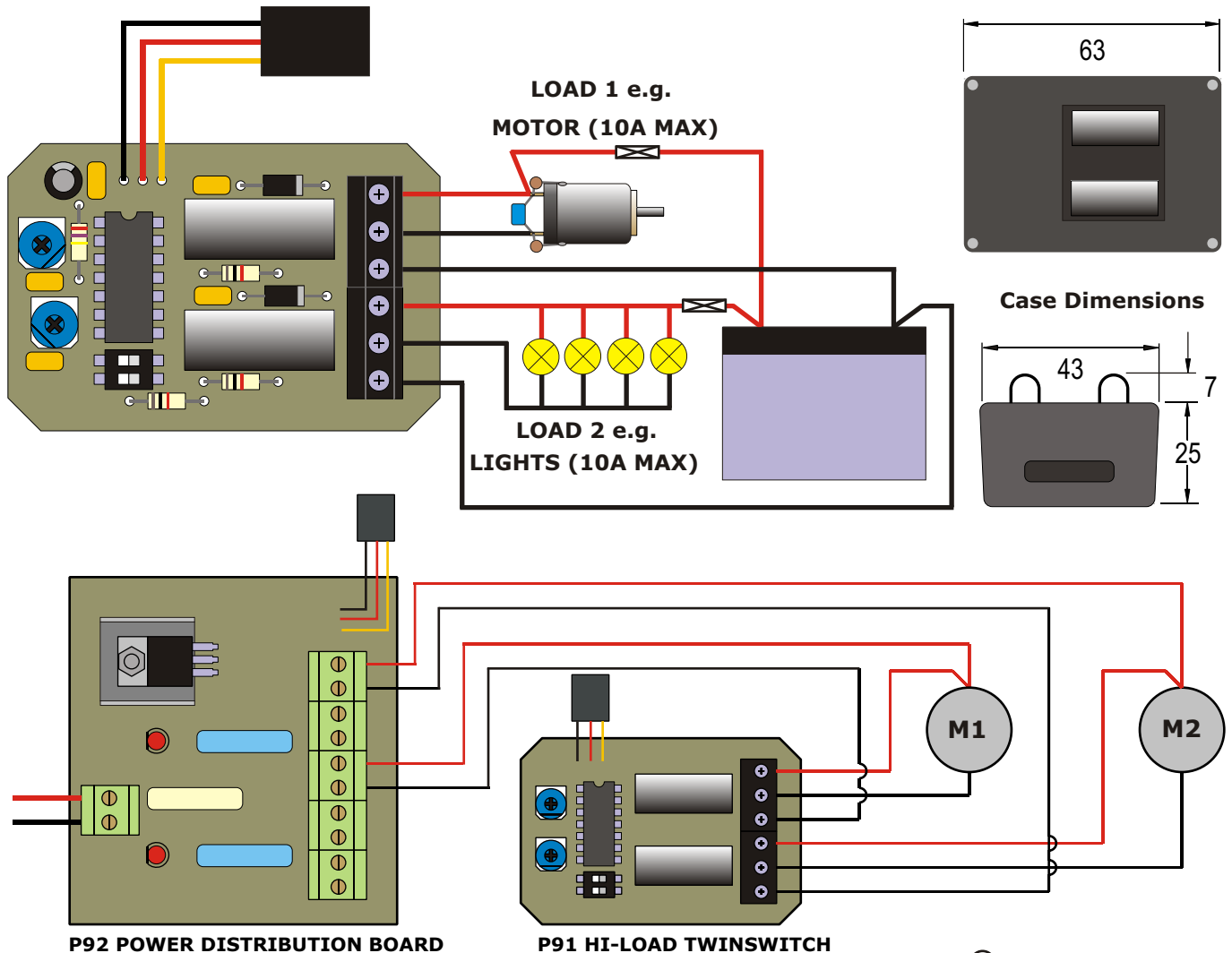
The P91 Hi-Load Twin-switch will operate two completely independent circuits from one R/C channel. Both circuits can be set to switch at any point on the Tx stick from just to the side of neutral to full-throw, and either can be selected as latching or non-latching. If that's not versatile enough for you, then *this little device will handle a continuous current of 10 Amps (peak 20A) on each circuit!* It's been designed especially to operate motorised functions such as fire-monitors, bilge pumps and twin-motor bow-thrusters. For example, set the switching point to 3/4 full-throw and the mode to non-latching; run it from your throttle output on a Y-lead and have that third MTB motor kick-in at 3/4 throttle - easy! It will, of course, also switch "conventional" loads such as lights and sound simulators. Note that while this unit CAN be operated using a channel controlled by a two-way ON/OFF switch on the transmitter, it will only give a set sequence of operations and not be truly selective. Contact ACTION for further information.

MICROCOMPUTER & MOSFET DESIGN

| | |
|--------------------------------------|----------------------------|
| Number of switch functions | 2 |
| Radio control channels required | 1 |
| Latching or Momentary mode selection | Via PCB switches |
| Switching points | Adjustable via PCB presets |
| Receiver voltage (range)* | 4.8 - 6 volts* |
| Load voltage (range) | 6 - 24 volts |

*Do NOT use a 5-cell rechargeable pack to power the receiver *directly*; it may fatally damage the unit.

Power *via* a regulated 5v or 6v supply such as a separate BEC or ACTION power board will be fine.





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| | |
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| Radio control channels required | 1 |
| Latching or Momentary mode selection | Via PCB switches |
| Switching points | Adjustable via PCB presets |
| Receiver voltage (range) | 4.8 - 6 volts* |
| Load voltage (range) | 6 - 24 volts |
| Maximum load current (each circuit) | 10A continuous (20A peak) |
| Output connections | Screw connectors |

***Do NOT use a 5-cell rechargeable pack to power the receiver *directly*; it may fatally damage the unit.**

Power *via* a regulated 5v or 6v supply such as a separate BEC or ACTION power board will be fine.

P91 CONNECTION (and some technical stuff!)

The P91 Hi-load switcher provides two independent switching channels. These can handle a continuous load of 10A each. Higher loads can be tolerated for a short period, though the average current in any five minute period must not exceed 10A. The maximum instantaneous current is 20A per channel. To protect the system the P91 includes flywheel diodes and filter capacitors which allows inductive loads such as motors or solenoids to be controlled. The system provides the option of making each channel either momentary (the channel activates when the switch point is passed and de-activates when the control stick goes under the switch point again) or latching (the channel changes state each time the switch point is passed). If you prefer to think of it this way, then Momentary mode gives a push button operation, while Latching mode gives a toggle switch action.

The switched loads are connected using the six screw terminals. With the terminal block on the right, the connections are:

- 1 Channel 1 Positive Supply
- 2 Channel 1 Load
- 3 Channel 1 Ground
- 4 Channel 2 Positive Supply
- 5 Channel 2 Load
- 6 Channel 2 Ground

The load to be controlled should be connected between the positive supply and the load terminal. The ground terminal should be connected to the negative supply on the battery. It is recommended that the ground for each channel is connected using wire of 1.5mm² cross sectional area or greater. They should not be looped through other systems but connected directly to the battery. It is essential that the positive supply for each load is fused with a 10A fuse. The ground connections should, likewise, be connected directly to the battery and not be looped through other systems. To provide protection for the MOSFETs when switching motors and other inductive loads, the positive supply terminals 1 and 4 should be connected to the corresponding load. The best protection is given when this wiring is as short as possible. See Diagram 1, which shows how to connect the P91 and two loads directly to a battery.

A simple way to connect the P91 is to use the ACTION P92 Distribution Board. This provides the fusing for the system and simplifies the wiring to the P91; See Diagram 2. If you are using the P92, you need to work out what the overall current drawn from the P91 will be. If both channels will be active at the same time and are going to draw a combined current in excess of 15A, then channel 1 and channel 2 should be connected separately to groups 1 and 2 on the P92. If the combined load is less than this then they can be connected on the same group. If this is on Group 2, remember the load drawn from the third output should also be considered. Connect the positive supply to the load directly to the selected '+ve' terminal on the P92; connect the ground from the P91 to the corresponding '-ve' terminal. The negative side of the load is taken to the "Load" terminal on the selected channel on the P91. The positive terminal on the P91 should be connected to the positive side of the load.

P91 SET-UP

To set up the P91, you will need to connect up the unit to a load that can be safely switched on or off and will cause no damage, harm or injury if it switches unexpectedly. If this cannot be achieved with the intended load, then for the purposes of set-up replace the load with a light bulb of appropriate voltage rating.

The simplest way of setting up the P91 is to place both channels in Momentary mode. This is done by setting both switches of SW1 to the "ON" position. If they are not already set to the Default settings, rotate the pots R1 and R2 as shown; this will set the switching points on both channels to about 50% of full stick movement. Connect the P91 to the required receiver channel and power up the transmitter and the receiver/P91 and the load. It is useful to connect a servo to another channel to verify that the signal from the transmitter is being received by the receiver.

To set up Channel 1:

1. Move the transmitter stick to the required switching point. The load will be either on or off at this point.
2. Adjust R1 until the load changes state i.e. if it was on it goes off; if it was off it turns on.
3. Verify the switch point by moving the control stick between maximum and minimum a few times, checking that the load changes state at the correct point. If it does not, make **fine** adjustments to R1 to bring it to the correct point. The load should switch on as the control moves towards maximum movement of the stick and off as it moves towards neutral.

4. If latching operation is required, set SW1 Switch 1 to the "OFF" position.

To set up Channel 2:

1. Move the control stick to the required switching point. The load will be either on or off at this point.
2. Adjust R2 until the load changes state i.e. if it was on it goes off; if it was off it turns on.
3. Verify the switch point by moving the control stick between maximum and minimum a few times, checking that the load changes state at the correct point. If it does not, make **fine** adjustments to R2 to bring it to the correct point.
4. If latching operation is required, set SW1 Switch 2 to the "OFF" position.

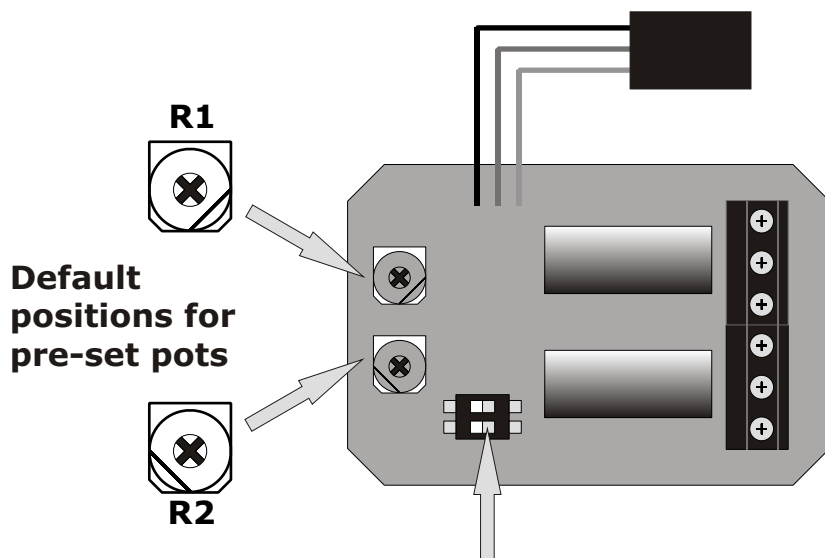
If you find yourself in a mess with the set-up procedure, reset the pots to their default position and start again!

RECOVERY SERVICE

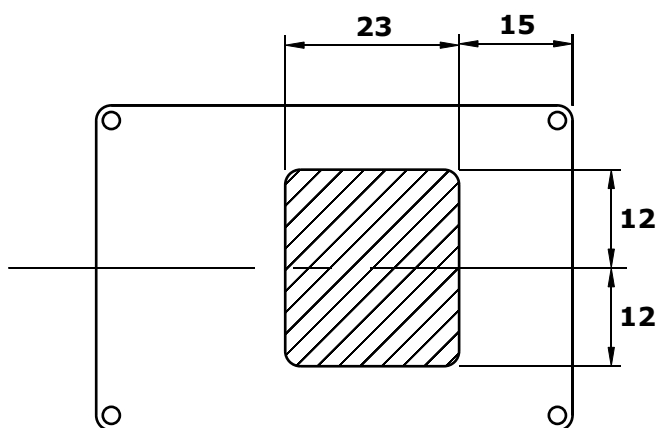
A recovery or repairs service ensures that you will not be left with a dead unit for any reason. The Service Charge for this kit is £13.00 including parts (including return shipping cost IN UK).

All returns should include full Credit Card details (Name & Address of cardholder, Card Number, Expiry Date and Card Security Number)

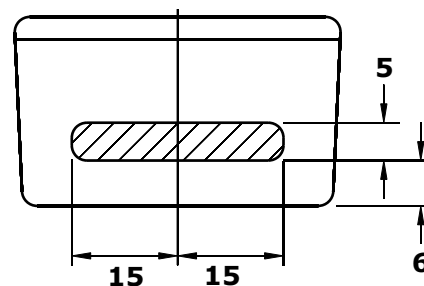
ACTION R/C ELECTRONICS, 1 Llwyn Bleddyn, Llanllechid, Bangor LL57 3EF, United Kingdom



**SW1: ON = Non-Latching (Momentary)
OFF = Latching (Toggle)**



Case Cut-out Dimensions



The small print.....

ACTION R/C Electronics guarantee all products to be free from manufacturing defects for 12 months from date of purchase. This does not cover suitability for specific applications; components worn or damaged by use, tampering or incorrect connection; alteration to original components; damage to batteries or other equipment through use; misuse, or shipping damage. Where goods are found to be faulty, the customer shall return them to ACTION R/C Electronics in their original condition and with their original instructions, packaging etc. Our liability is limited to repairing or replacing goods to their original specification and will not exceed the cost of the goods. By using the product the user accepts all liability. Where a fixed repair charge is applicable, ACTION R/C Electronics shall undertake repairs to the extent that they are judged economically viable. Where such is not the case then the customer will be offered the option of crediting the repair charge towards the cost of a new unit or having the faulty unit returned and the charge refunded (less the cost of return carriage). We reserve the right to modify this guarantee without notice.

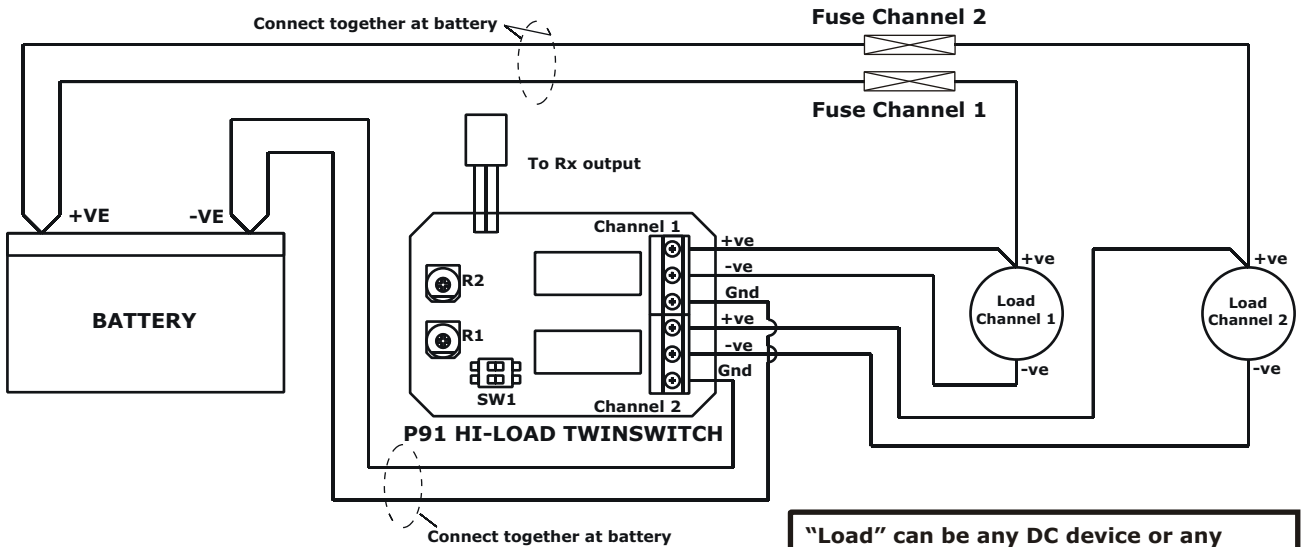


DIAGRAM 1 - CONNECTING TWO LOADS TO P91 AND BATTERY DIRECT

"Load" can be any DC device or any combination of them, up to a maximum of 10A current consumption per channel. Thus, for example, you could connect a fire-pump motor to Channel 1 and an array of lights to Channel 2.

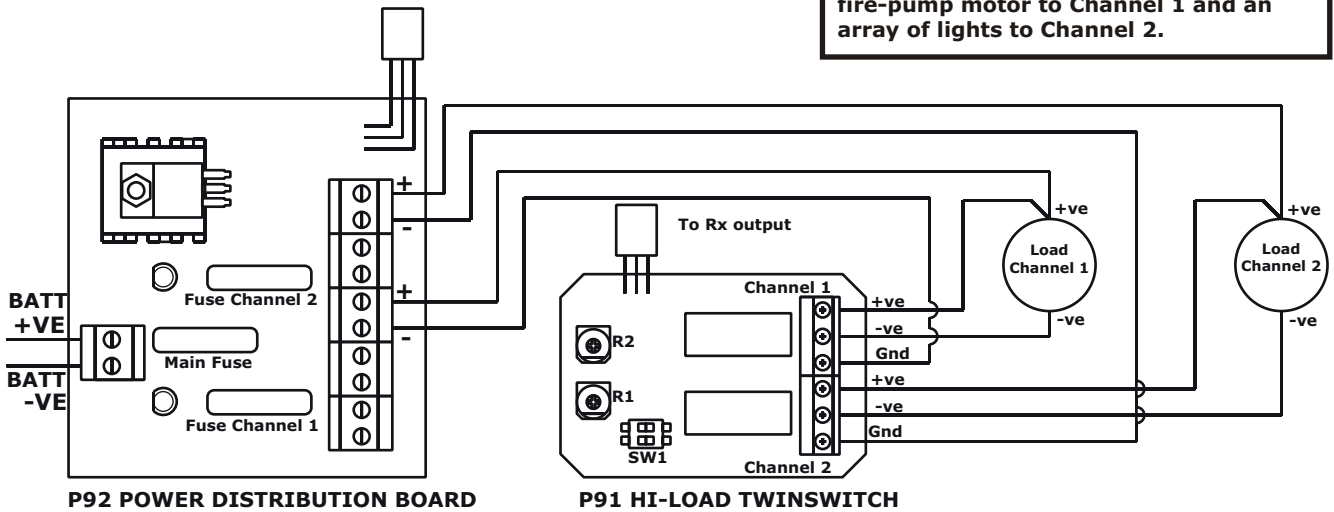


DIAGRAM 2 - CONNECTING TWO LOADS TO P91 AND BATTERY VIA P92

If you are unsure which ACTION units may be suitable for your requirements or you need advice or a wiring diagram, please don't hesitate to contact us!

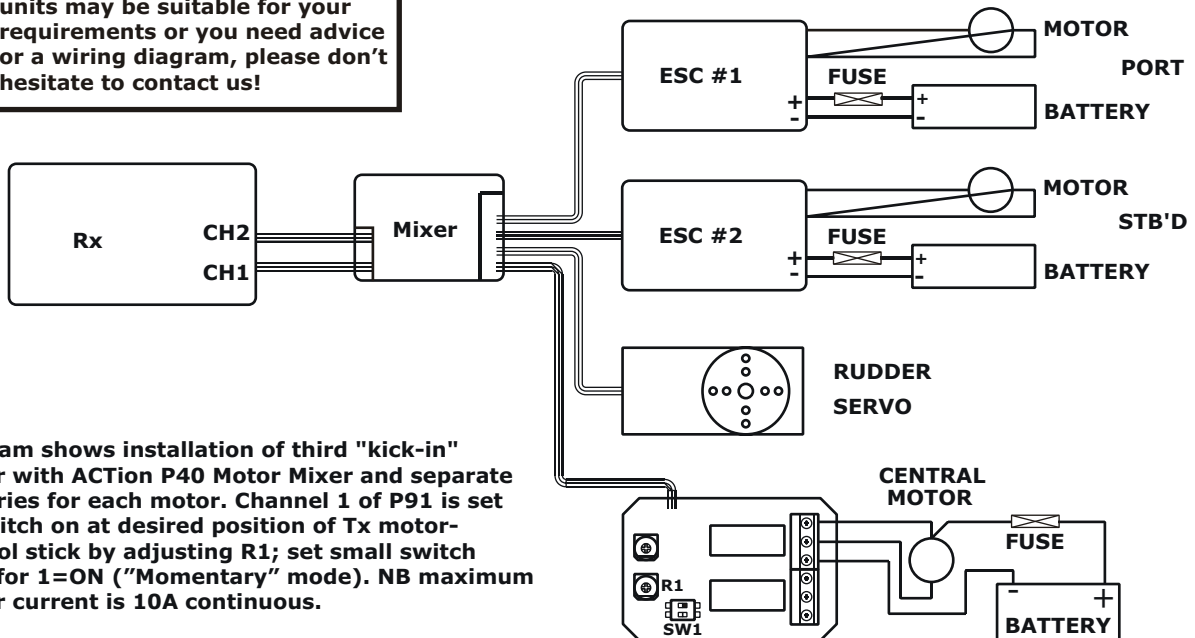
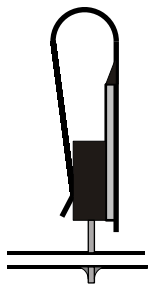


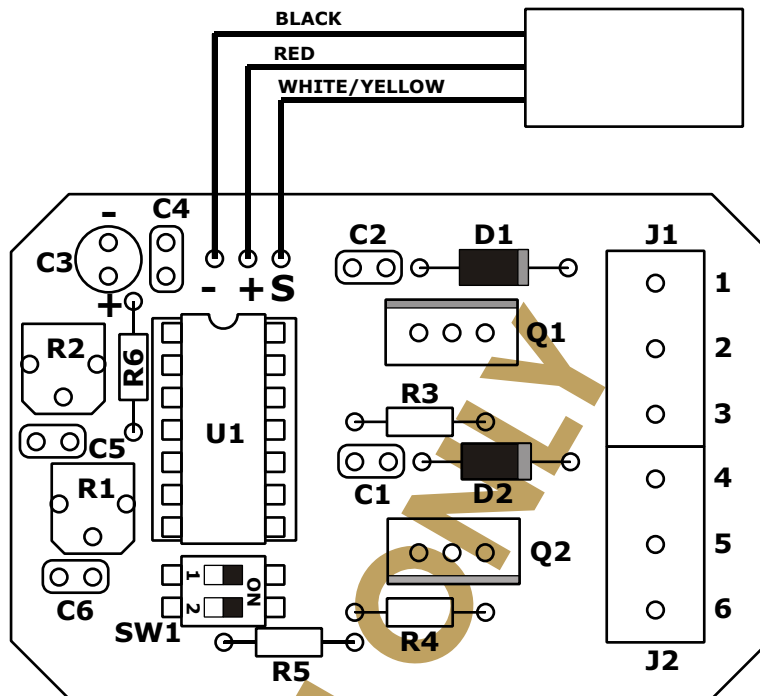
Diagram shows installation of third "kick-in" motor with ACTION P40 Motor Mixer and separate batteries for each motor. Channel 1 of P91 is set to switch on at desired position of Tx motor-control stick by adjusting R1; set small switch SW1 for 1=ON ("Momentary" mode). NB maximum motor current is 10A continuous.



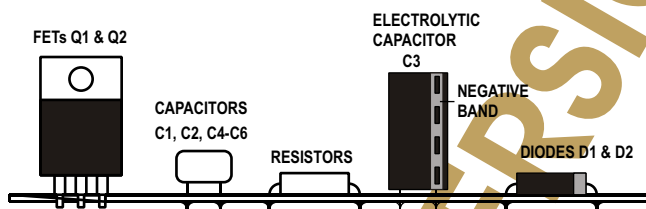
P91 HI-LOAD TWINSWITCH
Instructions for Kit version



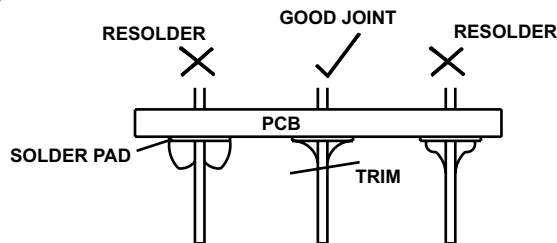
FITTING HEAT-SINKS
ONTO Q1/2



Component Layout Details



Component mounting details



Soldering tips

PARTS LIST

- U1 PIC 16F684 with socket
- R1, R2 10K pre-set pots
- R3, R4, R5 1K resistors (BROWN/BLACK/RED)
- R6 4K7 resistor (YELLOW/MAUVE/RED)
- C1,2,4-6 0.1uF monolythic capacitors
- C3 2u2F electrolytic capacitor
- D1, D2 1N4001 diodes
- Q1, Q2 NDP6060L MOSFETs with clip-on heat-sinks
- SW1 2-way DIL switch
- J1, J2, J3 2-way screw terminal blocks
- Case Rx 2009 with screws
- Lead Hitec generic type supplied, with alternative Futaba plug shell

P91 KIT INSTRUCTIONS

PCB

The PCB has an insulated (Component Side) and a tinned track side. Components are mounted on the insulated side and soldered on the track side. The PCB for this Project is fully prepared and requires no additional work. Look carefully at the area of the PCB you are working on when soldering to ensure that you do not apply an extra connection with a splash of solder.

TOOLS

For construction you will require a soldering iron with a fine pointed bit and flux cored solder (22 SWG recommended); a small pair of wire cutters, a screwdriver to make connections and, of course, a good level of light.

PARTS - DO NOT HANDLE ITEMS IN BLACK CONDUCTIVE FOAM UNTIL INSTRUCTED. (MOS DEVICES)

1. The short, creamy-coloured cylinders with coloured bands and a wire at each end are resistors R3 to R6. Refer to the parts list to ascertain the value indicated by the three coloured bands. The fourth band, which is usually gold, signifies the tolerance and can be ignored.
2. The three-legged components with blue, cross-slotted tops are variable resistors, or 'pots'. They should be fitted by inserting the ends of each leg into the PCB and gently rocking the pot from side to side while applying downward pressure to push the legs into the holes.
3. The tubular electrolytic capacitor (C3) is marked with the value 2.2uF and working voltage; it also has a band down one side of the plastic sleeve with (-) Negative sign on it which signifies which leg goes to the negative. The opposite leg of the capacitor, of course, goes to the positive. Capacitor polarity (+ and -) are clearly shown on the drawing.
4. The small brown components with two wires are monolithic capacitors C1, C2 and C3 C6. They can be fitted either way round.
5. The cylindrical black plastic components with a lead at each end and a silver-coloured bar are the diodes D1 and D2. They are polarity-sensitive and should be fitted as shown, with the silver bar towards the screw terminals.
6. The 14-pin PIC device (U1) is marked with its type code; see the drawing together with the Parts list. It is delivered in conductive foam and should be left in the foam until you are about to fit it. Being a MOS device, it can be damaged by static electricity and care must be exercised when handling. It is supplied with a socket. This will enable the builder to solder in the socket during construction, then fit the IC at the end of construction.
7. The MOSFET transistors Q1 and Q2 have three legs and a black plastic body with a silver metal tab on one side; this tab is shown in the drawing as a thick black line. These are MOS devices and care must be taken in handling. They must also be fitted as shown, with the metal tabs facing the outside of the PCB and the heat-sink tabs pushed onto the body as shown in the drawing.
8. The four-pin dual switch SW1 is used to select either momentary or toggle action for each of the two switched circuits. It should be fitted as shown.
9. The three 2-way screw connectors (J1, J2 & J3) interlock to form a 6-way connector.

CONSTRUCTION

NOTES ON CMOS DEVICE HANDLING. USE A SHEET OF ALUMINIUM OR TIN TO WORK ON; AN OLD METAL BISCUIT-TIN LID OR METAL COOKING FOIL WILL DO.

Place it on the work surface. Place the PCB, solder side down on it. Place the black conductive foam on it, touch the metal with the soldering iron tip and then rest your hands on it, holding them there while you read through this part of the instructions. The PCB, any tools, the MOS IC and you are now all at the same potential, i.e. static-neutralised.

I would suggest that you fit the socket for U1 first, it will help to give you your bearings as to what goes where. Note the small notch at one end of the plastic moulding and ensure that it is fitted as shown in the drawing, soldering all pins carefully. Resistors can be fitted either way round as can the monolithic capacitors, but C3 (2.2 uF electrolytic) must be fitted with care. The negative marking on the sleeve faces the outside edge of the PCB. The diodes also should be fitted with the silver bar at the correct end.

When fitting and soldering the connectors J1 J3 note that the face with the holes for the wires must face the outer edge of the PCB so you can fit wires to them. That may seem obvious but it has been known to be done wrong!

Fit the MOSFETS NDP6060L next. The metal tabs should be on the outside, and the legs pushed right into the PCB up to the point where they widen to prevent the component from going any further in. Push the metal heat-sinks into place, making sure that the tab fits up against the little stop inside the heat-sink.

Strip about 6mm of insulation from the end of each wire on the receiver connector lead; twist the individual strands or each separate wire together and tin them with solder. Clip off the end at about 45 degrees then push them into their respective holes in the PCB and solder. **MAKE SURE YOU FIT THEM IN THE RIGHT ORDER OR YOUR SWITCH WON'T WORK.**

The 14-pin IC should be plugged into the IC socket as the last operation of construction. Clip off all surplus component leads from underneath the board.

The rear of the board can now be cleaned with something like an old toothbrush and some spirit cleaner. Meths will do but Isopropyl is very much better. Then check all over the soldered side of the board for good joints and no solder bridges between tracks or round pads. That's the PCB construction completed.

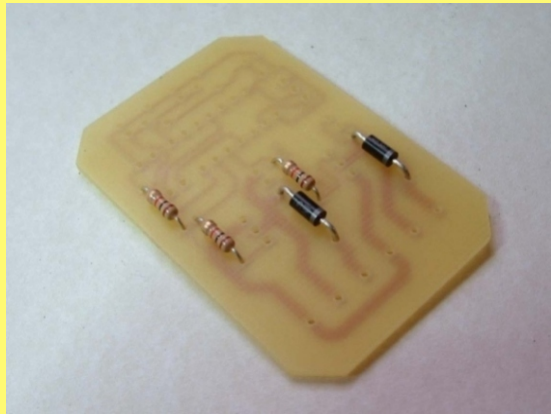
CASE

Refer to the dimensioned drawing. File out a narrow section at the top edge of one end of the case (not the flat part with the screw-holes, which is the lid, but the deeper box part) so that the receiver connector wires can exit the case after the lid has been screwed down. Mark and cut out the holes for the heat-sink in the lid and the main power connections in the base. This is easiest if you stick masking tape to the case first and use a sharp pencil to mark out. Drill a series of small holes e.g. about 3mm diameter, just around the inside of the marked line; snip the web between the holes with your side-cutters and push out the waste material. Using a fine warding file, file back the ABS to the marked line; remove the tape and de-burr the edges of the holes with a sharp blade.

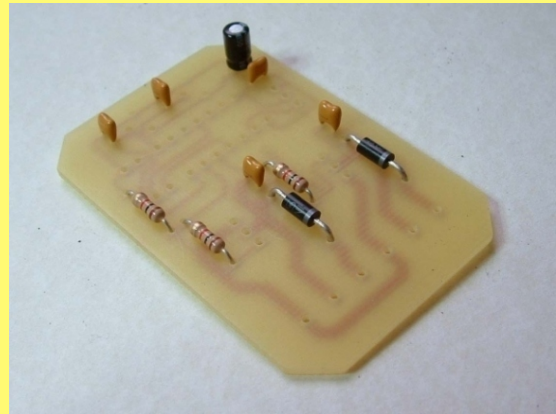
WARNING - DO NOT use the black foam as a packing foam in the finished unit, it is CONDUCTIVE.

P91 HI-LOAD TWIN SWITCH

PHOTOGRAPHIC BUILD SEQUENCE FOR KIT VERSION ONLY



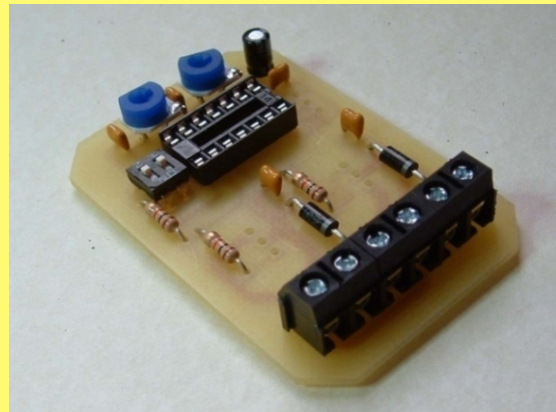
PICTURE 1: PCB with resistors and diodes fitted



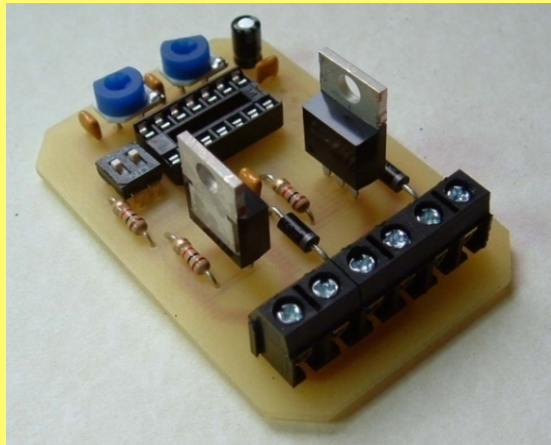
PICTURE 2: Capacitors added



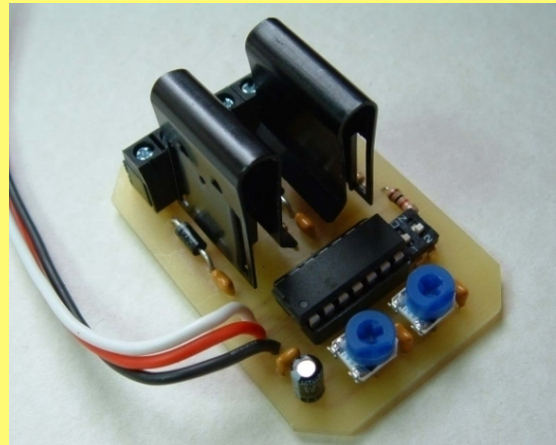
PICTURE 3: Trimmers and 2-way switches added



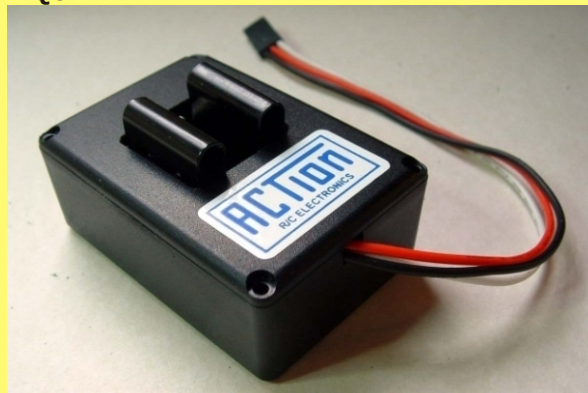
PICTURE 4: Fit screw terminals and I/C socket



PICTURE 5: Fit MOSFETs NOTE! ANTI-STATIC PRECAUTIONS REQUIRED



PICTURE 6: Fit heat-sinks and servo lead



PICTURE 7: Finished unit, showing cut-outs for heat sinks and slot for servo lead