

P98

HIGH POWER ELECTRONIC SPEED CONTROLLER

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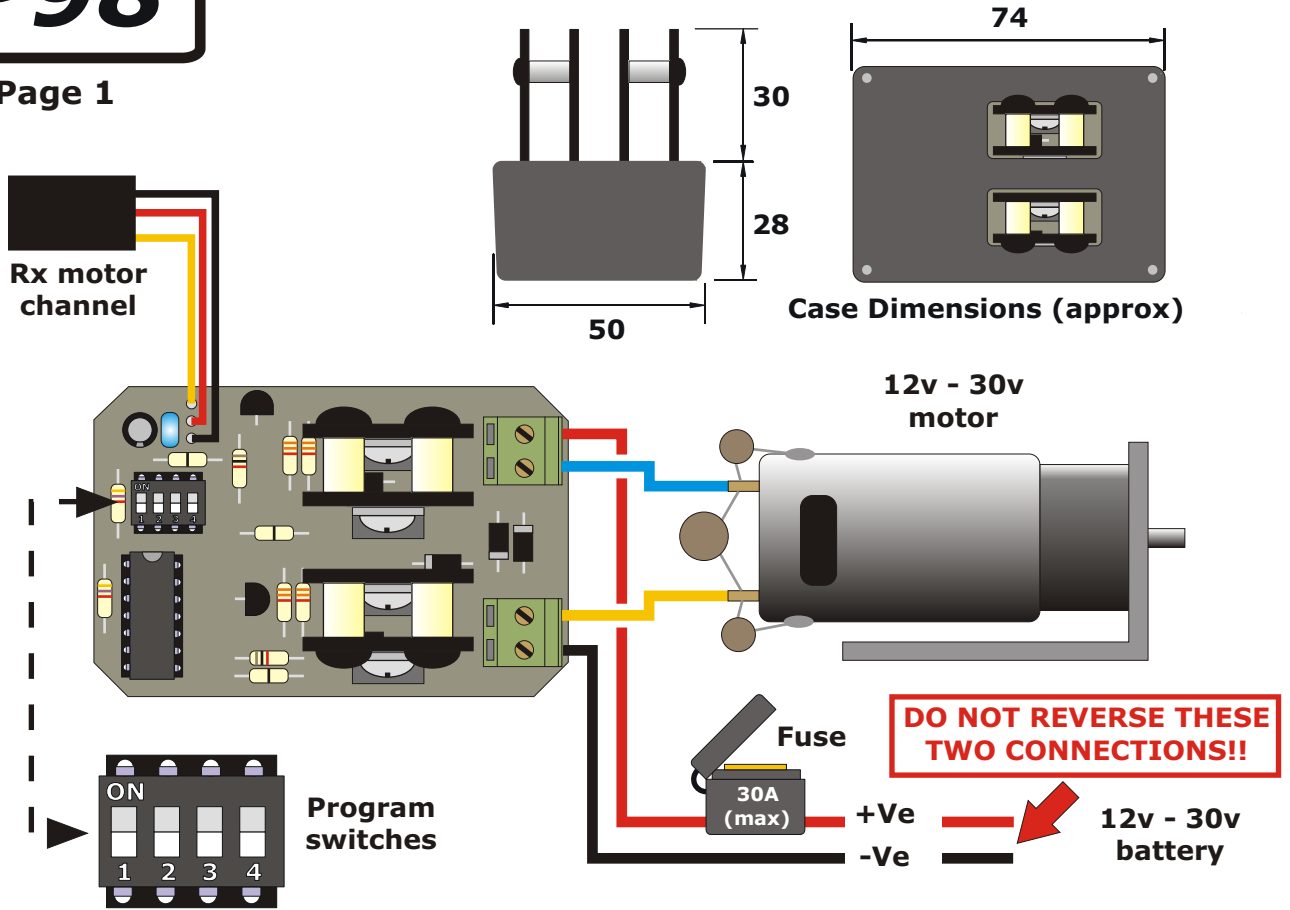


Fig 1: Overall wiring diagram

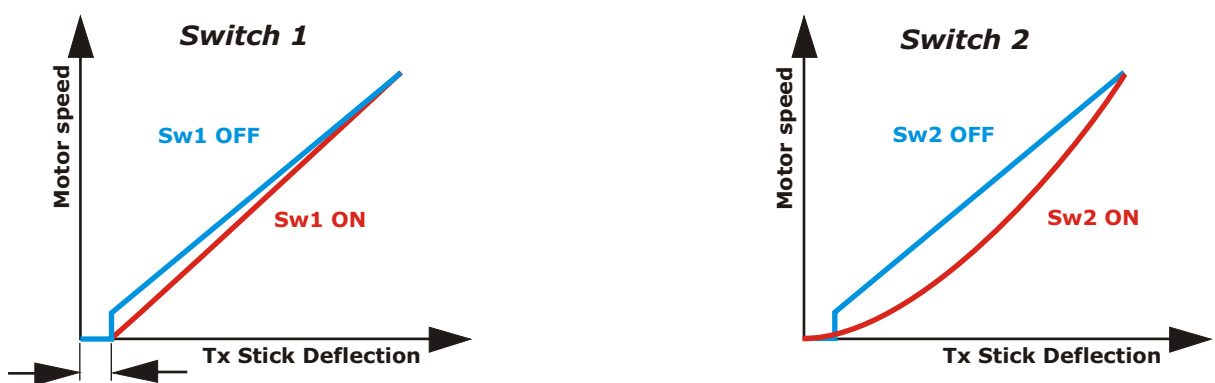
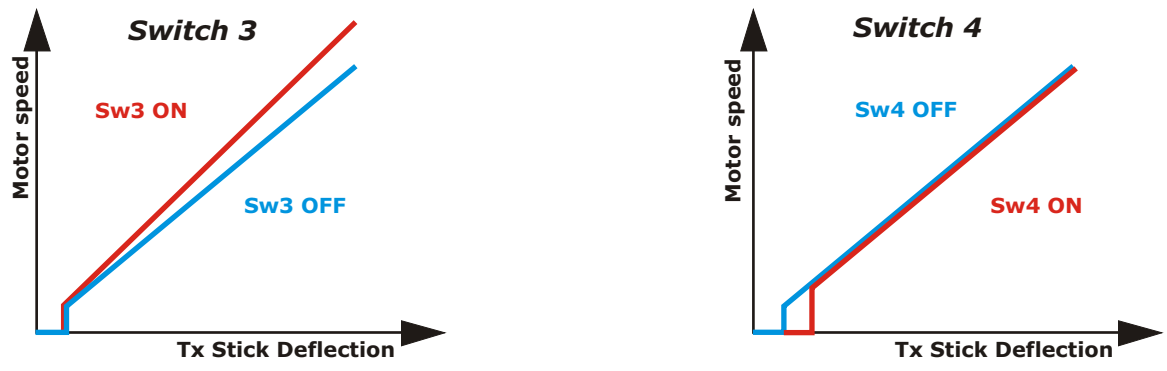


Fig 2: Switch functions



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Receiver power supply must NOT be less than 5.0v or more than 6.5v

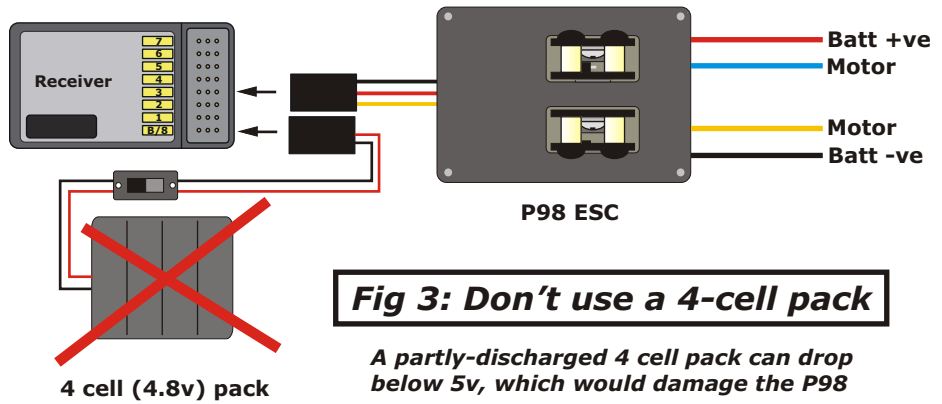


Fig 3: Don't use a 4-cell pack

A partly-discharged 4 cell pack can drop below 5v, which would damage the P98

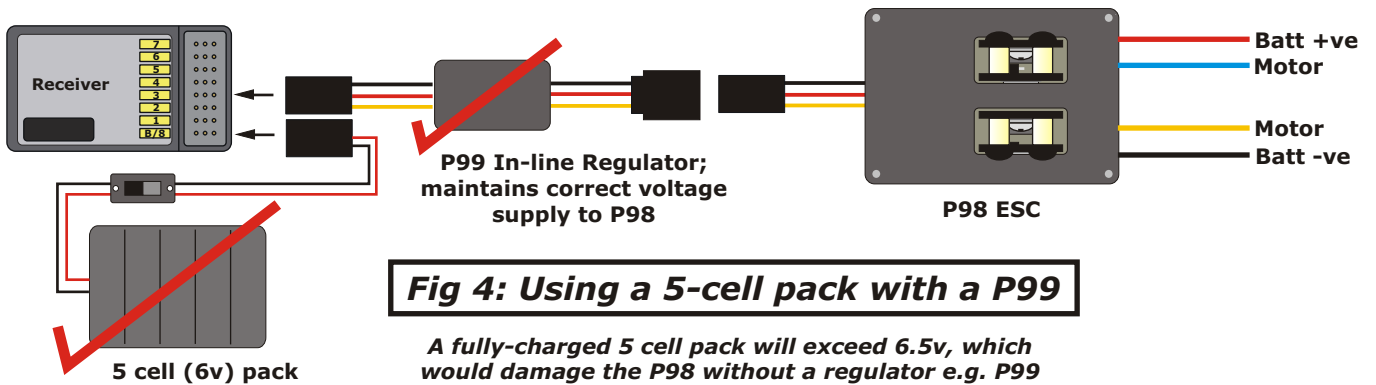


Fig 4: Using a 5-cell pack with a P99

A fully-charged 5 cell pack will exceed 6.5v, which would damage the P98 without a regulator e.g. P99

WARNING!! DIRECT-CURRENT ELECTRICITY IS DANGEROUS. THE METAL HEAT-SINKS ARE LIVE: DO NOT ALLOW THE TWO SETS TO COME INTO ELECTRICAL CONTACT WITH EACH OTHER OR WITH ANY OTHER WIRING, AND DO NOT TOUCH THEM WHILE THE CURRENT IS SWITCHED ON.

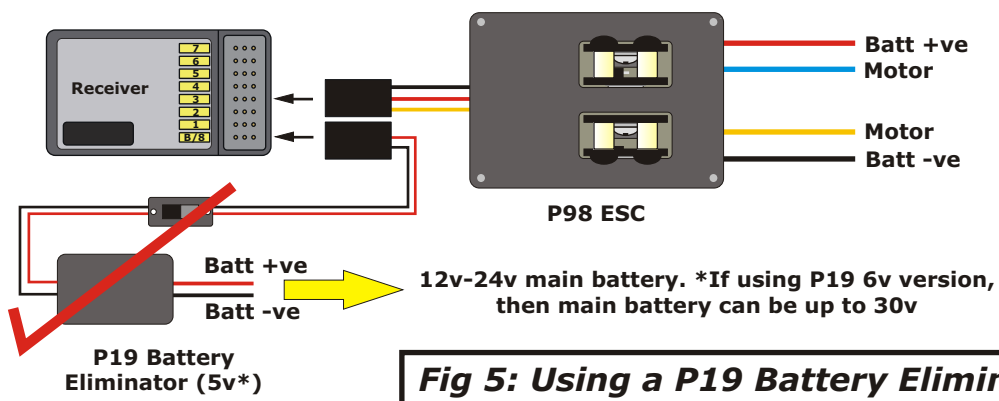
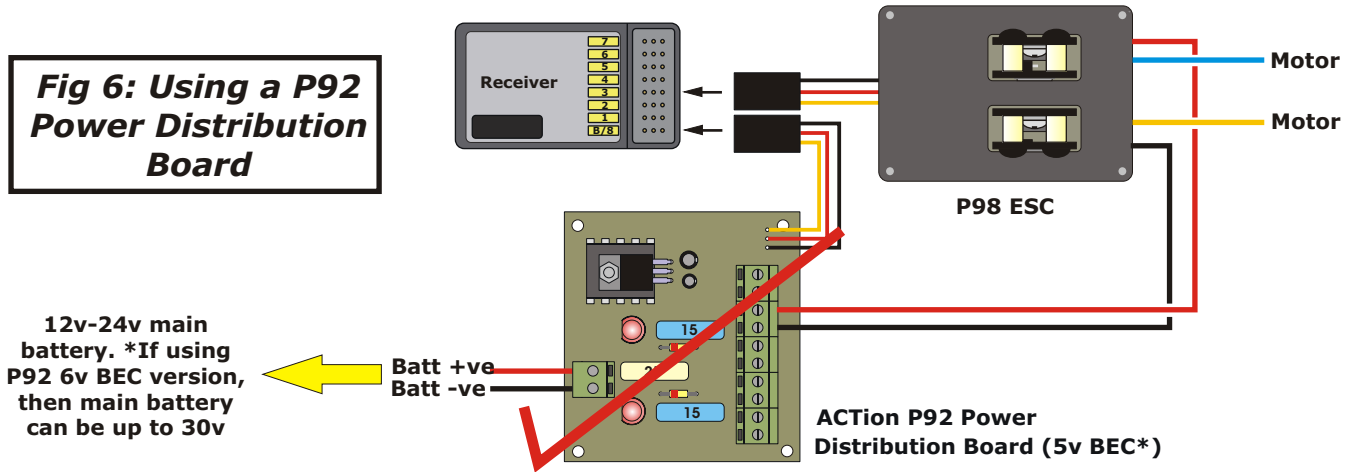


Fig 5: Using a P19 Battery Eliminator

Fig 6: Using a P92 Power Distribution Board



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HIGH-POWER ELECTRONIC SPEED CONTROLLER



P98 was developed primarily at the request of our Australian agents, Darke Horse Model Supplies, to use with their fan-cooled, planetary-gear 785 motors. These run on power supplies from a humble 12v up to a mind-boggling 20 cells (30v+), although their current consumption is relatively modest. Our Design Consultant, Dr Tim Fawcett, included some very useful features while writing the software for the microprocessor, with the result that the P98 is probably the most 'controllable' speed controller on the market anywhere in the world. Specifications are:

Motor voltage	12v Min; 32v Max
Motor Current	30A Max Continuous; 140A Surge
Rx Supply voltage	5.0v Min; 6.0v Max (6.5v absolute Max)
<i>(Internal Battery Eliminator Circuitry - 'BEC'- is not fitted to this speed controller)</i>	
Case size	74mm x 50mm x 28mm (+30mm for heat-sink fins)
Connections	Rx: 3-wire 22AWG silicon cable with generic Futaba plug Power + Motor: Rising clamp screw terminals
User-selected functions	Standard/Offset neutral transition speed Linear/Non-linear acceleration curve Standard/Extended speed range Normal width/Wide neutral (dead-band)

Accessories (Available separately)

P99 In-line 5v Voltage Regulator, for use with 5-cell Rx pack
Heat-sink water-cooling set

CONNECTING THE P98

*Note that the P98 has been optimised for a minimum motor voltage of 12v. If you wish to use a lower voltage supply then we recommend one of our other speed controllers e.g. P80 or P93. Refer to Fig #1. **It is most important that you connect the P98 with the battery poles the right way around. If you reverse their polarity - even for a moment - you will surely destroy the whole network of semiconductors and require expensive repairs. Check twice before you power up!*** You should use a suitable cable for motor and battery connections; we recommend you use multi-strand silicone covered cable of 14AWG 16AWG, both for its current-carrying capacity and its flexibility. You should always twist the bare cable ends and tin them with solder, or fit suitable crimp pin connectors. Never insert bare multi-strand cable into screw terminals as there is a danger of stray 'whiskers' coming into contact with adjacent live components. Use either soldered connections or suitable crimp spade connectors to the motor brush terminals. Motors should be fitted with RFI Suppressor capacitors.

Try to keep the wiring runs between the motor and ESC and also the ESC and battery as short as possible, and route it away from the wiring for the receiver, servos and especially the aerial. You **MUST** use a suitably-rated fuse between the P98 and the battery; ACTION can supply a heavy-duty fuse holder which accepts standard auto blade fuses and has a splash-proof cap.

The P98 requires a power supply to its logic circuitry of not less than 5v and no more than 6v; Refer to Figs #3 #6. You should avoid using a standard 4-cell rechargeable receiver pack because the voltage will eventually drop to less than 5.0v. This can result in the MOSFETs not being switched on and off properly which, in turn, will overheat and possibly destroy the unit. Conversely, if you use a 5-cell pack then the fully-charged voltage is in the region of 7.5v which would instantly blow up the microprocessor. Don't panic! There are several options which are all illustrated; P19, P92 and P99 are standard units available from ACTION.

The ABS case is supplied uncut. You should refer to Fig #7 for the dimensions of the cut-outs required. We have found it helps to put masking tape onto the case and use a sharp pencil to mark out the cutting lines. Drill a series of holes around the inside of each cut-out; join up these holes with a sharp knife or side-cutters and push out the waste material. Finally file back the material to

0843 2898528 or 0782 5511877 (Mobile)

the lines and clean up the edges with a fine file or emery paper, or scrape them with a knife blade. There is a photographic sequence of this whole procedure on our website click onto the P98 Information button and follow the file through to the P98 Kit Instructions.

OPERATING THE P98

This latest version of P98 has Autoset software installed. When the unit is switched on it will "listen" to the signal from the receiver and then automatically set its centre (neutral) position to align with the position of the transmitter throttle stick. This process takes approx 5 seconds from when the transmitter and receiver have been switched on and any binding procedure has been completed (for 2.4GHz radios). Always switch on the transmitter before the receiver and switch off the receiver before the transmitter. It is very important not to move the transmitter stick during this autoset period so we would advise you to leave the stick alone for at least ten seconds after switching on.

The various different functions can be accessed by moving the small white DIL (Dual In-Line) switches fitted to the unit, just adjacent to the receiver connecting wires (See also Fig #1). We recommend that you switch off both the main motor battery and the receiver power supply while you change these switch settings. Start by leaving all of the DIL switches in their OFF position and see how the motor responds to your stick movements. You can then experiment with different switch settings until you achieve the desired degree of control for your model. Note that you may use a combination of settings e.g. with *both* switches 1 and 2 ON you will obtain a very fine degree of slow-speed control.

The switch functions are described below and you can refer to Fig #2 for a graphic representation. The term "dead-band" refers to that small part of the travel of the transmitter stick around neutral where the speed controller does not signal the motor to start turning.

SW1 = Offset neutral. In normal operation (S1 = off), the motor speed stays at zero in the neutral (dead-) band. As soon as the stick moves out of the neutral band, the motor runs at a definite but low speed. The magnitude of this speed depends on the setting of S4, and its presence overcomes the starting torque of the motor - ensuring it can run. With S1 on, 'offset neutral' is selected. This has the motor speed output starting at zero as the stick moves out of the neutral band. This results in lower full-speed operation but allows operation of the motor at slower speeds. Below the threshold at which the motor can turn, a whining noise may be heard from it. This is not harmful but can be annoying.

SW2 = Non-Linear operation. In normal operation (S2 = Off), the motor speed output from the motor is linear - that is, the average voltage applied to the motor is directly proportional to the stick position. With S2 switched on, the voltage applied to the motor at lower stick settings is less than with S2 off. This gives more control at lower motor speeds (for example, for manoeuvrability) but there is less control of the motor speed at higher stick positions. The finest slow speed control is given by having S1 and S2 on.

SW3 = Extended range. In normal operation (S3 = Off) the P98 has its full-throttle positions corresponding to 1mS or 2mS signal pulse width (these are the nominal values for most radio sets). With some sets, particularly if offset neutral and wide neutral are selected, it may not be possible to achieve full speed. Selecting extended range (S3 = On) changes the maximum speed limits to 1.125mS and 1.875mS. This makes it easier to achieve full throttle.

SW4 = Neutral Width. In normal operation (S4 = Off) the system uses a narrow neutral width. This is very good for slow speed manoeuvring as it gives a very quick changeover from forward to reverse thrust. However it can make it difficult to achieve a position where the propellers are stationary, especially if the throttle ratchets are coarse. Selecting wide neutral gives a bigger dead-band, making it easier to select neutral. This is more suitable for a model designed for cruising or speed as opposed to manoeuvring.

Note: To prevent damage to the ESC or to the motor and drive-train, the P98 has an interlock to prevent the speed going from full ahead to full astern too quickly. If this is attempted, the ESC prevents the reverse of direction. The motor will continue to drive in the original direction at a slow speed. To clear the protection interlock, put the stick into neutral; this will clear the mode and allow normal operation. In normal use, always pause for a brief moment in neutral before changing direction, or move from forward to reverse using a steady motion.

WATER-COOLING

This is recommended for any installation where the motor(s) draw more than about 20A continuous current, or where the heat-sink fins on P98 run hot to the touch. ACTION can supply a pair of cast-metal blocks with integral brass tubes for this purpose. These are fitted as shown in Fig #8. Use flexible plastic or silicon tube to connect the cooling blocks to suitable pick-up and outlet fittings. We recommend buying a set of commercial fittings such as those manufactured by Raboesch. Note that if the motor and batteries become too hot to touch after just a few minutes running then there is likely a problem with the drive-train or motor/prop/power source combination.

WARNING!

WHENEVER THE MAIN MOTOR POWER SUPPLY IS SWITCHED ON, DO NOT ALLOW THE TWO PAIRS OF HEAT-SINK FINS TO COME INTO CONTACT WITH EACH OTHER OR WITH ANY OTHER WIRING, AND BE CAREFUL NOT TO TOUCH THEM.

DC electricity can be dangerous (don't forget it's what is used to power cattle fences!) so be sensible about how you fit and operate high-power electric motors and batteries. ACTION R/C Electronics Ltd will not accept any liability for damage or personal injury caused by failure to heed this warning.

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 unit is £19.50 including parts (this also includes the cost of return shipping within the UK). All returns for service or repair are payable with order, but contact us initially if you have any problems.

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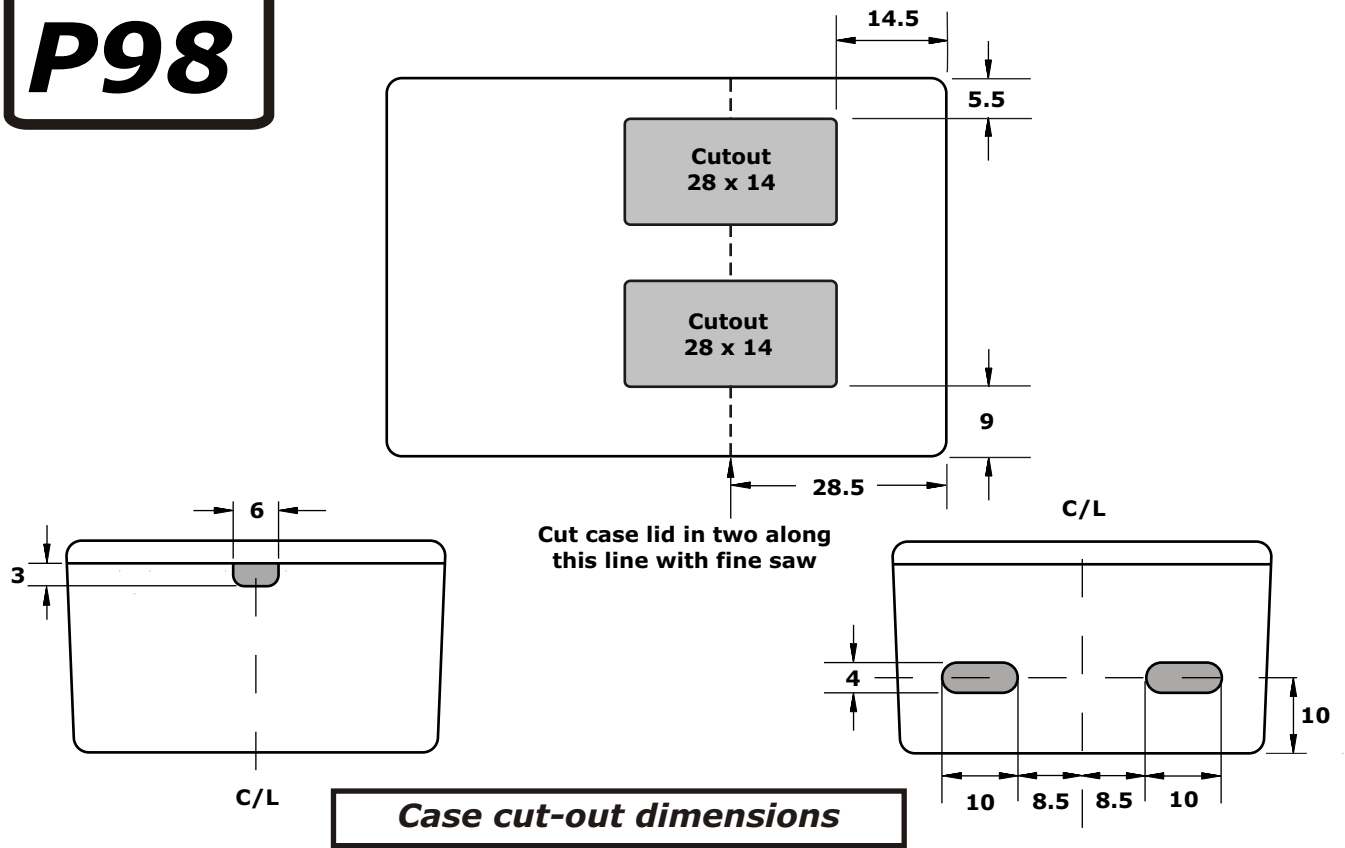
Internet: www.action-electronics.co.uk

The small print.....

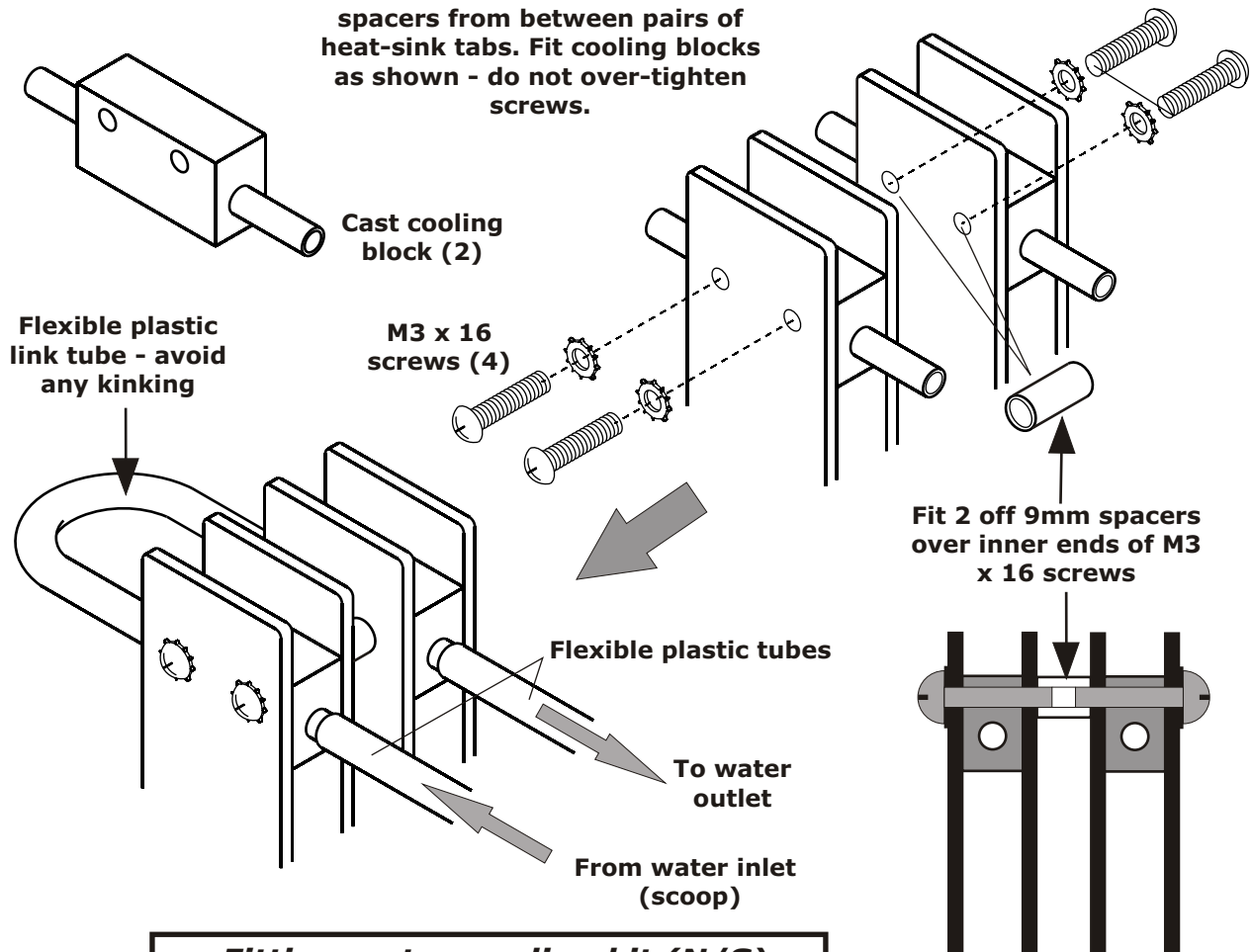
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P98



Remove standard screws and spacers from between pairs of heat-sink tabs. Fit cooling blocks as shown - do not over-tighten screws.



Fitting water-cooling kit (N/S)