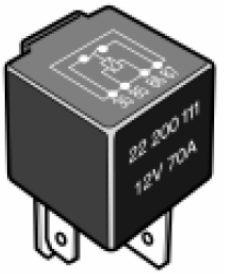
Modular Relay Conversion for the Gavin Scooter

INSTALLATION DETAILS AND ORDER CODES

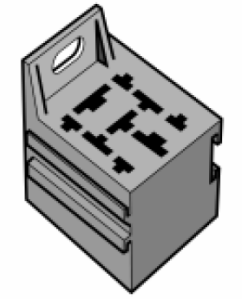


by Joe Hesketh

The following information has been collated following conversions of my own scooters which was achieved largely from information and assistance provided by Bob Cooper. It is hoped that it will save some leg work for owners wishing to source parts and complete the conversion themselves. It is assumed that the reader knows as little as I did when embarking on this, so you may wish to skip some of the details.

Why convert the relay?

In the event of a current surge (e.g. a foreign object in the blades stalling the motor), the relay will often weld shut and require replacement. This requires a new relay to be soldered to the circuit board or a new board with relay carried as spares. In addition, the original relay (Tyco T90 series) is not readily available from electronics suppliers in the UK.



The conversion allows a replacement to be made by simply unplugging the fried relay and plugging in a fresh one, which takes seconds. The modular relays used do not require a separate circuit board and connect directly to the motor wires, via female blade terminals fitted into a moulded socket attached to the motor lid.

The new relay typically used is rated to 40A which is slightly higher than the 30A on the standard relay. Although the higher rating may be of some benefit against surges, the motor stalling will push the current draw up into the 50-80A range, so the real benefit is the modularity and ease of repair rather than any additional protection.

The modification is fairly common amongst scooters in DIR-UK, and so the capacity for team spares and compatibility add to the benefits of this conversion for UK owners.

What needs to be replaced?

The whole of the circuit board assembly needs to be replaced along with some of the wiring. However, it is suggested that you retain some of the wiring, (i) to make the conversion easier, and (ii) to allow you to replace the original relay unit more easily (e.g. if you ever need to return the whole back end to Gavin Water Sports).

It is easier to retain the wires coming directly from the motor to avoid the need to have to unscrew and remove the motor itself.

- The negative (black) wire can be kept in place - both the lead from the motor to the negative motor socket on the compartment lid, and the small lead from that same socket to the black reed switch socket.

- The positive (red) wire would ordinarily plug into the relay socket. Introducing a break in this wire (similar to the one in the negative lead - i.e. male/female

blade with PVC tubing to insulate) allows the existing blade on the end of this wire to be retained and also makes reconnecting the old relay assembly easier.

Another wire to retain (although not use) is the thin black lead from the relay to the other reed switch socket. This can be kept safe with the circuit board, again to aid its quick replacement.

The New Relay

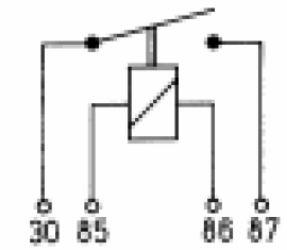


Figure 1

The relay has four plugs, each of which correspond to terminals which are numbered (see Figure 1 for circuit layout). Looking at the back of the socket (or with the pins facing you on the relay, which is the same orientation) the numbered terminals appear as per Figure 2. In addition the pins are marked with the numbers on the relay unit itself (Figure 3).

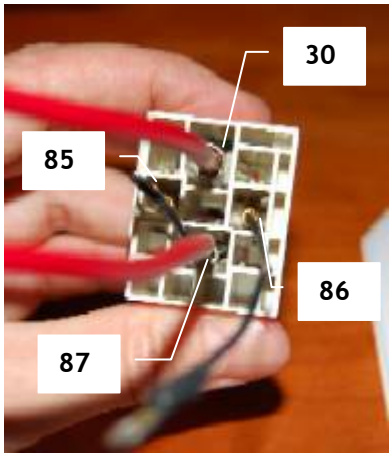


Figure 2

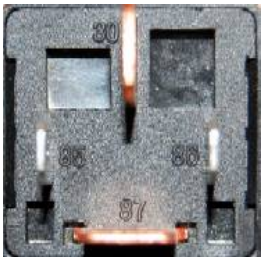


Figure 3

The terminals have latches which lock them into place when pushed into the socket (you can remove them by squeezing the latch with a small flat-bladed screwdriver from the other side). The relay then plugs into the terminals. Note that some relays have longer blades than others and the body of the relay might not plug in completely flush with the socket.

Installation Notes

Figure 4

After removing the old circuit board and preparing the terminals for the wires as per the destination table below, mount the socket to the motor compartment lid using one of the screws from the old circuit board. Some of the older opaque lids are thinner than the new acrylic ones, so be careful not to screw right through to the other side.

Then complete the wiring as per the destination table (you may find it easier to plug some of the latched ends into the socket prior to affixing this to the lid). Figure 4 also shows the completed wiring.

If assembling this from a pre-prepared kit, the numbers (and colours) of wires already prepared may vary. Kits I have previously assembled (Figure 5) have included wires B, E, F and G along with a length of PVC tubing to insulate the new break in the red motor lead. If the blades on the break are not wide enough to stop the tubing sliding off you may wish to secure (or replace) this with electrical tape. In either case, both end of wires C and D should be kept in place.

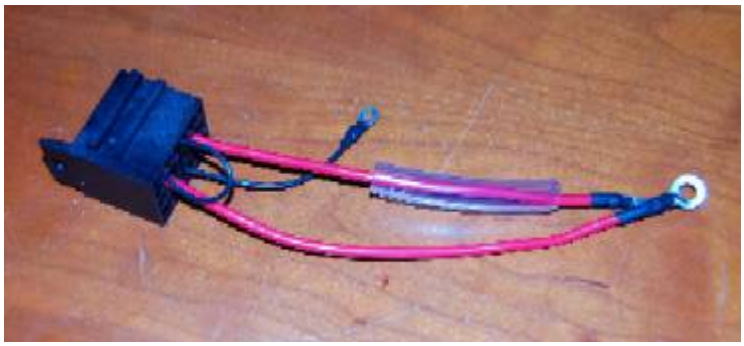


Figure 5

Wiring details

The following table gives details of the terminals required and connective destinations for each end of each wire. Note before making connections permanent that some wires share a single terminal. The thick wire used for the power connections should be rated for at least 25A.

Wire	End	Colour	Type	Terminal Connector	Destination	Comments
A	1	Red	Thick	Male blade (6.3mm)	Motor	Existing Wire and terminal
A	2	Red	Thick	Female blade (6.3mm)	B1	Existing Wire and terminal, connect to B1 and insulate
B	1	Red	Thick	Male blade (6.3mm)	A2	Connect to existing wire (A2) and insulate
B	2	Red	Thick	Female blade with latch (9.5mm)	Relay socket (30)	
C	1	Black	Thick	Male blade (6.3mm)	Motor	Existing wire and terminal
C	2	Black	Thick	Ring terminal (6.4mm)	Lid motor socket (black)	Existing wire and terminal (shares terminal with D1)
D	1	Black	Thin	Ring terminal (6.4mm)	Lid motor socket (black)	Existing wire and terminal (shares terminal with C2)
D	2	Black	Thin	Ring terminal (4.3mm)	Lid reed switch socket (black)	Existing wire and terminal
E	1	Red	Thick	Female blade with latch (9.5mm)	Relay socket (87)	Shares terminal with G1
E	2	Red	Thick	Ring terminal (6.4mm)	Lid motor socket (red)	
F	1	Black	Thin	Ring terminal (4.3mm)	Lid reed switch socket (red)	
F	2	Black	Thin	Female blade with latch (6.3mm)	Relay socket (86)	
G	1	Black	Thin	Female blade with latch (9.5mm)	Relay socket (87)	Shares terminal with E1
G	2	Black	Thin	Female blade with latch (6.3mm)	Relay socket (85)	

Part numbers and ordering details

If you need to order all the parts from scratch, the following indicates the numbers of parts needed for one module (as above, assuming using existing wiring where possible). In most cases the minimum order for terminals will be in units of 10.

Description	Part Ref	Supplier	Size/Type	Qty
24V Miniature Relay (normally open with bracket)	22 400 111	PVL	40A	1
Socket Base	10 700 005	PVL	Type D	1
Female Blade with Latch	FBL9	VWP	9.5mm	2
Female Blade with Latch	FBL6	VWP	6.3mm	2
Male Blade	MB6	VWP	6.3mm	1
Ring Terminal	R6	VWP	6.4mm	1
Ring Terminal	R4	VWP	4.3mm	1
Red Cable (44/0.30mm, 3mm^2)	44R	VWP	27.5A	1

The relays and sockets are available from Pressure Vacuum Level Limited (PVL). As of writing they don't have online ordering though take orders over the phone and the prices have increased from those listed on the specification sheet. As well as the 40A model, though not included on the above sheet, is a 24V 30A relay with part reference 22 400 117. PVL dispatched these relays as a substitute on my last order.

The blade terminals are hard to source in the right size, though are available from Vehicle Wiring Products Limited (VWP), which stocks other useful items as well such as tubing (the PVC tubing can also be used to insulate the rods on the larger battery packs). I bought the heavy duty cable from here as well, though you could use boat cable or any wire that's thick enough and rated to at least 25A.

Team Spares

As mentioned above, the plug and play advantage of these relays increases if more users employ the modification. The carriage costs from suppliers like PVL on small numbers of relays may be unreasonable so it is suggested that anyone ordering may like to place an order for a reasonable quantity and notify other DIR-UK members that they are the current source for purchasing spares. As of the time of writing, I have a number of pre-prepared kits as well as spare relays (the 30A model, see above) and sockets in stock.