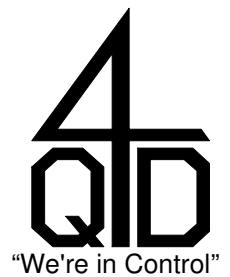


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Hand Control box and Relay Board, for Twin Horns and lighting.

The Relay board is primarily aimed at miniature locomotives, in conjunction with the hand control box, **RBT-810** (Reversing Bell Throttle Box), to operate twin horns and lighting. The relay board's operation is independent of the controller - it is worked by two wires from the hand control box.

However the design of the relay board is extremely versatile and may be used without the **RBT-810**. It will also find uses in industrial machine control and other applications where a small relay board is required.

24v motor systems

Normally the board is supplied for 24v operation, with 24v horns and lighting - **HRB-324**.

By scratching through point K on the board and altering the wiring, the relays still work from 24v but 12v may be used for horns and lighting.

12v motor systems

A 12v version is also available - **HRB-312**. In this horns, lighting and relay board all operate from 12v. Wiring is exactly the same as for the 24v version with 24v horns and lighting.

Version with Fourth relay

A version of the relay board is available with 4th relay to drive, for instance, reversing lights. This is not included in these instructions but a wiring diagram is available from our [www](http://www.4qd.co.uk) site:

www.4qd.co.uk/wire/diags/hrb24+rev.png

The Hand Control box has no ignition switch (refer to controller instruction manual). To switch off the controller the hand control box should be unplugged - acting as an ignition switch.

If a separate ignition switch is required, then this should be inserted in the yellow wire.

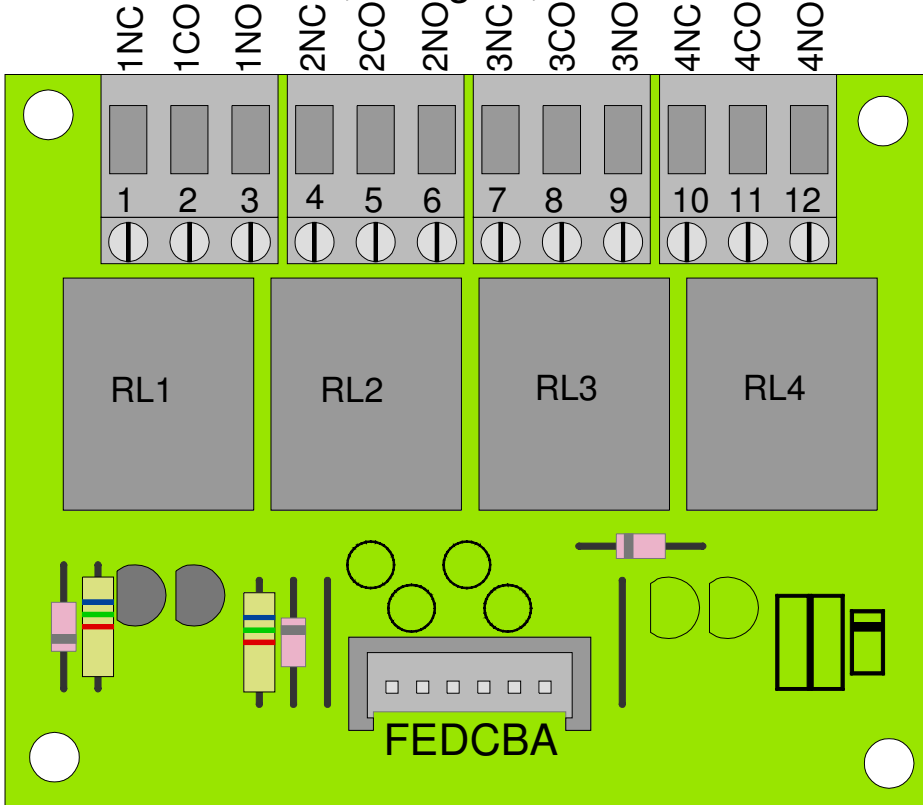
The wiring diagrams illustrate use with a VTX controller. See page 4 for use with 4QD series.

Mounting

The Relay Board is supplied with plastic mounting pillars. It requires 4 off 4mm diameter holes in a rectangle 68mm x 53 mm.

Make sure nothing touches the underside of the Relay Board - this could blow it!

Screw terminals, for lights, horns etc



Outlined components are not fitted on standard issue boards.

IDC connector for control signal.

Order Code: HRB-424

Operation

A six way input connector is used, though normally only two pins are used. The extra four pins are provided to add to the board's versatility.

Connections are as below.

() indicates that the connection is not normally used.

[] indicates alternative function which may be obtained by altering the board.

Pin	Purpose	Alternative use
A	(Battery negative)	
B	RL3	[RL4]
C	RL3	
D	RL2 and RL1	[RL2]
E	RL2 and RL1	[RL1]
F	(Battery positive)	

RL1 and RL2 are operated via a single wire to either input pin E or pin D. Two pins are used so it is possible to split operation and have the relays operating separately (not a feature of the standard board).

Connecting one of these pins to B- (battery -ve) operates RL1 and connecting it to B+ (Battery +ve) operates RL2.

Connecting pin C or B to Battery - operates RL3.

Ratings

Relays are rated at (Resistive load.):

12A	28V DC
12A	120V DC
7A	240V AC

Dos and Don'ts

Do:

Make sure that you have broken link K if you are using 12v horns.

Mount the board somewhere where dirt and rain won't get to it,

Do not:

Connect the frame connection of the horn to the centre (CO) terminal.

Horn frames are often live and therefore the two frames may be connected together through your mounting. Operating either horn in this situation will effectively short out the battery via the horn board and relays. This may destroy the horn relay board!

Connect any two CO contacts together.

Doing so will destroy the board when either relay is operated - unless the appropriate links are scratched through.

Hand Control Box

The hand control is shown right: its operation should be self explanatory.

There is no ignition switch~: simply unplugging the hand control does the same job as an ignition switch.

It contains a built-in 5 LED voltmeter for 24v batteries. The LEDs are all illuminated at full battery voltage and they dim and extinguish one by one as the battery discharges.

The LED voltages are shown below: at the higher voltage the LED starts to dim and is entirely off at the lower voltage.

Green 25.1 — 24.6

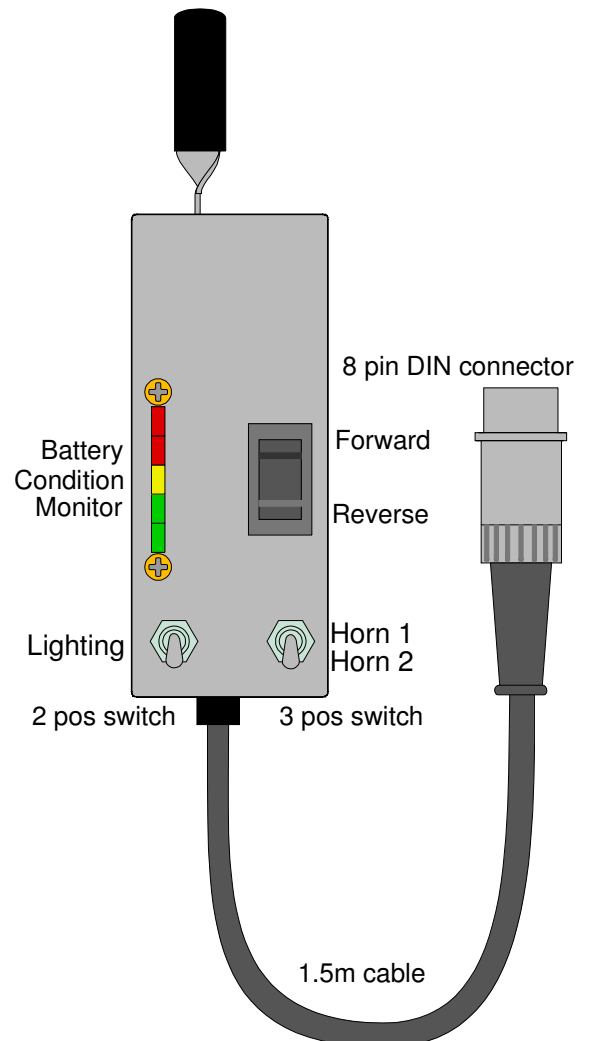
Green 23.3 — 22.8

Yellow 21.5 — 21.0

Red 20.7 — 19.2

Red 18.9 — 17.4

The two toggle switches at the bottom operate the relays: if used without the relay board, they have no function.

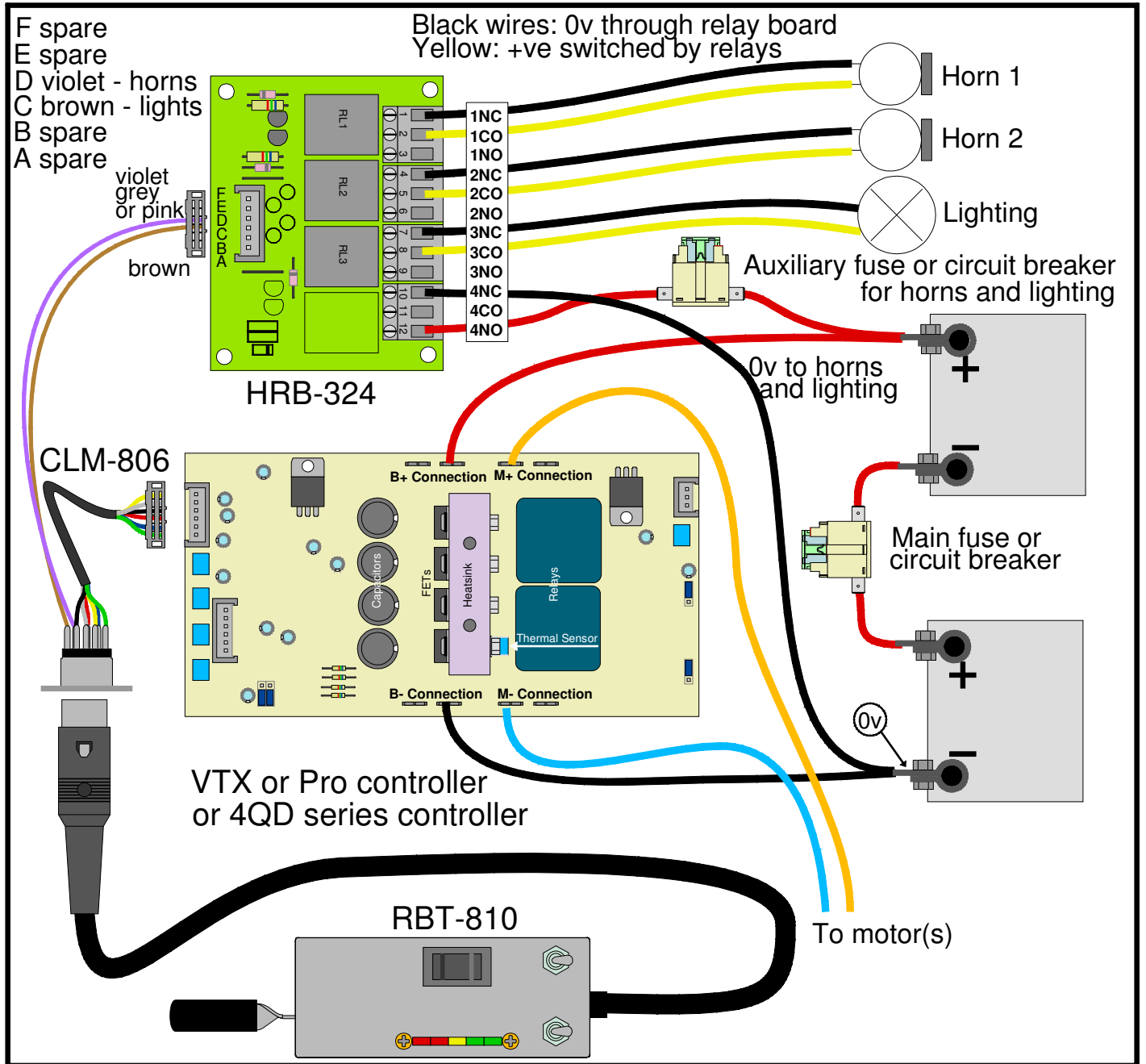


Wiring: 24v motor, lights and Horn

The diagram below shows the wiring with hand control box, and speed controller.

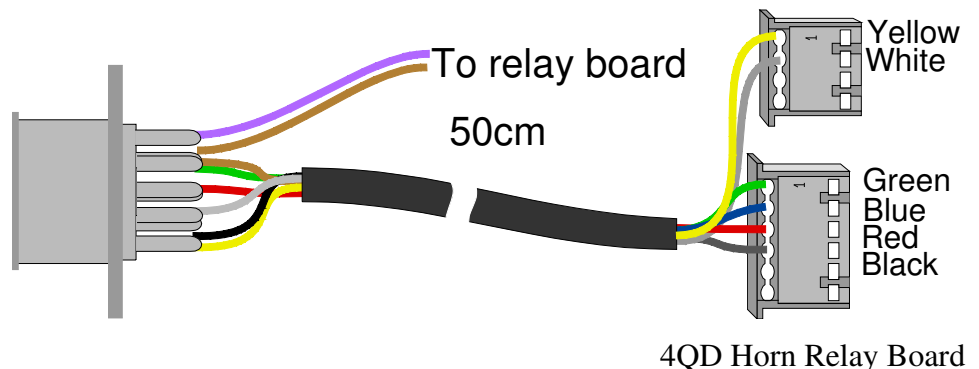
Notice the 'Auxiliary Fuse or circuit breaker' - this is to protect the lighting and horns and their wiring and should be rated at no more than 10 amps.

As below, the standard board operates from 24v and must use 24v horns and lighting. Wiring for the 12v board with 12v accessories is the same.



Use with 4QD series

This is the same as above or opposite but the single 6 way connector is replaced by a 4 way and a 6 as shown right.



Wiring: 24v motor with 12v lights and Horn

The diagram below shows the wiring with hand control box, and speed controller.

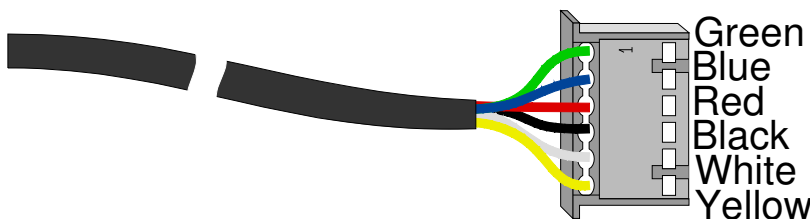
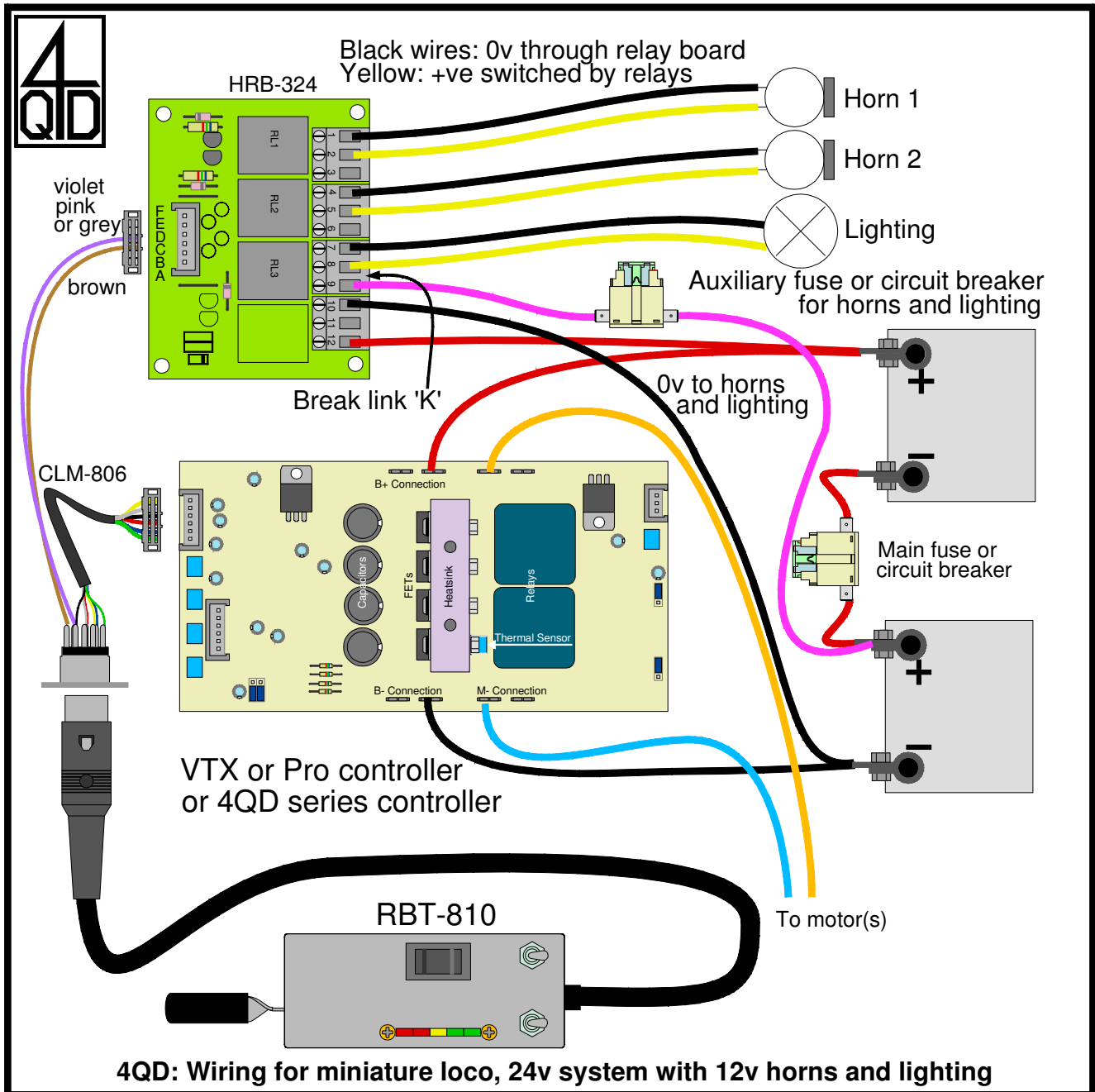
As below, the standard board operates from 24v and must use 12v horns and lighting.

Notice the 'Auxiliary Fuse or circuit breaker' - this is to protect the lighting and horns and their wiring and should be rated at no more than 10 amps.

Note: scratch-through link marked 'K' must be broken beneath board where arrowed. Failure to do this will blow tracks on the board!

Breaking link K will affect voltage to all 3 relays (RL1, RL2, RL3).

The copper of the link must be broken so there is no connection.



Use with Pro-150

This is exactly the same as above or opposite

The only difference is that the BCM will read about 0.6 v less than battery voltage.

Catching diodes

Many horns are inductive. These will cause electrical noise and will shorten the life of the relay contacts. In extreme conditions, the electrical noise can blow transistors on the relay board, or even (in theory, at least) cause the controller to blow. We therefore recommend you fit 'catching diodes' across the

horns. Diode type 1N4002 or similar is readily available. Diode's Anode (marked with a white band) connects to horn +ve (yellow wires in diagrams). More information on <http://www.4qdtcc.com/catch.html>

Schematics

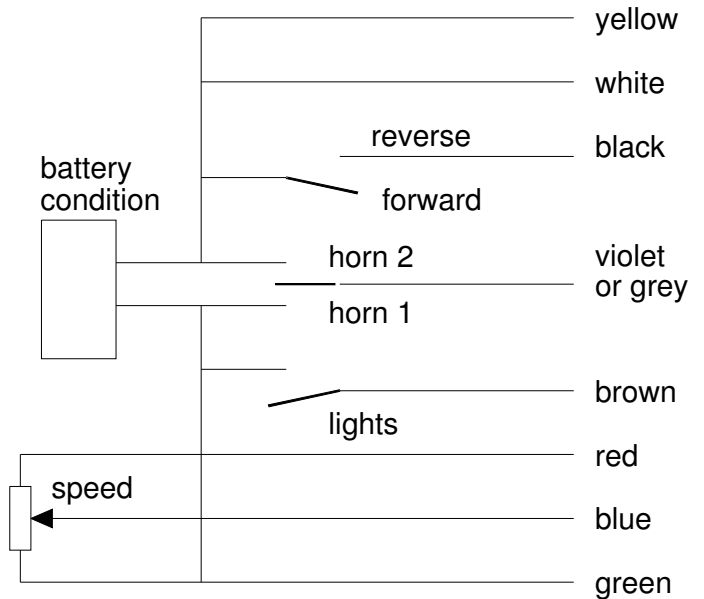
The information here is not intended to encourage you to modify the board and you do so entirely at your own risk. Be sure you understand the information fully before you proceed.

Please note that 4QD can take no responsibility for alternative wiring schemes. The information here is given in good faith and you break these points or modify the board you do so entirely at your own risk.

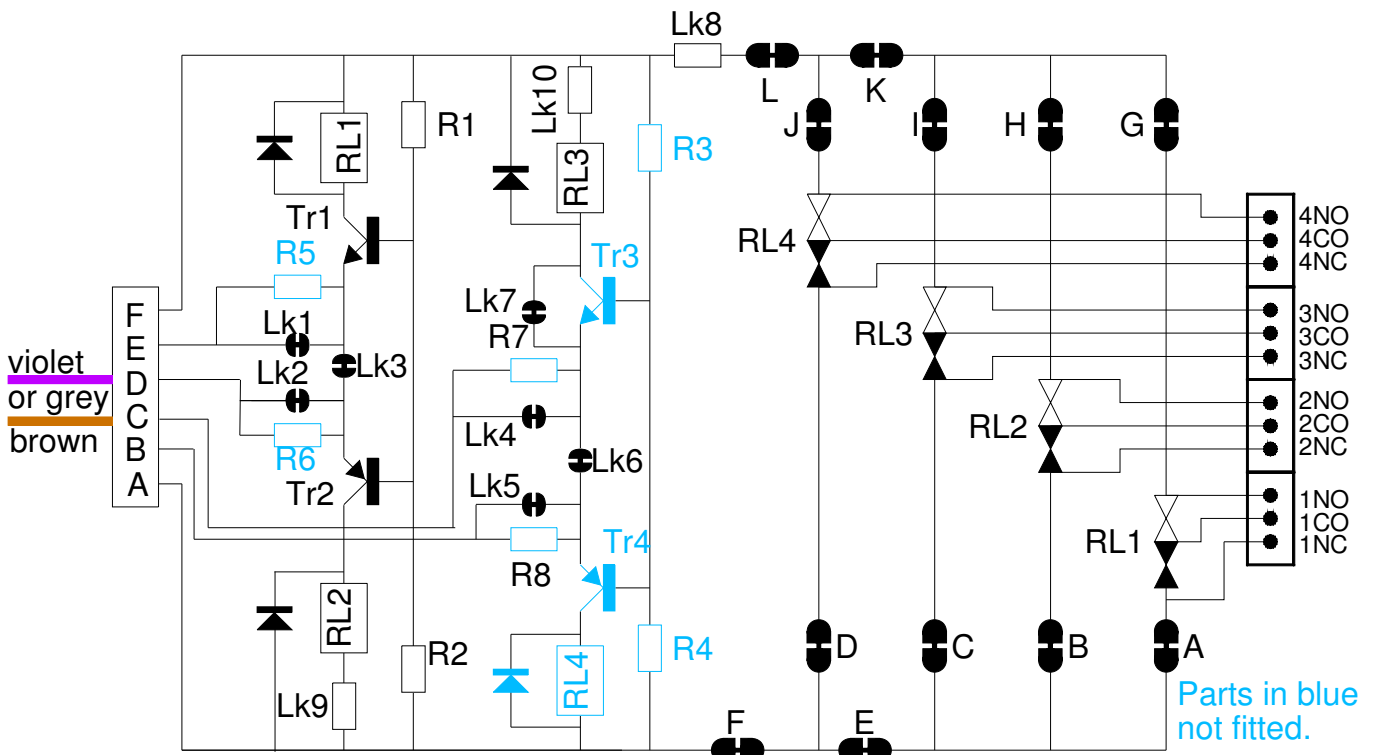
Below is the schematic of the board showing the relay contact wiring. The relay board schematic corresponds best with the physical layout of the relay board if this is viewed from the copper (soldered) side

Notice the break-points marked A through L. These are present so that the relay contacts may be isolated as required, and the relay coils may be powered from the 6 way input connector, for uses other than described herein.

Note RL4 and the components shown in grey below are not fitted on the standard board: the screw connector associated with RL4 is used for supplying battery power to the relay coils and/or the relay contacts.



RBT-810 - Hand Control Box wiring



Horn Relay Board HRB-324 circuit diagram

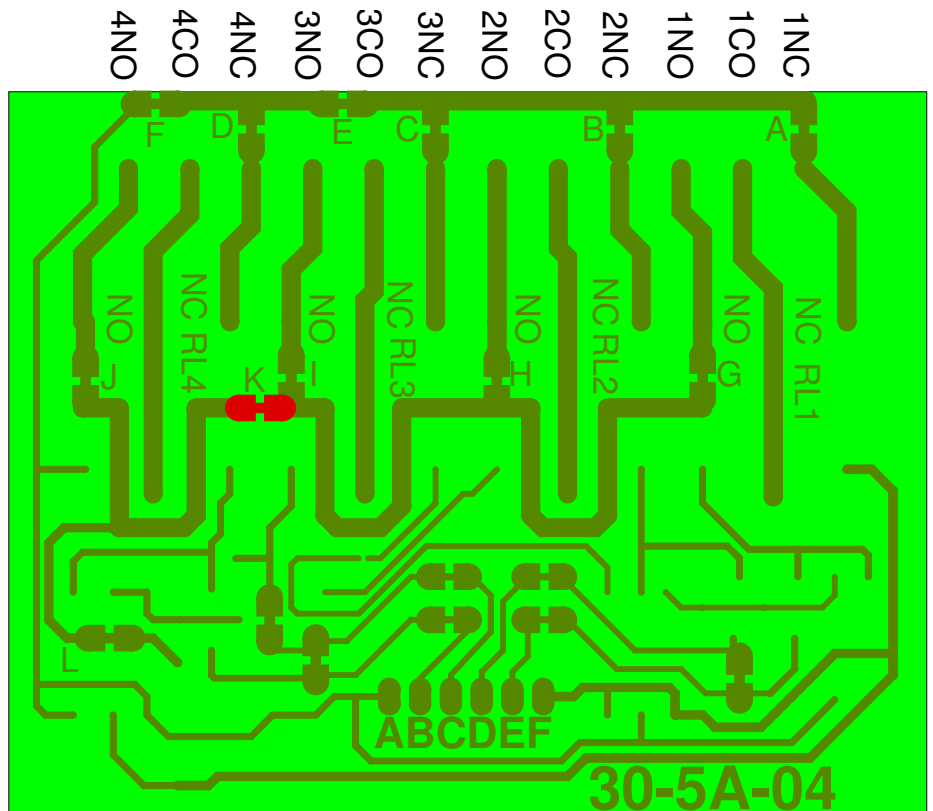
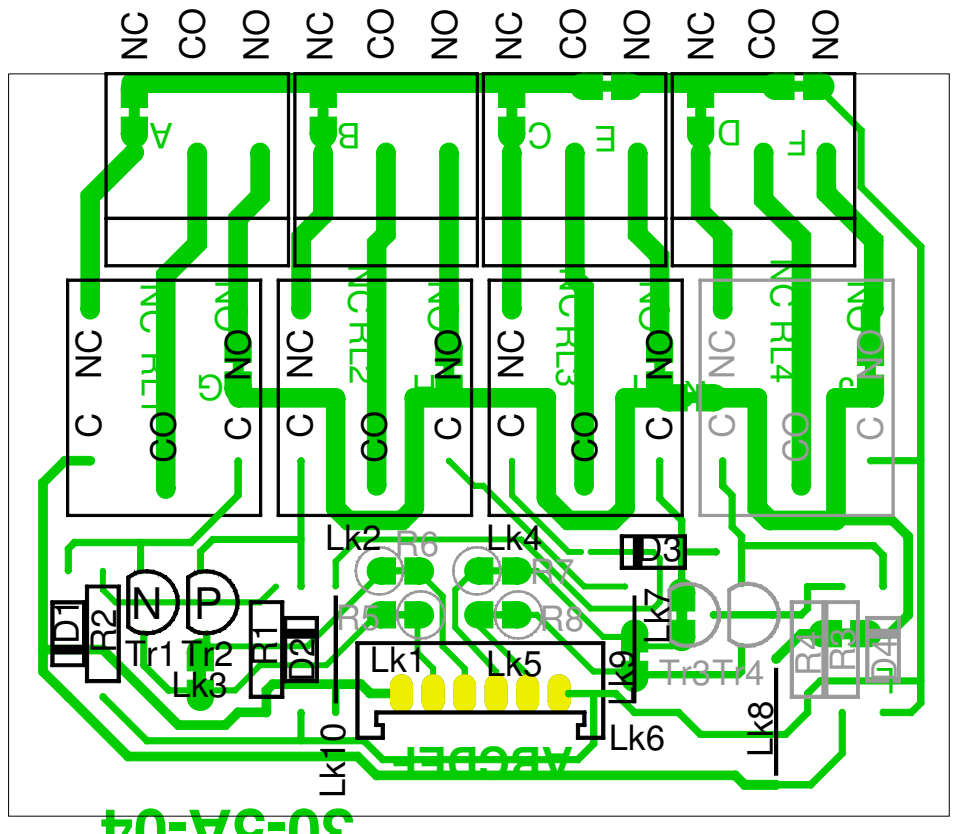
Board layout

The board layout below is given to help locate the links and other features mentioned in the text.

This diagram on the right is as viewed from the component side, with the board transparent so the copper underneath can be viewed.

Not all components shown are fitted - see circuit diagram.

Below is shown the underneath of the board. Link K is marked in red



Service.

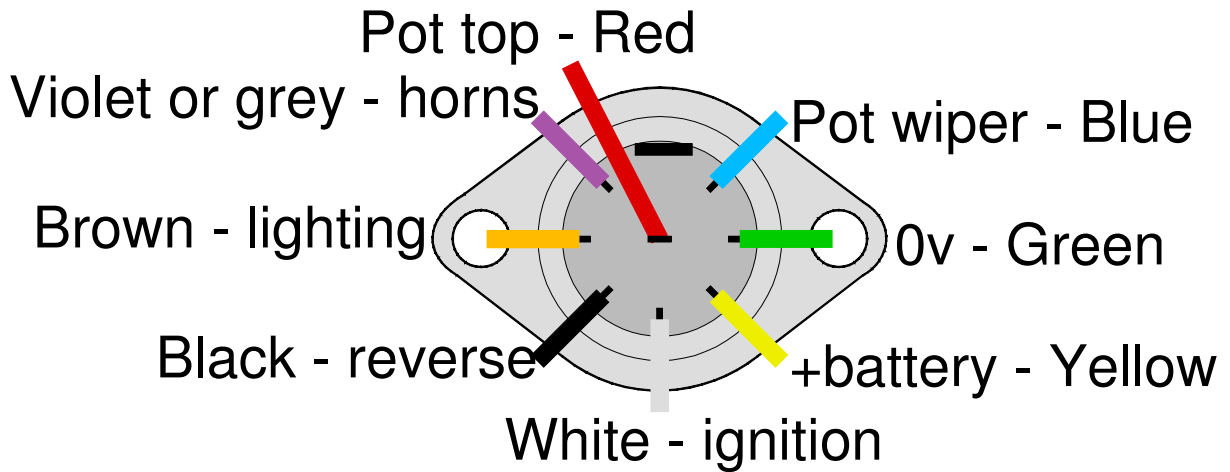
The Relay board is very simple: there is little to go wrong.

However external faults may causes excess currents and the links (which are intended as scratch-through options) may then act as fuses, so if you have a problem, inspect the lettered links . If they do fuse, they can be repaired with fine wire: a single strand from a 7/02 wire is suitable. Alternatively 4QD supply self-resetting fuses which may be used.

It is also inexpensive, so it really is not economical to repair, should you damage it.

Connections: CLM-806

Note that there is a plastic filler in the centre of the 6 core, to maintain its shape. Cut this off as required.



View of connections to chassis mounted DIN socket

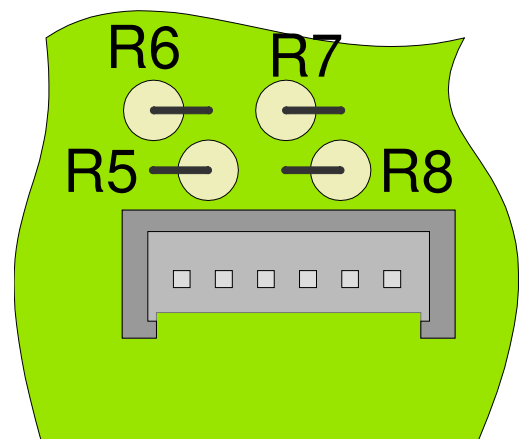
36v operation

The standard board has relay coils for 24v operation. However if the appropriate series resistor is fitted, these can be operated from 36v instead of 24v.

There are 4 possible resistor positions, R5, R6, R7 and R8 on the circuit. There are positions for the resistors just behind the 6 way input connector. Resistor positions are shown right. Beneath each resistor is a scratch-through link which must be broken to engage the resistor.

With the standard wiring, only R6 and R7 will be used. However, to prevent mis-wiring blowing the board it is suggested that all four scratch through links be broken.

For 36v operation, 820 ohms 1/4 watt should be suitable (relay coil resistance is about 1600 ohms).



When modified thus, the same wiring is used as for the 24v system with the 12v tap (if required) done the same way as for a 24v battery (page 5).