Timpdon Electronics

UltraRad Radio System Controller Model *URC9*

The ***UltraRad*** Controller Model ***URC9*** is a radio controlled PWM motor speed controller for battery electric vehicles, designed to operate as part of the ***Timpdon Electronics UltraRad*** radio control system.

In addition to motor speed control, it incorporates two additional radio controlled switches for automatic control of directional forward/reverse lights.

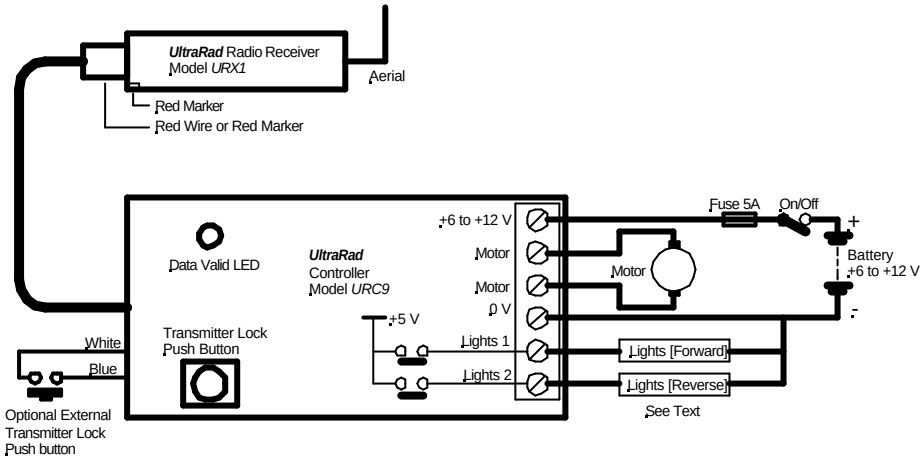
For operation, the ***URC9*** requires the following additional ***UltraRad*** radio system components, supplied separately:

UltraRad* Radio Transmitter Model *UTX1, UTX2 or UTX3
UltraRad* Radio Receiver Model *URX1

Features

- Connects directly to any ***UltraRad*** radio receiver.
- Can be locked to any ***UltraRad*** transmitter.
- Digital microprocessor controlled bi-directional motor speed controller.
- High efficiency, pulse width modulated motor output for accurate speed control, especially at low speeds.
- Forward and reverse vehicle lighting automatically controlled by reverser setting.
- Small size – 55mm x 37mm x 15mm.
- Wide battery voltage range – 6 to 12 V d.c.
- 2.5 A maximum continuous motor load current.

Installation and Wiring



Notes

1 Connect the **V+** terminal to the **battery positive** and the **0V** terminal to the **battery negative**. Connect the two **motor** terminals to the motor. Keep the motor leads as short as possible and twist them together, to minimise electrical interference.

If, on testing, the direction of travel is opposite to that you expected, reverse the **motor** connections at the terminal block.

2 **Take care with the battery polarity**. The ***URC9*** is **not** protected against reverse supply polarity.

Reversed polarity will result in very high currents and may damage the ***URC9*** and the radio receiver ***URX1***. You are recommended to fit a 5A fuse in the positive battery lead for protection.

3 Fit a power **on/off** switch in the **battery positive** supply lead. Remember the ***URC9*** and the ***URX1*** use power even when the speed is set to zero. The quiescent current is approximately 20 mA plus an additional 25 mA when the reverser is set to the **reverse** position.

4 Connect vehicle lighting circuits between the **Lights 1** and **Lights 2** terminals, and the **0V** supply. Note that each lighting output is a 5V supply rated for a maximum load of 25 mA. Both lighting outputs are designed for use with LED indicators only and are not suitable for incandescent bulbs. See below for further advice.

5 Plug the flying lead into the connector on the ***URX1*** radio receiver. Make sure that the **red wire** or **red marker** is on the **same side** as the **red marker** on the ***URX1***. **If you apply power with this connector reversed, you will irreparably damage the *URX1*.**

6 If the ***URC9*** is mounted in an inaccessible position, you may fit an additional external normally open transmitter lock push button switch connected between the **White** and **Blue** wires, if desired. These wires are connected to the same points as the internal push button. If not used, tape these wires up or cut them back.

7 Two 0.1 µF motor suppression capacitors are supplied loose with the ***URC2***. Connect one capacitor directly between each motor terminal and the metal body of the motor.

Data Valid LED

The **Data Valid** LED will flash once each time a valid radio control data packet is received from the ***UltraRad*** transmitter.

In general, data is transmitted approximately once every second, increasing to a maximum of one transmission every 300 milliseconds when settings values are being changed.

On first power up, this LED may not flash, as when the ***URC9*** is shipped, it is not normally locked to any transmitter.

On first use, therefore, you must lock it to your transmitter, following the instructions below.

Transmitter Lock

The ***URC9*** will respond only to a single ***UltraRad*** radio transmitter, to which it has been locked. The transmitter to which it will respond can be changed by the user at any time, using the following procedure.

1 Ensure that only the ***UltraRad*** transmitter to which the ***URC9*** is to be locked is powered up in the vicinity.

2 Apply power to the ***URC9*** and ***URX1***.

3 Press and hold the **transmitter lock** push button for two seconds, and then release it. The **Data Valid** LED will illuminate while the push button is pressed.

4 If the ***URC9*** has correctly locked to the transmitter, the **Data Valid** LED will start flashing in synchronism with the **Transmit** LED on the ***UltraRad*** transmitter.

5 Your radio control system is now fully operational, and will remain locked to the selected transmitter until you change it again. The lock setting will be remembered when you remove power from the ***URC9***.

Fail Safe

In normal operation, the vehicle will maintain the control settings sent in the last valid radio transmission received by the ***URC9***. However, if no valid data is received for a continuous period of 10 seconds, the vehicle will be halted automatically. Normal operation will be resumed when radio control is re-established.

Upon request, and to special order, *Timpdon Electronics* can supply the ***URC9*** with the fail safe system disabled. On this model [***URC9/FS***], if the transmitter is switched off, or switched to another channel, the vehicle will continue operating forever at the last valid transmitted setting, until radio contact is re-established.

This feature permits a number of vehicles to be driven at the same time from a ***UTX3*** 10 channel transmitter.

Vehicle Lighting

The ***URC9*** is designed to control automatically directional **front** [**white** or **yellow**] and **rear** [**red**] lamps on each end of the vehicle.

Each output **Lights 1** or **Lights 2** provides a **+5 V** supply rated for a maximum current of **25 mA**. This is adequate to power four separate LED lamps, each taking 5 mA, providing two **white** or **yellow** lamps at the **front** of the vehicle and two **red** lamps at the **rear**.

This current level is adequate for realistic lighting levels on all types of LED.

In normal operation, **Lights 1** output is energised when the reverser is set to **Forward** and **Lights 2** when the reverser is set to **Reverse**. If the reverser is set to Stop, the previous output is maintained.

The **Aux 1** transmitter control turns lighting **On** and **Off**, and the **Aux 2** control inverts the sense of the **Lights 1** and **Lights 2** outputs to permit the correct lighting colours to be set on a double ended locomotive running in reverse.

The table below shows the state of each lighting output for all combinations of **Aux 1**, **Aux 2** and **Reverser** settings.

Transmitter Switches		Reverser Setting			
		Forward		Reverse	
Aux 1	Aux 2	L1	L2	L1	L2
Off	Off	Off	Off	Off	Off
Off	On	Off	Off	Off	Off
On	Off	On	Off	Off	On
On	On	Off	On	On	Off

LED Selection

Any standard LED type and colour may be used for lighting. Select the appropriate LED shape and diameter to suit the gauge of your model. In general, round LEDs of 3 m or 5 mm diameter are likely to be the most suitable.

To minimise the number of separate lamps you need to fit, you may use three lead bi-colour LEDs, containing both **red** and **yellow** LEDs in the same package. In this case, however, you must use **common cathode** LED packages, where the common centre lead is connected to the **negative** [**0V**] supply. This is the type most commonly available.

LED Series Resistors

Remember that a LED is a current operated device. As the **Lights 1** and **Lights 2** outputs are at a fixed voltage level [**5 V**], each LED must be supplied by a separate series resistor to limit its current to about **5 mA**.

The resistor value required is dependent on the colour of the LED, as different colour LEDs have different forward voltage drops which must be taken into account. Refer to *Timpdon Electronics* **Technical Note 1 — Using LED Indicator Lamps** for more information. This is available from the *Timpdon Electronics* website — www.timpdon.co.uk/telec/downloads.

For the ***URC9***, the following resistor values are recommended for each LED colour, for a current of **5 mA**:

LED Colour	**Nominal Forward Volt Drop**	**Recommended Series Resistor**
Red	1.8 V	680 Ohm
Yellow	2.1 V	560 Ohm
Green	2.2 V	560 Ohm
Blue	3.5 V	330 Ohm
White	3.5 V	330 Ohm

To reduce the light intensity of any LED, simply increase the value of the series resistor.

To increase the light intensity, reduce the resistor value, but note that if you are using **four** LEDs on any lighting output, the values shown above are the **minimum** permitted.

Lighting Wiring Diagram

The wiring diagram below shows a complete installation using two **red** and two **white** LEDs at each end of the locomotive.

If you are using fewer LEDs, simply omit those not required.