Timpdon Electronics

GigaRad Radio System
Receiver / Controller
Model *GRX1*

This advanced 2.4 GHz ***GigaRad*** Radio Receiver/Controller is designed to be used with any model of ***GigaRad*** transmitter.

It is intended primarily for radio control of battery electric model rail vehicles.

It provides:

- One standard RC PWM bi-directional **Speed** output for the control of any standard third party RC electronic speed controller.
- One standard 4 kBd serial data **Auxiliary** output for the optional control of auxiliary functions such as lights and sound cards, using an appropriate ***GigaRad*** **Auxiliary Controller**.

It complies fully with all UK legislation for licence free operation.

Specification

Frequency	2.4 GHz Radio Control Model Band
RF Sensitivity	-94 dBm
Modulation	Gaussian Frequency Shift Keying
Range	Up to 100 metres with any ***GigaRad*** transmitter, in a normal model railway or garden environment.
Size	47 mm [over pins] x 35 mm x 11 mm
Power Supply	5.0 V +/-0.25 V, at 15 mA, derived from 5.0 V BEC within Speed Controller

Introduction

The ***GRX1*** comprises a 2.4 GHz ***Gigarad*** receiver and controller within a single package.

The receiver will operate with any ***GigaRad*** transmitter and, during setup is bound to a particular transmitter, such that it will respond only to transmissions from that transmitter. It may be re-bound by the user to another transmitter at any time.

The ***GRX1*** controller is designed primarily for the control of battery electric vehicles. For motor control, it requires the use of a third party electronic speed controller. Any standard RC ESC may be used, **provided that it equipped with a battery eliminator circuit [BEC] to provide 5 V power to the GRX1.**

The ***GRX1*** provides two outputs, both via standard 3 pin servo plugs:

- A standard RC PWM bi-directional **Speed** output, generating 1 to 2 ms pulses, repeated at intervals of 25 ms. This output is connected directly to the ESC for motor control and power supplies to the ***GRX1***.
- A standard serial digital data **Auxiliary** output, operating at 4 kBd, transmitting details of the **Speed**, **Reverser** state and settings of the four transmitter **auxiliary switches**. Three bytes of data are transmitted every 25 ms.

  This output may, optionally, be used in conjunction with a range of ***GigaRad*** **auxiliary controllers** to control lighting, sound cards and other auxiliary functions.

Mounting the GRX1

The aerial of the 2.4 GHz receiver is mounted within the ***GRX1*** package.

To maximise operating range, the ***GRX1*** should ideally be positioned within the vehicle in free space where it is not shielded by any metal body of the vehicle.

A certain amount of experiment may be required to determine the best location within a metal bodied vehicle, although, provided that it is not totally enclosed within a metal box, it should not be difficult to achieve adequate radio performance.

Within a non-metallic bodied vehicle, no problems with mounting positions should be encountered.

User Notes

Set Up of Mtroniks Speed Controllers continued

During normal operation, the **LEDs** on the speed controller indicate its operating status:

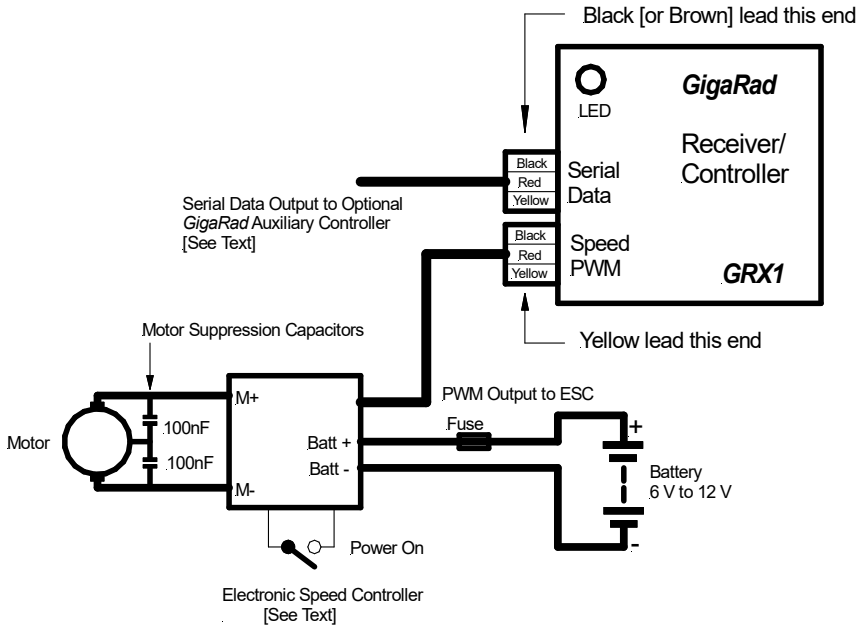
- **Green** LED **On** — Full Forward [or Reverse for Inverse Set up]
- **Both** LEDs **On** — Stop
- **Red** LED **On** — Full Reverse [or Forward for Inverse Set Up]
- **Both** LEDs **Off** — Intermediate speed

Binding

Before use, the ***GRX1*** must be bound to the transmitter with which it is to be used. Once bound, this process need not be repeated unless you wish to use a different transmitter.

All binding procedures are undertaken from the transmitter, and no access to the receiver is required. Refer to the user manual of your ***GigaRad*** transmitter for binding instructions.

Wiring and Connections



Notes on Wiring and Connections

1 Wire up your ESC, motor and battery in accordance with the installation instructions of the speed controller you are using. Depending on make and model, you may need to fit a power switch in the battery positive lead. For all controllers, you are recommended to fit a suitable protective fuse in the battery positive lead.

2 Keep the power leads from the ESC to the motor as short as practicable, and run them close together. This will reduce the generation of electrical noise.

3 You are strongly recommended to fit the motor suppression capacitors supplied with the ***GRX1*** to minimise the risk of system malfunction caused by electrical noise from the motor. Connect one 100 nF capacitor directly between each motor terminal and the metal body of the motor.

4 Plug the three core lead from the ESC to the **Speed** output pins of the ***GRX1***. Ensure the correct orientation of the connector — see wiring diagram. Note that, on some ESCs, the **0V** wire may be coloured **brown**, not **black**.

5 If you are using a ***GigaRad*** **Auxiliary Controller** for the control of lighting or other auxiliaries, plug its three core lead to the **Auxiliary** output pins of the ***GRX1***. Again, ensure the correct orientation of the connector — see wiring diagram.

6 Refer to the user manual of the **Auxiliary Controller** for output wiring, if used.

7 Before first applying power, carefully check your wiring and plugged connections carefully, particularly with regard to voltage polarities. If you connect the battery with the wrong polarity, you may well destroy the ESC.

8 Remember that nothing will work until you have bound the ***GRX1*** to your transmitter.

9 Your vehicle should now be ready to run.

10 If, on first trials, the vehicle direction is the reverse of what you want, either swap the two connections from the ESC to the motor, at the motor terminals, or simply reverse the control direction of the ESC, if you are using an ***Mtroniks*** model. Refer to **Page 10** for details.

Set Up of Mtroniks Speed Controllers

All ***Mtroniks*** electronic speed controllers, other than ***Plug and Play*** versions, have a **Set Up** facility to match the motor voltage control to the actual PWM pulse widths generated by an RC transmitter.

Whilst the ***GRX1*** is itself calibrated to match accurately the standard specification for such pulse widths, you are recommended to calibrate the speed controller in-situ to achieve the widest control range.

Set Up Procedure

1 First, make sure that the transmitter and receiver are bound, and that the receiver and motor speed control are operating normally with the existing speed controller set up.

2 Then de-energise the speed controller and receiver, leaving the transmitter energised.

3 Set the transmitter **Speed** control to **maximum**, and the **Reverser** to **stop**.

4 Then power up the speed controller and receiver.

The **red** and **green** LEDs on the speed controller will **flash** alternately. Whilst these are flashing, **within two seconds**, press and release the **Set Up** push button on the speed controller. The **red** LED will go **off**, and the **green** LED will remain **on**.

5 Now set the transmitter **Reverser** to **forward** and then back to **Stop**.

The **red** LED on the speed controller will go **off** and the **green** LED will go **on**.

6 Now set the transmitter **Reverser** to **reverse** and then back to **stop**.

Both **red** and **green** LEDs on the speed controller will go **on** to indicate that set up is complete.

7 Normal operation will now commence.

If the vehicle direction of motion is the opposite to that you expected, repeat the set up procedure, reversing the transmitter **Reverser** directions in **Steps 5** and **6**, setting the **reverse** direction first, followed by **forward**.

Serial Data Output Format

The **Serial Data** output from the ***GRX1*** is a three byte packet. This data packet is continually transmitted, once every 25 ms.

Data Format of each byte is:

One Start Bit	= **Logic 1**
Eight Data Bits	= **Logic 0** or **Logic 1**
One Stop Bit	= **Logic 0**

Data bits are transmitted **Most Significant Bit** first.

Bit width is 256 us, representing a baud rate of 4 kBd, giving a total transmission time of 7.68 ms.

Byte 1 **Speed Setting**

Hex Value	Decimal Value	Setting
0x00	000	Zero Speed
to		
0xFF	255	Full Speed

Byte 2 **Reverser Setting**

Hex Value	Decimal Value	Setting
0x00	000	Full Reverse
0x80	128	Stop
0xFF	255	Full Forward

Byte 3 **Auxiliary Data**

Data Bit Format [**Logic 1** State] is:

Bit 0	Auxliiary Switch 1 = On
Bit 1	Auxliiary Switch 2 = On
Bit 2	Auxliiary Switch 3 = On
Bit 3	Auxliiary Switch 4 = On
Bit 4	Reverser = Forward + Aux 1= On
Bit 5	Reverser = Reverse + Aux 1 = On
Bit 6	Reverser = Forward
Bit 7	Reverser = Reverse

The decoding, and subsequent output of this serial data is dependent upon the model of ***GigaRad*** **Auxiliary Controller** in use.

Indicator LED

At all times, the ***GRX1*** indicator **LED** shows the current operational status of the unit.

LED Indication	Interpretation
LED Off	No power to ***GRX1***.
Slow Flash [5 per second]	No valid radio pulses detected at power up.
	Transmitter not on, or not bound.
LED On	Bind procedure successful.
Fast Flash [40 per second]	Normal operation.
	LED flashes once each time a valid radio Data packet is received.
Very Slow Flash [1 per second]	Loss of valid radio pulses following normal operation.

Fail Safe

The ***GRX1*** is fitted with an automatic fail safe to stop the vehicle in the event of prolonged loss of radio control.

If radio control is lost, the vehicle will continue under the last valid control settings received , for a period of ten seconds. This permits operation where radio communication is lost temporarily as, for example, in tunnels.

If loss of radio communication persists for more than 10 seconds, the automatic fail safe system will perform an emergency stop:

- The **Speed** setting will be set to **zero**.
- The **Reverser** setting will be set to **Stop**.
- All **auxiliary** settings will be set to **Off**.

Normal operation will be resumed automatically as soon as radio communication is re-established.

During loss of radio communication, and following an emergency stop, the indicator **LED** will flash very slowly — 1 flash per second.

Electronic Speed Controller

Although the ***GRX1*** is designed to work with any standard RC model speed controller, ***Timpdon Electronics*** recommends the following controller as ideal for almost any model rail vehicle:

Mtroniks **Micro Viper Marine 10**

- UK Company
- Economical - Less than £25
- 6V to 12 V [nominal] supplies
- 10 A current limit
- 1 kHz PWM motor control
- Forward and Reverse
- Power On/Off switch already fitted and wired
- On board 5V, 1.2A BEC
- Only 26 mm square

See

www.mtroniks.net

for full details

Caution

Use only versions of ***Mtroniks*** speed controllers equipped with the manual **Set Up** button, as shown in the illustration above. **Do not use the *Plug and Play* versions**. Although they work well, you have to remember to set the transmitter controls correctly at power up, if you do not want them to calibrate incorrectly.