Auxiliary Serial Data Output Format

The **Serial Data** output from the ***GRX2*** 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 **Regulator 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
Bit 5	Reverser = Reverse
Bit 6	[Reserved] = 0
Bit 7	[Reserved] = 0

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

Timpdon Electronics

GigaRad Radio System Receiver / Controller Model *GRX2*

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 live steam model rail vehicles, fitted with separate servos for the control of regulator and reverser.

It provides:

- Three standard RC PWM **servo** outputs for the control of **Regulator**, **Reverser** and **Auxiliary 1** [e.g. Steam Whistle]
- One standard 4 kBd serial data **Auxiliary** output for the optional control of auxiliary functions such as lights, using an appropriate *Timpdon Electronics* ***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	4.8 V at 15 mA [plus servo current]

Introduction

The ***GRX2*** 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 ***GRX2*** controller is designed primarily for the control of live steam vehicles, with separate **regulator** and **reverser** servos, and optional **Auxilary** servo for steam whistle or drain cocks.

The ***GRX2*** provides four outputs, all via standard 3 pin servo plugs:

- A standard RC PWM **Regulator servo** output, generating 1 to 2 ms pulses, repeated at intervals of 25 ms.
- A standard RC PWM **Reverser servo** output, generating 1 to 2 ms pulses, repeated at intervals of 25 ms.
- A standard RC PWM **Auxiliary 1 servo** output, generating 1 to 2 ms pulses, repeated at intervals of 25 ms.
- A standard digital **serial data** output, operating at 4 kBd, transmitting details of the **Regulator** and **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 any suitable ***GigaRad*** auxiliary controller, to control lighting or other auxiliaries.

Servo Calibration

The limit positions and range of each servo output can be individually electronically calibrated to match the servo position requirements for a particular vehicle. Once calibrated, calibration data is held in non-volatile memory within the ***GRX2***, and retained when power is removed.

All servo calibration is initiated and performed from the ***GigaRad*** transmitter, and no access is required to the vehicle, other than for visual observation of servo control arm and linkage positions.

Special Operating Features

The ***GRX2***, and associated ***GigaRad*** transmitter are designed with a number of special operating features, to ensure safe and effective operation of the vehicle.

- On the **Reverser** servo, the rotation rate between the **reverse**, **stop** and **forward** positions is controlled, to limit the force applied to the servo and servo linkages.

  The rotation rate of the **Reverser** servo is controlled to give a rotation period of approximately 1 second for a rotation angle of 90 degrees.

- The rotation rate of the **Regulator** and **Aux 1** servos is not restricted.

- As soon as the transmitter reverser control is set to **stop**, or changed from **forward** to **reverse**, or vice versa, the **Regulator** servo output will be set to **minimum**, irrespective of the setting of the transmitter **Speed** control.

- Following any change of the **Reverser** setting, and the consequent setting of the **Regulator** setting to **minimum**, the **Regulator** servo can not be moved from the **minimum** position for a fixed delay period. This is to ensure that the **Reverser** position has stabilised at its new setting before power is re-applied.

  There is a delay of 0.5 seconds following a reverser change from **stop** to **forward** or **reverse**, and a delay of 1 second for a reverser change from **forward** or **reverse** to the opposite setting, passing through **stop**.

Fail Safe

The ***GRX2*** 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 in, for example, tunnels.

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

- The **Regulator** servo will be set to **Minimum**.
- The **Reverser** servo will be set to **Stop**.

  The **Aux 1** servo will be set to **Off.**
- All other 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.

Mounting the GRX2

The aerial of the 2.4 GHz receiver is mounted within the ***GRX2*** package.

To maximise operating range, the ***GRX2*** 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.

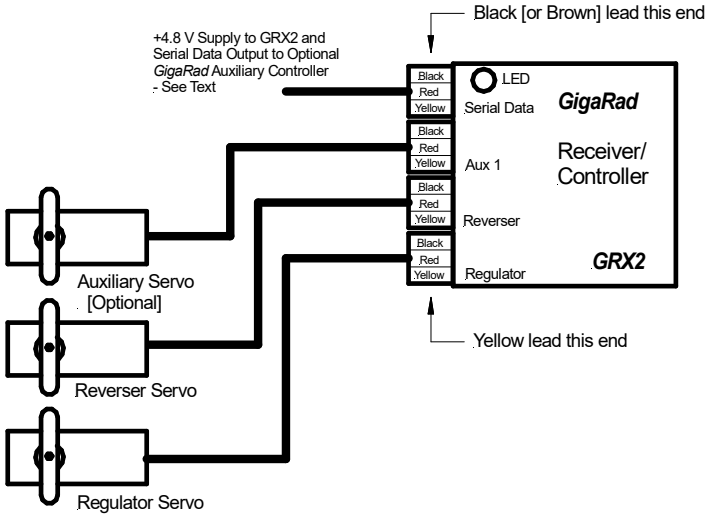
Within a non-metallic bodied vehicle, no problems with mounting positions should be encountered.

Binding

Before use, the ***GRX2*** 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 The ***GRX2*** is designed for use on 4.8 V d.c. nominal supplies. The use of 4 x 1.2 V high power [2600 mAh] re-chargeable NiCd or NiMh AA cells is recommended to provide adequate servo drive power. The absolute maximum permitted voltage is 5.5 V d.c.

2 The battery supply is connected to the ***GRX2*** via either the **serial data** connector, or the **Aux 1** connector, if not already in use, via the pre-wired free socket connector supplied, as follows

Red = **+4.8 V**, **Black** = **0 V**. ***You are recommend to fit a switch and 2A fuse in this supply, for safety***.

If you are using both an **Auxiliary Controller**, connected to the **serial data** connector and an **auxiliary servo**, connected to the **Aux 1** connector, connect the 4.8 V battery supply to the **red** and **black** flying leads of the **Auxiliary Controller**. Refer to the auxiliary controller user manual for more details.

3 Remember that a servo rotating rapidly can draw a current of up to 1A. Ensure, therefore, that your battery supply leads are adequately rated and kept as short as possible to minimise voltage drop in the wiring.

4 Plug the three wire connector of each servo on to the appropriate ***GRX2*** output connector, ensuring the correct polarity. Note that on some servos, the **0V** wire may be coloured **brown**, not **black**.

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

6 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 cause damage to system components.

7 Remember that nothing will work until you have bound the ***GRX2*** to your transmitter.

8 Your vehicle should now be ready to run, but remember that you will need to calibrate the servo settings. This should be done, at least initially, with all servo linkages disconnected, to avoid the possibility of jamming the servo against an end stop. Also, ensure that the servo horns are mounted so that the mid position of servo travel is set approximately to the mid position of the controlled element travel.

Indicator LED

At all times, the ***GRX2*** indicator **LED** shows the current operational status of the unit.

LED Indication	**Interpretation**
LED Off	No power to ***GRX2***.
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.