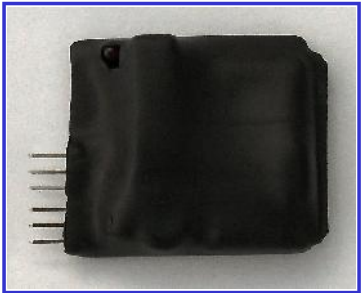


Timpdon  
Electronics

GigaRad Radio System

Servo Controller

Model GRX5



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

It is designed for the radio control of a single standard RC servo rotating between two fixed programmable positions, at a programmable rate.

The controller may be user programmed, in-situ for:

- ⌋ Servo activation by any one of the four transmitter Auxiliary switches Aux 1 to Aux 4.
- ⌋ Servo set and reset servo positions, and rotation rate.

The GRX5 is ideal for the control of level crossing gates and barriers and semaphore signals.

It complies fully with all UK legislation for

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 to 6V d.c. battery supply

The GRX5 comprises a 2.4 GHz GigaRad radio receiver and servo 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 output from the GRX5 is a standard servo control PWM signal, with two user programmable stable positions [Set and Reset] and a controlled rotation rate between these two positions.

The maximum rotation angle is constrained to that corresponding to a servo pulse width range of 1.50 ms +/- 638 us. On most standard servos, this will give a maximum rotation angle of approximately 120°. Both Set and Reset positions are user programmable to any value within these limits.

The rotation period between the Set and Reset positions is user programmable to one of eight time equal increment values between 2.5 seconds and 20 seconds for maximum rotation angle, and pro-rata for smaller rotation angles.

The activation of the servo output can be user programmed to respond to the operation of any one of the four available Auxiliary output switches on any GigaRad transmitter.

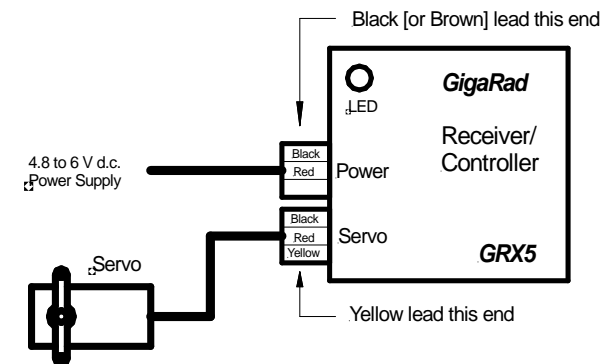
For each transmitter Auxiliary switch, Off corresponds to the servo Reset position, and On to the servo Set position.

## Binding

Before use, the GRX5 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 Connect the servo via its 3 wire plug directly to the GRX5 Servo connector. Ensure that you observe the correct polarity.
- 2 Connect a d.c. supply to the GRX5 Power connector. Ensure that you observe the correct polarity. The supply voltage must be between 4.8 V and 6 V nominal, to match the operating voltage limits of standard servos.

The servo system will only draw significant current while the servo is in motion, so 4 x AA primary or rechargeable batteries should be adequate, and give reasonable battery life.

You are recommended to switch off or disconnect the battery supply when your layout is not in use, to avoid draining the batteries unnecessarily.

- 3 Before use, The GRX5 must be bound to your transmitter, as described above, and programmed for servo rotation angles, rotation rate and transmitter Auxiliary control switch allocation. The calibration procedure is described below.

## Servo Mounting and Mechanical Set Up

For optimum performance and ease of calibration you are strongly recommended to follow the guidelines given here for servo mounting and set up.

- 1 Mount the servo so that the operating arm is approximately midway between the mechanical end stops of the servo when the mechanism to which the servo is connected is approximately at 50% travel. At this point, do not connect the final mechanism to the servo arm.
- 2 Connect the servo to the GRX5. Power up and bind the GRX5 to the transmitter.

The factory default settings for the GRX5, as shipped, are:

- ⌋ Reset Servo PWM = 1.30 ms
- ⌋ Set Servo PWM = 1.70 ms

This corresponds to a rotation angle of approximately 40°, centred on the mid position of servo mechanical rotation.

- ⌋ Rotation Period = Step 3

This corresponds to a period of approximately 3 x 2.5 s = 7.5 s for 120° rotation and 2.5 s for 40° rotation.

- ⌋ Transmitter operating switch = Aux 1

## Indicator LED

At all times, the GRX5 indicator LED shows the current operational status of the unit.

LED Indication	Interpretation
LED Off	No power to GRX5.
Fast Flash [ 5 per second ]	No valid radio pulses detected at power up.  Transmitter not on, or not bound.
LED On	Bind procedure successful. Normal operation.
Slow Flash [ 1 per second ]	Loss of valid radio pulses following normal operation.

## On Power Up

On power up of the GRX5, the servo will immediately move to the reset position, and remain there until the first valid data packet has been received from the transmitter. It will then assume the position specified by the current position of the appropriate transmitter Auxiliary switch.

## On loss of Radio Communication

If radio communication is lost, for any reason, during normal operation, the servo will remain in its last valid controlled state, until radio communication is restored or until power is removed from the GRX5 and re-applied.

## Calibration Procedure

continued

- 5 Now power up the transmitter and immediately—within two seconds—set the Aux 1 switch On and then Off. This instructs the transmitter and GRX5 to enter Calibration mode. The Calibration LED on the transmitter will go On, in addition to the Transmit LED.
- 6 Set switches Aux2 [C1] , Aux 3 [C2] and Aux 4 [C3] to select the calibration function to be performed, as listed in the table above.
- 7 For servo position calibration, use the transmitter speed control to set the servo to the required position for the selected function, by visual examination of the position of the linked mechanism.  
  
Take care that you do not attempt to move the servo to a position where the linked mechanism is solidly jammed in either the set or reset position. This will overload the servo as it attempts to reach a position it can not achieve and will result in high power consumption, servo over-heating and, in worst case, servo damage through electrical failure or stripped gears.
- 8 For Rotation Period selection, set the transmitter speed control to a position corresponding to the required band [1 to 8].
- 9 For Operating switch selection, simply select the switch to be used according to the table. Remember that the last switch selection saved will over-ride any previous selection.
- 10 When the desired SETTING has been completed, turn the Aux 1 switch [Save Cal] On and then Off. The current servo position, rotation rate or auxiliary switch setting will be saved to non-volatile memory within the GRX5 and used thereafter during normal operation, until re-calibrated.
- 11 Repeat Steps 6 to 10, as required, for any other settings requiring calibration. You need only calibrate those settings which you wish to change.
- 12 Once all required calibrations have been completed, turn the transmitter Off to exit Calibration mode.
- 13 When the transmitter is next turned On, the servo controller will operate with all new calibrations operational.

- 3 Set the transmitter Aux 1 switch to Off = Reset.

The servo will take up the factory default position, corresponding to a servo PWM pulse width of 1.30 ms.

- 4 Now set the transmitter Aux 1 switch to On = Set, and check that the servo arm rotates approximately 40°. Do not worry if the servo rotation direction is opposite to that required. This will be corrected during calibration.
- 5 Reset the transmitter Aux 1 switch to Off = Reset, fit the operating linkage between the operating mechanism and the servo, so that when operated, the mechanism will not hit a fixed barrier at either extreme.
- 6 This completes the mechanical set up procedure. You may now proceed to calibrate the GRX5 for final Set and Reset positions and rotation rate for the servo, and assign the transmitter Auxiliary operating switch required for operation [if different from Aux 1], as described below.
- 7 You may wish to experiment with calibration before fitting the servo operating linkage described in Step 5, in order to familiarise yourself with the procedure, without risking damaging the servo by accidental mis-setting.

## Calibration

The GRX5 incorporates the following user calibration facilities

- ⌋ Reset Servo position.
- ⌋ Set Servo position.
- ) Servo Rotation Period.
- ⌋ Selection of transmitter Auxiliary switch to be used for servo control.

All calibrations are performed using the GigaRad transmitter, and no access to the GRX5 is required.

For Servo Set and Reset position calibration, the servo setting is adjusted using the transmitter speed control knob, and the required setting determined by visual observation of the connected mechanical linkage.

For Servo rotation period calibration the period is set using the transmitter speed control knob. The full rotation angle of the knob is split into eight equal bands [1 to 8], corresponding to the period. Band 1 is minimum rotation period, and Band 8 is maximum. Estimate the position of the knob to give the required band by visual observation. Each band setting multiplies the base [minimum] rotation period by the band number.

For operating switch selection, the required Auxiliary switch is simply chosen.

Seven calibration selections can be made, each selected individually by the setting of transmitter switches Aux2 [C1], Aux 3 [C2] and Aux 4 [C3], with the transmitter operating in a special Calibration mode.

Once the appropriate selection has been made, it is saved to non-volatile memory by setting the transmitter Aux 1 [Save Cal] transmitter switch On and then Off.

Once set, all calibrations are retained in non-volatile memory and will remain active until changed again, even after power has been removed from the GRX5 and re-applied.

Before attempting any calibration, ensure that there are no other GigaRad receivers or controllers powered up which are already bound to the transmitter to be used, other than the one to be calibrated.

## Calibration Switch Settings

For the GRX5, transmitter calibration switch settings are as follows:

Calibration	Aux Switches		
	A4 C3	A3 C2	A2 C1
Servo Rotation Period	Off	Off	Off
Servo Reset Position	Off	Off	On
Servo Set Position	Off	On	Off
Servo Operating Switch			
Aux 1	Off	On	On
Aux 2	On	Off	Off
Aux 3	On	Off	On
Aux 4	On	On	Off

## Calibration Procedure

- 1 First ensure that the GRX5 is bound to the transmitter and is operating normally.
- 2 Then turn the transmitter Off.
- 3 Set the transmitter Speed knob to mid position.

This is important to ensure that, on entry to calibration, the servo will not attempt to move outside its available operating range, constrained by the operating linkage, to a position it can not achieve.

- 4 With the transmitter powered Off, set the Auxiliary switches as follows:

Aux 1 =	Off
Aux 2 =	On
Aux 3 =	On
Aux 4 =	On