

## Introduction

The **UltraRad** controller, Model **URC3** for live steam locomotives can control up to three standard Radio Control servos for regulator, reverser and steam whistle.

As all RC servos have different calibrations, and every locomotive requires a different set of servo settings for each function, it is necessary to provide a unique set of calibrations for each installation.

On the **UltraRad** system, servo calibrations are performed within the locomotive mounted controller, unlike a conventional RC system where adjustments are made using transmitter trim controls. In this way, a single transmitter can be used to control any locomotive without the need for any transmitter adjustments.

Each servo can be independently calibrated for end positions and, where appropriate, maximum rotation rates. Once calibrated, all settings are stored in non-volatile memory and retained even when power is removed from the **URC3**.

Any or all calibration settings can be changed at any time,

Calibration is performed using an **UltraRad** Transmitter, Model **UTX2** or **UTX3**, operating in a special calibration mode.

## Calibration Settings

A total of ten settings can be independently calibrated:

### Regulator Servo

#### 1 Minimum Position

The regulator servo position when the speed setting control is set to minimum

#### 2 Maximum Position

The regulator servo position when the speed setting control is set to maximum

Each regulator servo end position can be set anywhere within the operating range of the servo.

After calibration, for transmitter speed control settings between minimum and maximum, the servo position will be set proportionately between the minimum and maximum positions.

#### 3 Rotation Rate – Increasing Speed

The maximum rotation rate of the regulator servo for an increase in speed setting.

#### 4 Rotation Rate – Decreasing Speed

The maximum rotation rate of the regulator servo for a decrease in speed setting.

Each setting is adjustable from 1 second to 8 seconds rotation period between the calibrated minimum and maximum settings

The rotation speed of the servo is limited only when the speed setting control is changed at a rate faster than the calibrated value. At lower rates, the servo position will directly follow the transmitter speed setting control.

## Reverser Servo

### 5 Stop Position

The reverser servo position when the reverser switch is set to **Stop**.

### 6 Forward Position

The reverser servo position when the reverser switch is set to **Forward**.

### 7 Reverse Position

The reverser servo position when the reverser switch is set to **Reverse**.

Both **Forward** and **Reverse** positions are set to those corresponding to the maximum settings of the Transmitter reverser trim controls.

All servo positions can be set anywhere within the operating range of the servo.

### 8 Reverser Rotation Rate

The rate at which the reverser servo will turn when the reverser switch setting is changed.

This setting is adjustable from 1 second to 8 seconds rotation period between the calibrated full forward and full reverse positions.

## Auxiliary 1 Servo

### 9 Off Position

The Auxiliary 1 servo position when the Aux 1 control switch is set to **Off**.

### 10 On Position

The Auxiliary 1 servo position when the Aux 1 control switch is set to **On**.

Both servo positions can be set anywhere within the operating range of the servo.

The rotation rate of the Auxiliary 1 servo is preset at 1 second rotation period between the calibrated on and off positions.

## Calibration Procedure

All servo calibration is performed from the **UTX2** or **UTX3** transmitter, in calibration mode.

In this mode:

The **Tx** lamp is off

The **Cal** lamp flashes to show the current calibration step number [see below].

The **speed setting** [**Calibrate**] control sets the calibration value for the current step.

The **Aux 1** [**Save**] switch saves the current programming value and then proceeds to the next step.

The **Aux 2** [**Cancel**] switch cancels the current step, without changing the existing calibration value, and proceeds to the next step.

The **Reverser** switch has no function.

To enter calibration mode:

- 1 Ensure that the transmitter is on and locked to the receiver and controller to calibrated.
- 2 Make sure that both the **Aux 1** [**Save**] and **Aux 2** [**Cancel**] switches are off.
- 3 Press and hold the recessed **Cal** push button on the right side of the **UTX2** for five seconds, using, for example, a pencil point, until the **Cal** lamp changes from flashing to fully on.
- 5 Then release the **Cal** push button.

Once the transmitter is in calibration mode, there is no exit until power is removed and re-applied.

On entry to calibration mode, the calibration sequence will always be set to **Step 1**. At all times, the current step will be shown by the flash sequence on the **Cal** lamp, as shown below.

For each step in turn, set the **speed control** to give the required servo setting for the current calibration step.

When satisfied, turn the **Save** [Aux 1] switch on and off once only. The **Cal** lamp will flash for one second while the save command is transmitted. The calibration setting will be saved within the **URC3**, and the calibration procedure will then proceed to the next calibration step.

To proceed to the next calibration step without changing the existing calibration setting, turn the **Cancel** [Aux 2] switch on and off once only.

After Calibration **Step 10**, the sequence will restart at **Step 1**.

### Calibration Steps

Step	Calibration	Flash Sequence
1	Regulator Minimum Position	One – One
2	Regulator Maximum Position	One – Two
3	Regulator Rotation Rate – Increasing Speed	One – Three
4	Regulator Rotation Rate – Decreasing Speed	One – Four
5	Reverser Stop Position	Two – One
6	Reverser Maximum Forward Position	Two – Two
7	Reverser Maximum Reverser Position	Two – Three
8	Reverser Rotation Rate	Two – Four
9	Auxiliary 1 Off Position	Three – One
10	Auxiliary 1 On Position	Three – Two

## Restoring Normal Transmitter Operation

To restore normal transmitter operation, turn off the transmitter, and then turn it on again. The normal operating mode will be restored, using the current calibration settings.

This operation can be performed at any time during operation in calibration mode, and no change need be made to the **URC3** controller.

## A Cautionary Note

When setting maximum and minimum servo calibrations, you must make sure that the positions selected are within the linear operating range of the servo. If the selected position is outside the operating range – i.e. the servo is against an end stop, the servo will never be able to achieve its selected position. The effect of this is twofold:

- 1 The servo will draw a very large current continuously as it attempts to reach a position which is not achievable. Under these conditions, we have measured servo currents of 1A, instead of the usual operating current, while moving, of less than 100 mA and a current, when stationary, of about 20 mA. Excessive servo currents will very quickly flatten your batteries.
- 2 If the servo draws a very high current continuously, it will very rapidly overheat and may be permanently damaged either from overheating, or from stripped gears due to excessive torque.