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RC6-HH

With

**Turntable
Controller
Option**

Safe Wireless Motion
User Manual



RC6-HH with Turntable Controller Option - User Manual

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Revision 1.0, Oct 2014

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Disclaimers

WIRING AND INSTALLATION OF BATTERIES, MOTORS, LAMPS, AND OTHER ELECTRICAL COMPONENTS MUST BE IN ACCORDANCE WITH APPLICABLE LOCAL AND NATIONAL ELECTRICAL CODES.

RC4 Wireless devices and equipment are operated at the user's own risk and RC4 Wireless accepts no liability, either direct or consequential, as a result of using this or any other equipment.

RC4 Wireless does not guarantee the suitability of any product for any purpose; user assumes all risk. RC4 products must be used strictly in accordance with manufacturer's instructions and must not be used for unsupervised operation. RC4 Wireless products must be installed and operated only by qualified technicians, installed and used as outlined in the manufacturer's documentation, and should be inspected and tested on a regular basis to ensure proper and safe operation.

Not for Control of Pyrotechnical Devices

RC4 Wireless products should not be used to control pyrotechnics of any kind. RC4 Wireless accepts no liability if RC4 equipment is used for this or any other purpose.

Product Safety

Motor drivers, power drivers, and dimmers should not be allowed to operate at dangerous temperatures. Appropriately sized wire, connectors, and fuses/circuit breakers, as determined by local and national electrical codes and industry best practices, must be used. Suitable ventilation is required.

Additional information is provided in this manual, but this manual is not intended to be a comprehensive electrical safety guide.

Statements of RF Conformity

Operation of the RC6 Wireless Motion System is subject to the following two conditions: (a) this device may not cause harmful interference and (b) this device must accept any interference received, including interference that may cause undesired operation.

United States (FCC)

The RC6 system contains devices identified as FCC ID: MCQ-XBEE09P.
The RC6 complies with Part 15 of the FCC Rules.

Canada (IC)

The RC6 system contains RF Module XBEE09P, IC: 1846A-XBEE09P.
The RC6 system complies with IC ICES-003 Rules.

RC6 System Overview

The RC6 Safe Wireless Motion System provides a safe and reliable means for controlling motorized, battery-powered, untethered theatrical set pieces. Two transmitter types are available: the RC6-HH handheld model, and the RC6-RU rack-mount model.

RC6 Data Security and RF Range

Every RC6 transmitter is configured with a private, unique, and unalterable digital ID. Each RC6-RX remote data receiver is capable of decoding data only from the transmitter it is paired with.

It is not possible for multiple RC6 systems to cross-talk. Only devices from the same specific system, programmed with the correct transmitter digital ID, can intercommunicate.

The RC6 system operates in the 902-928Mhz Industrial / Scientific / Medical (ISM) RF band, using Frequency Hopping Spread Spectrum (FHSS) digital encoding. FHSS systems are resistant to interference, and multiple FHSS systems can effectively coexist and operate in the same RF band.

The reliable operating range typically exceeds 400 feet. (Useable range will vary with site conditions and must be determined through testing.)

RC6-HH Transmitter

The RC6-HH handheld transmitter is small and lightweight, with an array of controls for manually driving a set piece and monitoring the status of remote RC6 components. A large deadman pushbutton must be held by the operator during all movements; release of the deadman button will quickly stop the system.

The Turntable Controller Option sends wireless control data to a single RC6-1-MOT motor driver. The 1-MOT must be set up with an encoder for positional feedback.

Two control modes are provided: Jog Mode for manually spinning the turntable motor, and Target Mode to smoothly and accurately spin the turntable to preset positions.

Four presets can be configured, each with an encoder position, top speed, and acceleration rate. The acceleration rate is also used for deceleration; the servo process is start-to-finish symmetrical.

The values for each preset can be set using the RC6-HH User Interface. Enter the Setup Mode, select a parameter, and modify the value with the Dec/Inc buttons.

The position in a preset can also be captured from the current encoder position of the actual servo drive by pressing Dec and Inc simultaneously. This makes it easy to run the turntable to a desired location, then save that position as a preset.



Receiver

The RC6-RX receives digital radio signals from the transmitter, and delivers control data to RC6 motor drivers over short data cables.

This device is actually a transceiver, and also returns status information back to the transmitter from connected motor drivers.

Refer to the complete RC6 User Manual for additional details about connections and operation.



Motor Driver

The RC6-1MOT motor driver is a sophisticated bidirectional motor controller. It is capable of delivering up to 25A continuously at up to 30V (typically 24V), with built-in current limiting. A quadrature encoder input allows position tracking with 32-bit resolution. Four limit-switch inputs can be configured to stop the motor when closed or opened, or to reset the rotary encoder position to a preset value.

Up to eight axes are supported with one RC6 system. When using an RC6-HH Turntable Controller, only one RC6-1MOT is controlled, and it must be configured as Axis 1.

Refer to the complete RC6 User Manual for additional details about connections and operation.



RC4 MSS Motion Safety System

The RC4 MSS Motion Safety System is a heartbeat system that ensures reliable E-Stop functionality. A continuously changing control signal (the heartbeat) is generated at the transmitter. A heartbeat detector circuit in the RC6-1MOT driver, independent of other systems and not software-based, disconnects power to safety-critical devices if the heartbeat is too slow, too fast, or absent. In order to continue operating, the heartbeat must be continually changing state. If it stops while high, low, or anywhere in between, the heartbeat detector will shut things down.

Physical disconnection of power to critical devices is done with an external Main Contactor (MC) relay supplied by the user. The MC must be carefully selected to match the task at hand: it must operate at the voltage being used, and it must be able to reliably open connected circuits without contact welding.

When everything is operating normally, system software monitors the heartbeat and anticipates actions taken by the independent MC relay driver. Electronic power drivers are disabled before the MC contacts open, and are not enabled until after the MC contacts have closed. This ensures that little or no arcing occurs and MC contacts are maintained in optimal condition for as long as possible.

In the rare and unlikely case where something goes severely wrong, the Main Contactor relay may open when maximum power and current is flowing. It is the responsibility of the installer and user to be certain the MC contactor is correctly connected and capable of interrupting the highest possible loads.

RC6-HH Turntable Controller

The RC6-HH handheld transmitter is small and lightweight, with an array of controls.

A large deadman pushbutton must be held by the operator during all movements; release of the deadman button will quickly stop the system.

Internal Battery and Charging

The RC6-HH contains a NiMH 6V rechargeable battery. A suitable battery charger is provided with the device.

To avoid risk of fire and battery damage, use only battery chargers that are specifically designed for 6V NiMH batteries constructed with four AAA size cells. Chargers that auto-detect for a range of voltages are suitable, provided they will work at 6V.

If a battery charger is not available, a 6V power supply can be used. It will not charge the internal NiMH battery, but it will operate the RC6-HH. In any case, the DC inlet connector is center-positive.



User Interface

The RC6-HH User Interface consists of a two-line LCD display and four buttons: **Param Sel**, **Dec**, **Inc**, and **Save/Exit**.

When the device is in Jog Mode or Target Mode, pressing **Param Sel** will enter Setup Mode. To exit Setup Mode, Press **Save/Exit** to save changes, or turn the unit off and back on to abandon changes and restore previously saved settings.

Hidden Button Functions

To clear all internal settings in the RC6-HH to default values, hold the Param Sel button while turning power on, and continue holding the button until the screen briefly displays "Load Defs."

Setup Mode

From Jog Mode or Target Mode, press **Param Sel** to enter Setup Mode. The first or most recently changed parameter will be displayed on the LCD, with its current setting or value displayed below.

Press **Param Sel** repeatedly to advance through all available parameters. After the last parameter, the first is displays again, around and around.

Use the **Dec** and **Inc** buttons to change the value of the currently displayed parameter. For certain parameters, an external data value can be captured by pressing **Dec** and **Inc** together.

While in Setup Mode you can edit values for any and all parameters, as you like. When you are done making changes, press **Save/Exit** to save your modifications to non-volatile memory and exit Setup Mode.

If you do not press **Save/Exit**, none of your changes will be saved. If you turn off power without saving, the previous settings will be restored when you turn power back on.

Tn Enc Position

The RC6-HH Turntable controller provides four turntable position presets. For each preset, T1 – T4, an encoder position can be stored. This value is a 32-bit signed integer providing a range from -2 billion to +2 billion.

When Setup Mode is first entered, on the first press of the **Param Sel** button, the real encoder position of the remote RC6-1MOT motor controller is captured. That value can be assigned to a turntable position preset by pressing **Dec** and **Inc** together.

The captured encoder position is not updated if the remote piece is moved while the RC6-HH is already in Setup Mode. The encoder position within the RC6-1MOT will change, but the RC6-HH transmitter will not be aware of it. You must exit Setup Mode to capture the new remote position.

Tn Speed

The RC6-HH Turntable controller provides four turntable position presets. For each preset, T1 – T4, a transit speed can be stored. This is an 8-bit value from 0 – 255.

Tn Accel

The RC6-HH Turntable controller provides four turntable position presets. For each preset, T1 – T4, an acceleration/deceleration rate can be stored. This is an 8-bit value from 0 – 255.

Rem Low Batt Lev

The RC6-HH transmitter monitors the battery voltage at the remote RC6-1MOT motor controller and flashes a warning on the LCD display if that voltage drops below the setting of this parameter. It is a whole number representing 10ths of a volt. Thus, the value 100 is 10.0V.

When running a 24V system, the recommended Low Batt Level is 21.0V, a setting of 210. When running a 12V system, the recommended setting is 10.5V, a setting of 105.

Remote Status Display

This is the normal LCD display for both Jog Mode and Target Mode. The top line of the display indicates the Axis number (which is always A1 for Turntable control), the remote battery voltage, and the current draw in Amps for the remote turntable motor.

The bottom line indicates the current mode, the remote motor driver temperature, and the rotary encoder position of the turntable.

In Jog mode, the first character of the bottom line is "J." In Target Mode, the first character is "T" followed by the number of the currently selected Preset Target Position, from T1 to T4.

If the remote RC6-1MOT motor driver is powered and functional, the screen will indicate "No RX Data."

Preset Target Selection

In either Jog Mode or Target Mode, the current Preset Target can be selected with the **Dec** and **Inc** keys.

Hold the button when pressing it to display the encoder position value saved with the selected preset.

Use Setup Mode to change the values associated with each preset.

Jog Mode

Jog Mode provides a simple and intuitive means of spinning the turntable motor back and forth while monitoring encoder position.

Mode Toggle Switch

Set this switch to Alt (the up position) to select Jog Mode.

Deadman Button

The large square deadman button in the center of the RC6-HH must be held down while operating the remote motor.

Releasing the deadman button while an axis is moving will cause an emergency motor stop, bypassing the deceleration setting. Avoid doing this! Always stop the motor normally, then release the deadman button.

Joystick Left/Right

In Jog Mode, the X/Y Joystick at the top of the RC6-HH sets motor speed and direction on the X axis.

Press the joystick handle to the left to spin the motor counter-clockwise. The further left you push, the faster the motor will run.

Press the joystick handle to the right to spin the motor clockwise. The further right you push, the faster the motor will run.

With the joystick handle in its spring-loaded center position, the motor will be stopped. Let go of the joystick and the motor will decelerate – a smooth, controlled stop. Do this before releasing the deadman button.

Accel Rotary Control

This rotary control sets the acceleration and deceleration rate for Jog Mode. Lower settings result in slower changes in velocity; higher settings result in quick changes.

This control works in real-time, even while the motor is in motion.

Top Speed Rotary Control

This rotary control sets the top speed for Jog Mode, scaling the range of the joystick. Lower settings provide greater control at slow speeds with the joystick.

This control works in real-time, even while the motor is in motion.

Save/Exit Button

While in Jog Mode, the Save/Exit button displays the local battery voltage in the RC6-HH.

Target Mode

Target Mode is used only to move the turntable between position presets. No manual control is provided in Target Mode.

The joystick and rotary controls have no effect in Target Mode.

Mode Toggle Switch

Set this switch to Normal (the down position) to select Target Mode.

Deadman Button

The large square deadman button initiates servo movement of the turntable to the currently selected preset target position (T1, T2, T3, or T4).

The deadman button must be held for the entire time the turntable is executing the servo move. If the deadman is released, pressing it again will re-initiate the move using with programmed acceleration setting.

Releasing the deadman button while an axis is moving will cause an emergency motor stop, bypassing the deceleration setting. Avoid doing this! Always stop the motor normally, then release the deadman button.

Save/Exit Button

While in Target Mode, the Save/Exit button displays the local battery voltage in the RC6-HH.

Is it not recommended to check transmitter battery voltage while a servo movement is underway. Use this feature while the turntable is stopped and idle.

Setting Up a New Turntable System

To set up a new turntable system, follow these steps:

- Operate the RC6-HH transmitter in Jog Mode.
- Follow the RC6-1MOT initial setup steps to ensure motor direction and encoder count direction are correct.
- Use a 1MOT limit-switch input to clear the encoder to zero. The Lim4 input serves this purpose by default, clearing zero when the terminals are shorted. A simple momentary pushbutton connected to Lim4 will act as a Set Zero button.
- If necessary (it may not be), make PID and Acceleration adjustments in the 1 MOT motor driver.
- Experiment, cautiously, with short-range target presets in Target Mode. Use low settings for Accel and Speed, then increase these settings after each careful test, until you have determined the range of settings that work well with your turntable machine.
- If necessary (it may not be), make additional PID and Acceleration adjustments in the 1 MOT motor driver.
- Create longer-range target tests in Target Mode.
- When setting up real target presets for an actual show, be sure to set zero in the 1MOT at an appropriate predetermined position. Use Jog Mode to find each target position, then save the captured encoder value in Setup Mode by pressing Dec and Inc together for the Enc Position parameters.
- For each new target position, you must exit Setup Mode, find the next position using Jog Mode, then re-enter Setup Mode to save the new captured position.
- You can fine-tune preset encoder position with the Dec and Inc buttons, to simply decrement or increment the displayed value.
- Always exit Setup Mode with the Exit/Save button to ensure your new settings are stored in non-volatile eeprom memory.

Troubleshooting

Please contact RC4 Wireless for assistance.

Additional information will be added to this section in a future revision of this document.

Contact RC4 Wireless

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