RC5

4DIM

Series 2
High Security
Wireless Dimmer

Quick Start Guide

Overview

The RC4Wireless **RC5-4DIM** is a low-voltage 4-channel wireless dimmer. It communicates with **RC5** Wireless DMX Transceivers. **The RC5-4DIM** makes it easy to put lamps, motors, relays, solenoids, and more, in hand-held props, moving set pieces, and other hard-to-reach or mobile positions and locations.

RC5-4DIM will operate with 6V to 30VDC input and provide up to 100W per output at 12VDC. **RC5-4DIM** uses a high-efficiency switching power supply and high-frequency pwm (pulse-width-modulation) dimming to provide high output power with minimal heat and power loss. Dimmer outputs are thermally protected and overload protected. Under most fault conditions, individual dimmers will safely disable themselves until the problem is corrected.

Disclaimers

WIRING AND INSTALLATION OF BATTERIES, DIMMERS, AND LOADS MUST BE IN ACCORDANCE WITH APPLICABLE LOCAL AND NATIONAL ELECTRICAL CODES.

Not for Use Where Human Safety May Be At Risk

RC4 Wireless accepts no liability for direct, indirect, or consequential damages resulting from the use of any RC4 Wireless product or group of products. RC4 Wireless does not guarantee the suitability of any product for any purpose; user assumes all risk. RC4 dimmers must be used strictly in accordance with manufacturer's instructions and cannot be used for unsupervised operation. RC4 Wireless products must be installed and operated only by qualified technicians, as outlined in the manufacturer's documentation, and should be inspected and tested on a regular basis to ensure proper operation.

Not for Control of Pyrotechnical Devices

RC4 Wireless dimmers should not be used to control pyrotechnics of any kind. A brief output surge during power-up could trigger these devices. RC4 Wireless accepts no liability if RC4 equipment is used for this or any other purpose.

Product Safety

RC4 dimmers are capable of controlling very large currents at up to 30VDC (typically 12V or 24V). Dimmers should not be allowed to operate at dangerous temperatures. Appropriately sized wire and connectors must be used, along with suitable ventilation and external fuses rated for the load being operated.

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 equipment.

RC5-4DIM Hookup

RC5-4DIM is easy to hook up. All wiring is done with Anderson Powerpole connectors. Input power, usually from 12V rechargeable batteries, enters on the RED+ and BLACK- terminals. Each of the 4 dimmer outputs has a YELLOW+ and GRAY- terminal for direct connection to load devices.

The logic and dimmers in **RC5-4DIM** will operate with input voltages from 6V to 30VDC.

It is important that the supply voltage does not drop below 6V under full load. If the voltage dips too low, the logic will restart. This can result in output flicker or oscillation: the logic comes on, activates the load, the supply voltage drops under load, the logic goes off, the load is turned off, the voltage rises, the logic comes back on… and so on.

Maximum output power for each dimmer channel is conservatively rated at 100W. The power devices used are rated for a peak current of 42A, with an on-resistance of just 0.02 ohms. Thus, the theoretical maximum power handling at 12V is just over 500W per channel. In reality, surge currents, heating, and the current carrying capacity of the device leads and circuit-board traces limit the realistic maximum to something much lower.

Duty cycle also plays a role in determining maximum power. Given the ratings of the components, a 500W load could be handled for a brief time. But if a load is to be on for prolonged periods (i.e. hours at a time) then a load of less than 100W is recommended.

RC5-4DIM dimmers disable themselves if they overheat. If you find that large loads go off by themselves, this is probably what has happened. This problem can sometimes be resolved by improving ventilation, or re-orienting the dimmer so that the hot surface faces upward.

An internal automotive fuse is accessible by removing the bottom cover of the **RC5-4DIM**. (It has been bent over to clear space for the circuit board and components on the nearby radio board.) This fuse is in the positive+ leg of the power circuit. The dimmers deliver switching power on the negative- leg of the circuit. Thus, higher power levels and better circuit isolation can be achieved by returning load circuits directly to the positive+ power supply outside the **RC5-4DIM**, through appropriate external fuses. In this case, the yellow+ Anderson terminals are not used.

***More information about Anderson connectors is available at
http://www.andersonpower.com/products/singlepole-connectors.html***.

If your loads are small, use smaller fuse values to provide the best circuit protection. It is also advised to use a safety fuse right at the source battery terminals. This protects wiring and connectors leading up to the **RC5-4DIM**, as well as the **RC5-4DIM** itself and any connected load wiring.

Controls and Settings

All **RC5-4DIM** settings and indicators are recessed under holes in the case. Each dimmer channel has a pushbutton and an LED. There is also a *Channel Assign* button.

The red +V Logic LED indicates that the high-efficiency switching power supply is working, and 5V power is available to the internal radio receiver, microprocessor, and dimmers.

The COP (Computer Operating Properly) LED indicates that the **RC5-4DIM** microprocessor is working as it should. In some cases, different modes of operation are indicated by different blinking speeds and patterns.

The DMX Data LED indicates that the internal RC5 receiver board is producing valid dmx data packets.

RC5-4DIM Dimmer Test Modes

The button for each dimmer will momentarily turn the dimmer on at 75% when pressed. The indicator LED will come on, along with the connected load. Use this to check your wiring, connections, and lamps.

Dimmer indicator LEDs are after the internal fuse and will not light if the fuse is blown.

Assigning DMX Channel and Dimmer Curves

Channel setup requires an RC5 transmitter and a DMX data source. You must be able to bring all DMX channels to zero, and bring up one channel at a time to a specific level.

A portable* Lil' DMXter *or* Fleenor Gizmo *can be used if your regular console is inconvenient for this.

When you press the appropriate recessed buttons on the **RC5-4DIM**, it determines which channel is currently on, and what level it is at. That channel can be assigned to any dimmer, and the level of the channel determines which dimmer curve will be used.

Here is the procedure:

1. Zero all DMX channels.

2. Bring up a single DMX channel you wish to assign to a dimmer. When setting the dimmer, the level of the channel will determine the dimmer curve. There are three options:
    -   0-25% ignored, considered off
    -   25% - 49% selects inverse square law for LEDs
    -   50% - 74% selects linear curve for incandescent lamps (MR16, etc.)
    -   75% - 100% selects non-dim switch mode

3. With the desired channel up at the transmitter, go to the **RC5-4DIM** receiver-dimmer. Press and HOLD the Chan Assign button while momentarily pressing the button for the dimmer you wish to assign.

For example, to assign the currently active DMX channel to dimmer C, hold Chan Assign and tap the DimC button. The dimmer will come on when you release the buttons.

While the button are pressed and the channel is being assigned, the dimmer will switch off, and the COP indicator will blink rapidly. When you release the buttons, the COP indicator will restore to normal, and the dimmer will assume the level of the selected DMX channel.

That's it – the unit will remember the channel assignment and dimmer curve forever until you change them.

More About Dimmer Curves

ISL and LEDs

RC5-4DIM pwm dimmers are capable of very high resolution, making them ideal for smoothly dimming LEDs. To look smooth to the human eye, LEDs must be dimmed with an Inverse Square Law (ISL) curve, demanding very small changes in level at the bottom of the curve. At maximum resolution, **RC5-4DIM** can deliver ISL dimming with 16,384 steps, so a single step level change represents 0.0061% of full level. Compare this to standard linear DMX dimmers with 256 steps that each represent 0.3% of full level.

To achieve maximum resolution, the frequency of pwm pulses must be decreased. With 16,384 steps, **RC5-4DIM** still updates levels 750 times per second. Compare this to the 60 Hz power line driving conventional fixtures.

The disadvantage of updating at 750Hz is that it can be audible. If an incandescent lamp is used with the highest resolution ISL curve, the filament will noticeably sing.

For the highest possible ISL performance, all 4 RC5-4DIM dimmers must be set for ISL output.

Linear and Incandescent Lamps

When a linear dimming curve is used with an incandescent lamp, resolution is less critical, and singing filaments can be annoying. To achieve the lowest lamp noise, the frequency of pwm pulses must be increased. With 1024 steps, **RC5-4DIM** updates levels 25,000 times per second. This is well above human hearing, and still provides a resolution that is 4 times higher than traditional DMX dimming.

For high-frequency silent operation, all 4** RC5-4DIM **dimmers must be set for linear output.

Non-Dim

Some loads, including relays and power inverters, must be provided with simple on/off non-dim power. The non-dim output option ensures this will be the case, and includes level hysteresis: the source DMX level must rise about 53% to turn on, and drop below 47% to turn off. This ensures that the load will not oscillate if the source signal is jittery or sitting around 50%.

Non-dim mode is less complicated than pwm dimming and can provide faster responsiveness. While responsiveness is never a problem in any **RC5-4DIM** output mode, the fastest possible control routines are used when all 4 **RC5-4DIM** dimmers are set for non-dim output.

Mixing ISL and Linear Outputs – A Compromise

Of course, there will be times when a mix of LEDs and incandescent lamps must be operated from a single **RC5-4DIM**. The hardware of the **RC5-4DIM** requires that all 4 dimmers share the same base frequency and resolution, so a compromise is required when producing different dimming curves for each dimmer output. In this case, the pwm frequency is dropped to 12kHz, which is very high and produces minimal filament ring. The resolution for ISL is 2048 steps, which is far below the smooth perfection of 16,384 steps, but still far better than what would be seen with a traditional 256-step dimmer.

If any two** RC5-4DIM **dimmers are set for different output curves, the compromise frequency and resolution will be used. Linear and ISL curves are still provided, but they share the base resolution of 2048 steps at 12kHz.

For optimal performance with different dimmer curves in the same location, use multiple** RC5-4DIM **units.

RC5-4DIM Preliminary Specifications

RF

Frequency Range of operation: 902 - 928 MHz

Dimmers

Maximum Internal Fuse Current: 40A

Power Input: 6VDC – 30VDC (12V typical), 100mA minimum, plus
                      requirements of connected dimmer loads.

Dimmer Outputs: 4 individual dimmer channels, each with independently
                      assignable DMX channel and dimmer curve.

Maximum PWM Frequency (Linear Curve):   25kHz at 10-bit resolution
Maximum PWM Resolution (ISL Curve):   14-bits (16,384 steps) at 750Hz

Dimmer Technology: MOSFET PWM (pulse-width-modulation)
Absolute Maximum Output Current per Dimmer: 40A
Absolute Maximum Input Voltage: 30VDC
Typical Continuous Output Current per Dimmer: 10A
Surge Clamping Voltage: 42V

**RELIABLE TOTAL OUTPUT POWER IS LIMITED BY DUTY CYCLE, AMBIENT
TEMPERATURE, AND CIRCUIT-BOARD TRACE SIZE.**

User changeable Bussmann ATC load **fuse should not exceed 40A** and should be
fast-blow type. A lower fuse value should be used whenever possible.

How to Reach Us

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