

RC4 
Wireless Dimming
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FlexTX

RC4 System User Manual



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Soundsculpture - *Solid State of the Arts.*TM

1-866-258-4577

www.theatrewireless.com

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

Soundsculpture devices and equipment are operated at the user's own risk and Soundsculpture Incorporated accepts no liability, either direct or consequential, arising from the use of this equipment.

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The Soundsculpture RC4 radio system has not been evaluated by any safety agency for use where human safety may be at risk. Soundsculpture Incorporated accepts no liability if RC4 equipment is used for such purposes.

Not For Control of Pyrotechnical Devices

Soundsculpture RC4 receivers should not be used to control pyrotechnics of any kind. A brief output surge on dimmer outputs during power-up could trigger these devices. Soundsculpture Incorporated accepts no liability if RC4 equipment is used for such purposes.

Product Safety

RC4-TXD-Series transmitters are designed to meet or exceed applicable UL, CSA, and CE standards. They pass the dielectric withstand test (hipot) to 3000VAC. They use UL- and/or CSA-listed components where required, and are packaged in a grounded metal chassis. A Special Inspection label applied by the Electrical Safety Authority (ESA) of Ontario, Canada, is available on request.

The RC4-RX4-Series receiver/dimmers are capable of controlling very large currents at 12VDC. RC4 plastic cases, used because they are transparent to radio signals, are highly flame retardant. Nonetheless, dimmers should not be allowed to operate at a dangerous temperature. Appropriately sized wire and connectors must be used, along with suitable ventilation and external fuses rated for the load being operated. Additional information is provided in this manual.

Soundsculpture devices and equipment are operated at the user's own risk and Soundsculpture Incorporated accepts no liability, either direct or consequential, arising from the use of this equipment.

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RC4 FlexTX System Overview

The **RC4 wireless dimmer system** is an enhanced 4th-generation digital system for operating theatrical lighting, motors, and solenoids. It offers improved performance over previous Soundsculpture RC-Series systems, with more channels and a user interface that allows receivers to be configured remotely from the transmitter. **Spread-spectrum RF technology** ensures a secure, robust, and high-speed wireless link between all system components, and does not require special licensing for use anywhere in North America and specific locations around the world. (A special version of the RC4 is available for use in Australia.)

The **FlexTX rack mount transmitter** is a digital DMX device, compliant with the USITT DMX512/1990 (4uSec) standard. Twelve 0-10V control voltage inputs are also provided. Eight are true analog inputs with 256-step resolution, the remaining four are switch inputs. Any DMX or CV input can be patched to any of up to 128 wireless control channels (referred to in this manual and on the transmitter display is “rf channels”). The user may select how many wireless channels they wish to use, from 4 to 128 in increments of 4 (the default is 64 channels).

Up to 128 RX4 receiver/dimmers (STANDARD, MINI, or HO) can be configured and managed from the transmitter, and each provides **4 individually addressable dimmers built in**. All RX4 receivers can be operated from **8V to 18VDC** (receivers for 24V use are available by special order). Using the **Reference Voltage Dimming** feature, 12V lamps and other loads can be safely powered using batteries of a higher voltage. For example, 14.4V and 18V NiCad and NiMH batteries are readily available for portable power tools. Dimmers can be configured for **linear** dimmer output, **inverse-square-law** output (ideal for LEDs), or **switch mode**. The **Digital Persistence** feature is particularly useful with LEDs, smoothing their response for a very pleasing effect that mimics the fluid appearance of incandescent lamp dimming.

RX4-STANDARD receivers provide four pulse-width-modulated (PWM) dimmer outputs, each capable of delivering 150W into any kind of load (typically halogen lamps). Each dimmer can be individually assigned to any RC4 wireless control channel. Outputs assigned to the same channel can be externally wired in parallel to drive large loads. The total power handling of the RX4-STANDARD is limited to 500W by the capacity of the printed-circuit board traces and connector pins; components are substantially over-rated to ensure long life.

RX4-HO high-output receivers are similar to standard receivers but have a higher power capacity through heavier copper on the printed-circuit board, a cooling fan, and larger MOSFET components (the power transistors that do the work). Each HO dimmer can deliver 250 watts, with a maximum power limit for the entire receiver of 1000W.

For small spaces, the **RX4-MINI** is half the size of the other RX4 receivers. Ideal for tiny props or hiding in costumes, the MINI receiver can deliver 50 watts per channel, with a maximum power limit of 200W. The electronic assembly of the RX4-MINI can be removed from its chassis for even more flexibility when mounting in very small props or costumes.

Summary: Choose how many wireless channels you want (up to 128). Assign DMX and CV inputs to those channels. Assign each dimmer in a receiver to a wireless control channel. Configure each dimmer for optimal performance with the connected load.



Getting Started – Setting Up RC4 Components

Items You Do NOT Need to Get Started

RC4 systems may ship with some extra items that are *not* needed to get started, including:

- 12VDC power adaptor
- Short 25-pin D-Sub data adaptor cable
- Short data adaptor for use with MINI receivers
- Various extra connector shells, pins, etc.

Put these items in a safe place where they can be found in the future. More information about the power and data adaptors can be found in the Radio Settings section of this manual. If you have not received these items, don't worry – they are readily available if you need them in the future.

Parts of the RC4 System

The RC4 system consists of a rack-mount transmitter, transmitter transceiver, and one or more receiver/dimmers. Before the system can be used, each item must be properly set up and connected.

Transmitter



The FlexTX transmitter, the top-off-the-line model in the RC4-TXD-Series, is a 4-inch deep 3U rack chassis. Control signals are sent to a remote spread-spectrum radio transceiver via a supplied 25-pin D-Sub cable, and this transceiver communicates with radio-dimmers on stage. The 25-pin cable carries both power and data to the transceiver. Connect the rack chassis to the transceiver with this cable, and position the transceiver so the top surface is facing towards the receiver/dimmers (usually towards the theater stage).

The transceiver antenna is under the top surface of the case, as indicated on the transceiver label. No AC adaptor is required to power the transceiver – it is powered by the D-Sub data cable.

The spread-spectrum radios of the RC4 system will work through walls and other barriers to a distance of several hundred feet. This range will be reduced, however, by the density of obstructions, other radio activity in the 907 - 921Mhz band, and wide-band interference generated by nearby lamps, motors, etc. (including loads connected to RC4 receivers themselves). Line-of-sight from the transmitter transceiver to each RX4 receiver is great where possible, but is not essential.

The FlexTX includes a World-Voltage switching power supply that will operate safely with input voltage from 85VAC to 265VAC, 47 to 440Hz.



The transceiver shown here is grey. Production units are usually black.

Connect a DMX source to the DMX input on the transmitter. The FlexTX DMX input is not terminated. A terminated cable or in-line termination connector must be used if termination is required (i.e. the transmitter is at the end of the DMX line). In general, a 120-ohm resistor between pins 2 and 3 of a DMX connector will provide adequate termination.

Analog 0-10V control voltage (CV) inputs are also provided. These inputs are indicated on the LCD as CV1 to CV12 with levels displayed similarly to DMX levels. The input impedance of the analog CV inputs is 20K-ohms. It is best to drive these inputs with a low-impedance source. DMX and CV inputs can be mapped to dimmers in any combination and used simultaneously.

Receiver/Dimmers



Each receiver/dimmer must be set up with a charged battery and up to 4 lamps or other loads. For most applications, all of this can be done with a single 10-pin connector. Please review the Receiver Operation section of this manual for pin-out details and other information. The most popular batteries are 12V, but any battery from 8V to 18V may be used. In practice, 9V and 9.6V batteries are the lowest suitable power supply, allowing for a reasonably useful life before voltage decays to 8V under load.

Output channel assignments are configured from the transmitter.

Radio and dimmer control electronics will not operate properly with less than 8V of incoming power. This voltage must be maintained under load. Choose appropriately sized batteries and keep them charged.

Receiver electronics may be damaged by over-voltage. Do NOT operate at voltages higher than 18VDC.

FlexTX Transmitter Operation

The FlexTX Transmitter User Interface – Overview



All RC4-TXD-Series user-interfaces consist of a 16-key keypad, a 20-character x 2-line LCD display, and a rotary control. The rotary control can also be pressed as a button, usually the equivalent of the **Select / Enter** key.

Twelve of the keypad keys are used to select a function or function-group:

- The green keys invoke transmitter DMX channel assignment settings.
- The yellow keys invoke receiver settings.
- The blue keys are test functions.

The bottom 4 keys include **Exit** to escape any previously invoked function, generic user-interface functions **Left/-/No** and **Right/+/Yes**, and the **Select / Enter** key.

In some cases, the screen will show a number of parameters on screen. The **Left/-/No** and **Right/+/Yes** keys move the cursor between parameters, and the blinking cursor indicates the parameter that is active for editing with the rotary control.

The value of the selected parameter is adjusted by turning the rotary control. In most cases, the new value is saved by pressing the **Enter** button on the keypad, or pressing the rotary control knob. In other cases, as when adjusting RX receiver parameters before sending them to a receiver, values will remain as displayed while you navigate between parameters and screens.

In some modes, as when editing a DMX/CV Assignment, the **Left/-/No** and **Right/+/Yes** keys increment or decrement a specific value on the screen, usually the RF channel (-/+). This is the case when there are only two parameters on screen – one adjusted with the rotary control and the other with the -/+ buttons.

To escape any mode and return to the main *Watch Channels* screen, press **EXIT**.

WARNING: For test purposes, some FlexTX firmware versions includes a transmit interruption feature. From the main Channel Watch page, wireless channels will stop being sent when the Select/Enter key is pressed, and will resume when the EXIT key is pressed. The small rectangular Transmit LED on the transmitter transceiver indicates when channels are being transmitted. If it is not steadily shimmering, press EXIT to resume transmission.

TXD-Series Keypad Map

Set DMX Start Channel & Number of Channels	Edit Individual DMX and CV Channel Assignments	Save DMX Setup	Recall DMX Setup
Select Receiver RX Number / Get RX Status	Set RX Channel Assignments	Set Other RX Parameters	Send RX Config
Copy RX Setup to Scratchpad	Paste RX Setup from Scratchpad	Manual Channel Test & Channel Chase Enables	Auto-Chase Channel Test
Exit / Watch Channels	Move Left / Decrement / No	Move Right / Increment / Yes	Select / Enter

The Main Screen – Watch Channels

The FlexTX transmitter powers up to the *Watch Channels* screen. Using settings recalled from memory, the system immediately begins “spooling” the selected DMX and CV channels to the radio link. When RC4-RX4 receiver/dimmers see data with the correct system ID and channel, they respond as programmed.



In *Watch Channels* mode, the transmitter display indicates the number of wireless control channels currently configured (up to 128), and the real-time value of a selected DMX or CV input. The rotary control rolls through 512 DMX channels and 12 CV channels – a total of 524 possible settings. If the displayed channel is assigned to a radio channel, the assignment is displayed. To get to a distant numeric value more quickly, the **Left**/-/No and **Right**/+/Yes keys change the currently displayed channel in increments of 10 channels up and down with auto repeat.

The Watch Channels screen lets you monitor any DMX channel in the connected DMX universe, not just those assigned to wireless control channels. This makes it useful as a general DMX data tester.

Set DMX Start and Number of Channels (Contiguous Block of Channels)

The quickest and easiest way to assign DMX channels to radio dimmers is to use a contiguous block of DMX channels. In this case, only the first channel and the total number of channels need be specified. CV inputs cannot be assigned this way, but can be added by editing individual assignments afterward (more information below).

Press **Set DMX Start**. The LCD screen will indicate the DMX start and end addresses, and the total number of channels being assigned for wireless use. The *Start* channel and total number of *Chans* can be set. The *End* channel is calculated and displayed the system.



You can exit this screen without making changes by pressing the Exit button.

Use the **Left/-/No** and **Right+/Yes** keys to move the cursor between Start and Chans. Set the value of the selected parameter with the rotary control.



When the desired values are indicated, press the rotary control button or the **Enter** key.

*This action overwrites the current DMX channel assignments.
It does not affect saved DMX Setups.*



The screen will display a series of confirmations as the radio transceiver module is reconfigured, concluding with a confirmation of the selected settings.



Finally, the screen returns to the Watch Channels screen.



When setting high start addresses the channel assignments may wrap around from DMX512 to DMX001. In this case, CV channels are not included in the wrap around. CV channels cannot be assigned in this mode, they must be assigned using the **Edit DMX/CV Assigns** function (more info below).

Edit Individual DMX and CV Channel Assignments

To create a more sophisticated channel map where assignments are not contiguous and CV inputs are also available, press the **Edit DMX/CV Assigns** key. The screen will display the current assignment for the first wireless control (rf) channel.



Map DMX373 to rf 01

In this mode, the rotary control sets the DMX / CV source, while the **Left/-/No** and **Right/+ /Yes** keys select the target wireless control (rf) channel. When a desired combination is displayed, press **Enter** or the rotary control button to save the new assignment. Only one source can be assigned to each target rf channel.



Map DMX434 to rf 91
Press Enter to Save



Map DMX434 to rf 91

Similar to *Watch Channels* mode, the rotary control will scroll through CV inputs above DMX 512 and below DMX 1. This makes it easy to assign any of the 12 available CV inputs to any rf dimmer channel, with the rotary control providing access to 524 sources (512 DMX channels and 12 CV channels).



Map CV-08 to rf 87
Press Enter to Save



Map CV-08 to rf 87

Use Set DMX Start to create a map that is close to what you need. Then use Edit DMX/CV Assigns to add CV channels and adjust your channel assignments.

Save DMX Setup

Note: Current channel assignments are maintained even if you don't save them in a DMX Setup. Save and Recall of DMX Setups is provided to facilitate switching between different channel maps you may need for different shows, theatres, etc.

Three DMX/CV channel assignments can be saved. Each set of assignments is called a *DMX Setup*, even though they may also include CV inputs.

To save the current assignments you have created using the **Set DMX Start** and/or **Edit DMX/CV Assigns** functions, press **Save DMX Setup**. Use the rotary control to select the destination memory location 1-3, then press the **Enter** key or the rotary knob to execute the save.



Upon execution, any previously stored settings in the selected memory location are overwritten.

When the save is complete, you are returned to *Watch Channels* mode.

Recall DMX Setup

Note: Current channel assignments are maintained even if you don't save them in a DMX Setup. Save and Recall of DMX setups is provided to facilitate switching between different channel maps you may need for different shows, theatres, etc.

To recall an assignment map for current use, press **Recall DMX Setup**. Use the rotary control to select the source memory location 1-3. Press the Enter key or the rotary knob to execute the recall.

Upon execution, previous settings are overwritten with the settings from memory.

Transmitter Channel Test Functions

It is often desirable to test dimmers at times when DMX data is not available. The FlexTX transmitter provides two very useful options to accomplish this.

DMX and CV inputs are not interrupted when test modes are invoked. Only the channel currently being tested is overridden. Test modes could, therefore, be used intentionally during a running show, in combination with the DMX and CV inputs.

It is important to be aware of any incoming DMX or CV data that may appear on live dimmers, even when a test mode is being used.

Manual Channel Test

Invoked by pressing the **Manual Channel Test** button, this mode allows a radio dimmer channel to be manually faded up and down. The channel is selected using the **Left/-/No** and **Right/+ /Yes** keys. The level is adjusted in real-time with the rotary control. In addition, three levels of control resolution are provided: coarse (25-step increments), medium (5-step increments), and fine (1-step increments). Pressing the rotary control button cycles through these three options.

The Manual Channel Test screen indicates the control resolution (c, m, or f), current level (0 – 255), current wireless control (rf) channel and corresponding DMX or CV input channel, and whether or not this channel will chase (Yes or No) in the Channel Chase Test (more information below).



The Chase parameter is used by the Channel Chase Test function (described below). Toggle between Yes and No for the currently displayed rf channel by pressing the **Select/Enter** key.



Escape test mode by pressing the **Exit** key.

Channel Chase Test

FlexTX transmitters also feature a built-in chaser, ideal for testing a series of RC4 dimmer channels automatically and continuously. The chase process smoothly fades up and down from zero to 255 and back to zero, stepping through channels with the Chase parameter enabled from Manual Channel Test mode.

The speed of the chase is set with the rotary control. At the slowest speed, each channel fade is clearly visible and takes 3 to 4 seconds. At the fastest speed, channel stepping occurs at approximately 4 channels per second.



Select which channels will be part of the chase by pressing the **Manual Channel Test** key and making changes there. You can then return to the chase by pressing **Channel Chase Test**. It is not necessary to press **Exit** between these modes.

Escape test mode by pressing the **Exit** key.

RX4 Dimmer Settings (Done at Transmitter)

Each RX4 radio-dimmer watches for two different kinds of data packets coming from the transmitter:

- dimmer levels
- control/setup information

In either case, the correct system ID must be in the packet or the data will be ignored. This ensures that other RC4 transmitters will not control your receivers, and vice-versa.

Channel assignments and other settings for each radio dimmer are made at the transmitter, then uploaded to the corresponding receiver by using the **Send RX Config** function.

Dimmer configurations are stored both in the target receiver and in the transmitter. This makes it easy to create all your receiver configurations in advance, even if you do not have all your receivers powered up and “Active”.

The FlexTX transmitter provides a host of new setup features not available with previous RC4 systems. For each individual dimmer, the following selections are available:

- Wireless **Channel** (rf) Number (up to 128 available)
- **Dimmer Curve**: linear, inverse-square-law, or switch mode
- **Low Level Cut-Off**: levels below this setting are reduced to zero
- **Voltage Reference Dimming** level: sets the maximum average output voltage from 0.1V to 19.9V, or input battery voltage (no reference dimming)
- **Digital Persistence**: inserts a high resolution vector (fade) between the last dimmer value and the next one, reducing visible stair-stepping when using very fast light sources (particularly LEDs)

Select Receiver RX Number / Display Receiver Status (Battery Voltage)

Receivers are identified by their RX number, ranging from RX001 through RX128.

To select a receiver/dimmer for configuration, press **Select RX**. The block cursor will blink over the RX number on the transmitter LCD. Use the rotary control to set the RX number. As you scroll through RX numbers, the transmitter looks for live receivers. When it finds one, a small “A” is displayed beside the RX number on the transmitter LCD to indicate the presence of an Active receiver.



For any Active receiver, at any time, you can press and hold the **Select RX** button to display status information including the firmware version and current battery voltage. If no Active receiver is found, the message “NOT FOUND” is displayed.



or



When changing receiver setup parameters, it is not necessary to press Enter, but these values do not take effect until they are sent to a live dimmer unit using Send RX Config.

Press **Exit** to return to *Watch Channels* mode.

NOTE: Some receivers may contain customized firmware for special applications. A specific RXnum is required to activate these custom processes. For example, a custom dual-motor speed control might be activated by using RX128. Customized receivers usually default to their special functions if defaults are loaded using the receiver's recessed buttons. Refer to the documentation supplied with your customized receiver for additional information about your specific unit.

Set RX Channel Assignments

Each RC4-RX4 receiver/dimmer has four outputs. These outputs can be assigned to any wireless control (rf) channel. Even if you never adjust any other parameter, you will probably need to assign channels.

First you must select the RX number to be edited using the **Select RX** function. You can proceed to modify the configuration for this receiver regardless of whether or not it is powered up and Active. The receiver must be Active, however, to successfully upload your configuration to that receiver. All configuration settings are stored in the transmitter as well as the target receiver, allowing you to do your configuration programming before you set up your receivers.

To assign dimmers to specific control channels, press **Assign RX Chans**. The screen will indicate the selected RX number, the currently assigned control channels for the four dimmers (top line of the LCD), and the corresponding DMX or CV channels currently mapped (bottom line of the LCD). Use the **Left/-/No** and **Right/+/Yes** keys to move the cursor between dimmers.

If the selected receiver is Active, the transmitter will retrieve and display current settings from the receiver itself. Otherwise, the transmitter will use the settings stored locally.

RX4 receivers running firmware 3.008 or higher support all parameters of the FlexTX transmitter, and are also backward compatible with earlier TX32D and TX64D transmitters.

Receivers with firmware 2.xxx or earlier cannot be used with the FlexTX transmitter.

On the top line of the LCD display, each channel number has a small symbol to the left indicating the dimmer curve. A straight slant is linear, a curved slant is inverse square law, and a stair step is switch mode.

	(cursor here)			
<u>Dimmer 1</u>	<u>Dimmer 2</u>	<u>Dimmer 3</u>	<u>Dimmer 4</u>	
square law	square law	linear	switch	
chan 1	chan 120	chan 3	chan 4	



Receiver	DMX	DMX	DMX	DMX
RX001	373	492	375	376
(Active)				

Press the **Exit** key to escape back to *Watch Channels* mode.

The corresponding DMX/CV channels will change if the current DMX Setup is changed.

Set Other RX Parameters

In addition to a channel assignment, dimmer outputs have other parameters, as outlined below. For simple applications of wireless dimming, the default settings for these parameters are probably adequate (perhaps even ideal). But if you are using very large lamps and/or motors, alternative types of batteries at various voltages, or LEDs, these additional parameters are very powerful and substantially enhance the performance of the RC4 system. At the time of this writing, no other wireless dimming system provides functionality even remotely comparable.

These parameters can be edited by pressing **Set RX Params** and moving the cursor with **Left/-/No** and **Right/+/Yes** keys. The value under the cursor can be edited by turning the rotary control.

Multiple presses of **Set RX Params** scrolls through multiple setup pages with additional parameters. The first press invokes the settings for Low Level Limits and Dimming Curves, which are accessed from the same page. A second press of **Set RX Params** invokes settings for Voltage Reference Dimming. Finally, a 3rd press of **Set RX Params** invokes settings for Digital Persistence (dimmer smoothing).

Low Level Limit

Each dimmer output has a range of 1328 dimmer levels, implemented as a PWM (pulse-width modulation) signal at a base frequency of approximately 75Hz. This high internal resolution – much higher than the 255 step resolution of DMX itself – is the core of our very smooth square-law dimming and Digital Persistence smoothing features. Many competing DC dimmer systems provide only 255 steps of dimming; even the best usually top out at 1024 steps.)

In some cases, large loads draw excessive currents for brief periods when driven at low power levels. This is because PWM applies full power for a short slice of time at the lowest level and longer slices of time as power levels increase. In some cases, particularly with large loads that have a very low DC resistance at rest, short spikes at the lowest levels are stressful for the dimmer and can create undesirable electrical noise and interference. For example, a large motor will remain stalled, and a large lamp filament will remain cold and unlit, until a significant amount of energy is delivered. In these states, large transient spikes are being generated 75 times each second.

The **Low Level Limit** parameter ensures that power levels below a selected limit are reduced to zero. For large loads, a recommended Low Level Limit is 15 or higher (the maximum selectable is 31). For small loads a limit of 5 or less can be used. The available range is 0 to 31, and the default is 0.

If you are unclear about how to use this parameter, start with a value of zero. If you are using lamps that do not immediately light at low dimmer levels, or you are using motors that do not begin to turn (under load) at low levels, set the Low Level Limit to the value where light or motion begins.

<u>Dimmer 1</u>	<u>Dimmer 2</u>	<u>Dimmer 3</u>	<u>Dimmer 4</u>
square law	switch	linear	switch
chan 1	chan 120	chan 3	chan 4



Receiver	Low Level			
RX001 (Active)	20	0	0	0

Dimming Curve

When the square block cursor is blinking over a dimmer curve symbol, the curve can be changed by turning the rotary control. The options are linear dimming (indicated with a straight slant symbol), inverse square law dimming (indicated with a curved slant symbol), and switch mode (indicated with a stair step symbol).

Incoming dimmer data is mathematically converted from the 255-step DMX resolution to the 1328-step RX4 resolution in real-time. When enabled, this conversion also includes calculations for Voltage Reference Dimming and Digital Persistence smoothing (additional information below).

In some cases, dimmed power levels are not desirable. When turning on a relay or powering a DC device that requires clean constant power (like an inverter), a dimmer output can be set for switch mode. In this case, DMX dimmer levels of 127 or lower will turn the output off, while levels of 128 or higher will turn the output on.

Voltage Reference Dimming is not available in Switch Mode. The FULL BATTERY VOLTAGE is output when a switch channel is turned on. Low Level Limit has no effect in this mode.

Voltage Reference Dimming

From the Channel Watch screen, **press Set RX Params** twice to reach the Voltage Reference Dimming page. Use the **Left/-/No** and **Right+/Yes** keys to select the dimmer you wish to set.

Voltage Reference Dimming (VRD) allows the use of batteries and loads that are not the same voltage. For example, you may wish to use a 14.4V or 18V NiMH battery with 12V MR16 lamps, or a 10V water pump.

In these cases it is very important to note that the peak-to-peak voltage produced by the dimmer is still full swing from 0V to full battery voltage. Only the range of the pulse-width-modulation dimmer is modulated. Thus, if you are using an 18V battery and have set a Voltage Reference of 9V, the pwm dimmer will deliver an output range from 0 to 50% when receiving control signals of 0 – 100%. This range adjusts in realtime, so the VRD will compensate for a slowly diminishing battery, as well as voltage changes caused by the load pulling the voltage down.

VRD may not be suitable for direct connection to some voltage sensitive loads. In some cases, an integrator (power smoother) circuit can be used to convert the choppy pwm signal to a steady DC voltage. In the simplest form, this can be done with a single resistor and capacitor. The resistor should be a low value high-power type. The capacitor will generally be a large capacity low-ESR electrolytic rated for approximately double the source battery voltage. Consult Soundsculpture for additional assistance constructing power smoothers.

The default setting disables VRD so the dimmer uses the input battery voltage directly. This is indicated as **Vin** on the display. The rotary control button sets the VRD voltage for the dimmer indicated by the square blinking cursor. Press the rotary control button to toggle between **Vin** and 12.2V, and turn the rotary control, to change the CRD voltage setting.

The VRD voltage display can be confusing because there is no decimal point. Voltages are displayed in the range of 0.1V to 19.9V as 001 to 199. Thus, 12.2V is displayed as 122.



Dimmer 3
VRD 3.4V



Dimmer 3
VRD 12.0V

Level Smoothing – Digital Persistence

From the Channel Watch screen, press **Set RX Params** three times to reach the Level Smoothing page. Use the **Left/-/No** and **Right+/Yes** keys to select the dimmer you wish to set.

Level smoothing is useful when using very fast lighting sources, like LEDs. When the RX4 processor converts incoming 255-step DMX levels to 1328-step pwm levels, it inserts a short vector (fade) from the previous level to the new level. Rather than jumping from one level to the next, the transition is smooth and much more pleasing to the eye. It emulates the response of traditional lamp filaments, which take time to change. This technique vastly reduces visible “stair stepping” of fast lamps. The range of smoothing is from 0 (disabled) up to 31. At maximum level, the smoothing effect is comparable to the rise and fall times of a 20W MR16 halogen lamp.

Digital persistence at the dimmer is much more effective than a ramp up/down from a DMX controller, because the controller is limited to 255 steps. Stair stepping between these steps can be highly visible. For smoothing times that are slower than the maximum period provided by the RX4 dimmer, a combination of maximum dimmer smoothing (31) and a DMX ramp-up is very effective.



Dimmer 1
Smoother Level 31 (maximum)

In the example above, dimmer 1 is set for square-law dimming with maximum smoothing. This is often ideal for use with LEDs, particularly white LED MR16s, which will now respond very much like a 20W halogen lamp.

Data Timeout Period (not user adjustable)

For various reasons, rf dimmer data could be interrupted. When this happens, dimmer outputs will be maintained at their last known value for approximately 2 seconds while the receiver waits for valid data to reappear. This period is not user adjustable. If no good data has been received in this period, all dimmer levels are cleared to zero.

The RC4 radio link is robust enough that single data packets are seldom lost, never mind the hundreds of packets sent in a 2 second period. Visible effects of radio interference are virtually non-existent with the RC4 system.

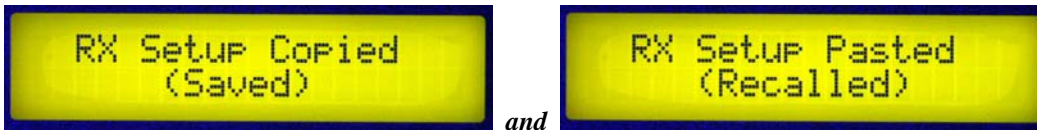
The DMX512/1990 specification published by the United States Institute for Theatre Technology requires DMX devices to have a loss of data tolerance of not less than 1 second. The FlexTX transmitter has a loss of data tolerance of just over 1 second on DMX inputs. There is no correlation between the DMX loss of data timeout, and the RC4 Data Timeout Period. A Faulty DMX link leads to the former; radio interference leads to the latter.

RX Setup Copy / RX Setup Paste

When configuring many receivers, several are often programmed identically or very similarly. To speed the process of setting up and programming these receivers, an RX Setup scratchpad memory is provided.

From any RX Setup screen (invoked with the **Select RX**, **Assign RX Chans**, and any of the multiple **Set RX Params** pages), all current settings can be saved to the scratchpad by pressing **RX Setup Copy**. All parameters are saved, including those not currently displayed. For example, Low Level cut-off values are not displayed from the RX Chans screen, but Low Level settings are still written to the scratchpad when the Copy key is pressed.

Similarly, the settings currently in scratchpad memory can be recalled to overwrite the currently displayed RX setup by pressing **RX Setup Paste**. All parameters are overwritten, including those not currently displayed.



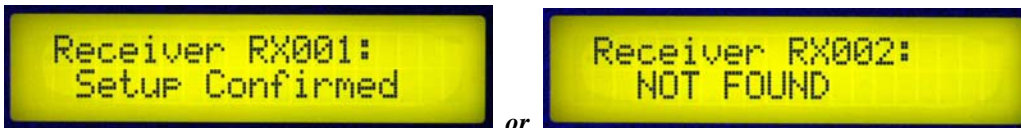
Use the **Select RX** key and rotary control to select source and destination RX numbers for Copy and Paste.

Send RX Config

When the **Send RX Config** key is pressed, all settings for the selected RX are uploaded by radio to the corresponding RX4 receiver/dimmer. At the same time, and regardless of the presence of an Active receiver, settings are saved in local transmitter memory.



If the corresponding receiver is not Active, the transmitter LCD will report RXxxx Not Found. Otherwise, the LCD will report Setup Confirmed. The confirmation process verifies every parameter sent, while also retrieving the receiver firmware version, current battery voltage, and more.



A receiver/dimmer will assume a new RX number if it receives a control packet while the **Set RX** recessed button on the receiver itself is held down. In this case, the RX value of that packet will become the new RX number for that receiver. Subsequent control packets for this RX number will be accepted and acknowledged with no need to hold down the Set RX button. (See the Receiver Operation section for additional information.)

In a properly functioning system, it is never necessary to use the Set RX button on a receiver. Every receiver should have its own RX number for the entirety of its service life. The only time the Set RX function should be used is when adding a new receiver to an existing system, or resetting a receiver after default settings have been loaded.

RX4 Receiver Operation



RX4 Receiver Buttons and Indicators

As noted in previous sections, RX4 radio-dimmer are configured and controlled remotely from a TXD-Series transmitter, using the transmitter's user interface. This is the only way to configure each output, selecting the dimmer channel, switch or dim mode, and Low Level limit.

Inside the plastic receiver enclosure are two circuit boards: the radio board, and the dimmer board.

The RX4 receiver has a simple user-interface intended to help with wiring and load testing, and restoring internal settings to default values. Various LEDs indicate the status of the dimmer and radio boards.

On the dimmer board there are five recessed push buttons, four function LEDs, and four additional LEDs directly connected to the four dimmer outputs. From left to right, the switches and function LEDs on the RX4-STANDARD and RX4-HO are:

Button: Output 4 Test

Button: Output 3 Test

Button: Output 2 Test / Power Up Load Default Settings

Button: Output 1 Test / Assume RX Number of Incoming Setup Packet

LED: Setup Data Receive Indicator (green)

LED: Dimmer Level Receive Indicator (green)

LED: Computer Operating Properly (COP) / Battery Voltage Indicator

LED: Data Error Indicator (red)

Reset Button: Hardware Reset / System Restart



Changing the RX Number

To change the RX number of a receiver, send a configuration from the transmitter using the RX number you desire, while simultaneously holding down the **Assume RX Number** button on the receiver (4th button from the left). The RX number of the sent data packet will be assumed by the receiver and stored in eeprom.

*The receiver **MUST** be powered on and Active during this process.*

The radio board must be programmed with the correct system number.

Subsequent configurations for this RX number will be accepted without holding any button down.

When a receiver accepts new configuration data, it displays a short “light show” acknowledgement on its four LEDs. It also sends a digital acknowledgement back to the transmitter. The light show is displayed if a configuration message comes in for the current RX number, or if a configuration message comes in while the **Assume RX Number** button is down. In the latter case, the new RX number becomes the current RX number for future configurations.



The receiver shown here is white. Production units are black.

NOTE: Some receivers may contain customized firmware for special applications. A specific RXnum is required to activate these custom processes. For example, a custom dual-motor speed control might be activated by using RX128. Customized receivers usually default to their special functions if defaults are loaded using the receiver’s recessed buttons. Refer to the documentation supplied with your customized receiver for additional information about your specific unit.

Default Settings

To restore receiver default settings, hold down the recessed **Test Out 2 / Set Def** button while powering up the receiver or pressing the recessed **Reset*** button immediately to the left of the Data Error LED. This will load the following settings:

RX Number = 1

Output 1 Assigned to rf Channel 1
Linear Dimmer
Low Level 0 (zero)
Voltage Reference Dimming disabled (Vin)
Smoothing disabled (0)

Output 2 Assigned to rf Channel 2
Linear Dimmer
Low Level 0 (zero)
Voltage Reference Dimming disabled (Vin)
Smoothing disabled (0)

Output 3 Assigned to rf Channel 3
Linear Dimmer
Low Level 0 (zero)
Voltage Reference Dimming disabled (Vin)
Smoothing disabled (0)

Output 4 Assigned to rf Channel 4
Linear Dimmer
Low Level 0 (zero)
Voltage Reference Dimming disabled (Vin)
Smoothing disabled (0)

To change these settings, send a new configuration from the transmitter.

It is likely that you will also need to restore the RX number to a value other than RX001. If so, follow the procedure in the proceeding section.

NOTE: Some receivers may contain customized firmware for special applications. A specific RXnum is required to activate these custom processes. For example, a custom dual-motor speed control might be activated by using RX128. Customized receivers usually default to their special functions if defaults are loaded using the receiver's recessed buttons. Refer to the documentation supplied with your customized receiver for additional information about your specific unit.

* This is NOT the protruding reset button on the rear of the radio, which resets only the radio board.

Dimmer Power Wiring and Fusing

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

Beside the main power connector on RX4 receiver-dimmers is a pair of clips for a *load fuse*. Standard AGC fuses fit easily into these clips. This fuse is in the positive side of the dimmer output circuit.

To effectively protect the load, wiring, and electronics, and to reduce potential hazards, one of the following dimmer fusing techniques **MUST** be used:

1. Choose a load fuse that accurately reflects the total load for all four channels. This technique is best when loads are relatively small, i.e. one MR16 on a single channel.
2. Use external fuses for each individual output, appropriately sized for each load. Put the fuse in the positive side of the load circuit, returning directly to the positive side of the supply battery, rather than the positive output terminals on the dimmer. RX4 dimming is done on the negative side. ***This option is recommended for high currents.*** A small fuse should still be installed on the RX4 board to drive the indicator LEDs. A positive lead must still come to the receiver to power the logic circuitry.

DO NOT OPERATE LOADS WITHOUT FUSES. YOU MUST FUSE EVERY CIRCUIT.

DO NOT simply install the largest fuse you can find and forget about it. This can result in an unsafe situation, possibly a fire or burn hazard. It is not recommended to internally fuse any RX4 receiver above 25A.

DO NOT fuse any single RX4 dimmer above 25A. With all 4 dimmers individually fused at 25A, a total of 100A can flow. At 12V this is 1200W, substantially beyond the maximum rating of the product. Continuous current exceeding 500W requires the RX4-HO receiver. In any case, be sure to use appropriate connectors and large wire gauges, and monitor the system closely – particularly the operating temperature – at all times.

Here are some typical fuse values:

75 watt MR16 halogen lamp: draws 6.25A at 12VDC. Use an 8A fuse.

1/4HP 12VDC motor: typically draws 20A when operated smoothly, but could surge to 40A on a fast start-up. Use a 25A fast-blow fuse and avoid rapid start-up (ramp up the power level slowly).

Do not use slow-blow fuses. They do not protect semiconductors in a fault condition.

It is difficult to apply typical safety standards to these devices, because of the unusual circumstances of theatrical prop construction. The “rule of thumb” is that nothing should be allowed to operate at a dangerous temperature. Appropriately sized wire gauges and connectors must be used, along with suitable ventilation and external fuses rated for the load being operated.

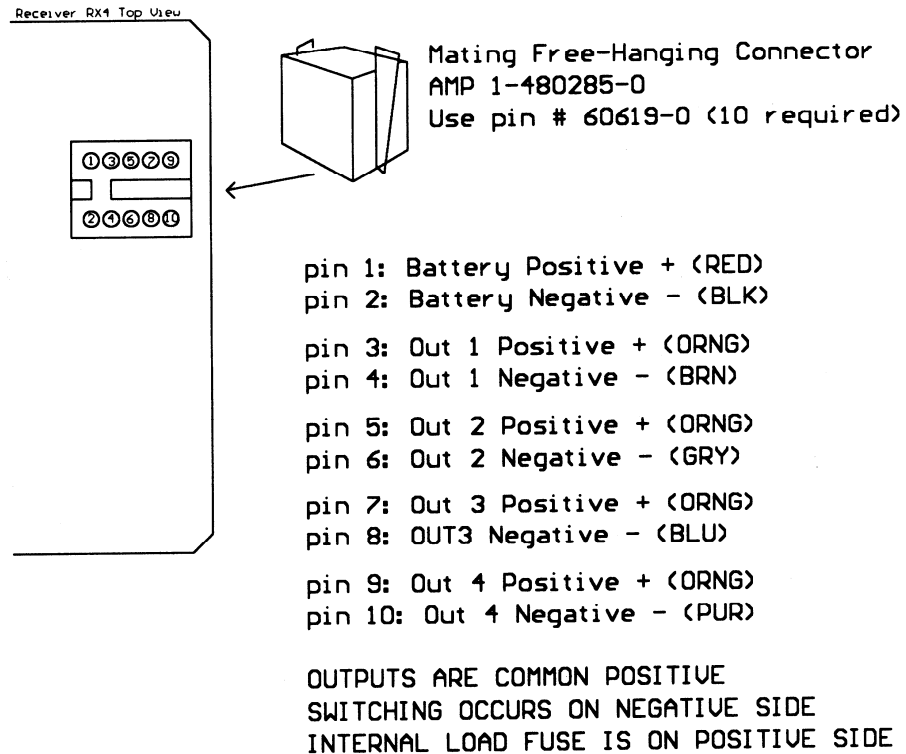
WIRING AND INSTALLATION OF BATTERIES, DIMMERS, AND LOADS MUST BE IN ACCORDANCE WITH APPLICABLE LOCAL AND NATIONAL ELECTRICAL CODES.

RC4 devices are operated at the user’s own risk and Soundsculpture accepts no liability, either direct or consequential, arising from the use of RC4 equipment.

RX4 Receiver Power Connection Diagram

The RX4-STANDARD is remarkably versatile and powerful for its small size. Four outputs deliver pulse-width-modulated power capable of driving high current motors, lamps, and other inductive or resistive loads. Each output is rated for 150W, equivalent to approximately 12.5amps at 12 volts. The four outputs can be combined in any combination to drive larger loads, to a maximum of 500W into a single load (40A).

Total receiver power handling is limited by circuit-board traces (copper trace thickness and width) and connector pins. For higher power handling, use the RX4-HO (high output) which is directly interchangeable with the RX4-STANDARD and can deliver up to 1000W (with caution, and adequate ventilation).



The recommended AMP tool for these connector pins is **part number 91504-1**. A discontinued AMP tool that can sometimes be found used is **part number 90124-2**. Shells, pins, and tools are available from most electronic component suppliers, including www.digikey.com, or from Soundsculpture Incorporated.

Channels connected in parallel must have their channel-select and Low Level limit switches set identically to avoid one channel taking a heavy load on its own. Damage resulting from inappropriate configurations will not be covered under warranty.

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



The RX4-STANDARD and RX4-HO (high output) receivers includes a 6-pin auxiliary power input connector:

Pins 1, 3, and 5 are wired in parallel with pin 1 on the 10-pin connector. This is +V in.
Pins 2, 4, and 6 are wired in parallel with pin 2 on the 10-pin connector. This is GND in.



In some cases, the 6-pin connector can be used for high-power battery input, while the 10-pin connector can be used just for outputs. If all pins of both connectors are used, eight wires are available for both power in and dimmer out. This results in symmetrical current carrying capacity on both sides of the dimmers.

Some models of RX4 receiver include an optional 2-pin logic battery connection. Pin 1 is positive (+), pin 2 is negative (-). This connector can be used as a 12V unregulated power output to external electronics, or be used for a 12V lead-acid battery or large storage capacitor. This allows the logic and RF circuitry in the RC4 receiver to continue functioning even if the load-bearing batteries run down.

If a non-rechargeable battery is used with this connector, it should be protected from reverse current with a diode. Significant output currents are present on this connector.

RX4-HO High Output Receivers



The high output (HO) version of the RX4 receiver features upgraded MOSFET power components and a cooling fan. Even with these enhancements, high-current power handling can be dangerous and should not be sustained indefinitely.

At 12VDC, a 1000W load demands over 80 Amps of power. The batteries, wires, connections, and fuses required to handle this kind of load are very large.

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

To accommodate large loads, both the RX4-STANDARD and the RX4-HO feature a 6-pin auxiliary power input connection. Used together with the 10-pin power input/output connector, there are four separate connections in parallel to bring power in, and another four to carry power out to the load(s). Thus, each wire and connection can carry up to 20A at 12V, provided it is of an appropriately large gauge.

The fuse on RX4 receiver boards cannot carry 80 Amps. When wiring large loads, the positive (+) side of the circuit should be completely external to the RX4 receiver, and it should be carefully and safely fused. A small-gauge wire can be used to bring the positive supply to the RX4 internal control electronics, and the fuse on the RX4 can be 1A or even smaller, since it will only supply the indicator LEDs.

All RX4 dimmers introduce pulse-width modulation on the negative (-) side of the circuit, acting as a dimmer on the negative line to the load. This is where you need heavy wire and you should utilize all 4 input and output connections across both power connectors.

If you are using the RX4 as one large dimmer on a single channel, you can wire the outputs of each channel in parallel. For this to work effectively, circuit impedance and resistance for each channel must be closely controlled. More current will flow through shorter circuits, thicker wires, and tighter connections, and this can cause more than a fair share of the total load to be flowing through a particular dimmer channel.

This kind of overloading causes overheating and damage that is not covered under warranty, and can be a fire hazard. For optimal safe performance, resistances of each parallel circuit should be as close to identical as possible. Beware of faulty or worn connectors adding substantial resistance.

Damage caused by not configuring parallel channels identically is not covered under warranty, and can be a fire hazard. When ganging output channels together, they must be set to the same data channel, and have the same Low Level cut-off value. Otherwise, one or more channels could switch off while other channels are still operating, causing damage to channels that remain on and causing too much current to flow through single conductors and connections.

It is also advised to set the Low Level cut-off quite high when loads are large. This prevents high EMI/RFI when dimmers attempt to drive a cold filament or stalled motor.

Before using any RX4 receiver at high power levels, please re-read this manual and double-check your choices of battery, wire, fuses, and connectors. Nothing should run hot; if something does run hot, it is under-rated or improperly applied and should be replaced with a component that does not run hot.

If the receiver itself is running hot, then either:

- additional ventilation is required
- running time is too long (it needs time to cool off)
- load current are too high
- any combination of the above

DO NOT continue to operate the receiver under these conditions.

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

Be careful –high power loads are operated at your own risk, and Soundsculpture cannot be held responsible for any damages whatsoever, whether direct or consequential.

RX4-MINI Receivers



The RX4-MINI is the smallest, most portable receiver for the RC4 wireless dimming system. It can be used in small props, costumes, and anywhere else with limited space. Just like the larger RX4-STANDARD and RX4-HO receivers, the RC4-MINI provides up to four channels of dimming. It is configured from an RC4-TXD-Series transmitter, just like the other RC4 receivers.

Summary of Differences Between the RX4-MINI and the RX4-STANDARD

The block diagram from the RX4-MINI is nearly identical to the diagram for the RX4-STANDARD, but it does not include auxiliary power inputs.

The circuit board traces in the RX4-MINI are narrower and cannot carry as much current. To save space, the MOSFET power drivers do not have heat-sinks. For both of these reasons, the current handling of the MINI receiver is substantially less than other RC4 receivers.

Programming and diagnostics of the radio module in the MINI receiver requires a special 4-pin adaptor. This adaptor is detailed later in this manual. (Most users will never need to configure their radio modules.)

Because of a lack of space in the MINI receiver, the radio antenna is mounted in one end of the enclosure, below the cover. Over long distances, better radio performance may result when this end of the receiver is facing towards the transmitter transceiver. Over typical distances, antenna position will have no effect on performance, provided the antenna is not blocked by metal or batteries (this is also true for other RC4 receiver models). The antenna end of the enclosure is clearly marked on the unit.

Connections and Wiring

The RX4-MINI 10-pin power connector has the same pin-out as the standard power I/O connector on other RC4 receivers. No auxiliary power connector is provided.

Maximum power handling is 50W per channel, 200W maximum. When running at maximum power, it is recommended to limit the maximum time the channel is activated to avoid overheating.

The highest fuse rating that should ever be used in a MINI receiver is 16A. In practice, the smallest appropriate fuse should be used for the connected load(s) and will typically be much smaller than 16A. If you are running a single 50W MR15 lamp, use a 5A fuse. Use fast-blow fuses to protect the power driver electronics.

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

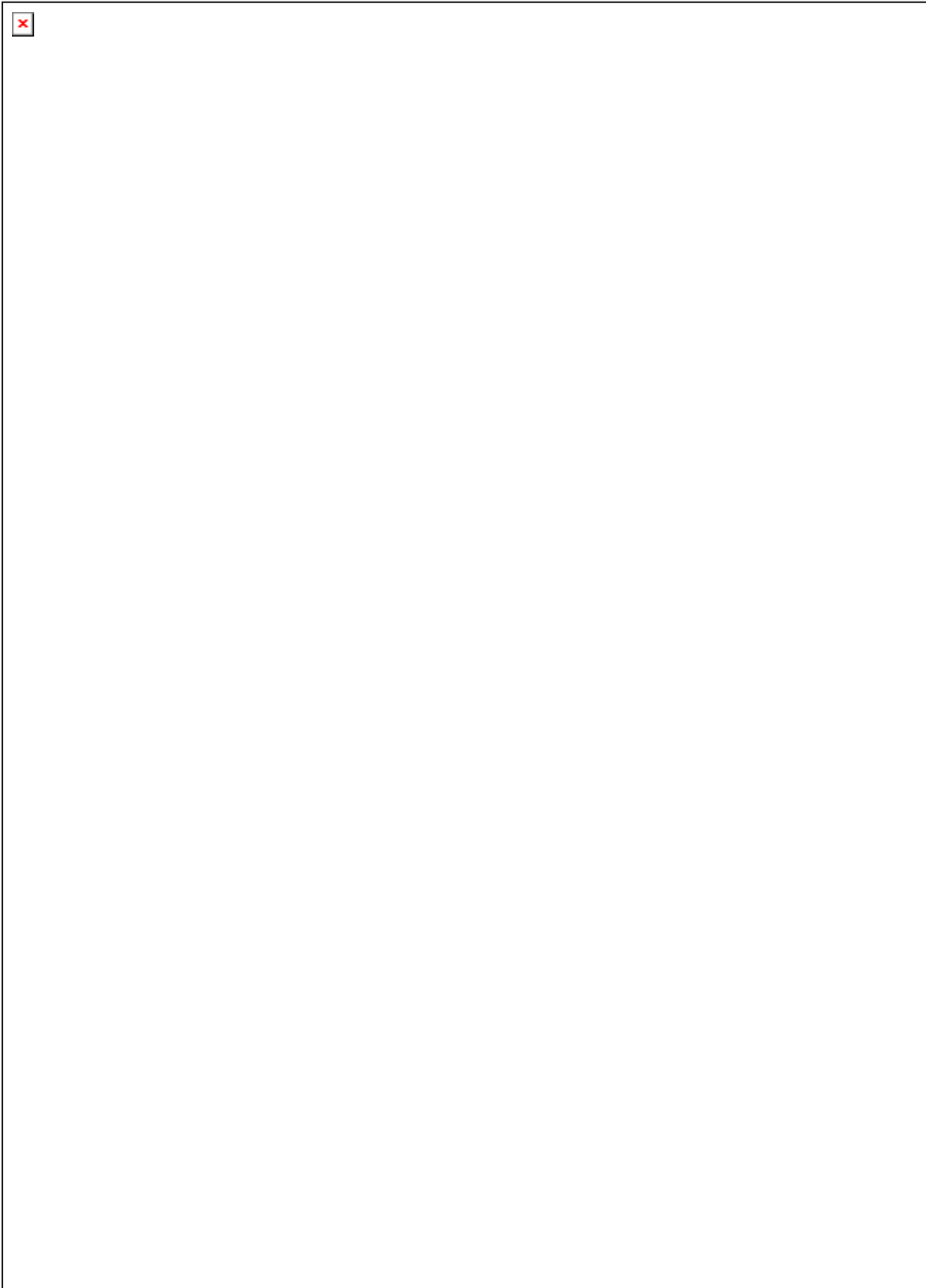
Configuring Channels

Programming channels, Low Level cut-off, and dimmer/switch mode is done the same way for all RC4 receivers.

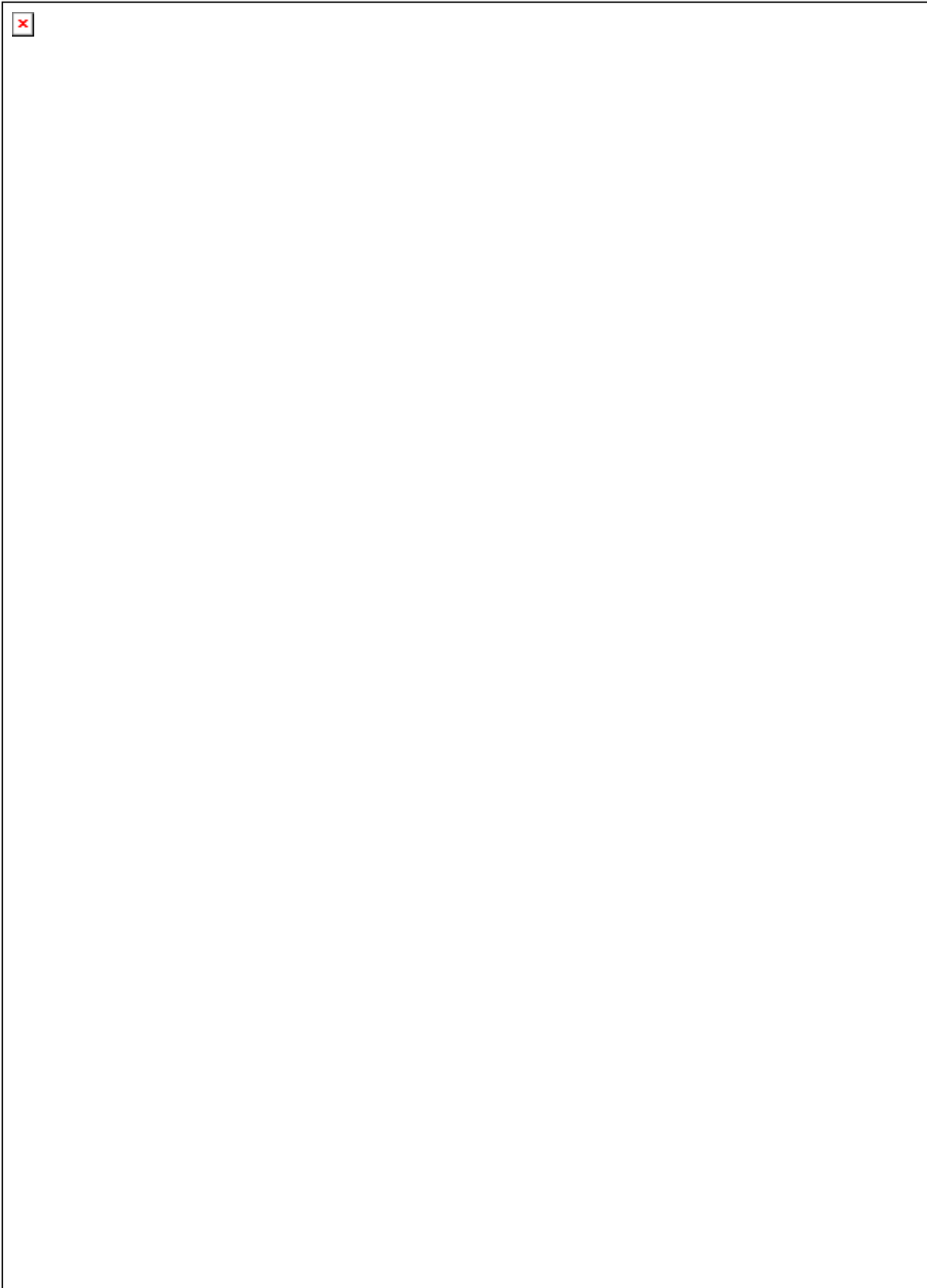
Buttons and LEDs

The positions of the recessed buttons and LEDs are different but clearly marked on the unit. The same functions and indications are provided.

RX4-STANDARD and RC4-MINI Typical Wiring Diagram



RX4-STANDARD / RX4-HO Typical High-Power Wiring Diagram



Receiver Load Testing – Receiver Test Buttons

All RX4 receivers have a channel test button for each on-board dimmer. These buttons are recessed to avoid accidental activation and can be pressed with any slender object. Test buttons override incoming levels only while pressed. Any combination of the four channels may be tested simultaneously.

For dimmers configured as dimmers, the channel will fade up when the test button is pressed. For dimmers configured as switches, they will cleanly switch on to full when the test button is pressed.



Receiver Battery Voltage Indication

The Computer Operating Properly (COP) blinking LED on RC4-RX4 receivers also indicates battery voltage. At 10.5V or higher, this LED is green and blinks slowly. Below 10.5V it is red and blinks rapidly.

These voltage thresholds have been selected with rechargeable lead-acid batteries in mind. A 12V lead-acid battery should never be discharged below 10V or it will be chemically damaged, leaving it unable to fully recharge to original capacity.

RX4 electronics will work correctly with battery voltage down to 8V. This makes it suitable for use with various alternative batteries, including NiCad and NiMH battery packs.

When using RX4-STANDARD or RX4-HO receivers, an auxiliary logic battery can be used to ensure radio and logic circuitry continues to operate when the load battery is severely discharged.

Radio Settings

Some RC4 system settings reside in the radio modules used at each end of the wireless link – the transmitter transceiver and the radio boards in the receivers. These settings are stored in EEPROM memory and do not require adjustment under normal circumstances. Nonetheless, it may some day be necessary to adjust a System ID or other parameter. This is done using an RS-232 data terminal, or terminal emulator software on a PC with a COM port. When making changes to radio settings, power and data connections must be made at the rear of the transceiver or receiver unit (with the exception of the RC4-MINI receiver, detailed later in this manual).

A 12VDC power adaptor, along with a short 25-pin D-Sub adaptor cable are required. These items may have been supplied with your RC4 system but are rarely (if ever) used. (If you did not receive them with your system, they can be purchased from Soundsculpture for a nominal charge.)



Do not attempt to change system settings while powering the receiver from the 10-pin RC4 power connection. This powers both the radio board and the dimmer logic board, and does not leave the radio board available for data on the rear 25-pin port.

The data cable observes RS-232 standards with data on pins 2/3, handshaking on pins 4/5/6/20, and common on pin 7. Readily available cables can be used if the supplied cable is lost or damaged.

Note that RC4 radios never require configuration under normal circumstances.

Set System ID

The System ID is a number from 0 to 65535. Values below 1000 are reserved for older 16-channel RC3 systems. RC4 systems are assigned System IDs of 1000 or higher.

Every RC4 user is assigned a unique System ID when their system is shipped, and a database of these numbers is carefully managed and maintained. To avoid data collision with other users, system numbers should NOT be changed. Some users have multiple RC4 systems, however, and may wish to change the System ID in receivers to move between systems.

Do not change a transmitter System ID without authorization from Soundsculpture Incorporated. Do not use System IDs not assigned to you.

Set System Baud Rate

The default baud-rate for 32-channel systems is 38.4kbps (kilobits per second).

Additional System Parameters

Each radio module must be configured for proper operation in the RC4 architecture. Each System ID should have only one transmitter (master), and any number of receivers (slaves). To assist advanced users, the LAWNII User's Manual accompanies this manual.

The radio settings used for the RC4 system create a low-latency master-slave network with no built-in acknowledgements or retries. This is because normal acknowledgement and handshaking protocols sacrifice timing for accuracy and can cause unexpected delays in data transmission. For real-time control systems, different techniques must be used. The microprocessors at each end of the RC4 dimmer control system use real-time cyclical-redundancy to ensure reasonable accuracy without introducing varying delays. The coding for this technique is proprietary to the Soundsculpture RC4 system.

LAWNII settings can be made using an RS232 terminal, or a PC running a terminal emulation program with a COM port. It is important that the terminal emulator be able to send control characters (i.e. Ctrl-C).

The Microsoft Windows Operating system comes bundled with the HyperTerminal terminal emulation program. It can be used to configure LAWNII radios. Be sure to use the following settings:

- Direct connect to any available COM port
- VT100 emulation
- Control keys act as Terminal keys (very important)
- Standard ASCII character set

Additional information about connecting to the LAWNII radio with HyperTerminal is included in the LAWNII radio manual.

Some users of LAWNII systems have had difficulty using HyperTerminal, with no problems using other terminal emulators. If HyperTerminal does not work for you, please try an alternative emulator program.

Setting the System ID

The System ID of each LAWNII radio must be the same for the transmitter and all receivers used in a single RC4 system. If you own and use more than one RC4 radio system, you may wish to move receivers between systems. This can be done by changing only one parameter (SYS) in the LAWNII radio. All other settings can be left unchanged and do not need to be re-entered:

```
<connect at 38400 baud>  
<Ctrl-C three times to enter command mode>  
SYS <use number for your system>  
SAVE <allow at least 500ms for save to complete>  
TRANS
```

To avoid conflicts, Soundsculpture RC4 systems use System IDs of 1000 or higher.

Using Other Channels

At the factory, all RC4 LAWNII transceivers are set up on radio channel 2 (CHA 2). LAWNII radios support three channels (1, 2, and 3) and any of these may be used with the RC4 system. If another channel is used, this setting must be changed at every LAWNII in the system – the transmitter and each receiver.

Note: *If you are using multiple RC3 systems and experience reduced refresh rates as they try to share radio bandwidth, try changing the channel of one system. If you are using 2 systems, run them on channels 1 and 3 to keep them as far apart in the radio spectrum as possible.*

Complete LAWNII Configurations for the RC4 System

For a single Transmitter (TX) LAWNII:

```
AUTOLF ON
ABAUD 38400 *
MYC RC4TX
DFCN RC4TX
SYS <number for your system>
CHA 2 <other channels can be used>
PACTIME A 1
BE E 0
UNPROTO RC4RX
LAWNGRAM ON
TRANSGRA ON
LCALLS RC4TX
PACLEN <number of wireless control channels + 4>
TIMEOUT 0
SAVE <allow at last 500ms for save to complete>
TRANS
```

For any number of Receiver (RX) LAWNII's:

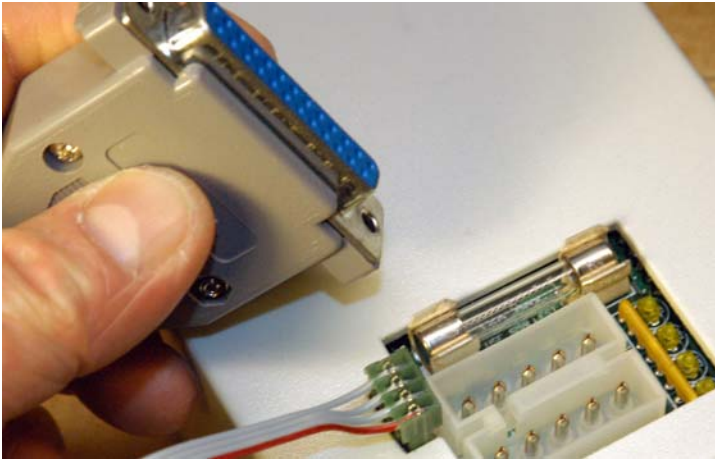
```
AUTOLF ON
ABAUD 38400 *
MYC RC4RX
DFCN RC4RX
SYS <use number for your system>
CHA 2 <other channels can be used>
PACTIME A 1
BE E 0
UNPROTO RC4TX
LAWNGRAM ON
TRANSGRA ON
LCALLS RC4RX
PACLEN 0
TIMEOUT 0
SAVE <allow at last 500ms for save to complete>
TRANS
```

* If you are not already connected at 38400 baud, you will have to reconnect to the LAWNII radio at this speed after setting ABAUD 38400. New LAWNII radios are configured at the default baud rate of 9600, so initial connections must be made at this speed. The RC4 dimmer system requires a baud rate of 38400.

The transmitter and any associated receivers MUST have the same SYS and CHA settings of they will not communicate with one another.

RX4-MINI Lawn-II RF Module Setup

Connection to the radio module in the RX4-MINI is made through a small 4-pin Amp MTA-100-series header beside the main power connector. An adaptor allows connection to a terminal or computer COM port, and a source of power.



The header is Amp 640456-4. It mates with any Amp MTA-100 4-pin connector. The specific part number varies with wire gauge being used; a suitable part for 26AWG wire is Amp 640442-4.

Pinout:

Pin 1: GND / Serial Data Common

Pin 2: 12VDC

Pin 3: RS-232 Data Receive (RX)

Pin 4: RS-232 Transmit Data (TX)

This is a 3-wire RS-232 interface with no handshaking. With working data and power connections, radio configuration is the same as for other RC4 receivers.

Note that RC4 radios never require configuration under normal circumstances.

A General Discussion of Radio Reliability

The Soundsculpture RC4 system is exceptionally reliable when properly set up. The most critical factor when using the system is transmitter and receiver placement, since these units house high-frequency radio antennas. Consider the following guidelines when installing the transmitter and all receivers:

- The antenna surfaces must not be obstructed by metal objects. Remember that lead-acid batteries have lead inside, and count as an obstruction.
- Internal antennas are most effective when facing other units in the system (i.e. receivers should face towards the transmitter and vice-versa). Alternatively, all antennas can face in the same direction towards a reflective surface like a ceiling or rear wall. Reflections of nearby surfaces usually deliver a solid radio link.
- Avoid many solid obstructions between the transmitter and receivers, especially as the distance between them is extended. Stage sets, flats, etc., generally cause very little degradation of signal. Cinderblock and concrete walls and fire doors, however, will cause greater attenuation.

In an environment with a continuous solid reflective surface (like a ceiling) and a minimum of obstructions (no walls), RC4 spread spectrum receivers work flawlessly for indoor point-to-point distances exceeding 300 feet, covering thousands of square feet. Transceivers facing each other with unobstructed line-of-sight can operate across thousands of feet.

A typical theatre environment with the transmitter transceiver secured overhead, and receivers on stage (less than 100 feet away) is ideal. No user-detectable errors should occur, regardless of electrical noise from nearby equipment. Set pieces in the house area should also perform correctly via reflections off the stage floor (i.e. the chandelier in *The Phantom of the Opera*).

Errors will generally not sustain more than 1/75th of a second, the maximum amount of time before every channel has been reset by redundant data transmissions. However, if errors are caused by consistent multi-path interference or insufficient signal level, problems may persist or repeat.

The RC4 software protocol has been designed to be tolerant of the kinds of interference and interruptions that are typical of RF data links, while being optimized for realtime performance. Moderate interference should not cause user-detectable errors.

Troubleshooting

The RC4 system is VERY tolerant of radio signal degradation and electrical noise. Most users have no problems... in fact, at the time of this writing only one radio interference problem has ever been reported with an RC4 system, and was corrected when the transmitter was moved away from an unusually noisy lamp. If you think you are suffering from radio interference problems, **FIRST** be absolutely certain your batteries are good.

Simple Solutions to Common Problems

Problem:

When channel levels are brought up, the load (lamp, motor, etc.) operates for a brief moment then goes off. A second or so later, it comes back on. The problem appears cyclical or intermittent.

Cause:

When a lead-acid battery is measured with no load it reads approximately 12V. This is true even for a substantially discharged battery. RC4 electronics require very little current to operate, and a discharged battery still provides enough power for the receiver to come on and indicate traffic.

Here's the problem cycle:

1. When RF control data indicates an output level, the output driver delivers battery power to the load. If the battery is under-rated or under-charged, voltage will drop substantially under load.
2. When the battery voltage drops below 8V the RC4 receiver will shut down. This disconnects the load from the battery.
3. With the load disconnected, battery voltage drifts back up. (It eventually drifts back up to 12V, unless the battery is seriously damaged). When battery voltage climbs above 9V, the RC4 receiver comes back on and starts monitoring control data again.

...And the cycle starts all over again.

In some cases, exactly the same symptoms are caused by undersized wire or poor connections between the battery and the RC4 receiver. These cause resistance, resulting in a voltage drop at the receiver when the load increases (Ohm's Law).

This cycle through steps 1, 2, 3 and back to 1 results in the symptom described. The actual cycle time varies with battery size, battery charge, the size of the load, power levels selected, and wire sizes used. Eventually the battery is damaged and fails to drift back up enough to continue the cycle.

To prove this is happening, put a volt-meter across the power input terminals at the RC4 receiver. The voltage will drop when the load comes on. When the voltage drops enough, the load will go off. When the voltage drifts back up enough, the load will switch back on.

If these voltage fluctuations are apparent at the receiver but not at the battery terminals, then wire and connections are at fault – you must conduct adequate current from the battery to the receiver to avoid these unwanted voltage drops.

Solution:

Ensure the battery is fully charged using a smart charger that accurately indicates the condition of the battery. Be sure the battery is rated large enough for the intended load for the operating time you require. Be sure wire gauges are large enough, especially between the battery and the receiver/dimmer. Be sure connections are tight and strong. Hot wires or connections are probably causing problems.

Problem:

Fades are not smooth, channels intermittently black-out for a second or more.

Cause:

The RC4 system depends on RF signals getting from the transmitter to the receivers. An antenna is under the top cover of each 7" x 4" x 2" enclosure -- one at the transmitter, and one in each receiver.

The RC4 system operates in the 907 – 921Mhz range using spread-spectrum digital radio. Although output power is quite low, high frequency signals bounce easily and receivers are very sensitive. This means that receivers can find good data most of the time.

The system will not work, however, if the tops of the plastic enclosures are blocked with batteries or metal coverings. Signals must be able to get in and out of the top of each box, both at the transmitter and at each receiver.

Solutions:

Make sure the top area of each plastic enclosure is not blocked by batteries or metal obstructions. These block radio signals.

Small clusters of wiring, gridwork, bars across the top of the enclosures, etc. generally DO NOT cause problems. Make sure there is a path for SOME signal to get through and the system should work fine. Where quasi-line-of-sight is attainable:

1. Position the transmitter transceiver overhead, above the stage or other area where receivers are positioned. The top of the transceiver should be facing down, towards the receivers.
2. Position receivers facing up, towards the transmitter transceiver.

Where line-of-site cannot be achieved, or there are numerous obstructions between transmitter and receiver:

1. Position the transmitter transceiver so the top of the box is facing the ceiling above the stage. Signals will bounce back down and flood the stage. Avoid metal obstructions or large harnesses of wiring in the signal path.
2. Position receivers so the top of each box is facing the ceiling of the stage. Reflected signals will bounce directly into the receiver antennas.

The RC4 system is VERY tolerant of signal degradation and electrical noise. Most users have no problems... in fact, at the time of this writing only one radio interference problem has ever been reported with an RC4 system, and the problem was corrected when the transmitter was moved away from an unusually noisy lamp. If you think you're suffering radio interference problems, **FIRST** be absolutely certain your batteries are good.

Problem:

You need to operate two or three RC4 systems in close proximity without interference. Out of the box, systems do not directly address each other's receivers but responsiveness is clearly degraded.

Cause:

RC4 radios have 3 radio channels available, but most systems are set for the default channel 2. To ensure the fastest response time with the largest number of channels, almost all available radio bandwidth of a channel is used by a single system. When two systems try to share bandwidth on the same radio channel, both systems perform poorly.

Even when this happens, multiple RC4 systems cannot directly address each other's receivers because they have different digital System IDs.

Solution:

Set nearby RC4 systems to operate on different channels. When operating two systems, set them to operate on channels 1 and 3. We do not recommend operating more than 3 RC4 systems in close proximity.

Problem:

You only have one RC4 system but you suspect there might be another one operating nearby.

Solution:

Radio power and sensitivity of RC4 transceivers are tuned for good performance within most interior spaces, with little chance of signals getting outside a building, or into an adjacent building. There is always a possibility, however, of interference between spaces within a single facility. If you suspect there is another RC4 user within radio range, change your radio channel.

At the time of this writing, the need for such measures has never been reported by any RC4 user.

Reset and Initialize to Factory Defaults

All transmitter internal memories can be cleared to factory defaults by powering on the unit while holding down the **Set DMX Start** and **EXIT** buttons together. The LCD will ask you to confirm, do so by pressing **Right/+/Yes**.

WARNING: This action overwrites all eeprom memory, including DMX Setups and RX Configurations.

RC4 Specifications

RC4 RF Specifications

RF Channels: 3
Transmit Power: 13 dbm, typical
Sensitivity: -96 dbm, typical
Frequency:
- Channel 1: 907.45 MHz
- Channel 2: 914.81 MHz (default, used for most systems)
- Channel 3: 921.10 MHz
Modulation: FSK, spread-spectrum
No. Chips per bit: 16
Bit Rate (raw): 76.8 Kb/sec
Protocol: AX.25
Repeater: 7
Range:
- 300 feet typical indoors
- 3000 feet typical unobstructed outdoors
RF Module Power Consumption: 200mA at 12V DC
Operating Temperature: 0° to +50°C
FCC License: Approved by FCC and DOC (Canada), no user license required

RC4-FlexTX Transmitter Specifications

Input Power: World Voltage 85VAC to 265VAC, 47-440Hz
DMX Input: USITT DMX512/1990 (4uSec)
Number of Wireless Control Channels: 4 to 128, user configurable in increments of 4
Analog CV Inputs: 0 – 10V x 8 channels (256-step): CV1 to CV8
0 or 10V x 4 channels (switch): CV9 to CV12
CV input impedance 20K-ohm

RC4 Dimmer Specifications

RC4-RX4 Standard

Continuous current, per channel: 12.5A (150W)
Intermittent peak current, per channel: 20A (240W) ¹
Total current, sum of all channels: 42A (500W) ¹
Over-Current Protection on Dimmer Outputs: YES
Over-Temperature Protection on Dimmer Outputs: YES
Maximum input voltage: 18V, 12V typical
Minimum input voltage: 8V
Suitable for inductive loads (motors, solenoids, etc.): YES

RC4-RX4-HO (High Output)

Continuous current, per channel: 21A (250W)
Intermittent peak current, per channel: 30A (360W) ¹
Total current, sum of all channels: 83A (1000W) ¹
Maximum input voltage: 18V, 12V typical
Minimum input voltage: 8V
Suitable for inductive loads (motors, solenoids, etc.): YES

RC4-RX4-MINI

Continuous current, per channel: 5A (60W)
Intermittent peak current, per channel: 8A (100W)
Total current, sum of all channels: 17A (200W)
Over-Current Protection on Dimmer Outputs: YES
Over-Temperature Protection on Dimmer Outputs: YES
Maximum input voltage: 18V, 12V typical
Minimum input voltage: 8V
Suitable for inductive loads (motors, solenoids, etc.): LIMITED²

¹ Wiring instructions must be closely followed and adequate ventilation must be provided. Individual circuits must each be individually protected with fast-blow fuses.

² Can be used with small inductive loads with the addition of an external back-EMF snubber diode.

Specifications subject to change without notice. Soundsculpture assumes no liability or responsibility for safe operation of receivers, dimmers, batteries, wiring, fuses, and/or any other components or materials that may be connected or in proximity. Safe operation of high-current systems is the sole responsibility of the purchaser and/or user.

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