RC4 Wireless

RC4Magic Series 3

DMXio

Wireless DMX Transceivers

Secure Wireless DMX with RC4*Magic* Private System IDs

Disclaimers

WIRING AND INSTALLATION OF BATTERIES, DIMMERS, AND LOADS 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 equipment.

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 and safe operation.

Not for Control of Pyrotechnical Devices

RC4 Wireless products should not be used to control pyrotechnics of any kind. A brief output surge on dimmer outputs 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 receiver/dimmers are capable of controlling very large currents at up to 35VDC. 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.

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

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Harmonized Design for a World of Choices

RC4 Wireless has been making the world's most popular low-voltage wireless dimmers since 1991. Today, RC4 offers the first and only fully harmonized cross-platform wireless dimmer design that is compatible with all leading wireless DMX data protocols worldwide: **RC4*Magic*^{TM}**, Lumen Radio CRMX^{TM}, and Wireless Solution W-DMX^{TM}. With only minor hardware differences between models, and a nearly identical user-interface across all RC4 Series-3 devices, a new standard is set for ease-of-use and range of features.

This manual is for **RC4*Magic*^{TM} Series 3** DMXio Wireless DMX Transceivers, including specific details pertinent to **RC4*Magic*^{TM} Unique System IDs**, and **RC4*Magic*PC^{TM}** remote configuration software.

RC4Magic^{TM} Series 3

First launched in 2006 and widely considered the most popular wireless dimming in theatre, RC4*Magic* continues to grow and improve. With the introduction of RC4*Magic* Series 3, many new features have been added, while maintaining compatibility with all the RC4*Magic* Series 2 devices already in use worldwide.

RC4Magic DMXio Wireless DMX Transceiver

Wireless DMX

A pair of RC4*Magic* Series 3 DMXio units replaces a DMX data cable in lighting control applications. Configure one device as a transmitter, and one or more devices as receivers.

Any number of DMXio receivers can be used. Thus, a multi-unit RC4*Magic* Series 3 system can take the place of splitters, isolators, and distribution boxes, providing superior electrical isolation while eliminating unsightly wiring.

RC4*Magic* devices work reliably to 200 feet (65m) or more inside theatres and other performance spaces. The DMXio is easily configured as a transmitter or receiver with the push of a button, and remembers this and other settings on every power-up.

The wireless data from a DMXio transmitter can also be received by RC4*Magic* wireless dimmers, including RC4 *Magic* Series 2 and Series 3 DMX2dim, DMX4dim, DMX4dim-500, and numerous other RC4Magic devices.

Data Privacy and Security

Each RC4*Magic* Series 3 system is programmed with three unique system IDs. RC4 IDs serve as system identifiers and encryption keys, ensuring interference-free operation anywhere, anytime, worldwide. Every RC4 user and project has their own IDs. Private IDs are shared only by explicit request with a written agreement between all parties involved.

For example, your RC4*Magic* system ID0 (ID zero) is not the same as any other RC4 user`s ID0, so *your* equipment only talks to *your* equipment. Wireless DMX systems made by others give you selectable channels or IDs, but they are the same for everyone; that is *not* the case with RC4*Magic*.

RF Channels and Power-Up Scanning

When an RC4*Magic* Series 3 DMXio <u>transmitter</u> first powers up, it scans the 2.4GHz radio band looking for an area with the least traffic. It then sets itself to operate on that frequency and begins transmitting DMX packets digitally encoded with the selected RC4 System ID. When this power-up process is complete, the RF Connect LED blinks slowly to indicate a private local-area wireless network has been established.

When a DMXio <u>receiver</u> powers up, it scans the 2.4GHz band looking for signals from a DMXio transmitter on the selected RC4 System ID. When the connection is established, the RF Connect LED will blink steadily. When DMX channel data is received, the DMX/RF Data LED will blink rapidly with each data packet.

If a receiver does not detect valid data for several seconds, the start-up scan repeats. Thus, if the transmitter has been turned off and back on (or there has been a power failure) and it selects a different frequency, the receiver will rescan and reconnect. Thus, receivers always follow transmitters on the same System ID.

Multiple RC4*Magic* Series 2 and Series 3 systems using different IDs can operate at the same time in the same space, and each system will provide a separate wireless DMX universe on its own private wireless network. In a space with little or no other radio activity, there is enough bandwidth in the 2.4GHz band to support up to 15 full-speed RC4*Magic* systems, each with any number of receivers and dimmers. Even in crowded rf environments there will usually be enough bandwidth for several RC4Magic systems.

One wireless DMX universe with up to 512 channels uses one RC4Magic system ID. A DMXio transmitter on a separate ID is required for each different wireless DMX universe you use. Thus, 4 System IDs provide 4 individual wireless universes, provided you have enough RC4Magic hardware to make use of them. You can add RC4Magic devices to your system at any time – just tell us your System IDs when you order.

DMX Data Connections

The DMXio provides male and female 5-pin XLR connectors, compliant with USITT DMX512/1990. Internally, these two connectors are directly wired together with no active electronics in the signal path. They can be used for data pass-through and will not fail in the event of DMXio power failure.

DMX Termination

A DMX terminator is available within the DMXio and can be toggled on/off by pressing one button. The state of termination (on or off) is remembered and will be restored when power is cycled. Note, however, that termination is not engaged when the DMXio is not powered on.

DMXio Transmitter Mode

As a transmitter, the DMXio decodes the DMX universe arriving at the DMX connector, encodes and encrypts it, and broadcasts it using Direct Sequence Spread Spectrum (DSSS) digital radio. Unlike wired DMX, the RC4 wireless signal includes error checking and correction codes, and is not affected by minor interruptions and interference. DMX channels that are changing are allocated more bandwidth than channels that are not changing, and all channels are broadcast with appropriate speed, redundancy and accuracy.

Channel Range Limiting

By default, the DMXio transmits the entire DMX universe arriving at the wired DMX data input. The universe can be any number of channels from one to 512. The maximum number of channels in a DMX universe is 512, but some controllers produce fewer (some common numbers of channels are 64, 128, and 256).

To reduce wireless bandwidth consumption, it is sometimes desirable to limit the number of DMX channels actually being transmitted. For example, if you are using RC4Magic to wirelessly control two DMX4dim wireless dimmers, with a separate DMX channel assigned to each dimmer, you only need to transmit data for eight channels. If they are contiguous channels (say, 400 – 407), then limiting the transmitter to just that range reduces wireless bandwidth by as much as 99.98%!

If you're not sure how many channels you are using, or if you are using DMXio units for full-universe cable replacement, stay with the default settings and transmit the entire universe.

DMXio Receiver Mode

As a receiver, the DMXio decodes the wireless signal from the transmitter, rebuilds the DMX universe, and regenerates a standard DMX signal with the same number of channels and the same packet rate as the data going into the transmitter. DMX in and out are compliant with USITT DMX512/1990.

Power Requirements

Power can come from the supplied wall transformer, from external batteries, or (optionally via internal jumpers) from XLR pins 4 and 5. A pack of five (or more) AA or AAA batteries, or even a small 9V battery, can be used for portable operation with, for example, a Goddard Design DMXter, a BCI Pocket Console DMX, a Fleenor Gizmo, or any other DMX signal source. The input voltage range is 5V – 35VDC, and the DMXio consumes approximately 0.4W of power.

Signal Range and Antenna Options

In many cases, the DMXio can be connected right at your lighting console or other controller, before your DMX signal continues to other devices in your system. The distance from console to stage is rarely more than 100 feet, well within the 200 foot range of RC4*Magic*.

Line-of-sight is not required for RC4*Magic*, but dense objects between devices — like concrete walls — will attenuate the radio signal and reduce the available range.

The standard model DMXio provides an internal omnidirectional antenna. The external antenna option provides an RP-SMA antenna connector for use with high-gain and/or directional antennas, or in installations where a remote antenna is deployed using a coaxial antenna cable.

Restore Defaults

If settings for System ID, DMX termination, or channel limiting have been used, you might want to restore everything back to defaults when setting up for a new project. This is easily done by pressing two buttons together.

DMXio User Interface

The DMXio user interface consists of six LEDs and five recessed buttons. The LEDs are behind small round holes; the buttons are behind small

slotted openings. DMXio settings rarely need to be changed, and keeping the buttons recessed ensures settings will not be accidentally changed while handling the device. It also reduces the likelihood of tampering.

Buttons should be operated by inserting a small tool – like a bent paperclip – into the slotted openings.

Do not insert anything into the round LED holes. Doing so could damage the device and may not be covered by the RC4Magic Lifetime Warranty.

Selecting an RC4*Magic* System ID is done by holding a button while powering up a unit. These are "power-up" or "hidden" functions.

The most commonly used features and functions are accessed by pressing one button while the unit is powered on and operating. For example, the RX/TX button toggles between receiver and transmitter modes.

A few additional features are accessed using the Func/Shift button: Hold the Shift button then tap another button.

The label on the bottom of the DMXio provides a legend for the LEDs and buttons. All settings are saved in non-volatile memory and are restored on each subsequent power-up.

LED Indicators

With the DMXio mounting flanges down and the connectors facing you, the LEDs left-to-right are:

DMX/RF Data - Yellow

In <u>transmitter</u> mode, this indicator is on when valid DMX data is present at the wired DMX data connector. If DMX data is discontinued, this indicator will remain on for the data time-out period, usually 1 second. This is because the DMX specification allows data packets to be spaced up to 1 second apart.

In <u>receiver</u> mode, this indicator blinks on receipt of RF packets. When many DMX channels are changing rapidly, blinking will be visible; when channels are in a steady state, blinking is somewhat slower. Irregular or inconsistent blinking often indicates drop-outs caused by a poor RF connection when, for example, devices are too far apart.

On power-up, this is one of two LEDs that indicate the selected RC4 System ID. *See Selected ID* Indication at the end of this section.

COP/RX/TX - Green

COP means *computer operating properly* and is indicated with a cyclical blink.

When the COP indicator is primarily on (illuminated) then the DMXio is in transmitter mode. The COP feature causes it to blink off briefly but regularly.

When the COP indicator is primarily off (dark) then the DMXio is in receiver mode. The COP feature causes it to blink on briefly but regularly.

If the RC4 CodeLoader feature is enabled on power-up, this indicator will remain solidly on for 5 seconds. If CodeLoading data does not arrive within those 5 seconds, normal device operation resumes.

On power-up, this is one of two LEDs that indicate the selected RC4 System ID. *See Selected ID* Indication at the end of this section.

RF Power/RSSI - Red

In <u>transmitter</u> mode, this LED indicates the strength of the RF signal. It blinks faster with higher power levels.

In <u>receiver</u> mode, this LED is a receive signal strength indicator (RSSI). Faster blinking indicates a stronger more robust signal.

DMX Channel Range Limit - Yellow

If the range of transmit channels has been reduced (Transmit Low Channel is higher than 1, or Transmit High Channel is lower than 512) then this indicator is on. This is a warning that not all channels are being transmitted.

DMX Termination - Green

If DMX termination is enabled, this indicator is on and an internal terminator is applied to the XLR connections.

RF Connect - Blue

In <u>transmitter</u> mode, this indicator blinks slowly when a private local-area wireless network is established.

In <u>receiver</u> mode, this LED is solidly lit (no blinking) while it searches for a transmitter on the associated RC4 System ID. When a valid transmitter is found and a private local-area wireless network is established, this LED blinks at double the speed of the transmitter LED.

If no valid data is received from the transmitter for several seconds, the receiver radio is reset and this LED reverts to being solidly on. It then remains on until a valid transmitter is found again. This sequence of events is what occurs if a transmitter is turned off and on and locates itself on a different RF channel.

Selected ID Indication

On power-up, the DMXio indicates which RC4*Magic* System ID is active with a series of blinks on the two left-most LEDs. A blink-pattern legend is provided on the bottom device label.

If the DMX/RF Data LED (*yellow*) blinks several times, then **ID0** (zero) is selected.

If the COP/RX/TX LED (*green*) blinks several times, then **ID1** is selected.

If both of the above LEDs blink *together*, simultaneously, then **ID2** is selected.

If those same two LEDs *toggle back and forth*, then **ID3, the RC4 Public ID**, is selected.

Power-Up Button

Functions

If a button is held down during DMXio power-up, then a power-up "hidden" function is invoked. These are for selecting an RC4*Magic* System ID, or enabling the RC4 CodeLoader for firmware installation.

All RC4 users and projects are assigned three unique private system IDs. The IDs programmed into your units belong only to you; your IDs are not the same as anybody else's.

Most RC4*Magic* systems operate on ID0 (zero), the default setting from the factory. There is no need to change this setting unless multiple wireless DMX universes are being used. Each separate ID supports a separate and unique wireless DMX universe.

ID0 (zero)

ID0 (zero) is selected if the ID0 button is held during power-up. This is the default ID selection for new devices, and after Restore Defaults has been executed.

ID1

ID1 is selected if the ID1 button is held during power-up.

ID2

ID2 is selected if the ID2 button is held during power-up.

ID3 Public

ID3 is selected if the ID3 button is held during power-up. ID3 is the Public ID and is the same on all RC4*Magic* Series 2 and Series 3 devices every built. This allows devices from different systems, owned by different people, to be used together.

The Public ID is also used when initially setting up RC4*Magic*PC with a remote control dongle. Until your computer has connected to one of your devices and learned your unique system IDs, it does not know what they. After learning, RC4*Magic*PC software securely stores them on your PC.

RC4 CodeLoader Enable

The RC4 CodeLoader is resident in every RC4 Series 3 device and is carefully protected. It is enabled by holding the Func/Shift button during power-up. Then, if CodeLoading does not being within 5 seconds, the DMXio reverts to normal operation.

RC4 firmware files are encrypted before release, and decrypted by the CodeLoader, inside the DMXio. The RC4 CodeLoader also guards the device's unique serial number and RDM address. (Every RDM device in the world must have its own unique address.) Updating firmware in your DMXio will never corrupt this important device-specific information.

The RC4 CodeLoader facilitates firmware updating without corrupting user settings and configurations, provided the new firmware does not substantially change the range of available settings and their ranges. In most cases, a firmware maintenance release can be installed without effecting DMX channels, curves, and other user or application settings.

Connection to a host PC for CodeLoading is done with an <u>RC4 Series 3 USB CodeLoader Cable</u>. One end plugs into the DMX miniplug port on the Series 3 device, the other end plugs into a USB port on the PC.

The RC4 CodeLoader application runs natively on Microsoft Windows. With appropriate libraries it can also run on Apple Mac OSX, and most flavors of Linux. All you need is a working PC, an Internet connection (to retrieve new RC4 code files), a USB port, and the RC4 CodeLoader Cable.

Single-Button Functions

The most commonly used DMXio functions are accessed with a single press of a single button. All settings are saved in non-volatile memory and restored on subsequent power-ups.

RX/TX (Receive/Transmit Mode)

Press this button to toggle between receive and transmit mode, restarting the DMXio in the new mode.

TX Low Channel

This features uses RC4*Magic* OneTouch™ – the same process used to assign channels and curves on RC4 wireless dimmers. You need a DMX controller capable of clearing all DMX channels to numeric zero and bringing up a single channel to a level above 20%.

To set the TX Low Channel:

1. Connect a DMX console or other controller.
2. Clear all DMX channels to zero. Beware of fixture profiles that clear, for example, moving-light pan/tilt channels to a central level, rather than true zero. All DMX channels must be at actual zero.
3. Bring up the lowest DMX channel you want to transmit wirelessly. Set it to any level that is higher than 20%. It should be the only non-zero DMX channel.
4. Press and release the TX Low Channel button.

That's it! If you have selected a channel that is higher than 1, or if the TX High Channel is already set to a value lower than 512, the DMX Channel Range Limit LED will be on.

You can disable this feature by either setting TX Low Channel to 1 using the process above, or using the Restore Defaults function.

TX High Channel

To set the TX High Channel:

1. Connect a DMX console or other controller.
2. Clear all DMX channels to zero. Bring up the highest DMX channel you want to transmit wirelessly. Set it to any level that is higher than 20%. It should be the only non-zero channel.
3. Press and release the TX High Channel button.

That's it! If you have selected a channel that is lower than 512, or if the TX Low Channel is already set to a value higher than 1, the DMX Channel Range Limit LED will be on.

You can disable this feature by either setting TX High Channel to 512 using the process above, or using the Restore Defaults function.

Func/Shift Two-Button Functions

Lesser used DMXio features and functions are accessed by pressing and holding the Func/Shift button and then briefly pressing one other button.

RF Power
Hold Shift/Func and press the ID0 button to increment to the next RF power level. If the level is at maximum, it rolls over to the minimum on the next button press. Higher power levels are indicated by faster blinking of the RF Power LED.

DMX Termination
Hold Shift/Func and press the ID1 button to toggle DMX termination on/off. The current state is indicated by the DMX Termination LED. When the LED is on, termination is active.

Set Defaults
Hold Shift/Func and press ID3 to restore all internal DMXio settings to defaults. This includes:

- Select ID0 (zero)
- TX Low Channel is 1
- TX High Channel is 512
- DMX termination is off
- RF power is at maximum
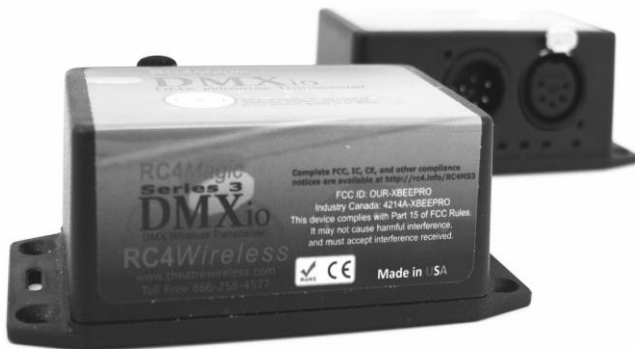
Manufacturer's Warranty

RC4Magic Series 2 and Series 3

The RC4*Magic* Lifetime Warranty is the best in the business and almost unlimited. If you have not misused or abused the device, we will fix it for free, forever. When timing is critical, we can often ship a refurbished replacement unit the same day you contact us, along with materials for returning your old unit. We may ask that you pay the cost of overnight shipping to get it there faster otherwise, we'll ship regular mail/post at our cost.

Examples of misuse or abuse not covered under warranty include, but are not limited to:

- Dimmer outputs ganged without ensuring they are configured identically
- Overvoltage (more than 35VDC applied)
- AC mains voltage applied
- Device operated underwater or while saturated with water
- Device crushed by a car, forklift, sledgehammer, etc.
- Device set on fire (not as a result of component failure under normal operating conditions)

Very few RC4*Magic* devices are returned for repair. Treat your RC4 devices with care and you're set for life!

RC4Magic Series 3 DMXio Device *Specifications*

- Dimensions: 3.4" x 2.3" x 1.55" nominal (approx. 86mm x 59mm x 40mm)
  Mounting flanges extend an additional 0.5" (13mm), for a bottom footprint of 4.4"
  x 2.3" (112mm x 59mm)
- DMX Connections: 5-pin male and female XLRs for DMX in and out,
  internally wired together
- **Power Input: 6VDC – 35VDC, 0.4W**
  Standard 2.1mm power receptacle, center positive
  Internal jumper option to take power from XLR pins 4 and 5
- 3 user-selectable RC4 Private System IDs, plus the RC4Magic Public ID
  (each ID supports one independent DMX universe)
- User selectable Transmit or Receive modes (press one button to toggle).
- User selectable internal DMX termination (press one button to toggle on/off).

Transmitter Mode

- **Only 1 transmitter device should be operated on any single RC4*Magic***
  System ID.
  Transmitter devices include DMXio and RC4MagicPC Remote Control Dongle.
- DMX Input: meets USITT DMX512/1990(4us) with 1-second data hold after
  dropout. Straight-thru hardware connection from DMX input to output for easy
  pass-through to additional DMX devices.
- DMX Channel Limiting: Set lowest and highest DMX channel using RC4
  OneTouch (default is full 512-channel universe)

Receiver Mode

- **Any number of DMXio receivers may be used in a system.**
- DMX Output: meets USITT DMX512/1990.
- The DMX specification allows up to 32 devices on a DMX output. The DMXio data
  output exceeds this requirement and is capable of driving additional devices.
- Internally protected against static discharge and excessive line loading.

RC4Magic DMX Protocol Compliance

- DMX inputs and outputs comply with USITT DMX512/1990(4us).
- Packets with non-zero start codes are not transmitted; RC4Magic cannot transfer
  proprietary data or RDM packets.
- DMXio receiver output replicates DMXio transmitter input, providing the same
  number of DMX channels and the same number of packets per second (pps).

- Minimum number of DMX channels per packet: 1
- Maximum number of DMX channels per packet: 512
- Maximum packet-per-second rate: 44pps with 512 channels, 10000pps with 1 channel

RC4Magic RF Specifications

- Indoor/Urban Range: Up to 300' (100 m), 200' (66 m) typical
- Outdoor Line-of-Sight Range: Up to 1 mile (1.6 km)
- Transmit Power Output: Up to 100 mW (20 dBm) EIRP [1]
- Receiver Sensitivity: -100dBm
- Operating Frequency: 2.4 GHz ISM band,
  DSSS (Direct Sequence Spread Spectrum)
  One RC4*Magic* DMX universe occupies one 802.15.4 channel
  (1/15th of the 2.4GHz ISM band)

Agency Approvals: United States FCC: OUR-XBEEPRO

Canada IC: 4214A XBEEPRO

Europe CE ETSI [1]

Japan: 005NYCA0378 1

[1] RC4*Magic* radio modules must be configured for 10dBm output in Europe, Japan and some other jurisdictions.

How to Reach RC4 Wireless

Physical Address

RC4 Wireless is a registered trade-name of Soundsculpture Incorporated of North Carolina.

Soundsculpture Incorporated / RC4 Wireless
13604 Heathwood Court
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USA

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Toll Free Fax 1-866-237-6641 (North America)

Internet

Email techsupport@theatrewireless.com
Skype rc4acw
Website www.theatrewireless.com

If you like your RC4 Series 3 device, please take the time to let others know.
Post information about your shows and productions at:
www.theatrewireless.com/customers/submit-your-project/

Like us on Facebook, and check out helpful tips we post from time to time:
www.facebook.com/RC4Wireless

Follow us on Twitter for news about coming events and RC4 discount offers:
www.twitter.com/RC4Wireless