Duo 2400 V3 Diversity Receiver

Instruction manual - International edition

Rev 1.0 - 30 Oct 2015

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Overview

One of the challenges of video downlinks on high frequency bands, such as 2.4GHz, is the signal breakup due to multipathing. ‘Nulls’ in the received signal occur when the direct signal from the transmitter arrives at the same time as a reflected signal, which happens to be 180 degrees out of phase with the direct signal.

Smart antenna design, such as ImmersionRC’s circular-polarized ‘SpiroNET’ antenna family, can reduce this effect, but it cannot completely eliminate it.

The Duo2400v3, the fourth in ImmersionRC’s series of 2.4GHz diversity receivers, can significantly improve reception in the presence of multipathing, by intelligently switching between two independent receivers when signal quality drops.

Another useful application of diversity switching is to select the best signal from two antennas, for example, one omnidirectional, and one directional, or a couple of directional antennas pointing in different directions.

Version 3 of the Duo2400 comes with 20 selectable channels support, covering Lawmate, standard ‘ImmersionRC/FatShark/Airwave’ channels, international band and USA bands. Bands can be scrolled through with the Band button and channels with the Channel button.

The Duo 2400 is also one of the first in a line of ‘smart’ receivers, designed for single-cable, plug and play, integration with the ImmersionRC Ground Station system.
Power, Audio, Video, and a bidirectional data link, are all passed through a single Mini-Din connector, connected to the Ground Station.

With > -90dB sensitivity per receiver the Duo 2400 is sensitive, very sensitive. Paired with an appropriate antennas, it will give you many miles/km of range. Add an antenna tracker, and a higher gain directional antenna, and this range increases significantly.

Equipped with two buffered AV outputs it allows you to connect your goggles, as well as your recording device, without the need for Y-cables or a signal splitter.

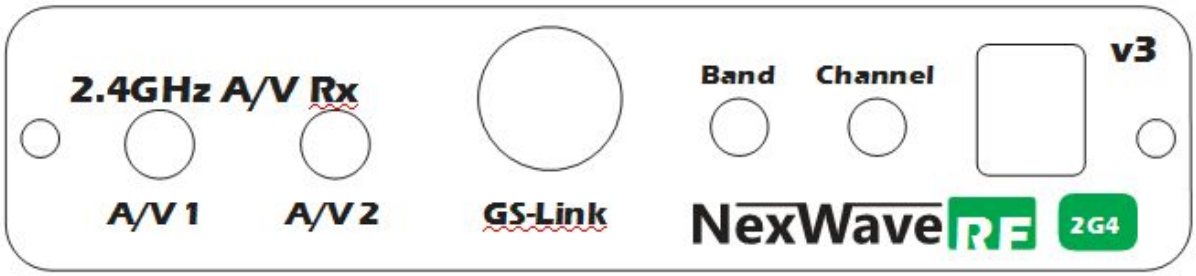
Package Contents

- Duo2400 v3 Receiver
- 2x linear polarized antennas with SMA connector (rubber ducky style)
- 1x power connection lead
- 2x 3.5mm Male to 3x Phono cable
- 2x ImmersionRC logo stickers

Technical Specifications

- FM Audio/Video Modulation
- -90dB typical sensitivity
- 50 ohm antenna impedance
- 1Vpp Video output level
- 3V pp Audio output Level
- Twin female SMA antenna connectors
- Can be powered from 6-16V (< 9v, or 2s recommended)
- Small, light weight, durable, anodized aluminum casing
- Weight: 170-grams
- Size : 103 x 90 x 23mm

Connectors and Pin-Outs



A/V connection

Two Audio/Video outputs are provided on the Duo2400, plus the GS-Link connection. These outputs are standard 3.5mm 4-pole jacks, compatible with all ImmersionRC and FatShark products equipped with the same connector.
Video, and Stereo-Audio are available on these jacks, which can be connected directly to an LCD headset, display, or recording device.

The A/V outputs may also be used to connect to the ImmersionRC iTelemetry dongle, to decode telemetry data from your model on your smart-phone or tablet (iPhone, iPad, and Android devices supported).

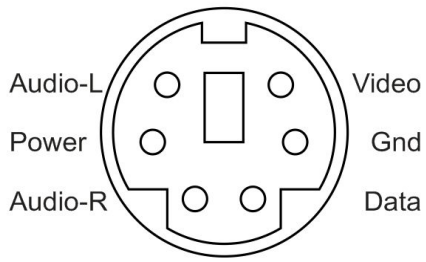
Power

The diversity receiver works best with either a 2S or 3S LiPo battery. A cable to connect the battery is provided. You will have to connect your preferred type of battery connector to the cable.

The receiver automatically sets audible low-voltage warnings based upon the type of battery sensed. See the programming section on how to set additional low voltage warnings.

Groundstation Link Connection

The Ground Station link is a standard 6-pin mini-din, as used for many years by PS/2 mice and keyboards.
This connector may be used to power the receiver, control band and channel options, and also interface to the Video, and Audio output lines.



The ImmersionRC Antenna Tracker v2, currently shipping, includes a compatible connector.

Instructions on use

Operating the Duo 2400 Diversity Receiver

The Duo 2400 A/V receiver can be configured to store user selected configuration settings. The selected channel will always be stored so at power up it defaults to the last selected channel. Other settings that can be configured are:

- Low voltage alarm threshold
- Low Batt 100mV
- Rx Ticks

Programming these settings is accomplished by using the CHAN push button, with feedback from the internal beeper, in a manner similar to that used by most ESCs (Electronic Speed Controllers).

To enter the programming menu, hold down the CHAN push button for 5 seconds or longer. Once the programming menu has been activated, the receiver will start cycling through the menu options, in the order listed.
To change one of the items, wait for it to be ‘played’, and immediately after, press the button.

The receiver will then ‘play’ the current value, as a number of beeps, and will then start from the first option, and play each option until the last. Selecting an option is simply done by waiting for it to be played and pressing the button briefly.

See beep codes in the table below.

Beep Codes

Beep Code	Menu	Menu Choices
– .	Low Batt Volts	1 – Auto (for 2S or 3S LiPo)* 2 – 6v 3 – 7v 4 – 8v 5 – 9v 6 –10v 7 – 11v 8 – 12v *Default: 6V for 2S, 9V for 3S*
– . .	Low Batt 100mV	*1 – 0.0v …. 10 – 0.9v* *Default: 0.5v (for threshold of 9.5v)* *(Ignored in Auto mode)*
– . . .	Rx Switch Tick	1 – Tick Off 2 – Tick On *

*Note that * indicates the default value .*

For example to change the Low Battery 100mV setting:

Button pressed for > 5 seconds

Dash Dot Dot	- second menu item		**press button briefly to enter setting**
Dot	-		**current setting (auto)**
Dot	- first available option	0.0v	**press button briefly**
Dot Dot	- second available option	100mV	**press button briefly**

At this point the Low Battery 100mV setting has been changed to '100mV'. The module will now continue with the next item in the menu, and continue to the end of the list. Once the end of the list is reached, the receiver will automatically exit the programming mode signaled by two short beeps.

Low Battery Volts and Low Battery 100mV

These two options can be combined to set the threshold at which the low-voltage alarm sounds.

In Auto mode (the default), the receiver will sense the attached battery voltage, and will set the alarm voltage accordingly (6V for 2S and 9V for 3S LiPo). This mode is designed only for use with LiPo batteries. For use with NiCD, NiMh, or other batteries, set the alarm voltage manually, for example:

9.2v	set LowBattVolts to 5 (9v), and LowBatt100mV to 3 (0.2v)
10.0v	set LowBattVolts to 6 (10v), and LowBatt100mV to 1 (0.0v)

When powering the receiver from LiPo batteries, it is important to note that the discharge curve is fairly flat, and drops off quickly near the end. Setting a threshold of around 3.0/cell is relatively safe. It is however highly recommended to perform a 'dry-run' after setting the voltage warning threshold to make sure the low battery warning is set up correctly.

If upon connection of a battery pack the receiver beeps continuously then the low battery warning is set higher than the voltage from the battery pack, so reset accordingly or charge the battery pack.

Note that regardless of the low battery alarm settings, a fixed alarm will occur when an input voltage smaller than 5V or larger than 13V is detected. This safeguards the receiver from being used with input voltages with which the correct operation cannot be guaranteed.

Safety Note: Even though this alarm will provide some protection against loss of video signal during an FPV flight, it is highly recommended to fully charge all battery packs used before each and every flight.

Rx-change Ticks

When the diversity receiver's microcontroller switches receivers, it issues an audible 'tick'. A useful confidence-building feature when using the receiver, but if you feel the ticking becomes annoying you have the option of turning it off.

Optimal Antenna Connection

The Duo2400 was designed to be connected directly to the antenna's RF connector with as short a cable as possible, or ideally no cable at all.
Months of testing has shown that with this configuration, the best reception will be obtained. You can even connect the Patch antenna directly to the Duo2400 (please be careful not to put too much force on the SMA connectors if this mounting technique is chosen)

Antenna Selection & Placement

The diversity receiver may be used with standard 2.4GHz antennas, equipped with a male SMA connector. The spacing between the two antennas is not too critical on the 2.4GHz band, even with two spiroNET antennas placed touching each other, multipathing effects will be greatly reduced.

Frequencies

The Duo2400v3 supports 20 frequencies, spread over 4 bands. These bands correspond to various standards commonly used in the 2.4GHz FPV world, and have some history behind them.

	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
Band 1 *Lawmate*	2410	2430	2450	2470	2370	2390	2490	2510
Band 2 *Airwave*	2414	2432	2450	2468	-	-	-	-
Band 3 *International Band*	2370	2396	2410	2430	-	-	-	-
Band 4 NexWaveRF USA (US)	2396	2396	2410	2430	-	-	-	-

Note that the ImmersionRC 700mW 2.4GHz transmitters are available (currently) in two versions, an international version, which uses the common Lawmate frequencies (Band 1), and a USA (Band 4, US) version, which uses three frequencies legal for use in the USA (and legal for US retailers to ship to domestic customers)

Band 3 falls within the UK/EU Amateur radio band, and is available by special order (contact your local retailer if you are interested in this product)

Support

First line of support is done by the reseller. If you encounter any problems with your ImmersionRC product contact them first.

For support on issues involving equipment from other brands and also general support for ImmersionRC products, the best place to go is the ImmersionRC section of FPVlab.com. We actively monitor this forum and provide support here.

Regulatory notice

The use of this product may be prohibited in your country/region/state, please verify that the RF output power and frequencies used by this transmitter comply with local rules and regulations, this product may require a license to operate.

Directions on safety

ImmersionRC advocates the safe use of their products, always make sure you equipment is in proper working order, is checked prior to every flight and that your are familiar with and respect the equipment's capabilities and limitations. Do NOT fly recklessly, do NOT fly near airports, freeways, towns, people, etc, basically anywhere where a equipment failure or pilot error can result in injury or damage to people and/or property.

Warranty

For warranty claims or repair requests please consult the retailer that you purchased this product from, they will be able to help you with your warranty claim or repair request.

Like Us

We would like thank you for purchasing this ImmersionRC product.

Like ImmersionRC's Facebook page and be kept up-to-date with news, product releases, firmware updates, tips and tricks, and other information relevant to the FPV hobbyist.

http://www.facebook.com/ImmersionRC

You can also follow us on Google Plus
google.com/+immersionrc

We have even been known to Tweet on occasion
https://twitter.com/@immersionrc