RFDMX User Manual

PRJ-DMX-MAN-001

RFDesign Pty Ltd
7/1 Stockwell Place
Archerfield, QLD 4108
rfdesign.com.au

Table of contents

1. Revision History

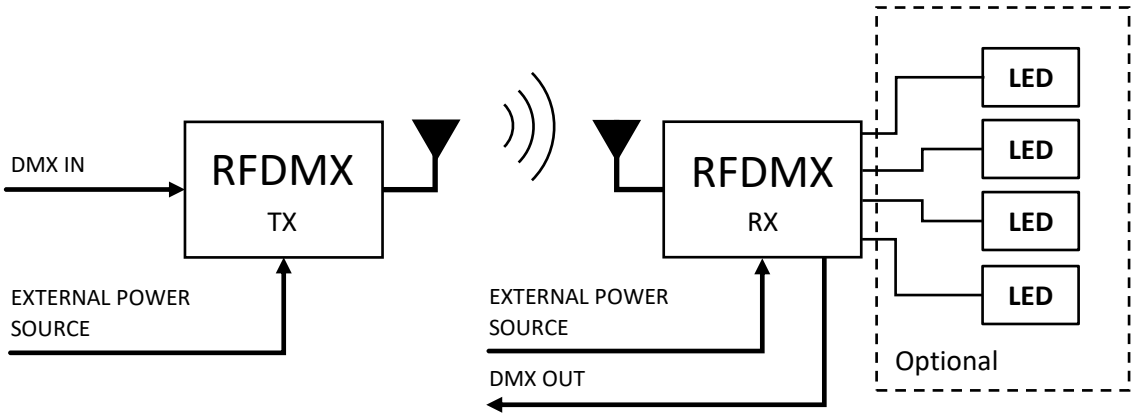
Version	Date	Description	Prepared	Approved
1	8-8-19	DRAFT	M. Ruggiero	
1.1	13-8-19	DRAFT	M. Ruggiero	
1.2	19-8-19	DRAFT	GFS	
1.3	25-9-19	DRAFT	GFS	

2. Overview

2.1 Features

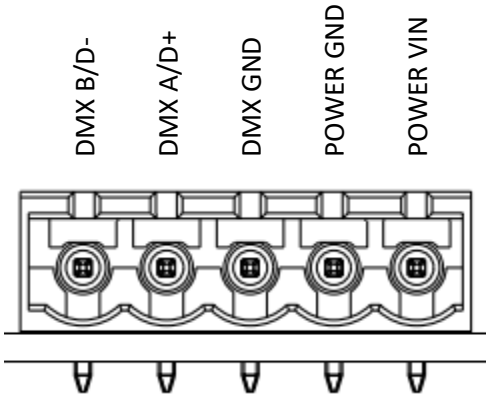
- Support to up to 512 DMX channels
- Same hardware can operate as transmitter or receiver
- Secure link between transmitter and receiver nodes
- One-off synchronization process
- Long-range resilient wireless communications
- On board LED driver (optional)
- DIP switch network and DMX address setup

2.2 Functional diagram



2.3 Connector Pinouts

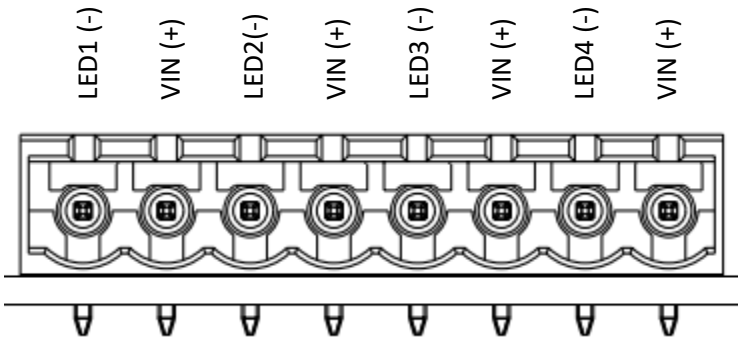
The RFDMX features a power and communications connector and a LED driver output connector. If the device is set to transmitter, power and DMX input are mandatory connections. If operating as receivers only power is required. In Transmitter mode the TX/RX- and TX/RX+ pins are DMX stream inputs to the RFDMX board and in Receiver mode, the TX/RX pins are DMX stream outputs.



Power and DMX connector front view

Pin	Description	Rated voltage
DMX B/D -	DMX512 Stream signal inverted	0 - 5V
DMX A/D+	DMX512 Stream signal	0 - 5V
DMX GND	Ground	0
POWER GND	Ground	0
POWER VIN	Supply Voltage	7 – 33V

The LED driver outputs can be connected when operating as receiver and are used to drive 4-channel LED's after decoding the DMX512 stream for the address set on the board. The supply voltage must high enough to drive the LED string if connected.



LED output connector front view

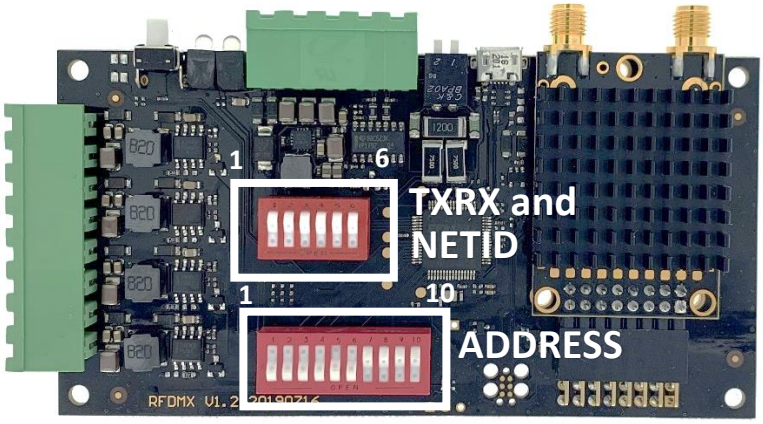
Pin	Description	Rated voltage
VIN (+)	LED supply – connected to the supply voltage VIN internally	7 - 33V
LED1 (-)	Open-drain LED output 1	0 - 33V
LED2 (-)	Open-drain LED output 2	0 - 33V
LED3 (-)	Open-drain LED output 3	0 - 33V
LED4 (-)	Open-drain LED output 4	0 - 33V

The board features a USB port which is used for firmware updates. No external power source is required during the firmware upgrade as the USB provides enough energy to the embedded microcontroller and long-range radio module.

The RP-SMA connectors should be connected to suitable antennas for required signal coverage, although the system will work with any 50Ω impedance element and the matching RP-SMA connector. Only ANT1 is used for transmitter and receiver units. Do not use ANT2.

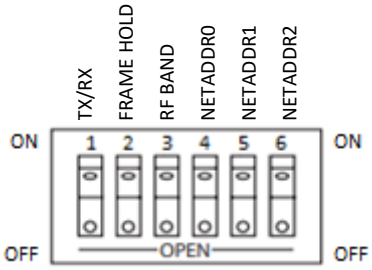
2.4 Switches and Buttons

The RFDMX contains a series of on-board DIP switches and buttons used to set network parameters, and to bond the boards. Changes to the DIP switch estates must be done prior to turning the device on.



2.4.1 RX/TX and Network ID DIP switches

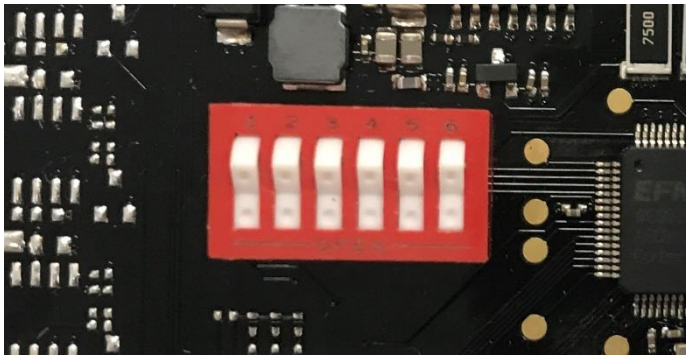
The RX/TX and Network ID are grouped in a single package containing 6 switches.



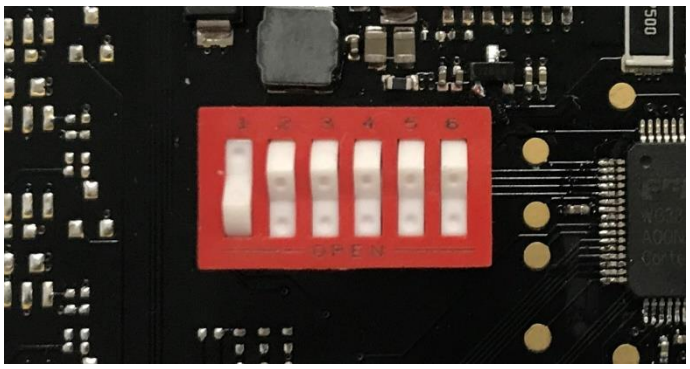
RX-TX and Network ID DIP switches top view

Switch	Name	Description
1	TX/RX	Operating mode ON: Transmitter (TX) OFF: Receiver (RX)
2	FRAME HOLD (RX mode only)	ON : DMX frame hold active OFF : DMX no frame hold
3	RF BAND	High / Low RF Band Selection
4	NETADDR0	System network address bit 0
5	NETADDR1	System network address bit 1
6	NETADDR2	System network address bit 2

RX-TX and Network ID DIP switches description



DIP switches Example 1 – RFDMX set to receiver mode



DIP switches Example 2 – RFDMX set to transmitter mode

2.4.2 Frame Hold (RX Mode only)

The Frame Hold feature monitors the DMX data frames being received from the TX unit.

With Frame Hold OFF, the received DMX data frames are regenerated and transmitted as they are received. Should a DMX data frame be lost or corrupted due to electrical noise or other radio interference, then the lost frame is skipped, causing an interruption in the DMX data stream.

Some lighting fixtures interpret a lost frame as complete loss of DMX data, and switch off automatically. On return of the DMX data they resume normal operation. These events are usually visible as a ‘dip’ or ‘flicker’ in the light fixture output.

With Frame Hold ON, the received DMX data frames are monitored. Should a DMX data frame be lost, then a repeat of the last frame is automatically generated and inserted into the DMX data stream. The data stream remains uninterrupted, and no visible ‘dip’ or ‘flicker’ occurs in the lighting fixture.

The Frame Hold feature will repeat the last frame up to a maximum of 30 frames, then will stop regenerating DMX data. For most applications this corresponds to approximately 1 second.

Frame Hold is ideal for installations where existing RF communications systems are in operation, and RF noise / interference is known to be present.

2.4.3 RFBAND Switch

The RFBAND switch allows the user to select the Upper or Lower range of the available RF spectrum for the RFDMX to operate in.

All TX and RX units in the same system must be set to the same RFBAND settings for correct operation.

In most installations, where a single RFDMX system is operating, the RFBAND will not need to be changed.

In installations where there are two (2) RFDMX systems operating in close proximity to each other, care must be taken to ensure the two systems are NOT using the same RFBAND setting.

2.4.4 NETID Switches

The NETID Switches allow the user to select up to 8 different spread spectrum channel hop sets.

All TX and RX units in the same system must be set to the same NETID settings for correct operation.

The NETID switches allow multiple RFDMX systems to co-exist over a wide area.

2.4.5 Transmitter (TX) to Receiver (RX) pairing

A single push-button is fitted to the RFDMX to initiate the pairing procedure.

The process for pairing RX units to a TX unit is as follows:

- Ensure TX and RX units to be paired have the identical BAND and NETID settings on their DIP switches.
- Power up RX unit. Wait 5 seconds, then press SYNC button. The ACT LED will start to flash. RX unit will remain in pairing mode, looking for a message from TX unit for 60 minutes.
- Repeat for all other RX units that need to be paired synchronisation with the TX unit.
- Power up TX unit. Wait 5 seconds then press SYNC button. ACT LED will flash for 5 seconds and TX unit will send sync message to all RX units already set in pairing mode. After 5 seconds, TX unit will return to normal operation mode.
- All RX units within radio range and in pairing mode will receive sync message and bind themselves to the TX unit. Once paired, the ACT LED will stop flashing and the RX unit will return to normal operation, now linked to the TX unit.

The pairing process can be repeated as required to add new RX units to an existing system.

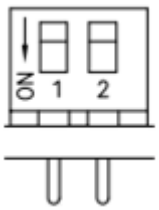
2.4.6 LED indication

LED's	Function	Transmitter (TX)	Receiver (RX)
LINK	Radio signal status indication	N/A	OFF for good radio link SLOW FLASH for reduced radio link FAST FLASH poor / no radio link
ACT	DMX512 Data Present / Sync Mode Display	Fast flash when valid DMX512 signal transmitted Slow flash during SYNC mode	Fast flash when valid DMX512 data is received from the TX unit Slow flash during SYNC Mode
PWR	Power OK and sync mode display	Fast flash when valid DMX512 signal connected. Slow flash during SYNC mode	Fast flash when valid DMX512 data is recovered and output on DMX512 port. OFF during SYNC mode.

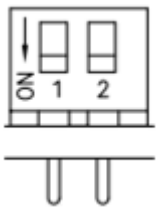
2.4.7 DMX termination switches

The termination switches should be turned on in the two most distant devices connected to the DMX bus. This ensures the differential bus termination is set to 120Ω. Both switches must be on to enable the termination load.

Unterminated



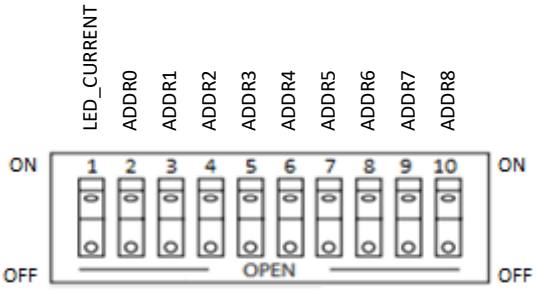
Terminated



2.4.8 DMX Address and LED current switches (LED Driver Model only)

The DMX512 address and the LED maximum current are also set using DIP switches.

Note that the DMX Address and LED Current switches have no effect on the output data available on the RX unit DMX512 output connector.



Address and LED current DIP switches top view

Pin	Name	Description
1	LED_CURRENT	LED output current ON: 700mA MAX OFF: 350mA MAX
2	ADDR0	Network address bit 0 – 001 (LSb)
3	ADDR1	Network address bit 1 – 002
4	ADDR2	Network address bit 2 – 004
5	ADDR3	Network address bit 3 – 008
6	ADDR4	Network address bit 4 – 016
7	ADDR5	Network address bit 5 – 032
8	ADDR6	Network address bit 6 – 064
9	ADDR7	Network address bit 7 – 128
10	ADDR8	Network address bit 8 – 256 (MSb)

Address and LED current DIP switches pins description

3. Technical Specification

5.1 Power Consumption

Table 7 – Power Consumption vs Mode of Operation

Mode of operation (24V DC Input)	TX / RX Model Current [mA]	TX / RX / LED Driver Model Current [mA]
TX Mode – No DMX512 Data	120mA	145mA
TX Mode – DMX512 Data Stream Active	135mA	160mA
RX Mode – Pairing mode, Waiting for sync	55mA	60mA
RX Mode – DMX512 Data Stream Active	55mA	60mA
RX Mode + LED Driver Active (All channels OFF)	TBA	TBA
RX Mode + LED Driver Active (1 Channel at 350m)	TBA	TBA
RX Mode + LED Driver Active (1 Channel at 700mA)	TBA	TBA
RX Mode + LED Driver Active (4 Channels at 350mA	TBA	TBA

Recommended external power supply:

For TX and RX only (No LED Driver) operation, an external DC power supply of +7V to 33V is required and must be able to supply at least 1A.

For RX + LED Driver operation, additional current is required to power the LED drivers. The input voltage should be selected to match the LED drivers being driven. Care should be taken to ensure there is enough DC voltage available to allow all series LED's to operate at their specified operating voltage.

For 350mA LED output current mode an additional 1.4A is required -> 3A is recommended

For 700mA LED output current mode an additional 2.8A is required -> 4A is recommended.

Radio Specification

Table 8- Performance	
RF Data Rate	224 Kbits/sec
Indoor Range	50 – 150m
Line-Of-Sight Range	2.5km or more depending on antennas
Transmit Power	0 to 30dBm in 1dBm steps
Receiver Sensitivity	-98dBm at 10^{-5} BER

Table 9 - Features	
Configuration Method	Board-level DIP switches
Frequency Band	902 MHz – 928 MHz
Interference Immunity	FHSS (Frequency Hopping Spread Spectrum)
Serial Interface Data Rate	250Kbits/sec DMX512 over RS485 physical interface

Table 10 - Networking and Security	
Addressing Options	512 addressable DMX channels, 4 channels decoded per receiver
Possible networks	16 x 2 frequency bands
Channels	21 Frequency Hopping Channels
Supported Network Topologies	Star: 1 transmitter, multiple receivers as required

5. Firmware update

The RFDMX firmware can be updated via the USB port. You will only need a micro USB cable and a computer running the flashing software. Disconnect any external power supplies and LED loads from the RFDMX before proceeding. Run the application, select the firmware file and connect the USB cable to the RFDMX. The software will automatically detect the board. Once that happens, you are required to click “connect” within 5 seconds, and “Program”.