

This documentation relates to Pluggy with firmware version 1.2.0.0 or later.

What is CRMX¹

CRMX is an acronym for Cognitive Radio MultipleXer - it is the first smart wireless system to automatically and continuously adapt to its surroundings in real time. CRMX was specifically developed to meet the demand for reliable, easy to use, and cost effective wireless lighting controls.

CRMX Pluggy FX and Pluggy RX

Building as a pin compatible replacement of the W-DMX TiNY module, LumenRadio offers CRMX Pluggy - the first plug-in module compatible with CRMX, CRMX², W-DMX G3, G4S and G5.

Pluggy is tested according to ETSI EN 300 328 (v2.2.2) as well as *pending* FCC certification with a modular approval up to 100mW.

Pluggy allows for a flexible integration where the option to install the module or not can be done late in the manufacturing process, or even post-sales by a certified service technician.

Features

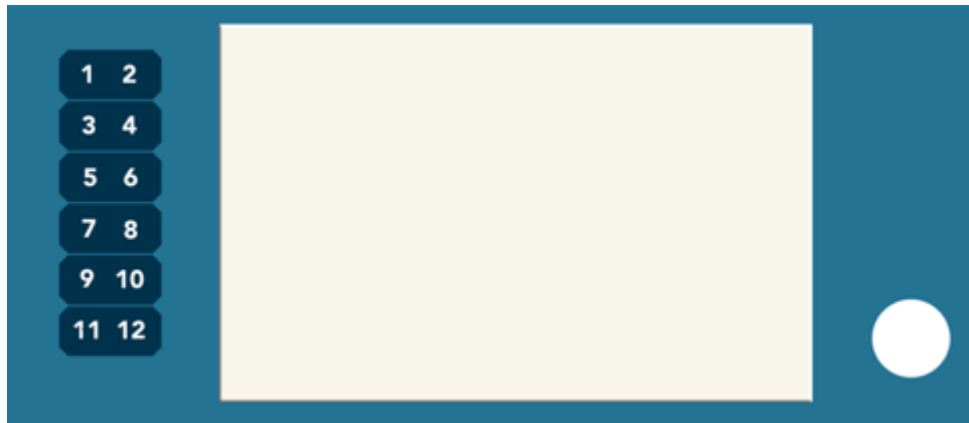
- Receives CRMX², CRMX Classic, W-DMX G3, G4, G4S and G5.
- Transmits CRMX Classic, W-DMX G3 and G4S (FX version only)
- Supports ANSI E1.11 - DMX512-A and ANSI E1.20 - RDM (RDM in RX mode only, FX version only)
 - Cognitive coexistence - dynamically avoids occupied frequencies (in CRMX modes)
 - DMX fidelity and frame integrity
 - DMX frame rate and frame size auto sensing
 - Fixed 5 ms end-to-end latency
 - U.FL/IPEX external antenna connector
 - All configuration data is stored in non-volatile memory, 20 years data retention
 - Pluggy contains upgradeable firmware for future proofing
 - Over-the-air firmware upgrades

Pin Assignments and Functions

This section describes the pin assignments and pin functions

Pin assignments

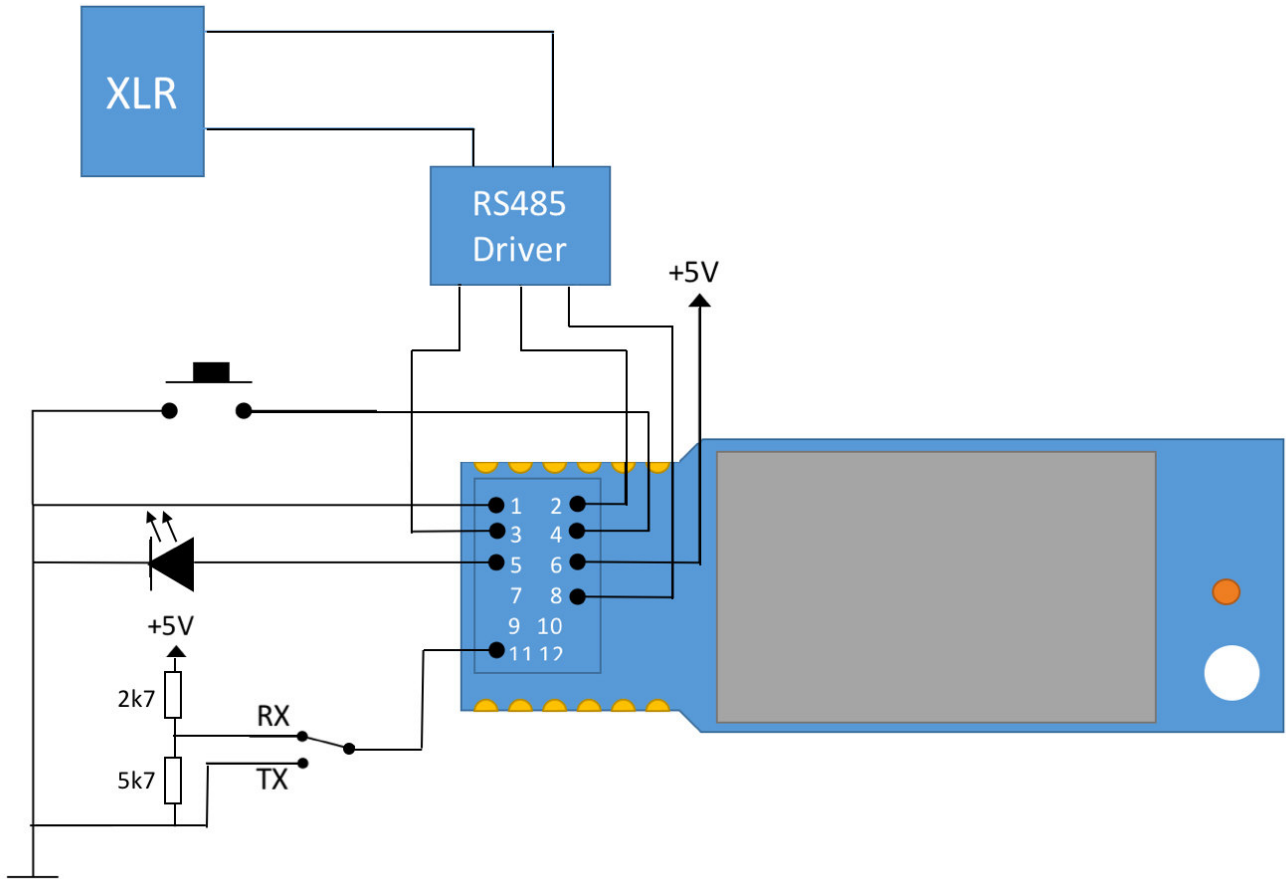
Module seen from the top



Pin functions

Pin	Name	Pin type	Description
1	VSS	Power	Ground (0V)
2	DMX_RXD	Digital input	DMX RXD
3	DMX_TXD	Digital output	DMX TXD
4	LINK_SW	Digital input	Link control switch input
5	STATUS_LED	Digital output	Status LED
6	VDD	Power	Power supply (5V)
7	N.C.	No connection	Internal use only - do not connect
8	RS485_DIR	Digital output	RS485 driver direction
9	RGB_RED	Digital output	RGB LED red signal
10	RGB_BLUE	Digital output	RGB LED blue signal
11	FLEX_MODE	Analog input	Flex mode selection pin (FX version only)
12	RGB_GREEN	Digital output	RGB LED green signal
ANT	RF ANT	RF	Antenna connector

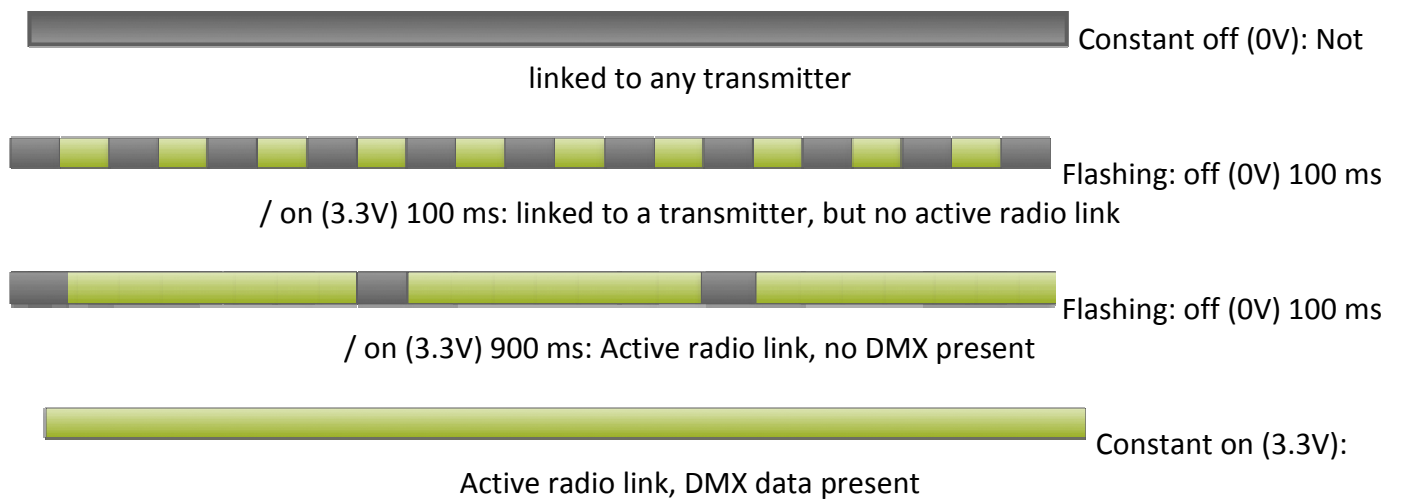
Typical application circuit



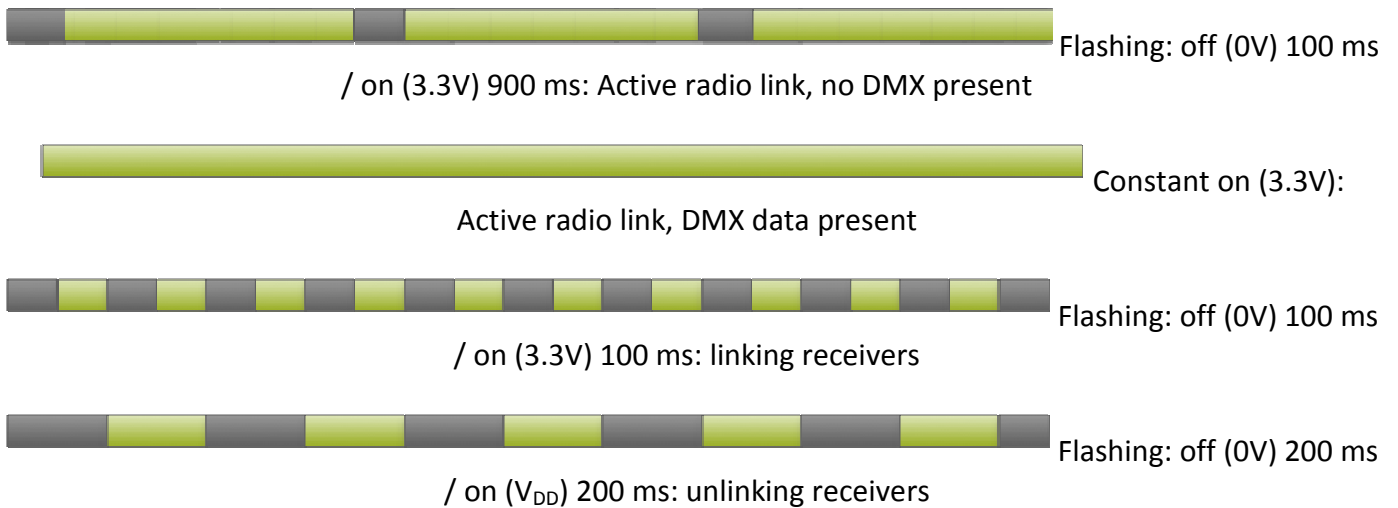
LED Outputs Status LED

The status LED (*STATUS_LED*) indicates the status of TimoTwo module. The LED indicator pin is an output pin capable of sourcing 5mA at the 3.3V. An appropriate current limiting resistor must be connected in series with the LED.

Receiver







Transmitter (FX version only)






RGB LED Receiver

In receiver mode the RGB LED indicates the signal quality of the received signal.

Color	Meaning	Comments
	>80%	Red = 0V, Green = 3.3V, Blue = 0V
	60-80%	Red = 3.3V, Green = 3.3V, Blue = 0V
	30-60%	Red = 3.3V, Green = 0V, Blue = 0V
	<30%	Red = 3.3V, Green = 0V, Blue = 0V, 1Hz blink

Transmitter (FX version only)

In transmitter mode the RGB LED indicates the currently used transmission protocol.

Color	Meaning	Comments
	CRMX	Red = 3.3V, Green = 3.3V, Blue = 3.3V
	W-DXM G3	Red = 0V, Green = 3.3V, Blue = 0V
	W-DXM G4S	Red = 3.3V, Green = 0V, Blue = 3.3V

Link switch input

The link switch input (*LINK_SW*) can be used to interface with a momentary (monostable) closing push button to facilitate a simple user interface. This is an alternative to using the SPI interface to integrate into a host device's menu system.

This signal is Internally pulled high to 3.3V.

The switch input has several functions, please see the table below for details about the functions of the switch input.

Function	Conditions
Link	Only for transmitters. Pull signal low (button pressed) for 0.1-1 second.
Unlink	Hold signal low (button pressed) for >3 seconds.
Change RX/TX mode	See Mode selection for more info
Change TX protocol	See Mode selection for more info
Force firmware update mode	Hold signal low (button pressed) during power on, then release button.

DMX Interface

The UART DMX/RDM interface of the Pluggy module consist of 3 digital signals that can be used to interface an RS485 driver IC compliant with the ANSI E1.11 DMX512-A standard to facilitate a DMX512-A compatible interface. Please refer to the [example schematic](#) for details on how to connect an RS485 driver IC. DE and DI signals shall both be connected to the direction pin (*RS485_DIR*).

The DMX interface can also be used for CMOS/TTL level directly interfacing, for instance to a host CPU.

NOTE: Signal on RXD pin must NOT exceed 3.3V ! If 5V signal is used, a level shifting circuit must be used - for instance a voltage divider.

DMX and RDM termination and line bias

DMX and RDM termination and line bias circuitry is not provided as part of Pluggy (since the data is provided at TTL level). This circuit is left to the device manufacturer to provide as required for each particular application and device.

Termination and line bias circuitry requirements shall follow "ANSI E1.20 - 2006 / Entertainment Technology-RDM-Remote Device Management over USITT DMX512 Networks" or later revisions.

IMPORTANT: Biasing is mandatory for all RDM implementations.

DMX frame rate and size

Pluggy will auto sense the DMX frame rate and frame size and accept all variations that are within the USITT DMX-512 (1986 & 1990) and DMX-512-A standards.

Minimum DMX frame size is 1 slot and maximum is 512 slots.

Minimum DMX frame rate for normal operation is 0.8 frames per second and maximum is 830 frames per second.

Input frame rates below 0.8 frames per second, i.e. more than 1.25s has elapsed since the start of the last frame, will be treated as a loss of DMX. Pluggy modules in receiver mode will set the RS485 driver IC to input mode until another DMX frame is detected. Pluggy in transmitter mode will keep the RS485 driver in input mode.

CRMX will propagate DMX through the system maintaining the input frame rate and frame size with the exception of frame rates that exceed those allowed by the DMX 512-A standard. Different generations of W-DMX modes have individual behaviour in relation to frame rate and synchronisation.

Input DMX frame rates above 830 frames per second will propagate through the system at 830 frames per second to ensure that the DMX output is compliant with the DMX512-A standard.

DMX start code frames

DMX packets with start codes other than the DMX default 0x00 (also known as the Null Start Code, or NSC) and the RDM start code (0xCC) will be propagated through the system, and are subject to the same rules and limitations as the null start code packets. Such frames are called Alternate Start Code, or ASC, frames.

RDM start code frames

Frames with RDM start code (0xCC) are handled separately by transmitters in CRMX systems, as part of the proxy functionality. Transmitters manage the interleaving of RDM frames with null start code packets across the air, and may interleave other RDM frames that are needed to manage the proxy functionality. This may result in RDM frames can appear on the DMX/RDM interface in a different order than on the input of the transmitter.

All RDM frames are handling in compliance with the PLASA E1.20 standard.

Pluggy FX in transmitter nodes discards all frames with RDM start code (0xCC) and RDM draft start code (0xF0).

Firmware update

The firmware in Pluggy can be updated. All manufacturers must consider the firmware update options to provide future proof integrations to the end-user.

DMX interface

The preferred way to update firmware in Pluggy RX and Pluggy FX is via the DMX interface and the [CRMX Upgrade cable](#). This requires the DMX interface to be accessible from outside the fixture.

See the [link switch section](#) for information on how to set Pluggy into firmware update mode.

Use the [CRMX Update utility](#) to update the firmware.

Over-the-air (OTA)

Pluggy FX and RX can be updated over-the-air by utilizing a special software tool that can be obtained from LumenRadio together with the [CRXM Upgrade cable](#)

For details about updates or for recommendations, please contact [support](#).

Mode selection (FX version only)

This chapter describes the different methods of selecting between the different flex modes – also known as modes of operation. This only applies to Pluggy FX. Pluggy RX can not be configured for this as it is only a receiver module.

Flex mode (RX/TX)

The Pluggy FX can act either as receiver or a transmitter of wireless DMX. The mode must be selected for the device to operate in the right way.

Selecting via input signal

Pin 11 on the module controls the flex mode selection behaviour. Note: Voltage on Pin 11 may not exceed 3.3V.

Voltage	Description
< 0.5V	Transmitter mode
1.5-1.8V	Software controlled
> 2.8V	Receiver mode

Software controlled mode selection

At power up Holding the link switch input low while powering up the device, and then releasing the input to go high within 3 seconds will toggle the RX/TX mode.




During operation By pressing the link switch shortly 5 times, and then press-and-hold the button for at least 3 seconds enters TX/RX mode selection. The Status LED will blink to indicate the currently selected mode. Press link switch momentarily to toggle mode, press-and-hold the link switch for at least 3 seconds to store the selection.

- 2 Hz blink: TX mode selected
- 5 Hz blink: RX mode selected

TX protocol selection

By pressing the link switch shortly 3 times, and then press-and-hold the button for at least 3 seconds enters TX protocol selection. The RGB LED will blink fast in different colors to indicate the currently selected protocol.

Press link switch momentarily to toggle mode, press-and-hold the link switch for at least 3 seconds to store the selection.

Color	Meaning	Comments
	CRMX	Red = 3.3V, Green = 3.3V, Blue = 3.3V
	W-DMX G3	Red = 0V, Green = 3.3V, Blue = 0V
	W-DMX G4S	Red = 3.3V, Green = 0V, Blue = 3.3V

Specification

TBD

Electrical

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{DD}	Supply voltage	4.5	5.0	5.5	V
I_{DD}	Supply current TX mode		150	250	mA
I_{DD}	Supply current RX mode		50	100	mA
T_A	Operating temperature	-20		75	°C
V_{IL}	Input voltage logic low	0		0.9	V
V_{IH}	Input voltage logic high	2.5		3.3	V
I_{LED}	Max current drive on LED pins			5	mA
f_{range}	Operating frequency range	2402		2480	MHz
RX_{sens}	Receiver sensitivity (0.1% BER)		-90		dBm
TX_{pout}	TX output power ¹			20	dBm
DMX_{size}	DMX frame size (excluding start code)	0		512	
DMX_{rate}	DMX frame rate	0.8		830	fps

¹From 2dBi antenna

Mechanical

General tolerance for dimensions: ± 0.1 mm

