RAJANT

BreadCrumb® DX2

Quick Start Guide
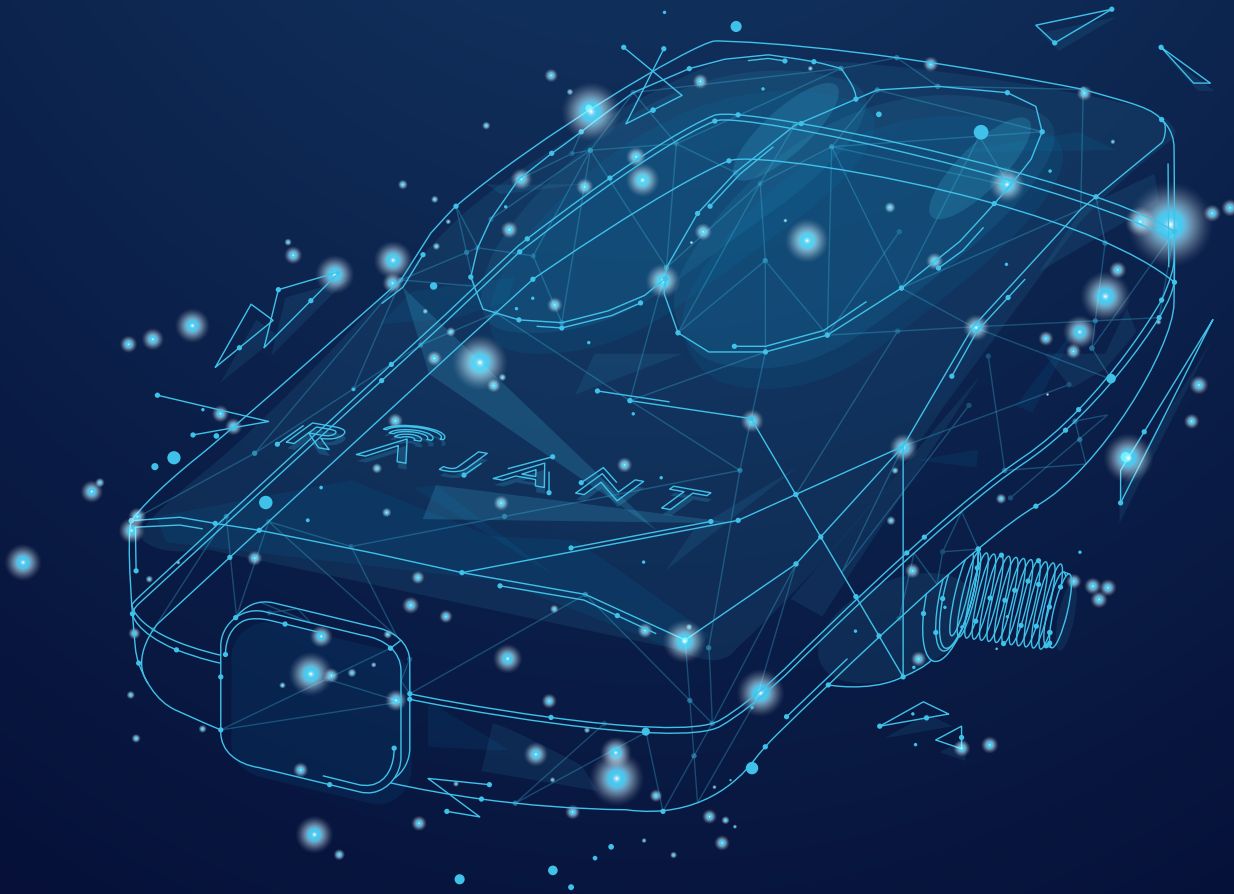
Contents _____

Last Updated: January 31, 2020

Enclosure Features _____

The external features of the DX2 enclosure are shown in the following images.

Figure 1: BreadCrumb DX2 Enclosure Features (Front)

(1) Micro-B female USB connector (shown without soft protective cover or soft cable boot)

(2) SMA female antenna connectors (left "A", right "B")

(3) One of two standoffs for mounting

Figure 2: BreadCrumb DX2 Enclosure Features (Back)

(1) RJ45 female connector for Ethernet and PoE (Power over Ethernet)

(2) SMA female antenna connectors

(3) Status LED

(4) One of two standoffs for mounting

Power Input _____

2.4 Power and Ethernet

The BreadCrumb DX2 has one RJ45 Ethernet port. The Ethernet port (ETH0) on the BreadCrumb DX2 supports 10 Base-T, 100 Base-TX or 1000 Base-T configuration. The port supports Auto MDI/MDIX allowing the use of either straight-through or crossover data cables for connections. The data interface includes electrostatic discharge, and electrical fast transient/burst immunity compliant to the IEC 61000-4-2, and IEC 61000-4-4-EFT standards, respectively.

2.4.1 Power Requirements

The BreadCrumb DX2 ETH0 port supports Passive Power over Ethernet (Passive PoE), and therefore acts as a dual function Ethernet and DC power input port for the BreadCrumb DX2. An external inline passive PoE injector is used to merge DC power for the BreadCrumb DX2 with data from a LAN port or a wired client.

To ensure proper operation of the BreadCrumb DX2, the inline injector must output a DC voltage between 8 VDC to 60 VDC @ 10 W minimum. Using a higher output voltage facilitates longer cable runs between the inline injector and the ETH0 port on the BreadCrumb DX2. For details on Rajant's VHDC-Series power accessories, please refer to the VHDC-Series spec sheet.

The average idle power consumption of a BreadCrumb DX2 is 2.8 Watts W at 24 V. The maximum peak power consumption of BreadCrumb DX2 is 7.5 W at 24 V. Up to 2.5 W of additional power will be needed if a peripheral is being powered by USB (500 mA at 5 V is available at the USB port). Input voltage to the DX2 should not dip below 10VDC. Power option include a POE Injector (RGPOE) readily available market wide.

Figure 3: POE Injector (RBGPOE)

Pin	Input to PoE Injector	Output from PoE Injector	Wire Color	Wire Diagram
1	Tx (+)	Tx (+)	White/Green	
2	Tx (-)	Tx (-)	Green	
3	Rx (+)	Rx (+)	White/Orange	
4	N.C.	+V	Blue	
5	N.C.	+V	White/Blue	
6	Rx (-)	Rx (-)	Orange	
7	GND	GND	White/Brown	
8	GND	GND	Brown	

Utilize pins 4&5 +VDC and 7&8 -VDC

Table 1: BreadCrumb DX2 Power Requirements (Passive PoE)

Input Voltage	Avg Idle Usage @ 24 V	Max Peak Usage @ 24 V
8 - 60 VDC	2.8 W + USB usage	7.5 W + USB usage

Mounting Instructions

The BreadCrumb DX2 offers features that support mounting to a surface.

There are two mounting standoffs on the bottom of the BreadCrumb DX2. The standoffs accept standard thread M3 screws and have 7.6 mm or .3 inch thread depth. Rajant recommends 4-5 threads minimum to mount. The distance between the mounting holes of the standoffs is 49 mm center to center.
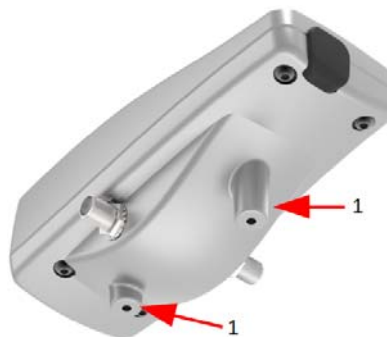

Figure 3: BreadCrumb DX2 Mounting Standoffs (Bottom)

(1) Standoffs for mounting

Launching BC|Commander _____

**Note, qll Breadcrumbs come standard from the factory with a calculated IPV4 address 10.x.y.z/8. It will be necessary to set up a network interface card to an IP consistent with this network for initial configuration.

Click on the BC|Commander shortcut on the start menu or quick link bar or double-click on the BC|Commander shortcut on the desktop in order to launch BC|Commander.

No shortcuts are automatically created on Linux, although you may opt to create your own. To launch BC|Commander, type bcc11 at a console.

BreadCrumb User Accounts _____

BC|Commander does not require a user to log in to use the application. However, an administrator must first log in to individual BreadCrumbs in order to monitor and manage them. BC|Commander provides three different login options, each with different privileges. The following table uses the factory default passwords for each role.

Account Name (Role)	Password and Access Type
view (Viewer)	password: *breadcrumb-view* - read-only access to configuration and status.
admin (Administrator)	password: *breadcrumb-admin* - read access to configuration and status, read/write access to non-security-related configuration. Permitted to execute non-security-related commands such as *reboot*, *zeroize* and *upgrade firmware*."
co (Crypto Officer)	password: *breadcrumb-co* - read and write access to all configuration. Read access to status. Permitted to execute all commands, set encryption keys, and set passwords.

Table 2: BreadCrumb User Accounts

3.2 Default Login Credentials

Because it is impractical to log in to each BreadCrumb individually, and because most BreadCrumbs in a network will have the same set of passwords, BC|Commander will automatically attempt to log in to any BreadCrumb it discovers using default login credentials (i.e., username and password).

Whenever BC|Commander is launched, the "Default Login Credentials" dialog window appears (see the figure below). This dialog can also be accessed from the "Mesh" menu.
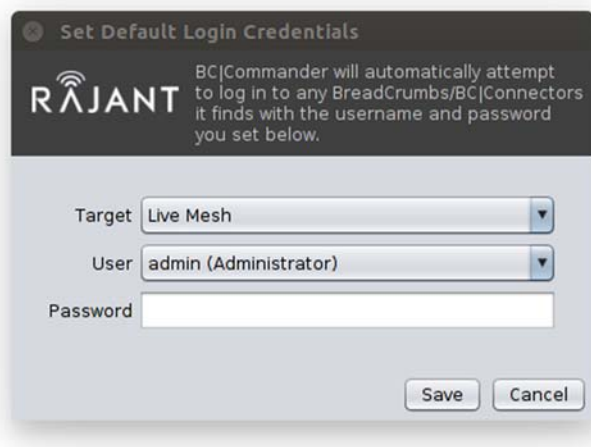

Figure 4: Default Login Credentials Window

BreadCrumb Configuration _____

This chapter lists the per-BreadCrumb configuration settings and their contextual help as shown in BC|Commander. Some settings may only be available on particular BreadCrumb models.

The following are some configuration guidelines for setting up and maintaining a Rajant mesh network:

Important Security Settings

To secure your mesh from unconfigured BreadCrumbs, Rajant strongly recommends that all Rajant mesh installations customize the following two settings. Alerts will appear for any BreadCrumbs that are using the default values of these settings.

- *Security: Network Key*
- *Security: BCAPI: User Credentials* (all passphrases)

Only BreadCrumbs with the same Network Key (and same Network Name and security settings) can mesh with each other, so the Network Key must be changed to the same new value on all of your BreadCrumbs so they can mesh.

Network: IPv4: IPv4 Address Assignment Method

BreadCrumbs support several IP address modes.

- Computed: This mode generates a unique IPv4 address based on the MAC address of the data interfaces. The advantage of the computed IP address mode is that a unique IP address is automatically assigned to the BreadCrumbs without using a DHCP server, or manually configuring a static IP address. Computed addresses are always in the 10.x.y.z class A address space.
- Manual: In this mode, a static IP address can be assigned to the BreadCrumb.
- DHCP: This mode enables DHCP client software on the BreadCrumb. Choosing this addressing mode will disable the DHCP server on the selected BreadCrumb. The BreadCrumb will request an address from a DHCP Server on the same segment as the BreadCrumb Network.

wlanX: Radio: Regulatory Compliance Mode

There are two modes: Automatic and Manual.

- Automatic mode restricts the available channels and output power of the radio card to comply with the wireless certification for the BreadCrumb by the relevant authority.
- Manual mode exposes more radio card settings. Access to these settings may be needed to satisfy installation requirements. This determination and configuration must be made by a qualified professional radio equipment installer.

wlanX: Radio: Channel Number

The radio card channel and operating frequency can be set from this dropdown menu. The available channels are dependent on the Regulatory Compliance Mode and the locked system setting Country Code.

Radio: Transmit Power

This sets the transmit power of the radio card. Settings are reported in dBm, and represent the transmit power at the antenna port of the BreadCrumb, not including any antenna gain or cable loss. The transmit power choices are dependent on the Regulatory Compliance Mode, the Channel Number and the locked system setting Country Code.

Frequently Asked Questions ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

What BreadCrumb DX2 models are currently available for purchase?

As of November 2019, two models are available:

- **DX2-24**
  Part Number: 23-100068-001

BreadCrumb® DX2-24 System: Single transceiver MIMO (2.4 GHz) kinetic mesh node. Includes X2- rubber USB block-off: 85-100027-001, and DX2- Rubber USB Boot: 85-100028-001. Requires mounting, antennas, Ethernet cable, and power supply.

- **DX2-50**
  Part Number: 23-100068-002
  BreadCrumb® DX2-50 System: Single transceiver MIMO (5 GHz) kinetic mesh node. Includes DX2- rubber USB block-off: 85-100027-001, and DX2- Rubber USB Boot: 85-100028-001. Requires mounting, antennas, Ethernet cable, and power supply.

What accessories are included with a DX2 system?

The following accessories are included:

- DX2- Rubber USB Block-off: 85-100027-001.
- DX2- Rubber USB Boot: 85-100028-001.

What accessories are separately available for purchase for the DX2?

- DX2- Rubber USB Block-off: 85-100027-001.
- DX2- Rubber USB Boot: 85-100028-001.
- Power supply, for indoor use only, passive Gigabit Ethernet PoE with 90-264 V AC input, and 24 V and 19 W DC output, includes US power cord, for use with DX2 on powered Ethernet cable (25-100168-001).
- Power supply, for indoor use only, passive Gigabit Ethernet PoE with 90-264 V AC input, and 24 V and 36 W high-power DC output, includes US power cord, for use with DX2 on powered Ethernet cable lengths up to 100 m (328 ft) (25-100168-002).

What type of antenna does Rajant recommend to use with the DX2?

It depends on the use. For drones and robots, Rajant typically recommends circular polarized antennas that are also found in the drone racing industry. FOXEER is an example of an antenna manufacturer Rajant recommends. Below is a sample with specifications.

FOXEER Thriverline FPV Antenna 5.8GHz Pagoda RHCP Omnidirectional Antenna for FPV Quadcopeter TX/RX (Black, SMA)

SMA Male

Specification:
- Center frequency: 5.8 GHz
- Bandwidth: 500 MHz (5.55 – 6.05 GHz)
- Matching: S11 < -20 dB, VSWR < 1.22 (at center frequency)
- Axial ratio: < 1.3
- Gain: 2dBi

- Radiation efficiency: 95%
- Polarization: RHCP
- Connector: SMA for optional
- Color: Black
- Length: 68mm Weight: 10g

Note: Do not use reverse polarity antennas.

How do I power a DX2 without using a PoE injector?

Drone customers often want to power directly with custom RJ-45 cabling to their own power supply to avoid the weight and bulk of a PoE injector. Rajant will supply pin schematics.

What is the power consumption?

2.8 W (average, idle) 7.5 W (maximum, peak) @ 24V.

RĀJANT

*If it's **Moving,** it's Rajant.*
*Industrial Wireless Networks **Unleashed.***

Rajant Corporation
200 Chesterfield Parkway
Malvern, PA 19355
Tel: +1 484 595 0233
Fax: +1 484 595 0244
Web: www.rajant.com

Updated 1/31/2020