

Sure Cross® Performance Radio Module with I/O



Datasheet



Sure Cross® Performance embeddable board modules were specifically designed for the needs of industrial users to provide connectivity where traditional wired connections are not possible or cost prohibitive. Wireless networks are formed around a Gateway, which acts as the wireless network master device, and one or more Nodes. Sure Cross Performance embeddable board modules communicate with all Sure Cross Performance radios.

- Wireless industrial I/O device with two sinking discrete inputs, two NMOS discrete outputs, two 0 to 20 mA analog inputs, and two switch power outputs
- Selectable transmit power levels of 250 mW or 1 Watt for 900 MHz models and 65 mW for 2.4 GHz models
- *FlexPower*® power options allow for 10 to 30 V dc, solar, and battery power sources for low power applications.
- DIP switches for user configuration
- Frequency Hopping Spread Spectrum (FHSS) technology and Time Division Multiple Access (TDMA) control architecture ensure reliable data delivery within the unlicensed Industrial, Scientific, and Medical (ISM) band
- Transceivers provide bidirectional communication between the Gateway and Node, including fully acknowledged data transmission

For additional information, updated documentation, and accessories, refer to Banner Engineering's website, www.bannerengineering.com/surecross.

Models	Antenna Connection	Frequency	Inputs and Outputs
DX80N9X2S-PB1	Ext. Reverse Polarity SMA, 50 Ohms	900 MHz ISM Band	Inputs: Two NPN discrete. two 0–20 mA analog Outputs: Two NMOS discrete
DX80N2X2S-PB1		2.4 GHz ISM Band	
DX80N9X2U-PB1	U.FL-R-SMT.(01)	900 MHz ISM Band	Switch Power: Two
DX80N2X2U-PB1		2.4 GHz ISM Band	



WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.



CAUTION: Electrostatic Discharge (ESD)

ESD Sensitive Device. Use proper handling procedures to prevent ESD damage to these devices. The module does not contain any specific ESD protection beyond the structures contained in its integrated circuits. Proper handling procedures should include leaving devices in their anti-static packaging until ready for use; wearing anti-static wrist straps; and assembling units on a grounded, static-dissipative surface.



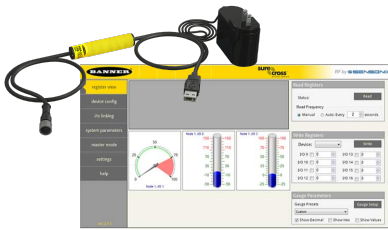
CAUTION: Never Operate 1 Watt Radios Without Antennas

To avoid damaging the radio circuitry, never power up Sure Cross® Performance or Sure Cross MultiHop (1 Watt) radios without an antenna.



Sure Cross® User Configuration Tool

The User Configuration Tool (UCT) software runs on any Windows machine and uses a converter cable to connect your Gateway to the computer.



The User Configuration Tool (UCT) offers an easy way to link I/O points in your wireless network, view I/O register values graphically, and set system communication parameters when a host system is not part of the wireless network. Download the most recent revisions of the UCT software from Banner Engineering's website: <http://www.bannerengineering.com/wireless>.

The UCT requires a special USB to RS-485 (model number BWA-UCT-900 for 1 Watt radios, BWA-HW-006 can be used for all other radios) converter cable to pass information between your computer and the Gateway.

Using Performance and Non-Performance Radios in the Same Network

To comply with federal regulations, the 150 mW radios and 1 Watt radios communicate differently. To mix Performance radios with non-Performance radios:

- Operate Performance radios in 250 mW mode to communicate with non-Performance radios (DIP switch 1 ON)
- Set non-Performance radios to use Extended Address Mode to communicate with Performance radios (DIP switch 1 ON)

For more detailed instructions about setting up your wireless network, refer to the Quick Start Guide (p/n [128185](#)). For more information about using Performance and non-Performance radios within the same network, refer the technical note titled *Mixing Performance Radios and 150 mW Radios in the Same Network* listed on the Wireless Support - FAQs section of Banner's [Wireless website](#).

Setting Up Your Wireless Network

To set up and install your wireless network, follow these steps.

Disconnect the power from your Sure Cross devices.

1. Configure the DIP switches of all devices.
2. If your device has I/O, connect the sensors to the Sure Cross devices. If your device does not have I/O, skip this step.
3. Refer to the wiring diagrams to apply power to all devices.
 - For two LED models, the Gateway's LED 1 is solid green and the Node's LED 2 flashes red to indicate there is no radio link to the Gateway.
 - For one LED models, the Gateway's LED is solid green and the Node's LED flashes red to indicate there is no radio link to the Gateway.
4. Form the wireless network by binding the Nodes to the Gateway. If the binding instructions are not included in the datasheet, refer to the product manual for binding instructions.
5. Observe the LED behavior to verify the devices are communicating with each other.
 - For two LED models, the Gateway's LED 1 is solid green and the Node's LED 1 flashes green to indicate it is communicating with the Gateway.
 - For one LED models, the Gateway's LED is solid green and the Node's LED flashes green to indicate it is communicating with the Gateway.
6. Conduct a site survey between the Gateway and Nodes. If the site survey instructions are not included in this datasheet, refer to the product manual for detailed site survey instructions.
7. Install your wireless sensor network components. If installation instructions are not included in this datasheet, refer to the product manual for detailed installation instructions.

For additional information, including installation and setup, weatherproofing, device menu maps, troubleshooting, and a list of accessories, refer to one of the following product manuals.

- Sure Cross® Quick Start Guide: [128185](#)
- Sure Cross® Wireless I/O Network Instruction Manual: [132607](#)
- Web Configurator Instruction Manual (used with "Pro" and DX83 models): [134421](#)
- Host Controller Systems Instruction Manual: [132114](#)

Configure the DIP Switches

Before making any changes to the DIP switch positions, disconnect the power. DIP switch changes will not be recognized if power isn't cycled to the device.

For parameters not set via DIP switches, use the User Configuration Tool (UCT) to make configuration changes. For parameters set using the DIP switches, the DIP switch positions override any changes made using the User Configuration Tool.

DIP Switch Settings

Device Settings	Switches							
	1	2	3	4	5	6	7	8
Transmit power level (900 MHz): 1 W (30 dBm)	OFF*							
Transmit power level (900 MHz): 250 mW (24 dBm), DX80 compatibility mode	ON							
Modbus or UCT configured (overrides DIP switches 3-8)		OFF*						
DIP switch configured		ON						
Link loss output: OFF or 0 mA				OFF*	OFF*			
Link loss output: ON or 20 mA				OFF	ON			
Link loss output: hold last state				ON	OFF			
Reserved				ON	ON			
0–20 mA scale ¹						OFF*		
4–20 mA scale ¹						ON		

* Default configuration

Analog Input and Output Scale

Use the DIP switch to select which current scale to use for all the device's analog inputs and outputs: 0 to 20 mA or 4 to 20 mA. When using a 4-20 mA sensor with a 0-20 mA input, the sensor uses the 4-20 mA section of the total range. Using a 4-20 mA with a 0-20 mA input allows you to determine when you have an error condition with the sensor. A normal input reading between 4 and 20 mA indicates a functioning sensor whereas a value below 4 mA indicates an error condition, such as a broken wire or loose connection. This DIP switch is used only on the 0 to 20 mA models, not the 0 to 10V models.

Link Loss Outputs

The SureCross DX80 wireless devices use a deterministic radio link time-out method to address RF link interruption or failure. When a radio link fails, all pertinent wired outputs are sent to defined states until the link is recovered, ensuring that disruptions in the communications link result in predictable system behavior.

Following a radio link time-out, all outputs linked to the Node in question are set to de-energize (discrete outputs to zero, analog outputs to 0 mA or 4 mA), energize (discrete outputs to one, analog outputs to 20 mA), or to hold the last stable state/value. Use the DIP switches to select the link loss output state.

Modbus/User Configuration Tool (UCT) or DIP Switch Configured

In Modbus/UCT Configured mode, the device parameters are changed using the User Configuration Tool (UCT) or a Modbus command. All DIP switch positions are ignored. In DIP Switch Configured mode, use the DIP switches to configure the parameters listed in the table.

Transmit Power Levels

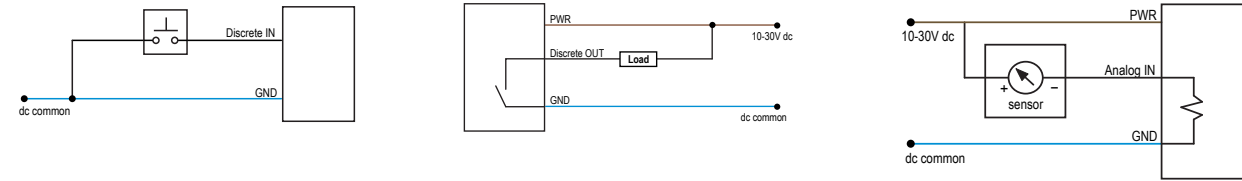
The 900 MHz radios can be operated at 1 watt (30 dBm) or 250 mW (24 dBm). While the Performance radios operate in 1 Watt mode, they cannot communicate with the older 150 mW radios. To communicate with the older 150 mW radios, operate this radio in 250 mW mode. For 2.4 GHz models, this DIP switch is disabled. The transmit power for 2.4 GHz is fixed at about 65 mW EIRP (18 dBm), making the 2.4 GHz Performance models automatically compatible with older 2.4 GHz models.

¹ Not used for 0–10 V analog I/O models

Wiring Diagrams

Pin	Description	Label
1	Analog IN 1 (0 to 20 mA)	AI1
2	Analog IN 2 (0 to 20 mA)	AI2
3	Discrete IN 3 (NPN)	DI3
4	Discrete IN 4 (NPN)	DI4
5	Ground	GND
6	Switch Power 1 (see Switch Power output register definition)	SP1
7	Switch Power 2 (see Switch Power output register definition)	SP2
8	Discrete OUT 3	DO3
9	Discrete OUT 4	DO4
10	Not used	-
11	Not used	-
12	Ground	GND
13	10 to 30 V dc	PWR
14	3.3 to 5.5 V dc low power connection	

Discrete Input Wiring for NPN Sensors Discrete Output Wiring (NPN or NMOS) Analog Input Wiring

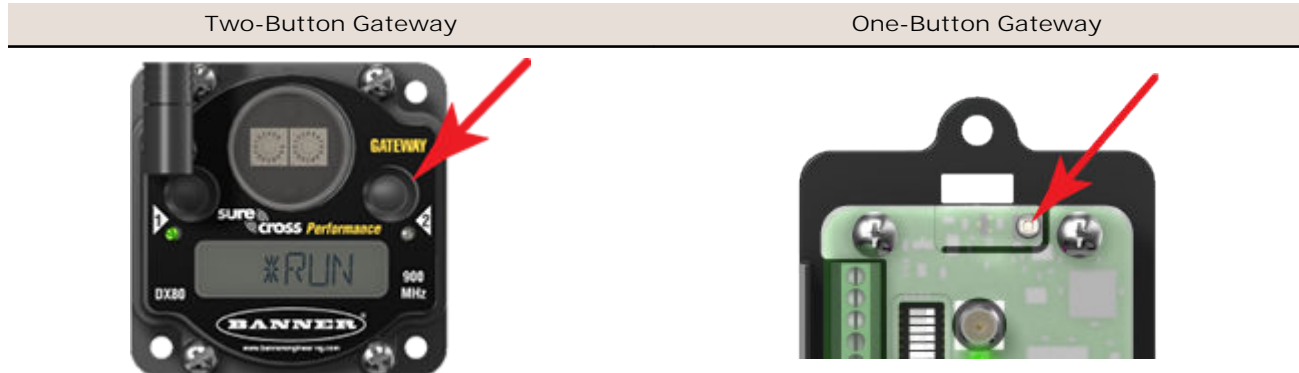


Bind Radios to Form Networks

Binding Nodes to a Gateway ensures the Nodes only exchange data with the Gateway they are bound to. For a more detailed definition of binding mode, refer to the *Advanced Setup* section of the *SureCross Wireless I/O Networks* instruction manual.

Apply power to the Gateway and Nodes.

1. Enter binding mode on the Gateway.
 - If you have a two-button Gateway, triple-click button 2
 - If you have a one-button Gateway, triple-click the button
 - If you have a Gateway with no buttons, remove the rotary dial access cover and set both the right and left rotary dials to 0, then set both the right and left rotary dials to F.



The LEDs flash alternately when the Gateway is in binding mode. Any Node entering binding mode will bind to this Gateway.

2. Enter binding mode on the Node.
 - If you have a two-button Node, triple-click button 2.
 - If you have a one-button Node, triple-click the button.
 - If you have a Node with no buttons, remove the top cover and set both the left and right rotary dials to F to enter binding mode. ²

The Node enters binding mode and locates the Gateway in binding mode.

For two LED models, the red LEDs flash alternately. After binding is complete, both LEDs are both solid red for a few seconds.

For one-LED models, the red and green LED flashes alternately while the Node searches for the Gateway. After binding is complete, the LED is red and green for four seconds (looks amber), then the red and green flash simultaneously (looks amber) four times.

The Node automatically exits binding mode, cycles its power, then enters RUN mode.

3. Use the Node's rotary dials to assign a valid decimal Node Address (between 01 and 47). The left rotary dial represents the tens digit (0 through 4) and the right dial represents the ones digit (0 through 9) of the Node Address.
4. Repeat steps 2 and 3 for all Nodes that will communicate to this Gateway.
5. Exit binding mode on the Gateway.
 - If you have a two-button Gateway, single-click either button.
 - If you have a one-button Gateway, single-click the button.
 - If you have a Gateway with no buttons, change the Gateway's rotary dials to a valid Network ID.

Valid Network IDs are 01 through 32, in decimal, established using the rotary dials. The left dial may be set to 0, 1, 2, or 3. The right dial may be set from 0 to 9 when the left dial is at 0, 1, or 2; or set to 0 through 2 when the left dial is at 3. (Positions A through F are invalid network ID numbers.)

When installing special kits with pre-mapped I/O, indicated by device model numbers beginning in DX80K, return the rotary dials to their original positions after binding. If the rotary dials are not returned to their original positions, the I/O mapping will not work.

LED Behavior for the Nodes

Nodes do not sample inputs until they are communicating with the Gateway. The radios and antennas must be a minimum distance apart to function properly. Recommended minimum distances are:

- 900 MHz 150 mW radios: 6 feet
- 900 MHz 1 Watt radios: 15 feet
- 2.4 GHz 65 mW radios: 1 foot

² Some older M-GAGE Nodes (models DX80N*X1W0POZR) may require F-F binding despite having a single button.

LED (Bi-color)	Node Status
Flashing green	Radio link okay
Green and red flashing alternately	In Binding mode
Both colors are solid for 4 seconds, then flash 4 times; looks amber	Binding mode is complete
Flashing red, once every 3 seconds	Radio link error
Flashing red, once every second	Device error

Installing the Board Modules

SureCross board modules must be mounted inside a panel or OEM enclosure.

Modbus Register Table

I/O	Modbus Holding Register		I/O Type	Units	I/O Range		Holding Register Representation	
	Gateway	Any Node			Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Discrete IN 3	-	0	1	0	1
2	2	2 + (Node# × 16)	Discrete IN 4	-	0	1	0	1
3	3	3 + (Node# × 16)	Analog IN 1	mA	0.0	20.0	0	65535
4	4	4 + (Node# × 16)	Analog IN 2	mA	0.0	20.0	0	65535
		...						
7	7	7 + (Node# × 16)	Reserved					
8	8	8 + (Node# × 16)	Device Message					
9	9	9 + (Node# × 16)	Discrete OUT 3	-	0	1	0	1
10	10	10 + (Node# × 16)	Discrete OUT 4	-	0	1	0	1
		...						
15	15	15 + (Node# × 16)	Control Message					
16	16	16 + (Node# × 16)	Reserved					

Specifications

Radio Range³

- 900 MHz, 1 Watt: Up to 9.6 km (6 miles)
- 2.4 GHz, 65 mW: Up to 3.2 km (2 miles)

Minimum Separation Distance

- 900 MHz, 1 Watt: 4.57 m (15 ft)
- 2.4 GHz, 65 mW: 0.3 m (1 ft)

Radio Transmit Power

- 900 MHz, 1 Watt: 30 dBm (1 W) conducted (up to 36 dBm EIRP)
- 2.4 GHz, 65 mW: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP

900 MHz Compliance (1 Watt)

- FCC ID UE3RM1809: This device complies with FCC Part 15, Subpart C, 15.247
- IC: 7044A-RM1809

2.4 GHz Compliance

- FCC ID UE300DX80-2400 - This device complies with FCC Part 15, Subpart C, 15.247
- ETSI EN 300 328 V1.8.1 (2012-06)
- IC: 7044A-DX8024

Spread Spectrum Technology

- FHSS (Frequency Hopping Spread Spectrum)

Link Timeout

- Gateway: Configurable via User Configuration Tool (UCT) software
- Node: Defined by Gateway

Discrete Input

- Rating: 3 mA max current at 30 V dc
- Sample Rate: 62.5 milliseconds
- Report Rate: On change of state
- ON Condition (NPN): Less than 0.7 V
- OFF Condition (NPN): Greater than 2 V or open

Analog Inputs

- Rating: 24 mA
- Impedance: Approx. 100 Ohms⁶
- Sample Rate: 1 second
- Report Rate: 16 seconds or On Change of State (1% change in value)
- Accuracy: 0.1% of full scale +0.01% per °C
- Resolution: 12-bit

Supply Voltage

- 10 to 30 V dc or 3.6 to 5.5 V dc low power option (Outside the USA: 12 to 24 V dc, ±10% or 3.6 to 5.5 V dc low power option)⁴

Current Draw (at 24 V dc)

- 900 MHz, 1 Watt: Approx. 3.5 mA
- 900 MHz, 250 mW: Approx. 1.5 mA
- 2.4 GHz, 65 mW: Approx. 3.5 mA

Current Draw (at 3.6 V dc)

- 900 MHz, 250 mW: Approx. 0.5 mA
- 2.4 GHz, 65 mW: Approx. 0.15 mA

Antenna Connection

- Ext. Reverse Polarity SMA, 50 Ohms: Max Tightening Torque: 0.45 N·m (4 lbf·in)
- U.FL-R-SMT.(01): Use cable BWA-HW-030 (U.FL to RP-SMA) or the equivalent

Interface

- Indicators: One bi-color LED
- Buttons: One

Wiring Access

- Terminal block

Operating Conditions⁵

- 40 °C to +85 °C (-40 °F to +185 °F)
- 95% maximum relative humidity (non-condensing)

Radiated Immunity HF

- 10 V/m (EN 61000-4-3)

Discrete Output Rating (NMOS)

- Less than 10 mA max current at 30 V dc
- ON-State Saturation: Less than 0.7 V at 20 mA

Discrete Output

- Update Rate: 1 second
- ON Condition: Less than 0.7 V
- OFF Condition: Open
- Output State Following Timeout: De-energized (OFF)

Switch Power Outputs

- Two

Accessories for the Board Models

<p>BWA-HW-034</p> <ul style="list-style-type: none"> DIN rail clip, black plastic 	<p>BWA-HW-030</p> <ul style="list-style-type: none"> u.FL to RP-SMA adapter cable 
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³ Radio range is with the 2 dB antenna that ships with the product. High-gain antennas are available, but the range depends on the environment and line of sight. To determine the range of your wireless network, perform a Site Survey.

⁴ For European applications, power the DX80 from a Limited Power Source as defined in EN 60950-1.

⁵ Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

⁶ To verify the analog input's impedance, use an Ohm meter to measure the resistance between the analog input terminal (AI.x) and the ground (GND) terminal.

MultiHop M-HBx and Performance PBx Models Mounted on the Base

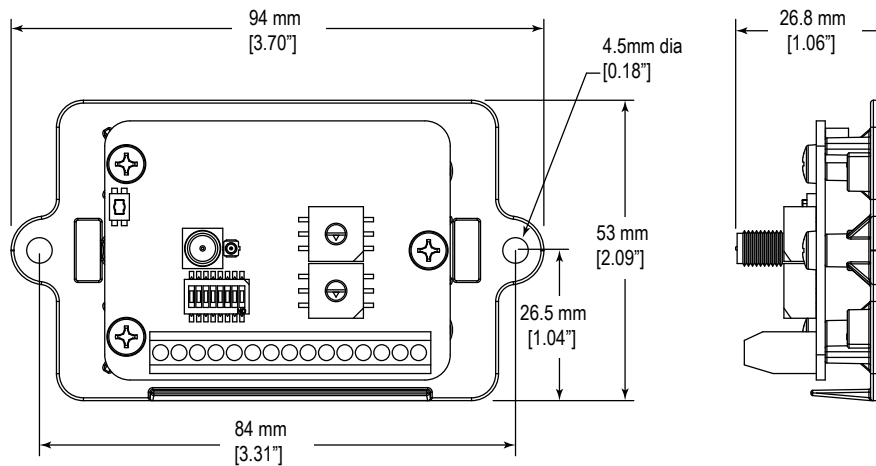


Figure 1. Most MultiHop M-HBx and Performance PBx models ship from the factory mounted on a plastic base.

Warnings

Antenna Installations. Install and properly ground a qualified surge suppressor when installing a remote antenna system. Remote antenna configurations installed without surge suppressors invalidate the manufacturer's warranty. Keep the ground wire as short as possible and make all ground connections to a single-point ground system to ensure no ground loops are created. No surge suppressor can absorb all lightning strikes; do not touch the Sure Cross® device or any equipment connected to the Sure Cross device during a thunderstorm.

Exporting Sure Cross® Radios. It is our intent to fully comply with all national and regional regulations regarding radio frequency emissions. Customers who want to re-export this product to a country other than that to which it was sold must ensure the device is approved in the destination country. A list of approved countries appears in the *Radio Certifications* section of the product manual. The Sure Cross wireless products were certified for use in these countries using the antenna that ships with the product. When using other antennas, verify you are not exceeding the transmit power levels allowed by local governing agencies. Consult with Banner Engineering Corp. if the destination country is not on this list.

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