

Datasheet

Configurable Node with an integrated battery, 1 selectable counter input, 1 selectable discrete input, and 1 discrete NMOS output



The Sure Cross® wireless system is a radio frequency network with integrated I/O that operates in most environments to eliminate the need for wiring runs.

- Wireless industrial I/O device with one selectable discrete input, one selectable counter input (rate or event; sinking, sourcing, or self-energized), and one NMOS discrete output
- User selectable 10 kHz event counter or 25 kHz rate counter
- FlexPower® technology driven by one lithium primary battery integrated into the housing
- DIP switches for user configuration
- Frequency Hopping Spread Spectrum (FHSS) technology ensures 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
- Lost RF links are detected and relevant outputs set to user-defined conditions

For additional information, updated documentation, and a list of accessories, refer to Banner Engineering's website, www.bannerengineering.com.



WARNING:

- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

Models

Models	Frequency	Environmental Rating	I/O
DX80N9X1S2A1	900 MHz ISM Band	IP67, NEMA 6	Inputs: One selectable discrete, one selectable counter Outputs: One NMOS sinking discrete
DX80N2X1S2A1	2.4 GHz ISM Band		

Internal antenna models are also available. For more information, contact your local Banner Engineering Corp. representative.

Storage and Sleep Modes

Storage Mode (applies to battery-powered models only)—While in **storage mode**, the radio does not operate. To put any integrated battery Sure Cross radio into storage mode, press and hold button 1 for 5 seconds. To wake the device, press and hold button 1 for 5 seconds. The radio is in storage mode when the LEDs stop blinking, but in some models, the LCD remains on for an additional minute after the radio enters storage mode. After a device has entered storage mode, you must wait 1 minute before waking it.

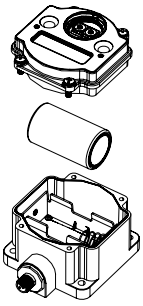
Sleep Mode (applies to both battery and 10–30 V DC powered models)—During normal operation, the Sure Cross radio devices enter **sleep mode** after 15 minutes of operation. The radio continues to function, but the LCD goes blank. To wake the device, press any button.

Install or Replace the Battery for a DX80 Integrated Battery Model

To install or replace the 3.6 V lithium "D" cell battery in any model with a battery integrated into the housing, follow these steps.

1. Remove the four screws mounting the face plate to the housing and remove the face plate.
2. Remove the discharged battery.
3. Install the new battery, verifying the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case.
4. After installing the battery, allow up to 60 seconds for the device to power up.
5. Properly dispose of used batteries according to local regulations by taking it to a hazardous waste collection site, an e-waste disposal center, or other facility qualified to accept lithium batteries.





CAUTION: There is a risk of explosion if the battery is replaced incorrectly.

As with all batteries, these are a fire, explosion, and severe burn hazard. Do not burn or expose them to high temperatures. Do not recharge, crush, disassemble, or expose the contents to water.

For non-hazardous locations, the replacement battery is model **BWA-BATT-011**. For non-hazardous or hazardous locations, the replacement battery is Xeno model XL-205F, Banner model **BWA-BATT-001**. For pricing and availability, contact Banner Engineering.

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 housed 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 board-level 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 housed 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 board-level models, the Gateway's LED is solid green and the Node's LED flashes green to indicate it is communicating with the Gateway.
6. Configure any I/O points to use the sensors connected to the Sure Cross devices.
7. 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.
8. 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 (p/n [128185](#))
- Sure Cross® Wireless I/O Network Instruction Manual (p/n [132607](#))

Configure the DIP Switches

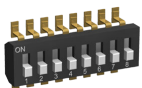
Before changing DIP switch positions, disconnect the power. Any changes made to the DIP switches are not recognized until after power is cycled to the device.

For devices with batteries integrated into the housing, triple-click button 2, then double-click button 2 to reset the device without removing the battery.

For parameters not set using the DIP switches, use the User Configuration Software to make configuration changes. For parameters set using the DIP switches, the DIP switch positions override any changes made using the User Configuration Software.

Access the Internal DIP Switches

Follow these steps to access the internal DIP switches.



1. Unscrew the four screws that mount the cover to the bottom housing.
2. Remove the cover from the housing without damaging the ribbon cable or the pins the cable plugs into.
3. Gently unplug the ribbon cable from the board mounted into the bottom housing. Skip this step if there is no ribbon cable (integrated battery models) or the ribbon cable is glued down (C housing models).
4. Remove the black cover plate from the bottom of the device's cover.
The DIP switches are located behind the rotary dials.

5. Make the necessary changes to the DIP switches.
6. Place the black cover plate back into position and gently push into place.
7. If necessary, plug the ribbon cable in after verifying that the blocked hole lines up with the missing pin.
8. Mount the cover back onto the housing.

DIP Switch Settings

Switches								
Device Settings	1	2	3	4	5	6	7	8
Rotary dial address mode	OFF*							
Extended address mode	ON							
Modbus or UCT configured (overrides switches 3-8)		OFF*						
DIP switch configured		ON						
Discrete IN Sinking (NPN)					OFF*			
Discrete IN Sourcing (PNP)					ON			
Counter type: rate (frequency) counter							OFF*	
Counter type: event counter							ON	
Report Rate 16 seconds								OFF*
Report Rate 1 second								ON

* Default configuration

Address Mode

The SureCross wireless devices may use one of two types of addressing modes: rotary dial addressing or extended addressing. In **rotary dial** address mode, the left rotary dial establishes the network ID and the right rotary dial sets the device ID. The wireless network is restricted to a maximum of 16 devices.

Extended address mode uses a security code to "bind" Nodes to a specific Gateway. Bound Nodes can only send and receive information from the Gateway to which they are bound. In extended address mode, wireless networks may contain up to 48 radio devices. For more information on extended address mode, refer to the SureCross™ Wireless I/O Network product manual.

The device ships in rotary dial address mode by default, with the DIP switch in the OFF position. To use extended address mode, change the DIP switch to the ON position.

Counter Input Type

Select from the two types of counters:

- **Frequency (rate) counter**—Calculates the frequency of the input signal, in Hz
- **Event counter**—Counts the total number of times an input signal changes to the OFF/0 state for NPN input type or ON/1 for PNP or Float input types

The counter values are saved in EEPROM every hour. After power up, the saved value is restored as the beginning count. Setting the counter using the preset or clear functions saves the preset value or zeroes in EEPROM. The counter increments on the falling edge of an input signal when the signal level crosses the threshold.

Discrete Input Type

Select the type of discrete input sensors to use with this device: sourcing (PNP) sensors or sinking (NPN) sensors.

Modbus/Software or DIP Switch Configured

In Modbus/Software Configured mode, use the User Configuration Software or a Modbus command to change the device parameters. DIP switch positions 3 through 8 are ignored. In DIP Switch Configured mode, use the DIP switches to configure the parameters listed in the table.

Report Rate

The report rate defines how often the device reports inputs to the Gateway. For FlexPower™ applications, setting the report rate/interval to longer intervals extends the battery life.

DIP Switch Settings - Counter DIP Switches (Integrated Battery Devices)

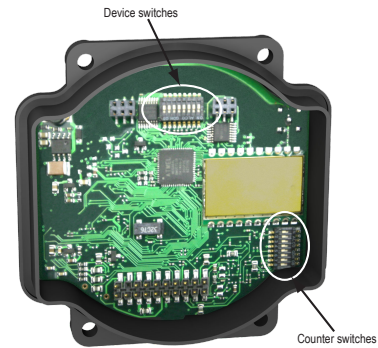
The counter input DIP switches define the characteristics of the counter inputs.

Counter Input 2 DIP Switches				
Device Settings	5	6	7	8
Debounce enabled (default)	OFF*			
Debounce disabled	ON			
Self-energized input (e.g. mag pickup) (default)		OFF*	OFF*	
Enable PNP (sourcing)		OFF	ON	
Enable NPN (sinking)		ON	OFF	
Low threshold (0.25 V) (default)				OFF*
High threshold (1.5 V)				ON

Debounce. Debounce establishes how to examine a signal's transitions. The factory default setting is to activate the input filtering to compensate for unclean state transitions. To turn off the input filtering, set the switch to the ON position.

Inputs. Counter switches 6 and 7 define the inputs as self-energized, sinking (NPN), or sourcing (PNP). A self-energized input does not require pull-up or pull-down devices for proper operation. A magnetic pick-up is a self-energized input. The input threshold can be adjusted to compensate for low amplitude signals.

Threshold. The counter has a selectable input threshold of 0.25 V or 1.5 V. For sinking (NPN) or sourcing (PNP) inputs, set the threshold to 1.5 V.



Wiring for Integrated Battery Counter Models

5-pin M12/Euro-style Male Connector	Pin	Wire Color	Description
	1	Brown	Open (10 to 30 V DC)
	2	White	Counter
	3	Blue	DC common (GND)
	4	Black	NMOS Discrete OUT (DO1)
	5	Gray	Discrete IN (DI1)

Figure 1. Discrete Input Wiring for PNP Sensors

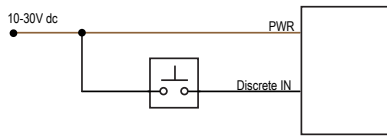


Figure 2. Discrete Input Wiring for NPN Sensors

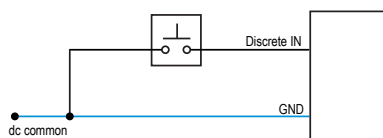
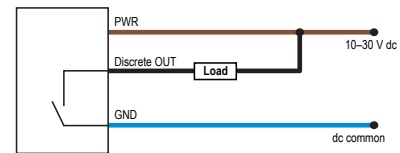


Figure 3. Discrete Output Wiring (NPN or NMOS)



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:

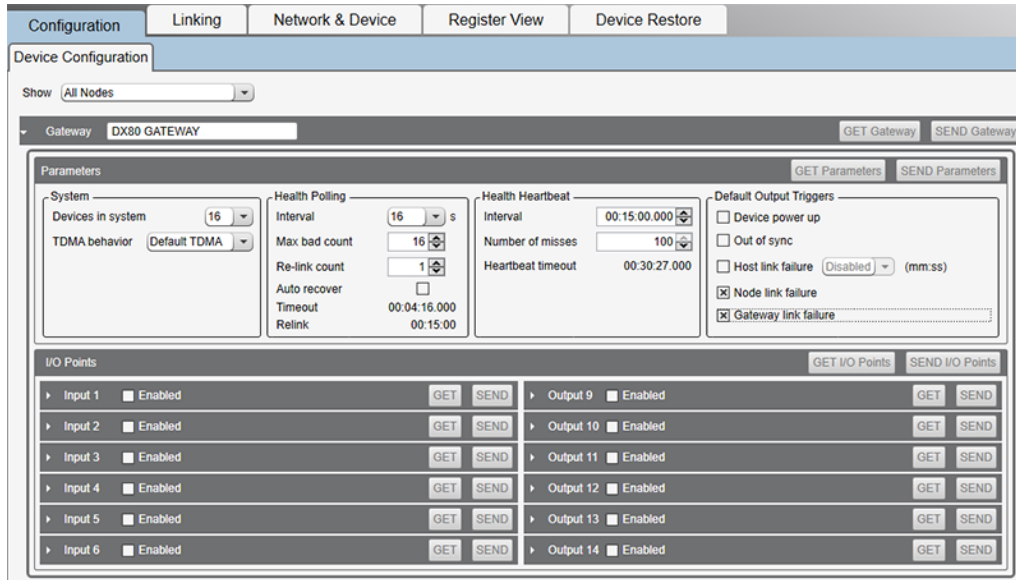
- 900 MHz 150 mW and 250 mW radios: 6 feet
- 900 MHz 1 Watt radios: 15 feet
- 2.4 GHz 65 mW radios: 1 foot

LED 1	LED 2	Node Status
Flashing green		Radio Link Ok
Flashing red	Flashing red	Device Error

LED 1	LED 2	Node Status
	Flashing red, 1 per 3 sec	No Radio Link

Sure Cross® User Configuration Software

The User Configuration Software offers an easy way to link I/O points in your wireless network, view I/O register values, and set system communication parameters when a host system is not part of the wireless network. The software runs on any computer with the Windows Vista, Windows 7, Windows 8, or Windows 10 operating system.



Use a USB to RS-485 adapter cable to connect a standalone DX80 Gateway to the computer. For DXM Controllers with an internal DX80 radio, connect a computer to the DXM Controller using the supplied USB or Ethernet connection. Download the most recent revisions of the configuration software from Banner Engineering's website: <https://www.bannerengineering.com/us/en/products/wireless-sensor-networks/reference-library/software.html>.

The USB to RS-485 adapter cable is not required for the DXM Controller. For standalone DX80 Gateway devices use:

- USB to RS-485 adapter cable model **BWA-UCT-900** for 1 Watt radios
- USB to RS-485 adapter cable model **BWA-HW-006** for all other radios

Configuration Instructions

Modbus Registers

I/O Point	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Nodes		Min.	Max.	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Discrete IN 1	0	1	0	1
		...					
5	5	5 + (Node# × 16)	Rate Count (Hz) or Event Count IN (high word)**	0	65535	0	65535
6	6	6 + (Node# × 16)	Event Count IN (low word)**	0	65535	0	65535
7	7	7 + (Node# × 16)	Reserved				
8	8	8 + (Node# × 16)	Device Message				
9	9	9 + (Node# × 16)	Discrete OUT 1	0	1	0	1
		...					
13	13	13 + (Node# × 16)	Clear Counter	0	1	0	1
14	14	14 + (Node# × 16)					
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

** DIP switch selectable between rate (default) and event counter. The rate counter uses I/O 5; the event counter uses I/O 5 and 6.

Event Counter Presets (Integrated Battery Models)

The event counter input can be preset from the Node menu system or from a host system using Advanced Control Messages. The LCD menu system on the Node allows the user to preset event counter values on each available counter input. From the host system, each device has allocated Node registers 7, 15, and 16 that send preset data to the event counter. When power is applied to the Node, the counter value is reset to the last saved value. The counter value is saved every hour.

Setting the counter using the preset or clear functions saves the preset value or zeroes in EEPROM.

Host Control Counter Preset

The event counter input is a 32-bit value that can be preset using the parameter control codes 143 (0x8F) and 144 (0x90).

Parameter control code 143 writes the lower half [15:0] of the counter and code 144 writes the upper half [31:16] of the counter.

Defining the Counter Select Mask using the second bit position selects the counter. Set Modbus register 16 to the high or low data value. Read Modbus register 7 for the transfer acknowledgement.

Node Reg 15	143 or 144 (0x8F or 0x90)	Counter Select Mask
Node Reg 16	Low or High Value	
Node Reg 7	Acknowledge Code 143 or 144	Acknowledge Counter Select Mask

Example: To preset the counter to the value 20,567,001 (hex 0139 D3D9), follow these steps:

1. Write the upper word to the counter using control code 144 (0x90).

Node Reg 15	0x90	2
Node Reg 16	0139	
Node Reg 7	0x90	2

2. Write the lower word to the counter using control code 143 (0x8F).

Node Reg 15	0x8F	2
Node Reg 16	D3D9	
Node Reg 7	0x8F	2

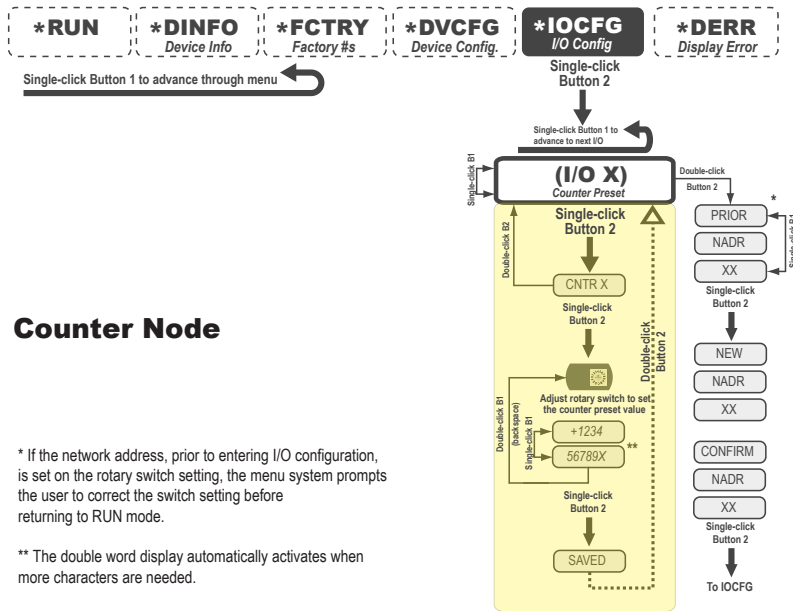
The counter has been preset to 20,567,001 (0x0139 D3D9)

Preset Using the Node's Menu System

To manually enter a counter preset, follow the LCD menu flow using the diagram shown.

1. Single click button 1 to move across the top level menus. Click button 1 until the display shows IOCFG.
2. Click button 2 to enter the I/O Configuration submenu structure.
3. Single click button 1 to move across the I/O points. Single click button 2 to enter the preset configuration for the desired I/O point. I/O 5 is the event counter or the rate counter, depending on the DIP switch configuration.
4. The screen displays the counter number. Single click button 2 to move down the menu structure.
5. Use the right rotary switch to begin setting the counter preset. Digit selection begins with the least significant digit (the right-most digit). After selecting the least significant digit of the counter preset, single click button 1 to advance left to the next significant digit.
6. Use the right rotary switch to select the second digit. Single click button 1 to advance to the next digit.
7. When the counter preset has been entered, single click button 2 to save the value. The second screen of counter preset digits displays only when more than four digits are necessary. The preset counter may be set from zero to 4,000,000,000.
8. Double click button 2 to exit this menu. If you try to leave this menu without resetting the rotary switch back to its network address position, the menu system prompts you to correct the switch setting before returning to RUN mode. The prior network address setting displays.
9. Single click button 2 to enter the new network address. The new address is confirmed.
10. Single click button 2 to save the network address and return to the IOCFG menu and RUN mode.

Counter Node Menu Structure



Clearing the Event Counter (Integrated Battery Models)

To clear the event counter,

- Map a push button on a Gateway to Node register 13 to clear a counter when the button is pressed; or
- Set the counter using the preset or clear functions to save the preset value or zeroes in EEPROM.

Specifications

DX80 Radio Specifications

Radio Range [¶]

900 MHz, 150 mW: Up to 4.8 km (3 miles)
2.4 GHz, 65 mW: Up to 3.2 km (2 miles)

Antenna Minimum Separation Distance

900 MHz, 150 mW and 250 mW: 2 m (6 ft)
2.4 GHz, 65 mW: 0.3 m (1 ft)

Radio Transmit Power

900 MHz, 150 mW: 21 dBm (150 mW) conducted
2.4 GHz, 65 mW: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP

Spread Spectrum Technology

FHSS (Frequency Hopping Spread Spectrum)

900 MHz Compliance

FCC ID TGUDX80: FCC Part 15, Subpart C, 15.247
IC: 7044A-DX8009

2.4 GHz Compliance

FCC ID UE300DX80-2400: FCC Part 15, Subpart C, 15.247
Radio Equipment Directive (RED) 2014/53/EU
IC: 7044A-DX8024

Antenna Connection

Ext. Reverse Polarity SMA, 50 Ohms
Max Tightening Torque: 0.45 N-m (4 lbf-in)

Link Timeout

Gateway: Configurable via User Configuration Software
Node: Defined by Gateway

Environmental Specifications

Operating Conditions

-40 °C to +85 °C (-40 °F to +185 °F) (Electronics); -20 °C to +80 °C (-4 °F to +176 °F) (LCD)
95% maximum relative humidity (non-condensing)
Radiated Immunity: 10 V/m (EN 61000-4-3)

Shock and Vibration

All models meet IEC 60068-2-6 and IEC 60068-2-27 testing criteria
Shock: 30G 11 ms duration, half sine wave per IEC 60068-2-27
Vibration: 10 Hz to 55 Hz, 0.5 mm peak-to-peak amplitude per IEC 60068-2-6

Environmental Ratings

IEC IP67; NEMA 6
Refer to the Sure Cross® Wireless I/O Networks Instruction Manual (p/n 132607) for installation and waterproofing instructions.

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

[¶] 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. Always verify your wireless network's range by performing a Site Survey.

Integrated Battery Counter Node Specifications

Supply Voltage

3.6 V DC low power option from an internal battery
Consumption: Less than 1.4 W (60 mA) at 24 V DC

Housing

Polycarbonate housing and rotary dial cover; polyester labels; EDPM rubber cover gasket; nitrile rubber, non-sulphur cured button covers
Weight: 0.30 kg (0.65 lbs)
Mounting: #10 or M5 (SS M5 hardware included)
Max. Tightening Torque: 0.56 N-m (5 lbf-in)

Interface

Two bi-color LED indicators, Two buttons, Six character LCD

Wiring Access

One 5-pin threaded M12/Euro-style male quick disconnect

Discrete Inputs

One, selectable
Rating: 3 mA max current at 30 V DC
Sample/Report Rates: 125 milliseconds

Discrete Input ON Condition

PNP: Greater than 8 V
NPN: Less than 0.7 V

Counter Inputs

Threshold: 1.5 V or 0.25 V (Sinking or sourcing selected inputs require the 1.5 V threshold setting)
Debounce: DIP switch selectable. Enable debounce to filter a noisy input signal that may lead to false triggers.
Event counter: Input rating 1 Hz to 10 kHz (For battery powered devices, the recommended input rating is less than 1 kHz)
Rate (frequency) counter: 1 Hz to 25 kHz
Threshold (sinking counter on Performance and MultiHop models): 1.7 V

Discrete Input OFF Condition

PNP: Less than 5 V
NPN: Greater than 2 V or open

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 Outputs

Update Rate: 1 second
ON Condition: Less than 0.7 V
OFF Condition: Open
Output State Following Timeout: OFF

Certifications



(CE approval only applies to 2.4 GHz models)

Included with Device

- BWA-HW-001: Mounting Hardware Kit, containing four M5-0.8 x 25mm SS screws, four M5-0.8 x 16mm SS screws, four M5-0.8mm SS hex nuts, and four #8-32 x 3/4" SS bolts
- BWA-902-C (900 MHz) or BWA-202-C (2.4 GHz): Antenna, 2 dBd Omni, Rubber Swivel RP-SMA Male. (Not included with Internal antenna models)
- Quick Start Guide (128185 for DX80 Gateways or 152653 for MultiHop models)

Warnings

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.** 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. This device has been designed to operate with the antennas listed on Banner Engineering's website and having a maximum gain of 9 dBm. Antennas not included in this list or having a gain greater than 9 dBm are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen such that the equivalent isotropically radiated power (EIRP) is not more than that permitted for successful communication. Consult with Banner Engineering Corp. if the destination country is not on this list.

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more sensors, more solutions