

## Datasheet

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 four selectable discrete inputs, four sourcing discrete sourcing outputs, two universal analog inputs, and two 0 to 20 mA analog outputs
- 10 to 30 V dc power input
- DIP switches for user configuration
- Modbus serial interface
- Site Survey analyzes the network's signal strength and reliability and displays the results on the Gateway's LCD
- 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/wireless](http://www.bannerengineering.com/wireless).



### 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.



### Important:

- **Electrostatic discharge (ESD) sensitive device**
- ESD can damage the device. Damage from inappropriate handling is not covered by warranty.
- Use proper handling procedures to prevent ESD damage. Proper handling procedures 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.

## Models

Models	Frequency	Environmental Rating	I/O
DX80G2M6S-P2-KR	2.4 GHz ISM Band	IP67, NEMA 6	<b>Inputs:</b> Four selectable discrete, two 0 to 20 mA or 0 to 10 V analog <b>Outputs:</b> Four sourcing discrete, two 0 to 20 mA analog

## Configuration Instructions

### 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: [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

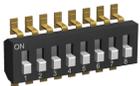
Before changing DIP switch positions, disconnect the power. DIP switch changes are not recognized until after power is cycled to the device.

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.

### Accessing the Internal DIP Switches

To access the internal DIP switches, follow these steps:

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.
4. Remove the black cover plate from the bottom of the device's cover.  
The DIP switches are located behind the rotary dials.



After making the necessary changes to the DIP switches, place the black cover plate back into position and gently push into place. Plug the ribbon cable in after verifying that the blocked hole lines up with the missing pin. Mount the cover back onto the housing.

### DIP Switch Settings

Device Settings	Switches					
	1	2	3	4	5	6 <sup>1</sup>
900 MHz transmit power level: 1 Watt (30 dBm)	OFF*					
900 MHz transmit power level: 250 mW (24 dBm), DX80 compatibility mode	ON					
Modbus or UCT configured (overrides DIP switches 3-8)		OFF*				
DIP switch configured		ON				
Inputs sourcing (PNP)			OFF*			
Inputs sinking (NPN)			ON			
Link loss output: zero				OFF*	OFF*	
Link loss output: one				OFF	ON	
Link loss output: hold last state				ON	OFF	
Link loss output: user configuration				ON	ON	
0 to 20 mA scale						OFF*
4 to 20 mA scale						ON

\* Default configuration

<sup>1</sup> Not used when configured for 0-10 V I/O.

### 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.

### Discrete Input Type

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

### Link Loss Outputs

The Sure Cross® 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 set 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 hold the last stable state/value. Use the DIP switches to select the link loss output state.

### Modbus/Software or DIP Switch Configured

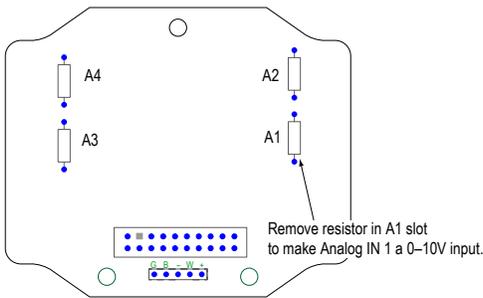
In Modbus/Software Configured mode, use the User Configuration Software or a Modbus command to change the device parameters. DIP switch positions 3 through 8 are ignored. In DIP Switch Configured mode, use the DIP switches to configure the parameters listed in the table.

### Transmit Power Levels

The 900 MHz radios transmit 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 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.

### Configuring Universal Analog Inputs for mA or V

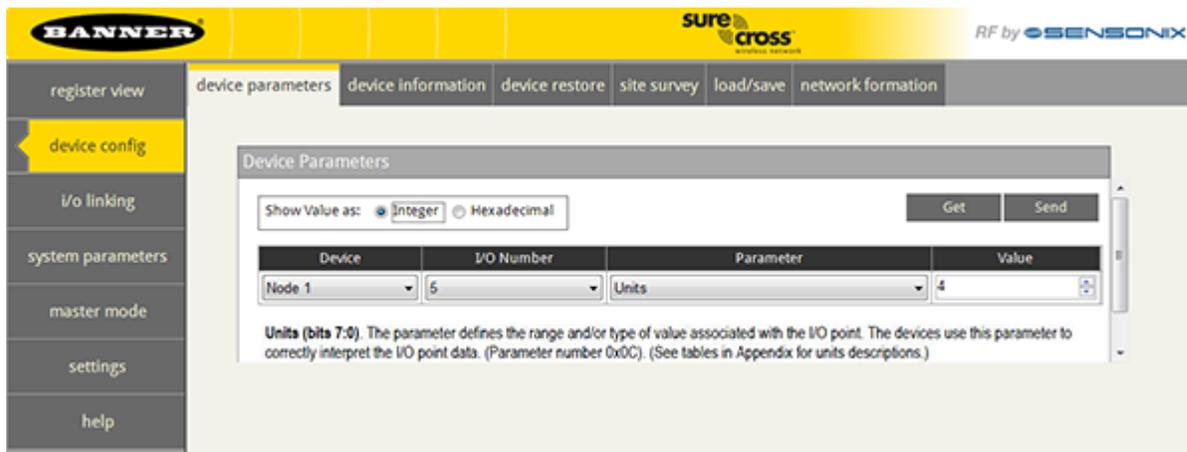
To configure inputs to use 0 to 10V instead of 0 to 20mA, remove the installed resistors from the marked locations on the wiring board. For example, to make analog input 1 a 0 to 10V input, follow these instructions.



Step 1. Cut out the resistor installed in the A1 (analog 1) slot. (Your wiring board may differ slightly from the board shown. Use the board's labels to confirm you have selected the correct resistor to cut.)

Step 2. Launch the User Configuration Tool software.

Step 3. Change the units parameter for this particular input on this device (Gateway or Node) to use voltage instead of milliamps. Refer to the Modbus Register table for the I/O number for each analog input. Writing a four (4) to the Units parameter defines the units as 0 to 10V. Writing a two (2) to the Units parameter defines the units as 0 to 20 mA.



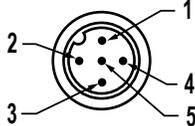
Note that a 220 ohm 0.1% resistor must be installed for a 0 to 20mA input. The resistor must be removed for an input defined as a 0 to 10V input.

### Wire Your Sure Cross® Device

Use the following wiring diagrams to first wire the sensors and then apply power to the Sure Cross devices.

### 5-pin M12/Euro-style Wiring for Gateways and DX85s

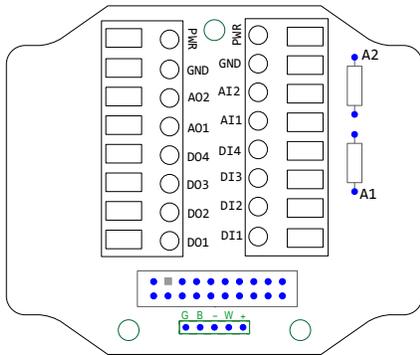
Wiring the 5-pin Euro-style connector depends on the model and power requirements of the device. Connecting power to the communication pins will cause permanent damage.

5-pin M12/Euro-style Male Connector	Pin	Wire Color	Description
	1	Brown	10 to 30 V dc
	2	White	RS485 / D1 / B / +
	3	Blue	dc common (GND)
	4	Black	RS485 / D0 / A / -
	5	Gray	Comms Gnd

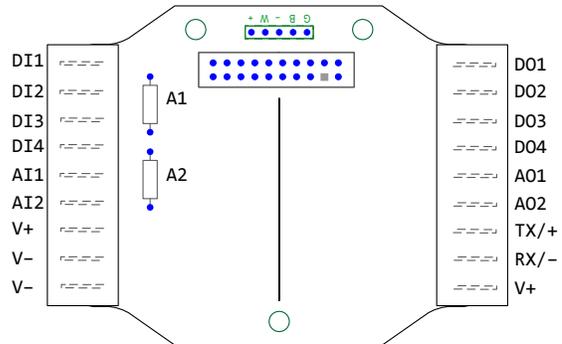
### Terminal Blocks

Refer to the Class I Division 2/Zone 2 control drawings (p/n [143086](#)) for wiring specifications and limitations.

IP67 Housing (P2 Models)	IP20 Housing (P2C Models)
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- AIx or Ax. Analog IN x
- AOx. Analog OUT x
- DIx. Discrete IN x
- DOx. Discrete OUT x
- GND. Ground/dc common connection
- PWR. 10 to 30 V dc power connection

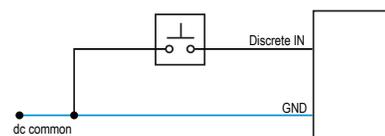
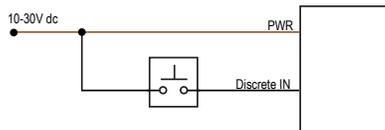


- RX/-. Serial communication line for the Gateway. No connection for Nodes
- TX/+. Serial communication line for the Gateway; no connection for Nodes
- V+. 10 to 30 V dc power connection
- V-. Ground/dc common connection

### Wiring Diagrams for Discrete Inputs

Connecting power to the communication pins will cause permanent damage. For the DX8x...C models, PWR in the wiring diagram refers to V+ on the wiring board and GND in the wiring diagram refers to V- on the wiring board. To power the sensor using the switch power output (SPx), replace the PWR with SPx in these wiring diagrams.

Discrete Input Wiring for PNP Sensors	Discrete Input Wiring for NPN Sensors
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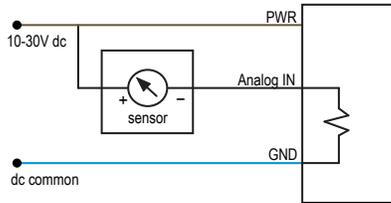
### Wiring Diagrams for Discrete Outputs

Connecting power to the communication pins will cause permanent damage. For the DX8x..C models, PWR in the wiring diagram refers to V+ on the wiring board and GND in the wiring diagram refers to V- on the wiring board. To power the sensor using the switch power output (SPx), replace the PWR with SPx in these wiring diagrams.

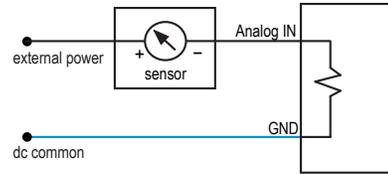
### Wiring Diagrams for Analog Inputs

Connecting power to the communication pins will cause permanent damage. Do not exceed analog input ratings for analog inputs. Only connect sensor outputs to analog inputs.

**Analog Input Wiring (10–30 V dc Power)**



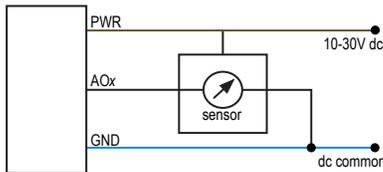
**Analog Input Wiring (4–20 mA, 2-Wire, Externally-Powered Sensors)**



### Wiring Diagrams for Analog Outputs

Connecting power to the communication pins will cause permanent damage.

**Analog Output Wiring**



### LED Behavior for the Gateways

Verify all devices are communicating properly. The radios and antennas must be a minimum distance apart to function properly. Recommended minimum distances are:

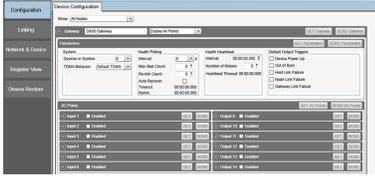
- 900 MHz 150 mW and 250 mW radios: 6 feet
- 900 MHz 1 Watt radios: 15 feet
- 2.4 GHz 65 mW radios: 1 foot

LED 1	LED 2	Gateway Status
Solid green		Power ON
Flashing red	Flashing red	Device Error
	Flashing amber	Modbus Communication Active
	Flashing red	Modbus Communication Error

For Gateway and Ethernet Bridge systems, active Modbus communication refers to the communication between the Gateway and the Ethernet Bridge. For GatewayPro systems, the Modbus communication LEDs refer to the communication internal to the GatewayPro. For Gateway-only systems, the Modbus communication LEDs refer to the communication between the Gateway and its host system (if applicable).

## 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 a USB or Ethernet connection. Download the most recent revisions of the configuration software from Banner Engineering's website:

[www.bannerengineering.com/wireless](http://www.bannerengineering.com/wireless).

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

## Holding Registers

Modbus Holding Register		EIP Registers		I/O Type	I/O Range		Holding Register Representation (Dec)	
Gateway	Node	Node			Min.	Max.	Min.	Max.
1	1 + (Node# × 16)	0 + (Node# × 8)	Instance 100 / N7	Discrete IN 1	0	1	0	1
2	2 + (Node# × 16)	1 + (Node# × 8)		Discrete IN 2	0	1	0	1
3	3 + (Node# × 16)	2 + (Node# × 8)		Discrete IN 3	0	1	0	1
4	4 + (Node# × 16)	3 + (Node# × 8)		Discrete IN 4	0	1	0	1
5	5 + (Node# × 16)	4 + (Node# × 8)		Analog IN 1 (mA/V)	0.0	20.0/10.0	0	65535
6	6 + (Node# × 16)	5 + (Node# × 8)		Analog IN 2 (mA/V)	0.0	20.0/10.0	0	65535
7	7 + (Node# × 16)	6 + (Node# × 8)		Reserved				
8	8 + (Node# × 16)	7 + (Node# × 8)		Device Message				
9	9 + (Node# × 16)	0 + (Node# × 8)	Instance 112 / N14	Discrete OUT 1	0	1	0	1
10	10 + (Node# × 16)	1 + (Node# × 8)		Discrete OUT 2	0	1	0	1
11	11 + (Node# × 16)	2 + (Node# × 8)		Discrete OUT 3	0	1	0	1
12	12 + (Node# × 16)	3 + (Node# × 8)		Discrete OUT 4	0	1	0	1
13	13 + (Node# × 16)	4 + (Node# × 8)		Analog OUT 1 (mA)	0.0	20.0	0	65535
14	14 + (Node# × 16)	5 + (Node# × 8)		Analog OUT 2 (mA)	0.0	20.0	0	65535
15	15 + (Node# × 16)	6 + (Node# × 8)		Control Message				
16	16 + (Node# × 16)	7 + (Node# × 8)		Reserved				

## Installing Your Sure Cross® Radios

Please refer to one of the following instruction manuals for details about successfully installing your wireless network components.

- DX80 and Performance Wireless I/O Network Instruction Manual: [132607](#)

## Specifications

### Performance 2.4 GHz Korean Radio Specifications

**Radio Range<sup>2</sup>**

2.4 GHz, 65 mW: Up to 3.2 km (2 miles)

**Antenna Minimum Separation Distance**

2.4 GHz, 65 mW: 0.3 m (1 ft)

**Radio Transmit Power**

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)

**2.4 GHz Compliance for Korean Radio Models**

KCC-CRM-BE2-DX

**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 Tool (UCT) software  
Node: Defined by Gateway

<sup>2</sup> 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.

## RS-485 Communication Specifications

### Communication Hardware (RS-485)

Interface: 2-wire half-duplex RS-485  
Baud rates: 9.6k, 19.2k (default), or 38.4k  
Data format: 8 data bits, no parity, 1 stop bit

## Specifications for the P2-KR Gateway

### Supply Voltage

10 V dc to 30 V dc (Outside the USA: 12 V dc to 24 V dc, ± 10%)

### Power Consumption

900 MHz Consumption: Maximum current draw is < 100 mA and typical current draw is < 50 mA at 24 V dc. (2.4 GHz consumption is less.)

### Wiring Access

Four PG-7, One 1/2-inch NPT, One 5-pin threaded M12/Euro-style male quick disconnect

### Discrete Inputs

Four, DIP switch selectable between sourcing/PNP and sinking/NPN  
Rating: 3 mA max current at 30 V dc  
Sample Rate: 62.5 milliseconds  
Report Rate: On change of state

### Discrete Input ON Condition

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

### Discrete Input OFF Condition

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

### Analog Inputs

Two, 0 to 20 mA (default) or 0 to 10 V (user configurable)  
Rating (mA): 24 mA  
Rating (V): 10 V  
Impedance: Approximately 220 Ohms  
Sample Rate: 62.5 milliseconds  
Report Rate: 1 second or On Change of State (1% change in value)  
Accuracy: 0.2% of full scale +0.01% per °C  
Resolution: 12-bit

### Housing

Polycarbonate housing and rotary dial cover; polyester labels; EDPM rubber cover gasket; nitrile rubber, non-sulphur cured button covers  
Weight: 0.26 kg (0.57 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, and Six character LCD

### Discrete Outputs

Four sourcing/PNP  
Update Rate: 125 milliseconds  
ON Condition: Supply minus 2 V  
OFF Condition: Less than 2 V  
Output State Following Timeout: OFF

### Discrete Output Rating (PNP)

100 mA max current at 30 V dc  
ON-State Saturation: Less than 3 V at 100 mA  
OFF-state Leakage: Less than 10 µA

### Analog Outputs

Two, 0 to 20 mA  
Update Rate:  
Accuracy:  
Resolution:

### Certifications



## 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

IEC 68-2-6 and IEC 68-2-27  
Shock: 30g, 11 millisecond half sine wave, 18 shocks  
Vibration: 0.5 mm p-p, 10 to 60 Hz

### 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.

## Included with the DX80 and DX80...C Models

- BWA-HW-002: DX80 Access Hardware Kit, containing four PG-7 plastic threaded plugs, four PG-7 nylon gland fittings, four PG-7 hex nuts, one 1/2-inch NPT plug, and one 1/2-inch nylon gland fitting. (Not included with IP20 DX80...C models)
- 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-HW-003: PTFE tape
- 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)
- MQDC1-506: 5-Euro (single ended) straight cable, 2m (Not included with FlexPower devices)
- BWA-HW-011: IP20 Screw Terminal Headers (2 pack) (Included only with the IP20 DX80...C models)
- Product datasheet and product family 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.** 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.

## Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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