Sure Cross® Performance FlexPower® Node

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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 networks are formed around a Gateway, which acts as the wireless network master device, and one or more Nodes.

- Wireless industrial I/O device with two NPN discrete inputs, two NMOS discrete outputs, and four 0 to 20 mA analog inputs
- Selectable transmit power levels of 250 mW or 1 Watt for 900 MHz models and 65 mW for 2.4 GHz models
- *Flex*Power® 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
- 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.

⚠️ **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: 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.

⚠️ **CAUTION: Electrostatic Discharge (ESD)**

ESD **Sensitive** Device. This product uses semiconductors that can be damaged by electrostatic discharge (ESD). When performing maintenance, care must be taken so the device is not damaged. Disconnect power from the device when accessing the internal DIP switches. Proper handling procedures include wearing anti-static wrist straps. Damage from inappropriate handling is not covered by warranty.

Models

Models	Frequency	I/O
DX80N9X2S-P5	900 MHz ISM Band	Inputs: Two NPN discrete, four selectable analog (0 to 20 mA or 0 to 10 V)
DX80N2X2S-P5	2.4 GHz ISM Band	Outputs: Two NMOS discrete Switch Power Outputs: Two [1]

DX80...C (IP20; NEMA 1) models are also available. To order this model with an IP20 housing, add a C to the end of the model number: DX80N9X2S-P5C.

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[1] To configure the switch power outputs, use the User Configuration Tool (UCT). Refer to the *UCT Instruction Manual* f(p/n 140628) for instructions.

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 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. 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*
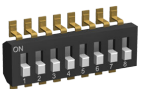
Configure the DIP Switches

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	7	8
Transmit power level (900 MHz): 1 W (30 dBm)	OFF*							

Device **Settings**	Switches							
	1	2	3	4	5	6	7	8
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 [2]						OFF*		
4–20 mA scale [2]						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 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/User **Configuration** Tool (UCT) or DIP Switch **Configured**

In Modbus/UCT Configured mode, use the User Configuration Tool (UCT) 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.

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*.
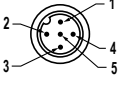
Wiring Your Sure Cross® Device

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

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[2] Not used for 0–10 V analog I/O models

5-Pin M12/Euro-style Male Quick Disconnect

Integral 5-pin M12/Euro-style male quick disconnect (QD) wiring depends on the model and power requirements of the device. Not all models can be powered by 10 to 30 V dc and not all models can be powered by 3.6 to 5.5 V dc. Refer to *Specifications* to verify the power requirements of your device. For *Flex*Power devices, do not apply more than 5.5 V to the gray wire.

5-pin M12/Euro-style (male)	Pin	Wire Color	Powered by 10 to 30 V dc	Powered by **Battery** or **Battery** Pack
	1	Brown	10 to 30 V dc	
	2	White		
	3	Blue	dc common (GND)	dc common (GND)
	4	Black		
	5	Gray		3.6 to 5.5 V dc

Terminal Blocks
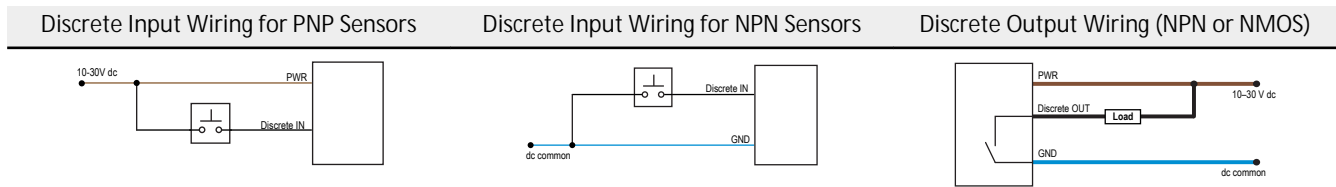
P5 Model	P5C Model
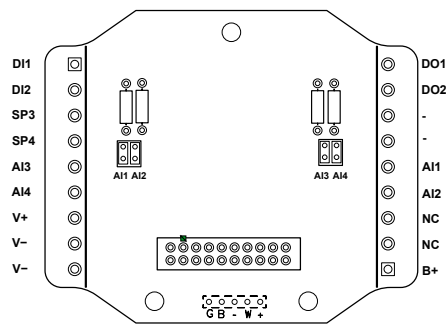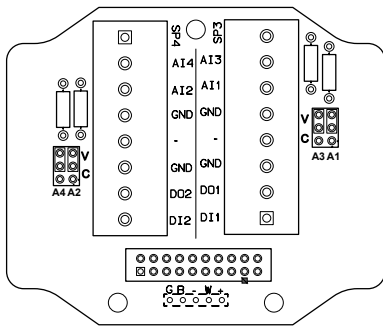
AI*x* or A*x*. Analog IN *x*
B+. 3.6 to 5.5 V dc (use for battery powered models only)
DI*x*. Discrete IN *x*
DO*x*. Discrete OUT *x*

GND. Ground/dc common connection
NC. No connection
SP*x*. Switch Power; provides variable power sources for external devices
V+. 10 to 30 V dc power connection
V−. Ground/dc common connection

Connecting power to the communication pins will cause permanent damage. For the DX8*x*...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 (SP*x*), replace the PWR with SP*x* in these wiring diagrams. Use the User Configuration Tool (UCT) to select the switch power voltage and warm-up time for your radio. For instructions, refer to the *UCT Instruction Manual*, p/n 140628)

Refer to the Class I Division 2/Zone 2 control drawings (p/n *143086*) for wiring specifications or limitations.

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

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)
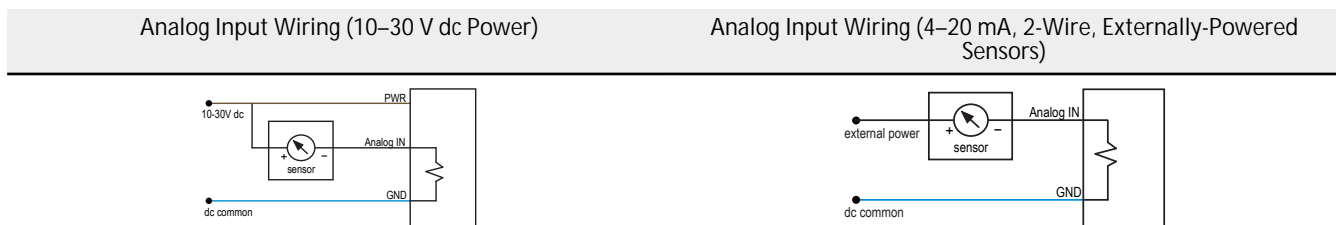
DX80...C Wiring

Wiring power to the DX80...C models varies depending the power requirements of the model. Connecting dc power to the communication pins (Tx/Rx) causes permanent damage. For *Flex*Power devices, do not apply more than 5.5 V to the B+ terminal.

Terminal Label	Gateway and DX85	10 to 30 V dc Powered Nodes	**Battery** Powered Nodes
V+	10 to 30 V dc	10 to 30 V dc	
Tx/+	RS485 / D1 / B / +		
V−	dc common (GND)	dc common (GND)	dc common (GND)
Rx/−	RS485 / D0 / A / -		
B+			3.6 to 5.5 V dc

Configuring the Universal Analog Input
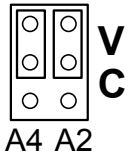
By default, the analog input jumpers are set to use voltage (0 to 10 V). To use the current (0–20 mA) analog input, follow these instructions:

1. Disconnect the power from the device.
2. Open the housing and access the wiring board.
3. Move the jumper for the desired analog input (shown are analog 2 and analog 4) from the V position (shown) to the C position. For the board models with two pins instead of three, remove the jumper to select 0–20 mA configuration.
4. Close the housing and reconnect the power.

Complete the configuration change using the User Configuration Tool.

1. With the Gateway connected to your computer, launch the User Configuration Tool software.
2. From the Device > **Configuration Settings** menu, select Comm Port and click Connect.
3. Go to the **Configuration** > Device **Configuration** screen.
4. Click the arrow next to the Node number to view its parameters.
5. Click GET Node.
6. Under Analog Signal **Conditioning**, change the Units from 0-10V to 0-20mA.
7. Click SEND.

To change the inputs from 0–20 mA to 0–10 V on models without jumpers, cut out and remove the resistor.

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** Tool

The User Configuration Tool (UCT) 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.
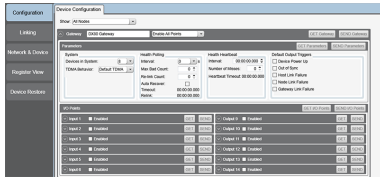
Use a USB to RS-485 adapter cable to connect a standalone DX80 Gateway to the computer. For DXM Controllers with an internal DX80 radio, connect a computer to the DXM Controller using a USB or Ethernet connection. Download the most recent revisions of the UCT software from Banner Engineering's website: *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

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*

Holding Registers

Modbus Registers		EIP Registers		I/O Type	I/O Range		Holding Register **Representation** (Dec)		Terminal Block Labels
Gateway	Node	Node			Min.	Max.	Min.	Max.	
1	1 + (Node# × 16)	0 + (Node# × 8)	Instance 100 / N7	Analog IN 1 (mA)	0	20	0	65535	AI1
2	2 + (Node# × 16)	1 + (Node# × 8)		Analog IN 2 (mA)	0	20	0	65535	AI2
3	3 + (Node# × 16)	2 + (Node# × 8)		Analog IN 3 (mA)	0	20	0	65535	AI3
4	4 + (Node# × 16)	3 + (Node# × 8)		Analog IN 4 (mA)	0	20	0	65535	AI4
5	5 + (Node# × 16)	4 + (Node# × 8)		Discrete IN 1	0	1	0	1	DI1
6	6 + (Node# × 16)	5 + (Node# × 8)		Discrete IN 2	0	1	0	1	DI2
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	DO1
10	10 + (Node# × 16)	1 + (Node# × 8)		Discrete OUT 2	0	1	0	1	DO2
…	…	…							
15	15 + (Node# × 16)	6 + (Node# × 8)		Control Message					
16	16 + (Node# × 16)	7 + (Node# × 8)		Reserved					

Specifications

Radio Range[3]
900 MHz, 1 Watt: Up to 9.6 km (6 miles)
2.4 GHz, 65 mW: Up to 3.2 km (2 miles)

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

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

Supply Voltage
10 V dc to 30 V dc or 3.6 V dc to 5.5 V dc low power option (Outside the USA: 12 V dc to 24 V dc, ±10% or 3.6 V dc to 5.5 V dc low power option)[4]
900 MHz Consumption: Maximum current draw is < 40 mA and typical current draw is < 30 mA at 24 V dc. (2.4 GHz consumption is less.)

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)

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

[4] For European applications, power this device from a Limited Power Source as defined in EN 60950-1.

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

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

Discrete Inputs (NPN)
Rating: 3 mA max current at 30 V dc
Sample Rate: 125 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 (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

Operating Conditions[5]
–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)

Environmental **Ratings**[6]
IEC IP67; NEMA 6
"C" Housing Models/External wiring terminals: IEC IP20; NEMA 1

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

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

Interface
Indicators: Two bi-color LEDs
Buttons: Two
Display: Six character LCD

Wiring Access
DX80 models: Four PG-7, One 1/2-inch NPT, One 5-pin threaded M12/Euro-style male quick disconnect
DX80...C models: External terminals

Spread Spectrum Technology
FHSS (Frequency Hopping Spread Spectrum)

Discrete Outputs (NMOS)
Update Rate: 1 second
ON Condition (NMOS): Less than 0.7 V
OFF Condition (NMOS): Open
Output State Following Timeout: OFF

Discrete Output **Rating** (Performance NMOS)
Less than 1 A max current at 30 V dc
ON-State Saturation: Less than 0.7 V at 20 mA

Switch Power Outputs
Two (SP3 and SP4)
Output voltage: Selectable using the User Configuration Tool (UCT) or Modbus commands

Certifications

Certifications for DX8x...C (External Wiring Terminal) and DX8x...E Models

CSA: Class I Division 2 Groups ABCD, Class I Zone 2 AEx/Ex nA II T4 — Certificate: 1921239

ATEX: II 3 G Ex nA IIC T4 Gc (Group IIC Zone 2) — Certificate LCIE 10 ATEX 1012 X

Refer to the Class I Division 2/Zone 2 control drawings (p/n *143086*) for wiring specifications or limitations. All battery-powered devices must only use the lithium battery manufactured by Xeno, model XL-205F.

Included with Model

The following items ship with the DX80 radios.

- 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-9O2-C (900 MHz) or BWA-2O2-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)
- 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)

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[5] Refer to the *Sure Cross® Wireless I/O Networks Instruction Manual* (p/n 132607) for installation and waterproofing instructions.
[6] Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

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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