

# SureCross DX70 Wireless Point-to-Point Kits

## Instruction Manual

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133214

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# 1 DX70 Point-to-Point Radios



The SureCross® DX70 wireless series consists of a radio frequency network built around two devices and configured I/O that operates in most environments and eliminates the need for wiring runs..

- Wireless industrial I/O system with discrete (sourcing or sinking) inputs and outputs, analog inputs and outputs, and a link loss output that may be selected or deselected to be one of the four outputs
- DIP switches for user configuration
- 10 to 30 V dc power input
- 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 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 accessories, refer to Banner Engineering's website, [www.bannerengineering.com/surecross](http://www.bannerengineering.com/surecross).

When ordering the SureCross DX70 device, order the kits listed below. The kits include the Gateway, Node, mounting hardware, access hardware, antennas, and cables. Each kit's devices ship from the factory bound and with the inputs and outputs mapped as shown in the I/O mapping tables.

Kit Models	Frequency	Inputs and Outputs
DX70K9M6EM1	900 MHz	Inputs: Four selectable discrete, two 0-20 mA analog Outputs: Four sourcing discrete, two 0-20 mA analog
DX70K2M6EM1	2.4 GHz	
DX70K9M6ED1	900 MHz	Inputs: Eight selectable discrete on the Node, four selectable discrete on the Gateway Outputs: Four sourcing discrete on the Node, eight sourcing discrete on the Gateway
DX70K2M6ED1	2.4 GHz	

Internal antenna models are also available, but are not UL Listed. For more information, contact your local Banner Engineering Corp. representative.



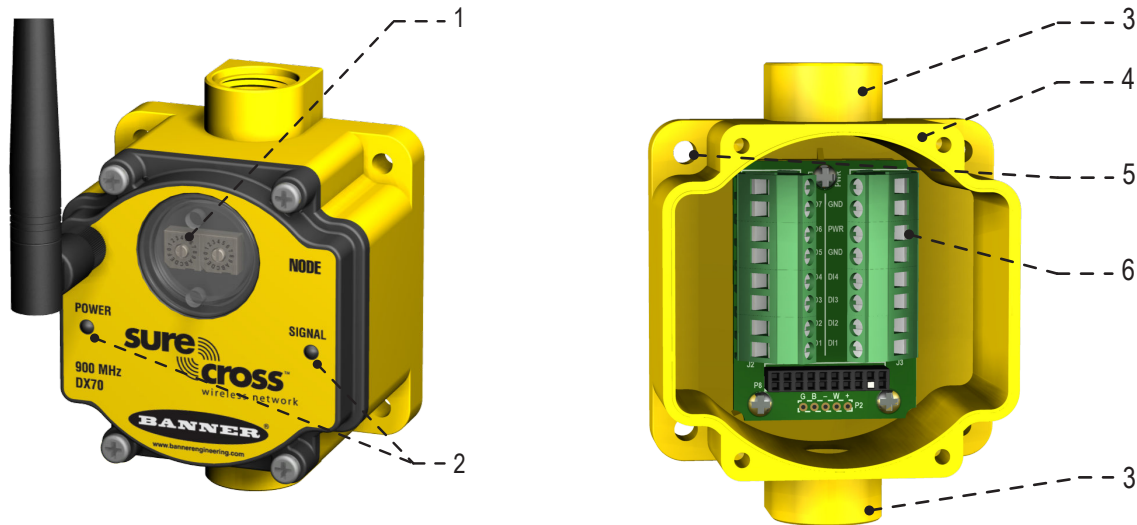
## WARNING: Not To Be Used for Personnel Protection

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.

Replacement DX70 Models			
Kit Models	Device	Frequency	Replacement DX70 Model
DX70K9M6EM1	Node	900 MHz ISM Band	DX70N9X6S4P4M2M2
	Gateway		DX70G9X6S4P4M2M2
DX70K2M6EM1	Node	2.4 GHz ISM Band	DX70N2X6S4P4M2M2
	Gateway		DX70G2X6S4P4M2M2
DX70K9M6ED1	Node	900 MHz ISM Band	DX70N9X6S8P4
	Gateway		DX70G9X6S4P8
DX70K2M6ED1	Node	2.4 GHz ISM Band	DX70N2X6S8P4

Replacement DX70 Models			
Kit Models	Device	Frequency	Replacement DX70 Model
	Gateway		DX70G2X6S4P8

## 1.1 Device Components



1. Rotary Dials. After the DX70 devices are bound, use the rotary dials on the Gateway to set the Network ID (NID) to a decimal value from 1 to 32.

2. LEDs. Power LED - Power indicator. A green LED indicates the power is on. Signal LED - Provides real-time feedback regarding RF link status and communications activity.

3. Port, NPT Gland, or Plug. If unused, install the provided plug into the 1/2 NPT threaded port. Use PTFE tape if an IP67 seal is required.

4. Housing. The rugged, industrial DX70 housing meets IEC IP67 standards.

5. Mounting Hole, #10/M5 Clearance. Mounting holes accept metric M5 or UNC/UNF #10 hardware — DIN rail mount adapter bracket available

6. Wiring Terminal Strip. The 16 wiring terminals accept wire sizes: AWG 12-28 or 2.5 mm<sup>2</sup>

## 2 Setting Up and Installing a DX70 Point-to-Point Network

To set up and install DX70 kits, follow these steps. These kits ship from the factory bound together and with their inputs and outputs mapped as shown in the I/O mapping tables.

1. Configure the Gateway and Node's DIP switches (if necessary).
2. Connect the sensors.
3. Apply power to the DX70 Gateway and Node.
4. Observe the LED behavior to verify the devices are communicating with each other.
5. Install your DX70 Gateway and Node into their final location.

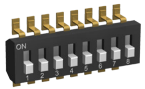
### 2.1 Configure the DIP Switches

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.

#### 2.1.1 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.

#### 2.1.2 DIP Switch Settings for the DX70 Devices

Use the DIP switches on the circuit board to set the following parameters. Changes made to the DIP switches affect all I/O for this device.

\* Default positions.

##### 2.1.2 Link Loss Output State

Use DIP switches 1 and 2 to select the state the outputs are changed to during a link loss.

DIP Switches		
1	2	Link Loss Output State
OFF *	OFF *	Off (discrete) or 0 mA (analog)
ON	OFF	On (discrete) or 20 mA (analog)
OFF	ON	Hold last stable state
ON	ON	Reserved

##### 2.1.2 Discrete Input Type Selection

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

DIP Switch	
3	Discrete Input Type
OFF *	PNP
ON	NPN

### 2.1.2 Use Input/Output 1 or Use Link Loss Indicator (EM1 Kit Only)

The lost link indicator option is only available with the EM1 kit. When DIP switch 4 is OFF (default position), the link loss error indicator uses output 1 and input 1 is not available. When DIP switch 4 is ON, input 1 is mapped to output 1. For the ED1 kit, this DIP switch is ignored.

DIP Switch	
4	Use Input/Output 1 or Use Link Loss Indicator
OFF *	Link Loss Error Indicator in Output 1 (Input 1 is unavailable)
ON	Input 1 mapped to Output 1

### 2.1.2 Link Loss Timeout

The link loss timeout is the length of elapsed time during which there has been no communication between the Gateway and Node. By default, if there has been no communication between the Gateway and Node for four seconds, the radio link has failed.

DIP Switch	
5	Link Loss Timeout
OFF *	4 seconds
ON	1 second

## 2.2 Wiring Your SureCross® Device

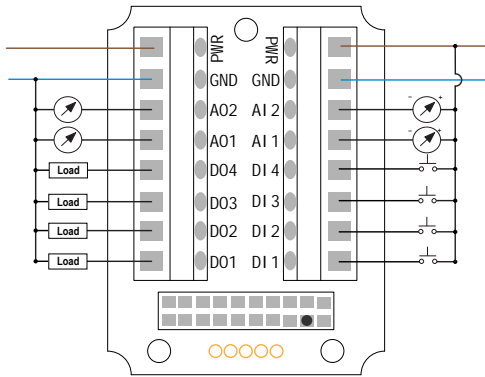
Use the following wiring diagrams to first wire the sensors and then apply power to the SureCross devices.

## 2.2.1 I/O Mapping

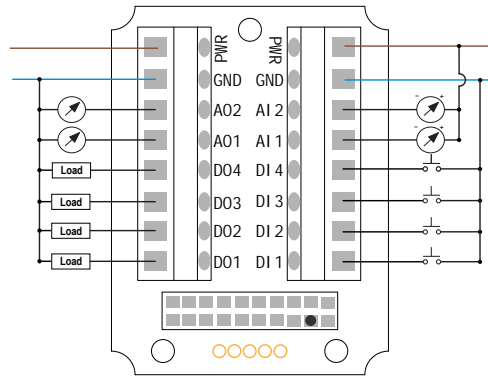
All DX70 pairs ship from Banner Engineering with the I/O mapped.

### 2.2.1 DX70...EM1 Kits

Using PNP Inputs



Using NPN Inputs



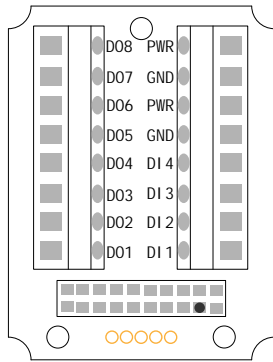
Terminal Label	DX70 Gateway		DX70 Node	Terminal Label
DI1	Discrete IN 1 *	--->	Discrete OUT 1 or Lost Link Indicator*	DO1
DI2	Discrete IN 2	--->	Discrete OUT 2	DO2
DI3	Discrete IN 3	--->	Discrete OUT 3	DO3
DI4	Discrete IN 4	--->	Discrete OUT 4	DO4
AI1	Analog IN 1	--->	Analog OUT 1	AO1
AI2	Analog IN 2	--->	Analog OUT 2	AO2
DO1	Discrete OUT 1 or Lost Link Indicator*	<---	Discrete IN 1 *	DI1
DO2	Discrete OUT 2	<---	Discrete IN 2	DI2
DO3	Discrete OUT 3	<---	Discrete IN 3	DI3
DO4	Discrete OUT 4	<---	Discrete IN 4	DI4
AO1	Analog OUT 1	<---	Analog IN 1	AI1
AO2	Analog OUT 2	<---	Analog IN 2	AI2

\* If discrete OUT 1 is used as a lost link indicator (default) then discrete IN 1 is non-functional. A one (1) in DO1's Modbus register indicates a lost radio link. A zero (0) indicates the radio network is operating normally. Please refer to the *Configuration* section to change this setting.

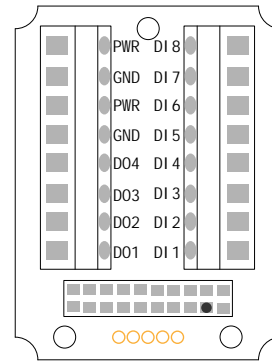
### 2.2.1 DX70...ED1 Kits

The lost link indicator is not available on this model.

4P8 Model (Gateway)



8P4 Model (Node)

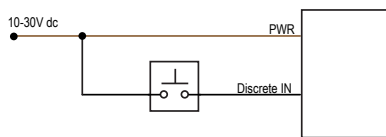


Terminal Label	DX70 Gateway		DX70 Node	Terminal Label
DI1	Discrete IN 1	--->	Discrete OUT 1	DO1
DI2	Discrete IN 2	--->	Discrete OUT 2	DO2
DI3	Discrete IN 3	--->	Discrete OUT 3	DO3
DI4	Discrete IN 4	--->	Discrete OUT 4	DO4
DO1	Discrete OUT 1	<---	Discrete IN 1	DI1
DO2	Discrete OUT 2	<---	Discrete IN 2	DI2
DO3	Discrete OUT 3	<---	Discrete IN 3	DI3
DO4	Discrete OUT 4	<---	Discrete IN 4	DI4
DO5	Discrete OUT 5	<---	Discrete IN 5	DI5
DO6	Discrete OUT 6	<---	Discrete IN 6	DI6
DO7	Discrete OUT 7	<---	Discrete IN 7	DI7
DO8	Discrete OUT 8	<---	Discrete IN 8	DI8

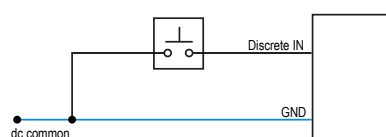
## 2.2.2 Sensor Connections

Refer to the sensor device data sheet for a device specific wiring diagram.

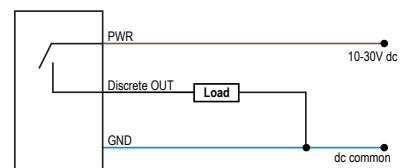
Discrete Input Wiring for PNP Sensors



Discrete Input Wiring for NPN Sensors

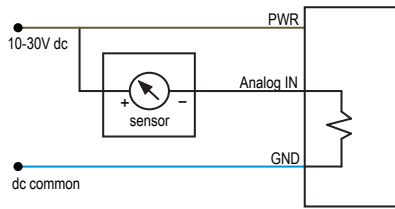


Discrete Output Wiring (PNP)

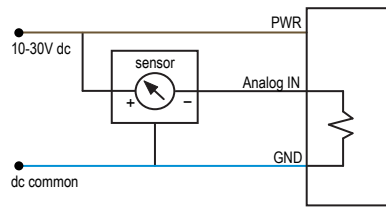




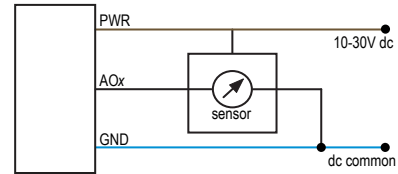
Analog Input Wiring (10 to 30 V dc Power) for 2-Wire Sensors



Analog Input Wiring (10-30V dc Power) for 3-Wire Sensors

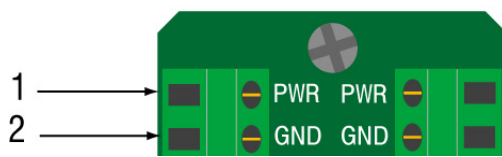


Analog Output Wiring



### 2.2.3 Apply Power to the DX70 Devices

Connect power to the DX70 Gateway and Node by connecting your 10 to 30V dc power directly to the terminal block PWR. Connect your ground to the GND terminal block.



- 1 Power (PWR)
- 2 Ground (GND)

## 2.3 Verify Communication Between Radios

Until communication is established, the Signal LEDs are solid red. When communication is established, the Signal LED flashes amber; the frequency of the flash indicates the communication signal strength.

Status	Power LED		Signal LED	
Power Applied	●	Green solid	-	-
RF Link Error	●	Green solid	●	Red solid
RF Link Good	●	Green solid	☀	Amber flash
Binding Mode	☀	Red flash	☀	Red flash
Successful binding	●	Red solid (for 3 seconds)	●	Red solid (for 3 seconds)

If you are testing the devices before installing them, verify the devices are at least two meters apart to avoid over-driving the link.

### 2.3.1 Signal Strength Indicator

The rate at which the Signal LED blinks amber indicates the signal strength between the Gateway and Node.

- Blinking every 1/8 second = fewer than 3% missed packets
- Blinking every 1/4 second = 3–25% missed packets
- Blinking every 1/2 second = 26–50% missed packets
- Blinking every 1 second = more than 50% missed packets

## 2.4 Installing Your SureCross® Radios

The following are some recommendations for installing your wireless network components.

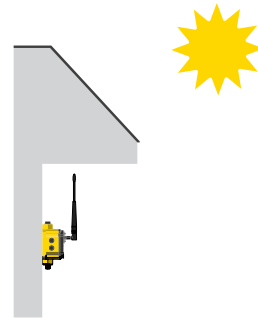
## 2.4.1 Mounting SureCross Devices Outdoors

Use a Secondary Enclosure. For most outdoor applications, we recommend installing your SureCross devices inside a secondary enclosure. For a list of available enclosures, refer to the *Accessories* list.

Point Away From Direct Sunlight. When you are not using a secondary enclosure, minimize the damaging effects of ultra-violet radiation by mounting the devices to avoid facing intense direct sunlight.

- Mount under an overhang or other source of shade,
- Install indoors, or
- Face the devices north when installing outside.

For harsh outdoor applications, consider installing your radio inside a secondary enclosure. For a list of available enclosures, refer to the *Accessories* list.



Mount Vertically to Avoid Collecting Rain. When possible, mount the devices where rain or snow will drain away from the device.

- Mount vertically so that precipitation, dust, and dirt do not accumulate on permeable surfaces.
- Avoid mounting the devices on flat or concave surfaces, especially if the display will be pointing up.

Remove Moisture and Condensation. If condensation is present in any device, add a small desiccant packet to the inside of the radio. To help vent the radios, Banner also sells a vented plug (model number BWA-HW-031) for the 1/2-inch NPT port of the SureCross radios.

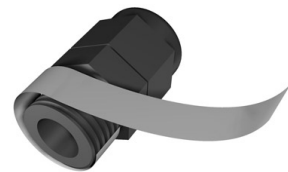


## Watertight Glands and NPT Ports

### Watertight Glands and Plugs

To make glands and plugs watertight, use PTFE tape and follow these steps.

1. Wrap four to eight passes of polytetrafluoroethylene (PTFE) tape around the threads as close as possible to the hexagonal body of the gland.
2. Manually thread the gland into the housing hole. Never apply more than 5 in-lbf of torque to the gland or its cable clamp nut. <sup>1</sup>



Seal any unused PG-7 access holes with one of the supplied black plastic plugs. To install a watertight PG-7 plug:

1. Wrap four to eight passes of PTFE tape around the plug's threads, as close as possible to the flanged surface.
2. Carefully thread the plastic plug into the vacant hole in the housing and tighten using a slotting screwdriver. Never apply more than 10 in-lbf torque to the plastic plug.

### Watertight NPT Plugs

Seal the 1/2-inch NPT port if it is not used. To install a watertight NPT plug:

1. Wrap 12 to 16 passes of PTFE tape evenly across the length of the threads.
2. Manually thread the plug into the housing port until reaching some resistance.

<sup>1</sup> This is not a lot of torque and is equivalent to the torque generated without using tools. If a wrench is used, apply only very light pressure. Torquing these fittings excessively damages the device.

- Using a 9/16-inch crescent wrench, turn the plug until all the plug's threads are engaged by the housing port or until the resistance doubles. Do not over-tighten as this will damage the SureCross unit. These threads are tapered and will create a waterproof seal without over-tightening.

## 2.4.2 Other Installation Requirements

### 2.4.2 Reduce Chemical Exposure

Before installing any devices in a chemically harsh environment, contact the manufacturer for more information regarding the life-expectancy. Solvents, oxidizing agents, and other chemicals will damage the devices.

### 2.4.2 Minimize Mechanical Stress

Although these radio devices are very durable, they are sophisticated electronic devices that are sensitive to shock and excessive loading.

- Avoid mounting the devices to an object that may be shifting or vibrating excessively. High levels of static force or acceleration may damage the housing or electronic components.
- Do not subject the devices to external loads. Do not step on them or use them as handgrips.
- Do not allow long lengths of cable to hang from the glands on the Gateway or Node. Cabling heavier than 100 grams should be supported instead of allowed to hang from the housing.

It is the user's responsibility to install these devices so they will not be subject to overvoltage transients. Always ground the devices in accordance with local, state, or national regulations.

## 2.4.3 Installation Quick Tips

The following are some quick tips for improving the installation of wireless network components.

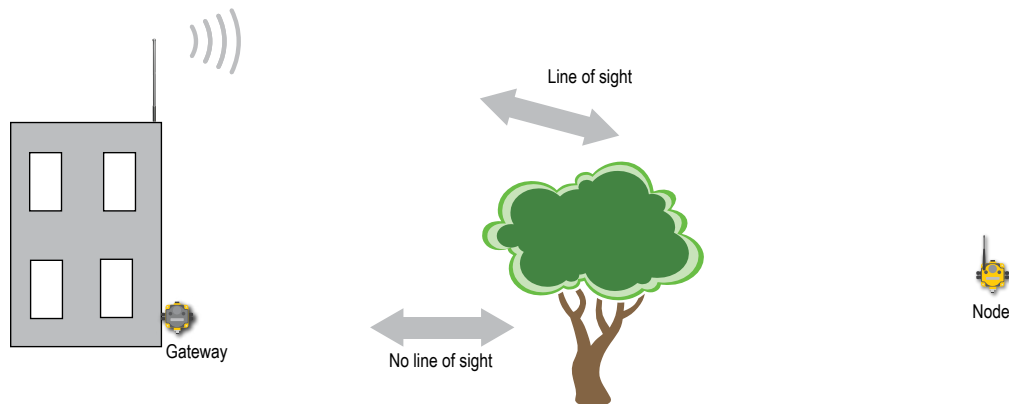
### Create a Clear Communication Path

Wireless communication is hindered by radio interference and obstructions in the path between the transmitter and receiver. To achieve the best radio performance, carefully consider the installation locations for the Gateways and Nodes and select locations without obstructions in the path.

For more information about antennas, please refer to the *Antenna Basics* reference guide, Banner document p/n 132113.

### Increase the Height of the Antennas

Position the external antenna vertically for optimal RF communication. If necessary, consider changing the height of the SureCross radio, or its antenna, to improve reception. For outdoor applications, mounting the antenna on top of a building or pole may help achieve a line-of-sight radio link with the other radios in the network.

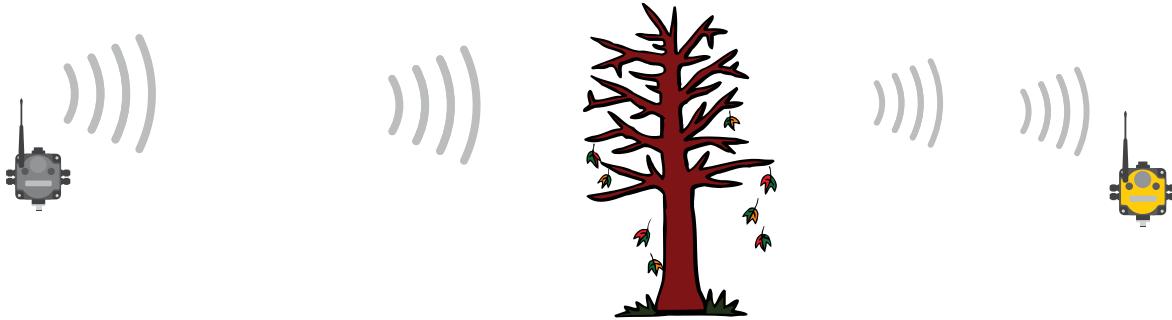


## Collocated Radios

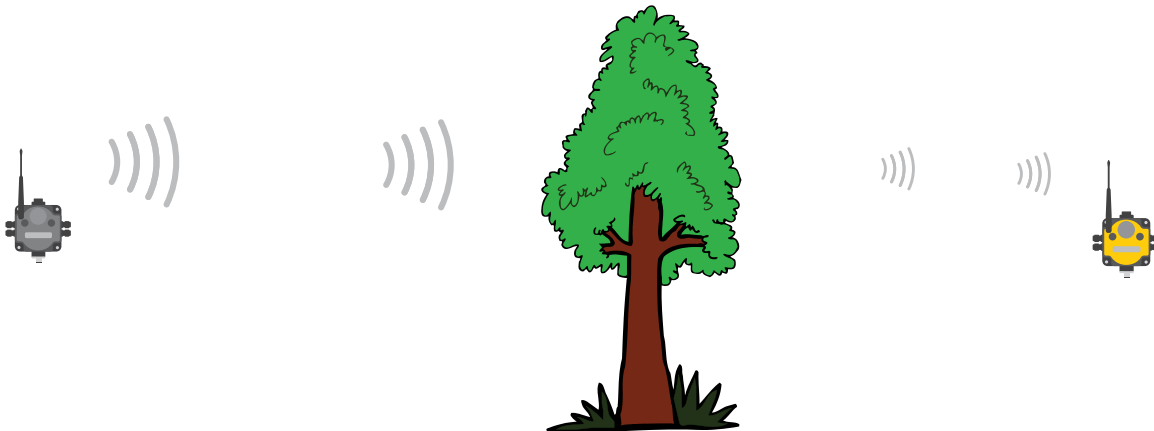
When the radio network's master device is located too close to another radio device, communications between all devices is interrupted. For this reason, always assign a unique Network ID to your wireless networks. The Network ID (NID) is a unique identifier you assign to each wireless network to minimize the chances of two collocated networks interfering with each other. Assigning different NIDs to different networks improves collocation performance in dense installations.

## Be Aware of Seasonal Changes

When conducting the initial Site Survey, the fewest possible missed packets for a given link is better. However, seasonal changes may affect the signal strength and the total signal quality. Radios installed outside with 50% missed packets in the winter months may have 80% or more missed packets in the summer when leaves and trees interfere with radio reception.



A good signal in winter doesn't always mean you will get the same signal strength the rest of the year.



During spring and summer, leaves may block more of the radio signal.

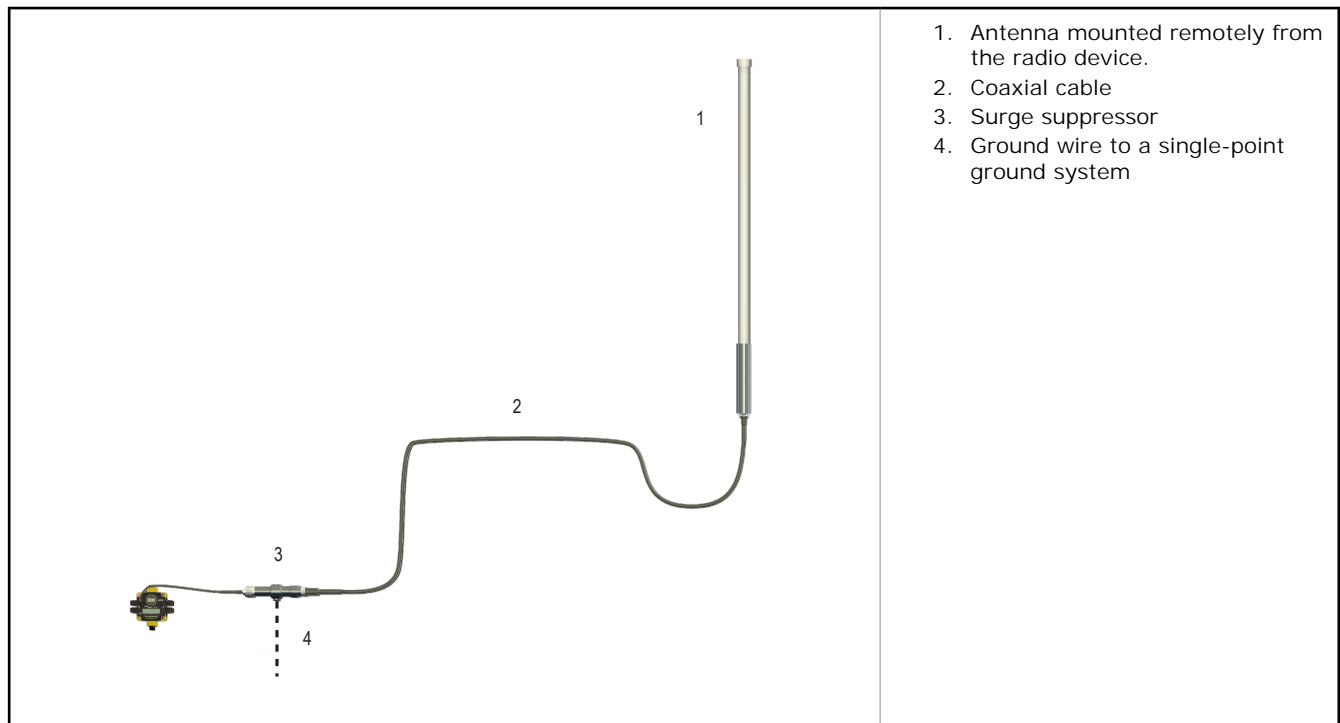
## 2.4.4 Basic Remote Antenna Installation

A remote antenna system is any antenna system where the antenna is not connected directly to the radio; coaxial cable connects the antenna to the radio.

When installing a remote antenna system, always include a lightning arrestor or coaxial surge suppressor in the system. Remote antenna systems installed without surge protection invalidate the warranty of the radio devices.

Surge suppressors should be properly grounded and mounted at ground level near where the cabling enters a building. Install the surge suppressor indoors or inside a weatherproof enclosure to minimize corrosion or component deterioration. For best results, mount the surge suppressor as close to the ground as possible to minimize the length of the ground connection and use a single-point ground system to avoid creating ground loops.

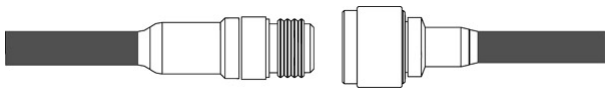
For more detailed information about how antennas work and how to install them, refer to [Antenna Basics](#) (p/n 132113) (also included as a chapter within the product manual).



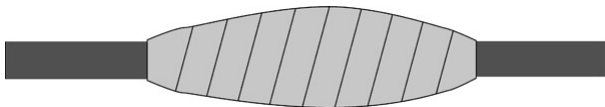
I/O Isolation. When connecting analog and discrete I/O to external equipment such as VFDs (Variable Frequency Drives), it may be appropriate to install interposing relays and/or loop isolation devices to protect the DX80 unit from transients, noise, and ground plane interference originating from devices or the environment. Contact Banner Engineering Corp. for more information.

## Weatherproof Remote Antenna Installations

Prevent water damage to the cable and connections by sealing the connections with rubber splicing tape and electrical tape.



Step 1: Verify both connections are clean and dry before connecting the antenna cable to the antenna or other cable and hand-tightening.



Step 2: Tightly wrap the entire connection with rubber splicing tape. Begin wrapping the rubber splicing tape one inch away from the connection and continue wrapping until you are one inch past the other end of the connection. Each new round of tape should overlap about half the previous round.



Step 3: Protect the rubber splicing tape from UV damage by tightly wrapping electrical tape on top of the rubber splicing tape. The electrical tape should completely cover the rubber splicing tape and overlap the rubber tape by one inch on each side of the connection.

## Antenna Installation

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 SureCross® device or any equipment connected to the SureCross device during a thunderstorm.

## Mount a Dome Antenna to the Enclosure

To mount an antenna directly to the outside of the enclosure, use the -D dome antennas. To mount, drill a hole in the enclosure and insert the antenna.



1. Dome antenna
2. DIN rail and DIN rail bracket
3. Enclosure

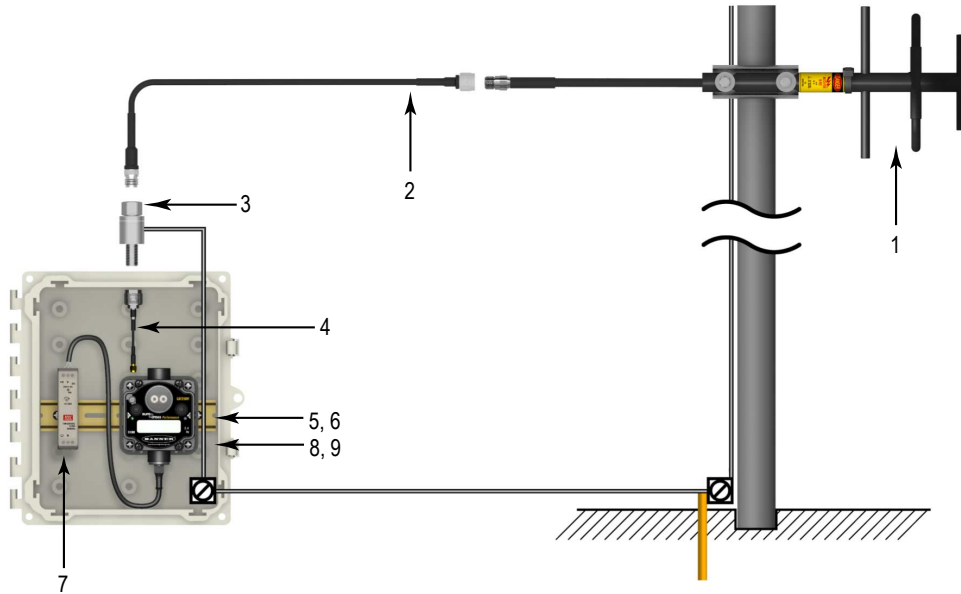
The -D dome antennas come with an 18-inch RP-SMA extension cable connected to the antenna. Use this extension cable to connect the antenna directly to the radio.

Models	Description	List Price
BWA-902-D	Antenna, Omni, 900 MHz, 2 dBd, Dome, RP-SMA MALE Box mount, 18-inch antenna cable	\$95
BWA-202-D	Antenna, Omni, 2.4 GHz, 2 dBd, Dome, RP-SMA MALE Box mount, 18-inch antenna cable	\$95


## Use an N-Type, Pole-Mounted Antenna


This antenna mounts remotely from the box, with the SureCross device mounted inside the box.

This configuration may be used either inside or outside the building, though a Yagi antenna is usually used in outdoors applications while an omni-directional antenna may be used either inside or outside a building. Ground the surge suppressor and antenna. 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.






1. N-type Yagi antenna
2. N-Type to N-Type antenna cable
3. Surge suppressor
4. RP-SMA to N-Type male antenna cable
- 5 and 6. DIN rail and DIN rail bracket
7. Power supply
- 8 and 9. Enclosure and enclosure cover/plate, etc

Directional (Yagi) Antennas with an N-Type Female Connection				
Models	Frequency	Description	List Price	
BWA-9Y6-A	900 MHz	6.5 dBd, 6.8 × 13 inches Outdoor	\$135	
BWA-9Y10-A		10 dBd, 6.8 × 24 inches Outdoor	\$150	


Omni-Directional Fiberglass Antennas with N-Type Female Connections				
Models	Frequency	Description	List Price	
BWA-906-A	900 MHz	6 dBd, Fiberglass, 71.5 inches	\$355	
BWA-208-A	2.4 GHz	8.5 dBi, Fiberglass, 24 inches	\$200	
BWA-206-A		6 dBi, Fiberglass, 16 inches (shown)	\$125	
BWA-906-AS	900 MHz	6 dBi, Fiberglass, 23.6 inches (1.3 inch dia.)	\$120	
BWA-908-AS		8 dBi, Fiberglass, 63 inches (1.5 inch dia.)	\$215	

Use the LMR400 cables to connect the surge suppressor to the antenna.

Models	Description	List Price	
BWC-4MNFN3	LMR400 N-Type Male to N-Type Female, 3 m	\$77	
BWC-4MNFN6	LMR400 N-Type Male to N-Type Female, 6 m	\$92	
BWC-4MNFN15	LMR400 N-Type Male to N-Type Female, 15 m	\$156	
BWC-4MNFN30	LMR400 N-Type Male to N-Type Female, 30 m	\$296	

Model	Description	Connection	List Price	
BWC-LMRSFRPB	Surge Suppressor, Bulkhead, RP-SMA Type	RP-SMA to RP-SMA	\$111	
BWC-LFNBMN-DC	Surge Suppressor, bulkhead, N-Type, dc Blocking	N-Type Female, N-Type Male	\$120	

Use the RP-SMA to N-Type male cables to connect the radio to the surge suppressor.

Model	Description	List Price	
BWC-1MRSMN05	LMR100 RP-SMA to N-Type Male, 0.5 m	\$40	



## 3 Maintenance

Follow these instructions to perform basic maintenance tasks.

### 3.1 Replacing the Main Body Gasket

---

Check the main body gasket every time a SureCross device is opened.



Replace the gasket when it is damaged, discolored, or showing signs of wear. The gasket must be:

- Fully seated within its channel along the full length of the perimeter, and
- Positioned straight within the channel with no twisting, stress, or stretching.

### 3.2 Replacing the Rotary Dial Access Cover

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Check the rotary dial access cover o-ring every time the access cover is removed.



Replace the o-ring when it is damaged, discolored, or showing signs of wear. The o-ring should be:

- Seated firmly against the threads without stretching to fit or without bulging loosely, and
- Pushed against the flanged cover.

When removing or closing the rotary dial access cover, manually twist the cover into position. Do not allow cross-threading between the cover and the device's face. After the cover is in place and manually tightened, use a small screwdriver (no longer than five inches total length) as a lever to apply enough torque to bring the rotary dial access cover even with the cover surface.

## 4 Troubleshooting Problems on Your DX70 Network

No LEDs. Recheck the power connections and power requirements. DX70 devices require 10 to 30V dc.

Signal LED is solid red or flashing red for more than 30 seconds. If the devices are less than two meters apart, they may not communicate properly (radios may saturate). The devices may be too far apart to achieve sync – consult factory for options.

Collocated Networks. To prevent interference between collocated networks, assign each wireless network a different Network ID.

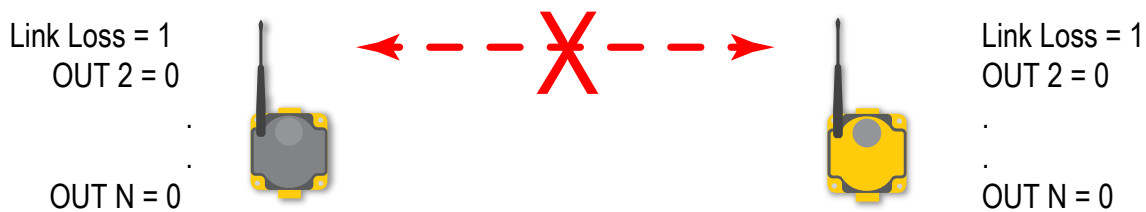
### 4.1 Radio Link Timeout and Recovery

The DX70 wireless devices employ a deterministic link timeout method to address radio link interruption or failure. As soon as a specific RF link fails, all pertinent wired outputs are brought to a predefined state until the link is recovered (default DIP switch setting).

Through this process, users of Banner wireless networks can be assured that disruptions in the communications link result in predictable system behavior.

The link time-out feature uses a fully-acknowledged polling method to determine the RF link status of each device on the network. If after a specified number of sequential polling cycles a device does not acknowledge a message, the devices consider the link to be timed out. After a link has timed out, the units must send and receive a specified number of communications packets before the link is reinstated. Outputs are restored to current values when the link is recovered.

The lost link option is available only on the DX70K\*M6EM1 kits.



The radio link between the devices has timed out. In this example, the lost link is energized and the outputs have been programmed by the DIP switches to go to their de-energized states (default DIP switch position).



The radio link between the devices has recovered and the outputs return to their current states.

A wireless network can be hindered by radio interference and by obstructions in the path of the receiver and transmitter. To achieve the best radio performance possible, carefully consider the installation locations for all devices. The need for a clear path increases as the transmission distance increases.

### 4.2 Collocated Networks

To prevent interference between collocated wireless networks, assign each wireless network a different Network ID. The Network ID is a unique identifier assigned to each wireless network using the rotary dials on the Gateway.

### 4.2.1 Setting the Network ID on the DX70s

The Network ID is a unique identifier assigned to each wireless network that minimizes the chances of two collocated networks interfering with each other. Assigning different NIDs to different networks improves collocation performance in dense installations.

To assign the Network ID for the DX70 network, use the Gateway's rotary dials. Valid Network IDs are 01 through 32, in decimal, establish using both rotary dials on the Gateway.

1. Set the Gateway's left dial to either 0, 1, 2, or 3.
2. Set the Gateway's right dial to any number 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.)

## 5 Advanced Setup Instructions and Additional Information

Refer to the following sections for advanced setup instructions or additional information on Banner's SureCross wireless technology and its uses.

### 5.1 Binding the DX70 Gateway and Node

---

DX70 Gateway and Node kits ship from the factory bound to each other.

You should only need to bind devices if you are replacing one of the devices in your existing pair. If the power is applied and the Power LED is solid green and the Signal LED is solid red for more than thirty seconds (indicating an RF link error), the devices need to be bound.

1. Install the supplied antennas to both the Gateway and Node.
2. Apply power to both devices and position the Gateway and Node at least two meters apart. The Power LED is solid green and the Signal LED is solid red, indicating an RF link error. <sup>2</sup>
3. Remove the rotary dial access covers.
4. On the Gateway, set both the left and right rotary dials to 0, then set both the left and right rotary dials to F. Note that both rotary dials for each device must be changed to F after applying power, not before applying power. The Gateway enters binding mode. Both the POWER and SIGNAL LEDs flash red.
5. On the Node, set both the left and right rotary dials to 0, then set both rotary dials to F. Binding should take less than twenty seconds. The Node enters binding mode and waits for the Gateway to respond. Both the Gateway's and Node's LEDs alternately flash red during pairing. After the devices are successfully bound, the Node's LEDs are solid red for a few seconds and the Node automatically exits binding mode. The Node Power LED is solid green and Signal LED is solid red, indicating the Node is bound.
6. Change the Gateway's rotary dials to a valid Network ID. Valid Network IDs are 01 through 32, in decimal, established using both 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.) <sup>3</sup>
7. The Node automatically synchronizes to the Gateway and establishes a radio link in less than a minute. When a radio link is established, the Power LED is green and the Signal LED flashes amber on both devices to indicate the signal strength.
8. On the Node, set both the left and right rotary dials back to 0, or any position other than F.
9. Replace both the rotary dial access covers.

Regardless of the position of the Node's rotary dials, the DX70 devices within this bound pair maintain a radio link. For successful binding, the Gateway and Node should be at least two meters apart and have the antennas installed.

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<sup>2</sup> Unbound devices will have a solid green Power LED and solid red Signal LED thirty seconds after power up. Bound devices have a solid green Power LED and a flashing yellow Signal LED within thirty seconds of power up.

<sup>3</sup> When multiple networks operate in the same area, assign a unique Network ID (NID) to the Gateway device within each bound pair. For more information about collocated networks and Network IDs, refer to [Troubleshooting Problems on Your DX70 Network](#) on page 18.



## 5.2 Specifications

Radio	General
<b>Radio Range</b> 900 MHz: Up to 4.8 km (3 miles) 2.4 GHz: Up to 3.2 km (2 miles) <b>Radio Transmit Power</b> 900 MHz: 21 dBm (150 mW) conducted 2.4 GHz: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP <b>900 MHz Compliance (150 mW)</b> FCC ID TGUDX80 - This device complies with FCC Part 15, Subpart C, 15.247 IC: 7044A-DX8009 <b>2.4 GHz Compliance</b> FCC ID UE300DX80-2400 - This device complies with FCC Part 15, Subpart C, 15.247 ETSI/EN: In accordance with EN 300 328: V1.7.1 (2006-05) IC: 7044A-DX8024 <b>Spread Spectrum Technology</b> FHSS (Frequency Hopping Spread Spectrum) <b>Link Timeout</b> 1 or 4 seconds	<b>Power</b> 10 to 30 V dc (Outside the USA: 12 to 24 V dc, $\pm 10\%$ ). (See UL section below for any applicable UL specifications) Consumption: Less than 1.4 W (60 mA) at 24 V dc <b>Housing</b> 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) <b>Antenna Connection</b> Ext. Reverse Polarity SMA, 50 Ohms Max Tightening Torque: 0.45 N·m (4 lbf·in) <b>Interface</b> Indicators: Red/Green Power LED, Red/Amber Signal LED <b>Wiring Access</b> Two 1/2-inch NPT <b>For European applications, power the DX80 from a Limited Power Source as defined in EN 60950-1.</b>

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.

Inputs	Outputs
<b>Discrete Inputs</b> Rating: 3 mA max current at 30 V dc Sample Rate: 62.5 milliseconds Report Rate: On change of state <b>Discrete Input ON Condition</b> PNP: Greater than 8 V NPN: Less than 0.7 V <b>Discrete Input OFF Condition</b> PNP: Less than 5 V NPN: Greater than 2 V or open <b>Analog Inputs</b> Rating: 24 mA Impedance: Approx. 100 Ohms Sample Rate: 62.5 milliseconds Report Rate: 1 second or On Change of State (1% change in value) Accuracy: 0.1% of full scale $\pm 0.01\%$ per °C Resolution: 12-bit	<b>Discrete Outputs</b> Update Rate: 125 milliseconds ON Condition: Supply minus 2 V OFF Condition: Less than 2 V <b>Discrete Output Rating (PNP)</b> 100 mA max current at 30 V dc ON-State Saturation: Less than 3 V at 100 mA OFF-state Leakage: Less than 10 $\mu$ A <b>Max. End-to-End Latency</b> 300 milliseconds <sup>4</sup> <b>Analog Outputs</b> Update Rate: 125 milliseconds Accuracy: 0.1% of full scale $\pm 0.01\%$ per °C Resolution: 12-bit <b>To verify the analog input's impedance, use an Ohm meter to measure the resistance between the analog input terminal (A1x) and the ground (GND) terminal.</b>

Environmental
<b>Environmental Conditions</b> Rating: IEC IP67; NEMA 6 Operating Temperature: $-40$ to $85$ °C Operating Humidity: 95% max. relative (non-condensing) Radiated Immunity: 10 V/m, 80-2700 MHz (EN61000-6-2) <b>Shock and Vibration</b> 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 <b>Operating the devices at the maximum operation conditions for extended periods can shorten the life of the device.</b>

Certifications
  IND. CONT. EQ. 447Y

<sup>4</sup> From the sample point and with a good RF signal.

## 5.2.1 DX70 Dimensions

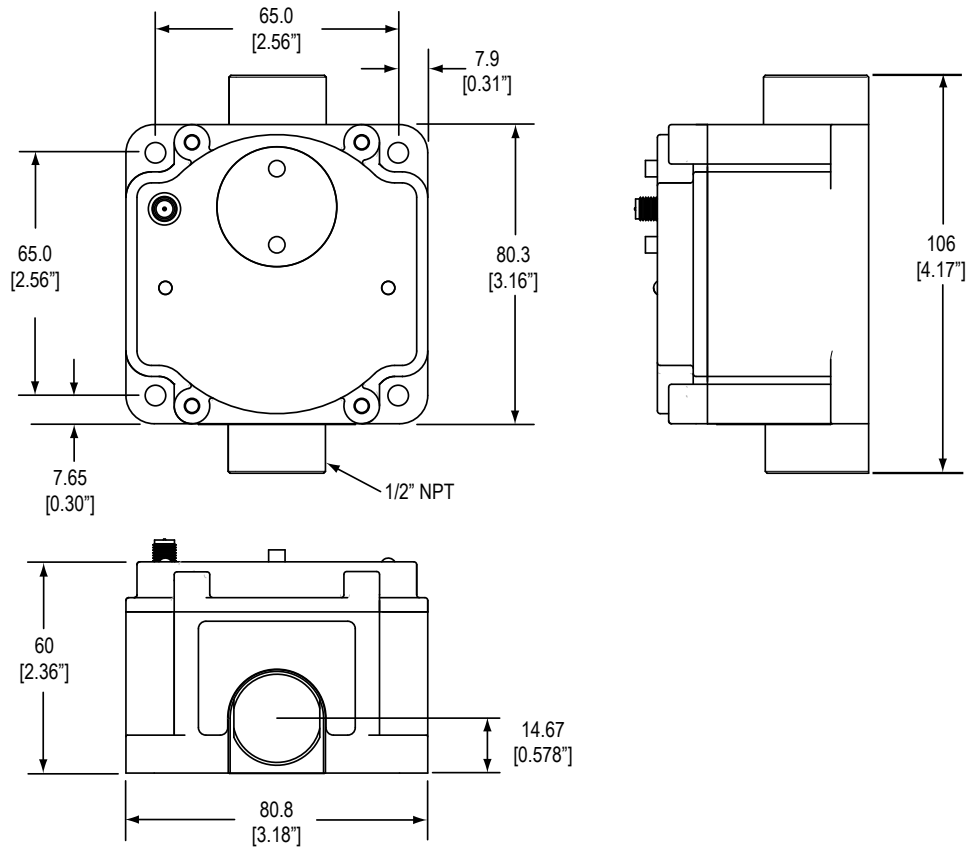
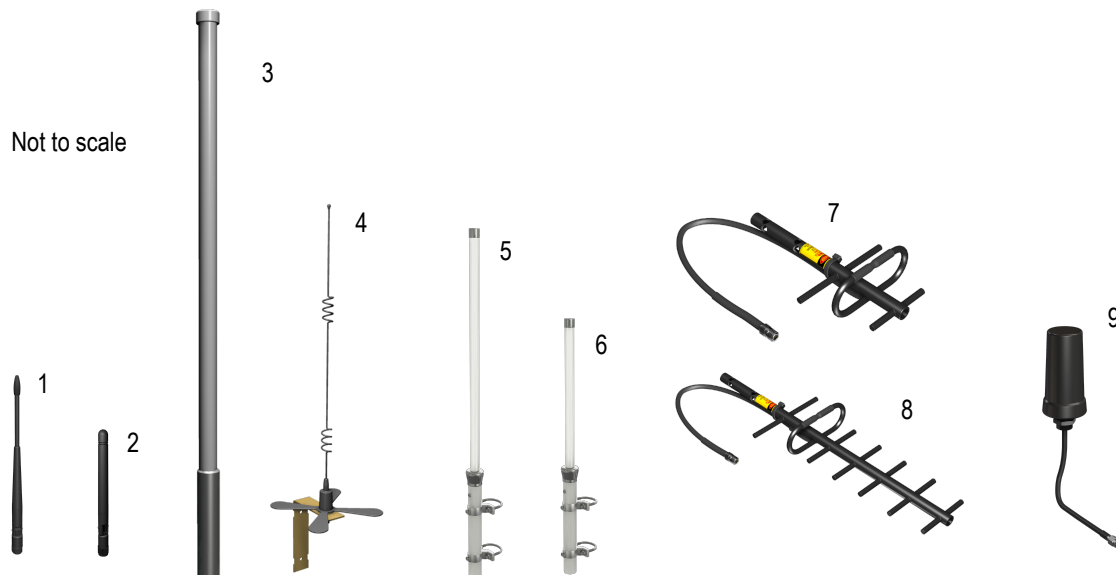


Figure 1. DX70 Gateway and Node Dimensions

## 5.3 Accessories

The accessories list includes FCC approved antennas, antenna cabling, surge suppressors, power supplies, replacement batteries, enclosures, cables, and other hardware.


### 5.3.1 Antennas





Omni-Directional Antennas					
	Part No.	Model No.	Frequency	Description	Connection
1	76908	BWA-902-C	900 MHz	2 dBi, Rubber swivel (ships with 900 MHz radios)	RP-RMA Male
	17721	BWA-905-C		5 dBi, Rubber swivel	
2	77816	BWA-202-C	2.4 GHz	2 dBi, Rubber swivel, 3 1/4 inches (ships with 2.4 GHz radios)	
	77817	BWA-205-C		5 dBi, Rubber swivel, 6 1/2 inches	
	77818	BWA-207-C		7 dBi, Rubber swivel, 9 1/4 inches	
3	77481	BWA-906-A	900 MHz	6 dBd, Fiberglass, 71.5 inches	N-Type Female
4	77819	BWA-905-B		5 dBd/7.2 dBi, with Ground Plane, 32 inches	
5	81080	BWA-208-A	2.4 GHz	8.5 dBi, Fiberglass, 24 inches	
6	81081	BWA-206-A		6 dBi, Fiberglass, 16 inches	
10	87062	BWA-906-AS	900 MHz	6 dBi, Fiberglass, 23.6 inches (1.3 inch dia.)	
	87061	BWA-908-AS		8 dBi, Fiberglass, 63 inches (1.5 inch dia.)	

Directional (Yagi) Antennas					
	Part No.	Model No.	Frequency	Description	Connection
7	77479	BWA-9Y6-A	900 MHz	6.5 dBd, 6.8 × 13 inches Outdoor	N-Type Female
8	77480	BWA-9Y10-A		10 dBd, 6.8 × 24 inches Outdoor	

Omni-Directional Dome antennas					
	Part No.	Model No.	Frequency	Description	Connection
9	25646	BWA-902-001	900 MHz	2 dBi, 18-inch cable	1/2" SS NPT
	25647	BWA-902-002		2 dBi, 18-inch cable	3/4" SS NPT
	25642	BWA-202-001	2.4 GHz	2 dBi, 18-inch cable	1/2" SS NPT
	25644	BWA-202-002		2 dBi, 18-inch cable	3/4" SS NPT
	78916	BWA-902-D	900 MHz	2 dBi, 18-inch cable	RP-SMA Box Mount
	28901	BWA-202-D	2.4 GHz	2 dBi, 18-inch cable	



Model No.	Frequency	Description	Connection	
BWA-205-M	2.4 GHz	5 dBi, Magnetic whip antenna	RP-SMA Male, 12 ft cable	

### 5.3.2 DC Power Supplies

Models	Description	List Price	
PS24W	DC Power Supply, 500 mA, 24 V dc, Demo kit power supply	\$49	
PSDINM-24-04	DC Power Supply, 0.4 Amps, 24 V dc, with DIN Rail Mount	\$35	
PSDINM-24-10	DC Power Supply, 1.0 Amps, 24 V dc, with DIN Rail Mount	\$40	
PSDINM-24-17	DC Power Supply, 1.7 Amps, 24 V dc, with DIN Rail Mount	\$54	
PSDINM-24-25	DC Power Supply, 2.5 Amps, 24 V dc, with DIN Rail Mount	\$60	


### 5.3.3 Surge Suppressors

Always install and properly ground a qualified surge suppressor when installing a remote antenna system (antenna not directly connected to the SureCross radio). Remote antenna configurations installed without a surge suppressor invalidate the manufacturer's warranty.

Model	Description	Connection	List Price	
BWC-LMRSFRPB	Surge Suppressor, Bulkhead, RP-SMA Type	RP-SMA to RP-SMA	\$111	
BWC-LFNBMN-DC	Surge Suppressor, bulkhead, N-Type, dc Blocking	N-Type Female, N-Type Male	\$120	


### 5.3.4 Antenna Cables

Use these RG58 cables to connect a radio to a bulkhead surge suppressor or a bulkhead surge suppressor to an RP-SMA antenna. These cables are typically used inside an enclosure or without an enclosure.


	Part No.	Model No.	Description
	78544	BWC-1MRSFRSB0.2	RG58, RP-SMA to RP-SMAF Bulkhead, 0.2M
	78337	BWC-1MRSFRSB1	RG58, RP-SMA to RP-SMAF Bulkhead, 1M
	78338	BWC-1MRSFRSB2	RG58, RP-SMA to RP-SMAF Bulkhead, 2M
	77488	BWC-1MRSFRSB4	RG58, RP-SMA to RP-SMAF Bulkhead, 4M

Use these LMR100 cables to connect a radio to an N-type antenna, N-type antenna extension cable, or N-type surge suppressor. These cables may be used inside or outside the enclosure or without an enclosure.



	Part No.	Model No.	Description
	77486	BWC-1MRSMN05	LMR100 RP-SMA to N-Type Male, 0.5M
	77820	BWC-1MRSMN2	LMR100 RP-SMA to N-Type Male, 2M

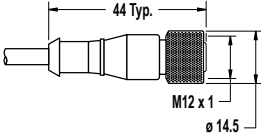
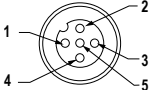
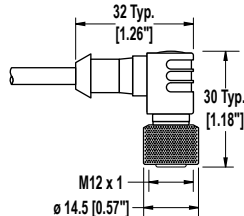
These LMR400 cables are antenna extension cables, connecting an N-type antenna to another N-type antenna cable. These cables are usually used outside the enclosure.

	Part No.	Model No.	Description
	77489	BWC-4MNFN3	LMR400 N-Type Male to N-Type Female, 3M
	77490	BWC-4MNFN6	LMR400 N-Type Male to N-Type Female, 6M
	77821	BWC-4MNFN15	LMR400 N-Type Male to N-Type Female, 15M
	77822	BWC-4MNFN30	LMR400 N-Type Male to N-Type Female, 30M

### 5.3.5 Euro-Style Cordsets - Single Ended

Right-angle cordsets are not compatible with the DX70 devices. When facing the Node or Gateway toward you and the quick disconnect connection is facing down, the right-angle cables exit to the right.

When using the FlexPower Node with integrated battery, use a double ended cordset. For a FlexPower Node with external power supply, use a single ended cordset. If using the communication lines, the cable length cannot exceed 3 meters, or 10 feet.

5-Pin Threaded M12/Euro-Style Cordsets (Single Ended)				
Model	Length	Style	Dimensions	Pinout (Female)
MQDC1-501.5	0.50 m (1.5 ft)	Straight		  1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
MQDC1-506	1.83 m (6 ft)			
MQDC1-515	4.57 m (15 ft)			
MQDC1-530	9.14 m (30 ft)			
MQDC1-506RA	1.83 m (6 ft)	Right-Angle		
MQDC1-515RA	4.57 m (15 ft)			
MQDC1-530RA	9.14 m (30 ft)			

Models	Length	Style	Description
BWA-QD5.5	-	-	Prewired 5-pin Euro connector, 1/2-14 NBSM
BWA-QD8.5	-	-	Prewired, 8-pin Euro connector, 1/2-14 NBSM
BWA-QD12.5	-	-	Prewired 12-pin Euro connector, 1/2-14 NBSM
FIC-M12F4	-	Straight	Euro-Style Field-Wireable Connector 4-pin Female Straight
DEUR-506.6C	1.83 m	Straight	Cordset, 5-pin Euro-style, double ended, male/female
MQDMC-401	0.5 m	Straight	Cordset, 4-pin Euro-style, single ended, male, longer pigtails for DX80...C models

### 5.3.6 Other Cables

Models	Description	List Price
BWA-RIBBON-001	Ribbon cable, 20-pin DBL socket	\$9
BWA-HW-010	Cable, FlexPower Current Monitoring	\$59

### 5.3.7 Enclosures

#### 5.3.7 Polycarbonate Enclosures with Opaque or Clear Covers

With Opaque Covers		
Models	Description	List Price
BWA-AH664	Enclosure, Polycarbonate, with Opaque Cover, 6 × 6 × 4	\$93
BWA-AH864	Enclosure, Polycarbonate, with Opaque Cover, 8 × 6 × 4	\$98
BWA-AH1084	Enclosure, Polycarbonate, with Opaque Cover, 10 × 8 × 4	\$120
BWA-AH12106	Enclosure, Polycarbonate, with Opaque Cover, 12 × 10 × 6	\$166
BWA-AH14126	Enclosure, Polycarbonate, with Opaque Cover, 14 × 12 × 6	\$195
BWA-AH16148	Enclosure, Polycarbonate, with Opaque Cover, 16 × 14 × 8	\$220
BWA-AH181610	Enclosure, Polycarbonate, with Opaque Cover, 18 × 16 × 10	\$260

With Clear Covers		
Models	Description	List Price
BWA-AH664C	Enclosure, Polycarbonate, with Clear Cover, 6 × 6 × 4	\$100
BWA-AH864C	Enclosure, Polycarbonate, with Clear Cover, 8 × 6 × 4	\$111
BWA-AH1084C	Enclosure, Polycarbonate, with Clear Cover, 10 × 8 × 4	\$141
BWA-AH12106C	Enclosure, Polycarbonate, with Clear Cover, 12 × 10 × 6	\$185
BWA-AH14126C	Enclosure, Polycarbonate, with Clear Cover, 14 × 12 × 6	\$204
BWA-AH16148C	Enclosure, Polycarbonate, with Clear Cover, 16 × 14 × 8	\$250
BWA-AH181610C	Enclosure, Polycarbonate, with Clear Cover, 18 × 16 × 10	\$290


Swing Panel Kits		
Models	Description	List Price
BWA-AH66SPK	Swing Panel Kit, 6 × 6, Includes Mounts, Screws, and Panel	\$54
BWA-AH86SPK	Swing Panel Kit, 8 × 6, Includes Mounts, Screws, and Panel	\$55
BWA-AH108SPK	Swing Panel Kit, 8 × 10, Includes Mounts, Screws, and Panel	\$60
BWA-AH1210SPK	Swing Panel Kit, 12 × 10, Includes Mounts, Screws, and Panel	\$65
BWA-AH1412SPK	Swing Panel Kit, 14 × 12, Includes Mounts, Screws, and Panel	\$70
BWA-AH1614SPK	Swing Panel Kit, 16 × 14, Includes Mounts, Screws, and Panel	\$75

Swing Panel Kits		
Models	Description	List Price
BWA-AH1816SPK	Swing Panel Kit, 18 × 16, Includes Mounts, Screws, and Panel	\$80

DIN Rail Kits		
Models	Description	List Price
BWA-AH6DRK	DIN Rail Kit, 6", Includes 2 Nuts, 2 Screws, and DIN Rail	\$30
BWA-AH8DRK	DIN Rail Kit, 8", Includes 2 Nuts, 2 Screws, and DIN Rail	\$31.50
BWA-AH10DRK	DIN Rail Kit, 10", Includes 2 Nuts, 2 Screws, and DIN Rail	\$33
BWA-AH12DRK	DIN Rail Kit, 12", Includes 2 Nuts, 2 Screws, and DIN Rail	\$35
BWA-AH14DRK	DIN Rail Kit, 14", Includes 2 Nuts, 2 Screws, and DIN Rail	\$36
BWA-AH16DRK	DIN Rail Kit, 16", Includes 2 Nuts, 2 Screws, and DIN Rail	\$38
BWA-AH18DRK	DIN Rail Kit, 18", Includes 2 Nuts, 2 Screws, and DIN Rail	\$39

Accessories		
Models	Description	List Price
BWA-AHSNK	Slot Nut Kit, Includes 2 Nuts and 2 Screws	\$25
BWA-AHSPM	Swing Panel Mounts (4 per Kit)	\$35
BWA-AHLK	Latch Kit, 2 Latches per Kit, Replacement Only	\$12
BWA-AHAK	Accessory Kit, Includes all screws, inserts, and mounting feet, Replacement Only	\$15

### 5.3.7 Fiberglass Enclosures

Models	Description	List Price	
BWA-EF14128	Enclosure Fiberglass Hinged 14" × 12" × 8"	\$135	
BWA-EF1086	Enclosure Fiberglass Hinged 10" × 8" × 6"	\$95	
BWA-EF866	Enclosure Fiberglass Hinged 8" × 6" × 6"	\$85	
BWA-PA1412	Panel, 14 × 12	\$26	
BWA-PA108	Panel, 10 × 8	\$22	
BWA-PA86	Panel, 8 × 6	\$10	
BWA-PM12	Pole Mount, 12 inch	\$73	
BWA-PM8	Pole Mount, 8 inch	\$55	
BWA-PM6	Pole Mount, 6 inch	\$52	

### 5.3.8 Replacement Parts for DX70 Models

Part No.	Model No.	Description
76907	BWA-HW-001	Mounting Hardware Kit  Screw, M5-0.8 x 25 mm, SS (4) Screw, M5-0.8 x 16mm, SS (4) Hex nut, M5-0.8mm, SS (4) Bolt, #8-32 x 3/4", SS (4)
76910	BWA-HW-003	PTFE Tape
16328	BWA-HW-004	Replacement Seals  O-ring, rotary access cover, PG21 (2) O-ring, body gasket (2) Access cover, rotary, clear plastic (2)
79438	BWA-CG.5-10	Cable Glands, 1/2-inch NPT, 10 pieces, cordgrips for cable diameters 0.17" to 0.45"
79984	BWA-HP.5-10	Dummy Hole Plugs, 1/2-inch NPT, 10 pieces
77161	SMBDX80DIN	Bracket assembly, DIN rail, flat mount

## 6 Radio Certifications

Banner's SureCross product line is certified by the FCC, European Union, and many other countries for operation within specific radio frequencies.

### 6.1 FCC Certification, 900MHz

The DX80 Module complies with Part 15 of the FCC rules and regulations.

FCC ID: TGUDX80 This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

#### 6.1 FCC Notices

**IMPORTANT:** The DX80 Modules have been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

**IMPORTANT:** The DX80 Modules have been certified for fixed base station and mobile applications. If modules will be used for portable applications, the device must undergo SAR testing.

**IMPORTANT:** If integrated into another product, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door, or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: Contains FCC ID: TGUDX80.

#### 6.1 Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna,
- Increase the separation between the equipment and receiving module,
- Connect the equipment into an outlet on a circuit different from that to which the receiving module is connected, and/or
- Consult the dealer or an experienced radio/TV technician for help.

Antenna Warning **WARNING:** This device has been tested with Reverse Polarity SMA connectors with the antennas listed in Table 1 Appendix A. When integrated into OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas not listed in the tables must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

#### 6.1 FCC Approved Antennas

**WARNING:** This equipment is approved only for mobile and base station transmitting devices. Antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

DX80 Module may be used only with Approved Antennas that have been tested with this module.

Model Number	Antenna Type	Maximum Gain
	Integral antenna	Unity gain
BWA-901-x	Omni, 1/4 wave dipole	≤2 dBi

Model Number	Antenna Type	Maximum Gain
BWA-902-C	Omni, 1/2 wave dipole, Swivel	≤2 dBi
BWA-906-A	Omni Wideband, Fiberglass Radome	≤8.2 dBi
BWA-905-B	Omni Base Whip	≤7.2 dBi
BWA-9Y10-A	Yagi	≤10 dBi

Table 1. Type certified antennas

## 6.2 FCC Certification, 2.4GHz

The DX80 Module complies with Part 15 of the FCC rules and regulations.

FCC ID: UE300DX80-2400 This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### 6.2 FCC Notices

**IMPORTANT:** The DX80 Modules have been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

**IMPORTANT:** The DX80 Modules have been certified for fixed base station and mobile applications. If modules will be used for portable applications, the device must undergo SAR testing.

**IMPORTANT:** If integrated into another product, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door, or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: Contains FCC ID: UE300DX80-2400.

### 6.2 Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna,
- Increase the separation between the equipment and receiving module,
- Connect the equipment into an outlet on a circuit different from that to which the receiving module is connected, and/or
- Consult the dealer or an experienced radio/TV technician for help.

**Antenna Warning WARNING:** This device has been tested with Reverse Polarity SMA connectors with the antennas listed in Table 1 Appendix A. When integrated into OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas not listed in the tables must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

### 6.2 FCC Approved Antennas

**WARNING:** This equipment is approved only for mobile and base station transmitting devices. Antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

DX80 Module may be used only with Approved Antennas that have been tested with this module.

Model Number	Antenna Type	Maximum Gain
	Integral antenna	Unity gain
BWA-202-C	Omni, 1/2 wave dipole, Swivel	≤2 dBi
BWA-205-C	Omni, Collinear, Swivel	≤5 dBi
BWA-207-C	Omni, Coaxial Sleeve, Swivel	≤7 dBi

## 6.3 Certified For Use in the Following Countries

The SureCross radio devices are approved for use in the following countries.

Country	Radio Modules		
	900 MHz (150 mW)	900 MHz (1 Watt)	2.4 GHz (65 mW)
Australia			x
Austria			x
Bahamas, The	x		x
Bahrain (Kingdom of)			x
Belgium			x
Brazil			x
Bulgaria			x
Canada	x	x	x
Chile			x
China, People's Republic of			x
Colombia	x		x
Cyprus			x
Czech Republic			x
Denmark			x
Ecuador			x
El Salvador			x
Estonia			x
Egypt			x
Finland			x
France			x
Germany			x
Greece			x
Guatemala	x		x
Hungary			x
Iceland			x
India			x
Ireland			x
Israel			x*

Country	Radio Modules		
	900 MHz (150 mW)	900 MHz (1 Watt)	2.4 GHz (65 mW)
Italy			x
Korea, Republic of (South)			x
Latvia			x
Liechtenstein			x
Lithuania			x
Luxembourg			x
Malta			x
Mexico	x	x	x
Netherlands			x
New Zealand			x
Norway			x
Oman, Sultanate of			x
Pakistan			x
Panama	x		x
Poland			x
Portugal			x
Romania			x
Saudi Arabia (Kingdom of)			x
Singapore			x
Slovakia			x
Slovenia			x
South Africa			x
Spain			x
Sweden			x
Switzerland			x
Taiwan (Republic of China)			x **
Thailand			x
Turkey			x
United Arab Emirates			x
United Kingdom			x
United States of America	x	x	x

Bulgaria - Authorization required for outdoor and public service use.

Canada- This Class A digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouiller du Canada. Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la Classe A prescrites dans le Règlement sur le brouillage radioélectrique édictés par le ministère des Communications du Canada.

France - In Guyane (French Guiana) and La Réunion (Reunion Island), outdoor use not allowed.

\* Israel - DX80 and DX99 models are certified for the external antenna models only.



Italy - If used outside of own premises, general authorization is required.

Luxembourg - General authorization is required for public service.

\*\* Taiwan - Taiwan is certified to operate specific DX70, DX80, and DX99 models. For a list of specific models, refer to the certificate.

### 6.3 Additional Statements - 900 MHz

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.

### 6.3 Transmit Power Levels

The SureCross wireless products were certified for use in these countries using the standard antenna that ships with the product. When using other antennas, verify you are not exceeding the transmit power levels allowed by local governing agencies.

## 7 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 SureCross® device or any equipment connected to the SureCross device during a thunderstorm.

**Exporting SureCross 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 SureCross 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.

**Violating Warnings.** The manufacturer does not take responsibility for the violation of any warning listed in this document. Make no modifications to this product; any modifications to this product not expressly approved by Banner Engineering could void the user's authority to operate the product. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. For the most recent version of any documentation, refer to: [www.bannerengineering.com](http://www.bannerengineering.com). © 2006-2014 Banner Engineering Corp. All rights reserved.

### 7.1 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.

THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp.

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