

## Datasheet



(2.4 GHz model shown)

The Sure Cross® wireless system is a radio frequency network with integrated I/O that can operate in most environments and 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.

- Selectable transmit power levels of 250 mW or 1 Watt for 900 MHz models and 65 mW for 2.4 GHz models
- 10 to 30 V dc power input
- Modbus serial interface and Ethernet interface
- 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
- Site Survey analyzes the network's signal strength and reliability and displays the results on the Gateway's LCD
- 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).

| Models      | Frequency        | Feature   |
|-------------|------------------|---|
| DX80P9T6S-P | 900 MHz ISM Band | Modbus/TCP or EtherNet/IP communication protocol                          |
| DX80P9A6S-P |                  | Modbus/TCP protocol (Configuration capability using the Web Configurator) |
| DX80P2T6S-P | 2.4 GHz ISM Band | Modbus/TCP or EtherNet/IP communication protocol                          |
| DX80P2A6S-P |                  | Modbus/TCP protocol (Configuration capability using the Web Configurator) |



### 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.

## Setting Up Your Wireless Network

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

Disconnect the power from your Sure Cross devices.

1. Configure the DIP switches of all devices.
2. If your device has I/O, connect the sensors to the Sure Cross devices. If your device does not have I/O, skip this step.
3. Refer to the wiring diagrams to apply power to all devices.
  - For two LED models, the Gateway's LED 1 is solid green and the Node's LED 2 flashes red to indicate there is no radio link to the Gateway.
  - For one LED models, the Gateway's LED is solid green and the Node's LED flashes red to indicate there is no radio link to the Gateway.
4. Form the wireless network by binding the Nodes to the Gateway. If the binding instructions are not included in the datasheet, refer to the product manual for binding instructions.



5. Observe the LED behavior to verify the devices are communicating with each other.
  - For two LED models, the Gateway's LED 1 is solid green and the Node's LED 1 flashes green to indicate it is communicating with the Gateway.
  - For one LED models, the Gateway's LED is solid green and the Node's LED flashes green to indicate it is communicating with the Gateway.
6. Conduct a site survey between the Gateway and Nodes. If the site survey instructions are not included in this datasheet, refer to the product manual for detailed site survey instructions.
7. Install your wireless sensor network components. If installation instructions are not included in this datasheet, refer to the product manual for detailed installation instructions.

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

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

## Configure the DIP Switches

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

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

### 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 |
| Transmit Power Level: 1 Watt (30 dBm)                          | OFF (default) |   |
| Transmit Power Level: 250 mW (24 dBm), DX80 Compatibility Mode | ON            |   |

### Transmit Power Levels

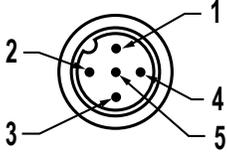
The 900 MHz radios can be operated at 1 watt (30 dBm) or 250 mW (24 dBm). While the Performance radios operate in 1 Watt mode, they cannot communicate with the older 150 mW radios. To communicate with the older 150 mW radios, operate this radio in 250 mW mode. For 2.4 GHz models, this DIP switch is disabled.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

## Wiring 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 dc 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          |

## Industrial Ethernet Wiring

Use the 4-pin industrial Ethernet connection to connect the radio network to an Ethernet-based host system.

|   | Wire No. | Wire Color   | Description |
|---|----------|--------------|-------------|
|  | 1        | White/Orange | +Tx         |
|   | 2        | White/Blue   | +Rx         |
|   | 3        | Orange       | -Tx         |
|   | 4        | Blue         | -Rx         |

## Modbus Holding Registers

There are sixteen Modbus holding registers for each device. Calculate the holding register number for each device using the equation:  $\text{Register number} = \text{I/O\#} + (\text{Node\#} \times 16)$ .

The Gateway is always device 0 and the Gateway's holding registers are registers 1 through 16. Registers for Node 1 are 17 through 32. Although only seven Nodes are listed, the registers continue for as many Nodes as are in the network. For example, the register number for Node 10, I/O point 15, is 175.

Table 1: Modbus Holding Registers

| I/O Point | Gateway | Node 1 | Node 2 | Node 3 | Node 4 | Node 5 | Node 6 | Node 7 |
|-----------|---------|--------|--------|--------|--------|--------|--------|--------|
| 1         | 1       | 17     | 33     | 49     | 65     | 81     | 97     | 113    |
| 2         | 2       | 18     | 34     | 50     | 66     | 82     | 98     | 114    |
| 3         | 3       | 19     | 35     | 51     | 67     | 83     | 99     | 115    |
| 4         | 4       | 20     | 36     | 52     | 68     | 84     | 100    | 116    |
| 5         | 5       | 21     | 37     | 53     | 69     | 85     | 101    | 117    |
| 6         | 6       | 22     | 38     | 54     | 70     | 86     | 102    | 118    |
| 7         | 7       | 23     | 39     | 55     | 71     | 87     | 103    | 119    |
| 8         | 8       | 24     | 40     | 56     | 72     | 88     | 104    | 120    |
| 9         | 9       | 25     | 41     | 57     | 73     | 89     | 105    | 121    |
| 10        | 10      | 26     | 42     | 58     | 74     | 90     | 106    | 122    |
| 11        | 11      | 27     | 43     | 59     | 75     | 91     | 107    | 123    |
| 12        | 12      | 28     | 44     | 60     | 76     | 92     | 108    | 124    |
| 13        | 13      | 29     | 45     | 61     | 77     | 93     | 109    | 125    |
| 14        | 14      | 30     | 46     | 62     | 78     | 94     | 110    | 126    |
| 15        | 15      | 31     | 47     | 63     | 79     | 95     | 111    | 127    |

| I/O Point | Gateway | Node 1 | Node 2 | Node 3 | Node 4 | Node 5 | Node 6 | Node 7 |
|-----------|---------|--------|--------|--------|--------|--------|--------|--------|
| 16        | 16      | 32     | 48     | 64     | 80     | 96     | 112    | 128    |

## EtherNet/IP™ Registers

### EtherNet/IP™ on ControlLogix PLC Register Map

A ControlLogix PLC may control the DX80 wireless system using EtherNet/IP through assembly objects and the Common Industrial Protocol (CIP). Add the SureCross Gateway to the ControlLogix PLC as a “Generic Ethernet Module.”

There is one input assembly object for all DX80 input points and one output assembly object for all DX80 output points. Each object is 228 elements long, with each element a 16-bit integer.

The SureCross Gateway is configured at the factory to send all inputs and outputs for the first 16 Nodes in the system. To change the factory settings, change the XML configuration file using the SureCross Web Configurator web pages.

Input Assembly Object, DX80 Input, Instance 100 (0x64). Words are not allocated for any specific unit but are used, in device order, for each of the device input registers selected using the EIP checkbox.

Output Assembly Object, DX80 Outputs, Instance 112 (0x70). Words are not allocated for any specific unit but are used, in device order, for each of the device output registers selected using the EIP checkbox.

For proper EtherNet/IP communication, the minimum requested packet interval should be 150 milliseconds or higher.

| Instance 100 |           | Instance 112 |            |
|--------------|-----------|--------------|------------|
| Word #       | Inputs    | Word #       | Outputs    |
| 0            | Input 1   | 0            | Output 1   |
| 1            | Input 2   | 1            | Output 2   |
| 2            | Input 3   | 2            | Output 3   |
| 3            | Input 4   | 3            | Output 4   |
| ...          | ...       | ...          | ...        |
| ...          | ...       | ...          | ...        |
| 226          | Input 227 | 226          | Output 227 |
| 227          | Input 228 | 227          | Output 228 |

### EtherNet/IP™ to PLC5 and SLC5 Register Map

Allen-Bradley's PLC5 and SLC5 family of devices use PCCC communications over EtherNet/IP. The DX80 wireless system supports these PLCs using input and output register arrays.

There is one input assembly object for all DX80 input points and one output assembly object for all DX80 output points. Each object is 228 elements long, with each element a 16-bit integer. The DX80 wireless data table addresses are N7 for read and N14 for write. The MSG instruction only handles up to 103 words; use multiple MSG instructions if all data is required.

| N7 - Read Registers |           | N14 - Write Registers |            |
|---------------------|-----------|-----------------------|------------|
| 0                   | Input 1   | 0                     | Output 1   |
| 1                   | Input 2   | 1                     | Output 2   |
| 2                   | Input 3   | 2                     | Output 3   |
| 3                   | Input 4   | 3                     | Output 4   |
| ...                 | ...       | ...                   | ...        |
| ...                 | ...       | ...                   | ...        |
| 226                 | Input 227 | 226                   | Output 227 |
| 227                 | Input 228 | 227                   | Output 228 |

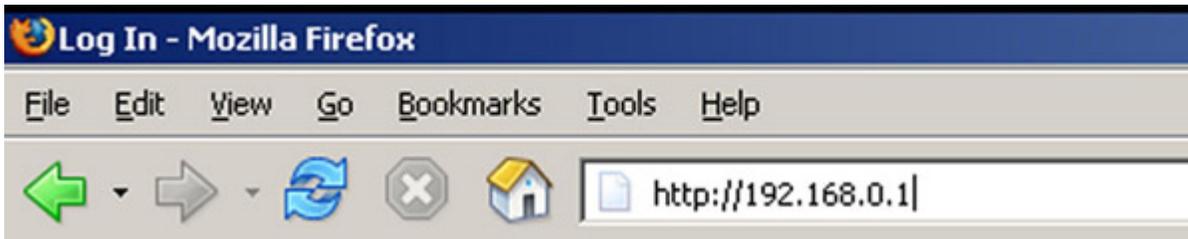
## Logging into the Web Configurator

The SureCross® Pro and DX83 Ethernet Bridge devices use an XML file to configure the network. To access the XML file, use any web browser set up for a direct connection to the Internet. If problems occur while connecting, verify the browser is not set to use a proxy server.

When connecting to the Ethernet Bridge, GatewayPro, or MultiHop Pro directly from a host computer, a crossover Ethernet cable is required; when connecting through a switch or Ethernet hub, use a standard Ethernet cable.

- The factory default IP address for the devices is: 192.168.0.1.

To change the device's default IP address, first set up the host PC with an IP address different from the Ethernet Bridge, GatewayPro, or MultiHop Pro IP addresses. (Please refer to Banner document [133116](#) for instructions on setting up the host computer's network IP address.) After changing the host's IP address, open a web browser and log into the Ethernet Bridge, GatewayPro, or MultiHop Pro by typing the IP address in the browser location window: `http://192.168.0.1`.



After entering the IP address, the home web page for the SureCross device displays. To log in, click on any tab at the top of the page. To log out, close the browser.

Admin-level access allows administrators to set up system users and their passwords. Admin-level access is also required to change the IP address of the system. For Admin-level access, enter the following as the user name and password:

- User name: root
- Password: sxi

For user-level access, enter the following as the user name and password.

- User name: system
- Password: admin



## 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](#).

## Specifications

### Radio Range

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

### Minimum Separation Distance

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

### Radio Transmit Power

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

### 900 MHz Compliance (1 Watt)

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

### 2.4 GHz Compliance

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

### Spread Spectrum Technology

- FHSS (Frequency Hopping Spread Spectrum)

### Link Timeout

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

### 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

### Communication Protocol

- Modbus RTU

### Modbus/TCP and EtherNet/IP

- 4-wire Industrial Ethernet
- 10/100 Mbps, full or half duplex, auto sensing

### Supply Voltage

- 10 to 30 V dc (Outside the USA: 12 to 24 V dc, ±10%).<sup>2</sup>
- Consumption: Less than 4.2 W (175 mA) at 24 V dc

### Housing

- Polycarbonate housing and rotary dial cover; polyester labels; EDPM rubber cover gasket; nitrile rubber, non-sulphur cured button covers
- Weight: 0.26 kg (0.57 lbs)
- Mounting: #10 or M5 (SS M5 hardware included)
- Max. Tightening Torque: 0.56 N·m (5 lbf·in)

### 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

- One 5-pin threaded M12/Euro-style male quick disconnect and One 4-pin female industrial Ethernet connection

### Environmental Rating

- IEC IP67; NEMA 6<sup>3</sup>

### Operating Conditions<sup>4</sup>

- 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

### Certifications



## Included with Device ('Pro Models)

The following items ship with the 'Pro radios.

- BWA-HW-001: Mounting Hardware Kit, containing four M5-0.8 x 25mm SS screws, four M5-0.8 x 16mm SS screws, four M5-0.8mm SS hex nuts, and four #8-32 x 3/4" SS bolts
- BWA-902-C (900 MHz) or BWA-202-C (2.4 GHz): Antenna, 2 dBd Omni, Rubber Swivel RP-SMA Male. (Not included with Internal antenna models)
- Quick Start Guide (128185 for DX80 Gateways or 152653 for MultiHop models)
- MQDC1-506: 5-Euro (single ended) straight cable, 2m (Not included with FlexPower devices)
- BWA-EX2M: Ethernet crossover cable, M12 industrial/RJ45, 2 meter

## Ethernet Cables

Use a crossover cable to connect the GatewayPro or DX83 Ethernet Bridge to a host system without using an Ethernet switchbox or hub. When using a switchbox or hub, use a straight cable.

| Models   | Description                                     |
|----------|---|
| BWA-E2M  | Ethernet cable, RSCD RJ45 440, 2 m              |
| BWA-E8M  | Ethernet cable, RSCD RJ45 440, 8 m              |
| BWA-EX2M | Ethernet cable, crossover, RSCD RJ45CR 440, 2 m |

<sup>1</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. To determine the range of your wireless network, perform a Site Survey.

<sup>2</sup> For European applications, power the DX80 from a Limited Power Source as defined in EN 60950-1.

<sup>3</sup> Refer to the [Sure Cross® Wireless I/O Networks Instruction Manual](#) (p/n 132607) for installation and waterproofing instructions.

<sup>4</sup> Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

## Warnings

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

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

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