

## Datasheet



The SureCross® 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.

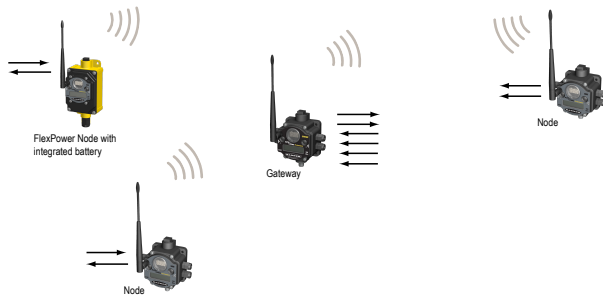


### CAUTION: Never Operate 1 Watt Radios Without Antennas

To avoid damaging the radio circuitry, never power up SureCross Performance or SureCross MultiHop (1 Watt) radios without an antenna.



## The SureCross® Performance Wireless Network



The SureCross® Performance wireless I/O network provides reliable monitoring without wiring or conduit installation. The SureCross wireless network operates independently or in conjunction with a host system, PLC, and/or PC software.

Each wireless network system consists of one Gateway and one or more Nodes. Devices ship with factory-defined discrete, analog, or a mix of discrete and analog inputs and outputs.

The SureCross® Performance network is a deterministic system—the network identifies when the radio signal is lost and drives relevant outputs to user-defined conditions. After the radio signal is reacquired, the network returns to normal operation.

### SureCross® Performance Gateways and Nodes

Every wireless network must have one Gateway, which schedules communication traffic and controls the I/O configuration for the network, and one or more Nodes.

A Gateway is the master device within each radio network. Similar to how a gateway device on a wired network acts as a “portal” between networks, the SureCross Gateway acts as the portal between the wireless network and the host controller. When the Gateway, using its Modbus RTU RS-485 connection, is a Modbus slave to a Modbus RTU host controller, the wireless network may contain up to 47 Nodes in a single wireless network. The Gateway holds the Modbus registers of all wireless devices within the network.

A Node is a wireless network end-point device used to provide sensing capability in a remote area or factory. The Node collects data from sensors and communicates the data back to the Gateway. Nodes are available in a wide variety of power or input/output options.

### SureCross® Performance GatewayPro

The SureCross® Performance GatewayPro combines the function of a SureCross® Performance Gateway with the ability to interface to Ethernet using Modbus/TCP or EtherNet/IP™ protocols.

There are two basic models of the GatewayPro:

- DX80P\*T6\*. The T6 model acts as a protocol converter only, offering the Modbus/TCP or EtherNet/IP communication protocols.
- DX80P\*A6\*. The A6 model includes DX80 wireless network configuration, Modbus RTU master, Modbus/TCP client/server, Script Basic, e-mail, data logging, and trending.

Connect a host controller system to the GatewayPro using its industrial Ethernet connection. To connect the GatewayPro to the host system without using an Ethernet switchbox/hub, some host systems may require a crossover cable.

By default, the GatewayPro is configured to use Modbus/TCP. To use EtherNet/IP, connect the GatewayPro to a managed switch and you must use the Web Configuration tool to select EtherNet/IP. For more information, see [SureCross Wireless I/O Product Manual](#) or [Host Configuration Manual](#).

## Setting Up Your Wireless Network

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

Disconnect the power from your SureCross devices.

1. Configure the DIP switches of all devices.
2. Connect the sensors to the SureCross devices.
3. Apply power to all devices.  
On the Gateway, LED 1 is solid green. On the Node, LED 2 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.  
On the Gateway, LED 1 is solid green. On the Node, LED 1 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.

- 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.

- SureCross Quick Start Guide: [128185](#)
- SureCross 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.

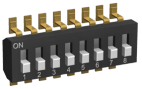
For parameters not set via DIP switches, use the User Configuration Tool (UCT) to make configuration changes. For parameters set using the DIP switches, the DIP switch positions override any changes made using the User Configuration Tool.

### Accessing the Internal DIP Switches

To access the internal DIP switches, follow these steps:

- Unscrew the four screws that mount the cover to the bottom housing.
- Remove the cover from the housing without damaging the ribbon cable or the pins the cable plugs into.
- Gently unplug the ribbon cable from the board mounted into the bottom housing.
- 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

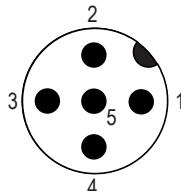
The 900 MHz radios can be operated at 1 watt (30 dBm) or 250 mW (24 dBm). While the radios operate in 1 Watt mode, they cannot communicate with 150 mW DX80 radio devices. To communicate with the 150 mW radio models, operate this radio in 250 mW mode. For 2.4 GHz radios, this DIP switch is disabled. The transmit power for 2.4 GHz is fixed at about 100 mW EIRP (18 dBm), making the 2.4 GHz Performance models automatically compatible with the DX80 2.4 GHz models.

## Wiring Your SureCross® Device

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


### 5-pin 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.

	Wire No.	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: Register number = I/O# + (Node# × 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
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

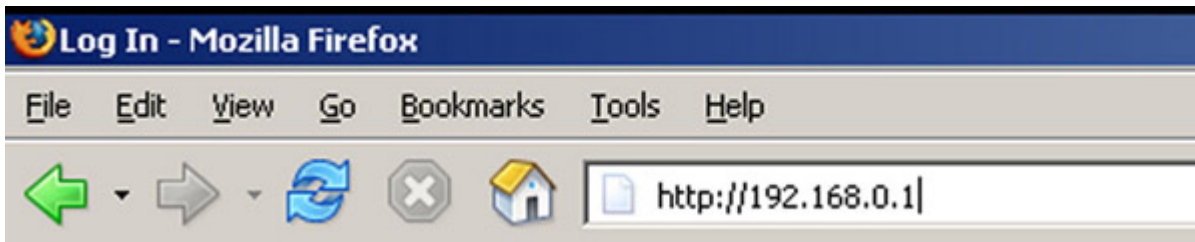
## Logging into the Web Configurator

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



## Mixing 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:

- Performance radios must operate in 250 mW mode, not 1 Watt mode (DIP switch 1 ON)
- Non-Performance radios must be set to use Extended Address Mode (DIP switch 1 ON)

For more detailed instructions about setting up your wireless network, refer to the Quick Start Guide, Banner document number 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 FAQ/ Knowledgebase section of Banner's Wireless Sensor Networks website.

## Specifications

Radio <sup>1</sup>	General
<p><b>Radio Range</b>            900 MHz (1 Watt): Up to 9.6 km (6 miles)            2.4 GHz (65 mW): Up to 3.2 km (2 miles)</p> <p><b>Radio Transmit Power</b>            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</p> <p><b>900 MHz Compliance (1 Watt)</b>            FCC ID UE3RM1809: This device complies with FCC Part 15, Subpart C, 15.247            IC: 7044A-RM1809</p> <p><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</p> <p><b>Spread Spectrum Technology</b>            FHSS (Frequency Hopping Spread Spectrum)</p> <p><b>Link Timeout</b>            Gateway: Configurable via User Configuration Tool (UCT) software            Node: Defined by Gateway</p>	<p><b>Power</b>            10 to 30 V dc (Outside the USA: 12 to 24 V dc, <math>\pm 10\%</math>). (See UL section below for any applicable UL specifications) <sup>2</sup>            Consumption: Less than 4.2 W (175 mA) at 24 V dc</p> <p><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)</p> <p><b>Antenna Connection</b>            Ext. Reverse Polarity SMA, 50 Ohms            Max Tightening Torque: 0.45 N·m (4 lbf·in)</p> <p><b>Interface</b>            Indicators: Two bi-color LEDs            Buttons: Two            Display: Six character LCD</p> <p><b>Wiring Access</b>            One 5-pin M12 Euro-style male connector and One 4-pin female industrial Ethernet connection</p>
Communication	Environmental
<p><b>Hardware (RS-485)</b>            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</p> <p><b>Protocol</b>            Modbus RTU</p> <p><b>Modbus/TCP and EtherNet/IP</b>            4-wire Industrial Ethernet            10/100 Mbps, full or half duplex, auto sensing</p>	<p><b>Rating</b>            IEC IP67; NEMA 6 <sup>3</sup></p> <p><b>Operating Conditions</b>            Operating Temperature: <math>-40\text{ }^{\circ}\text{C}</math> to <math>+85\text{ }^{\circ}\text{C}</math> (<math>-40\text{ }^{\circ}\text{F}</math> to <math>+185\text{ }^{\circ}\text{F}</math>) (Electronics); <math>-20\text{ }^{\circ}\text{C}</math> to <math>+80\text{ }^{\circ}\text{C}</math> (<math>-4\text{ }^{\circ}\text{F}</math> to <math>+176\text{ }^{\circ}\text{F}</math>) (LCD) <sup>4</sup>            Operating Humidity: 95% max. relative (non-condensing)            Radiated Immunity: 10 V/m, 80-2700 MHz (EN61000-6-2)</p> <p><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</p>

## 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.

<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 *SureCross 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.

Models	Description	List Price
BWA-E2M	Ethernet cable, RSCD RJ45 440, 2 m	\$41
BWA-E8M	Ethernet cable, RSCD RJ45 440, 8 m	\$71
BWA-EX2M	Ethernet cable, crossover, RSCD RJ45CR 440, 2 m	\$41

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