

# SureCross Performance Node

Configurable Node with up to 12 sourcing discrete inputs or outputs



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.

- Wireless industrial I/O device with up to 12 sourcing discrete inputs or outputs. Default configuration is set to 6 inputs and 6 outputs (without bit-packing).
- Selectable transmit power levels of 250 mW or 1 Watt and license-free operation up to 4 watt EIRP, with a high-gain antenna, in the U.S. and Canada for 900 MHz
- 10 to 30V dc power input
- DIP switches for user configuration
- Frequency Hopping Spread Spectrum (FHSS) technology and Time Division Multiple Access (TDMA) control architecture ensure reliable data delivery within the unlicensed Industrial, Scientific, and Medical (ISM) band
- Transceivers provide bidirectional communication between the Gateway and Node, including fully acknowledged data transmission
- Lost RF links are detected and relevant outputs set to user-defined conditions

For additional information, the most recent version of all documentation, and a complete list of accessories, refer to Banner Engineering's website, [www.bannerengineering.com/surecross](http://www.bannerengineering.com/surecross).

Models	Frequency	I/O
DX80N9X6S-P8	900 MHz ISM Band	Discrete I/O: Up to 12 PNP inputs or up to 12 PNP outputs (for a total of 12 I/O) (Default configuration is 6 IN and 6 OUT, without bit-packing)
DX80N2X6S-P8	2.4 GHz ISM Band	



DX80...C (IP20; NEMA 1) models are also available. To order this model with an IP20 housing, add a C to the end of the model number: DX80N9X6S-P8C.



## WARNING: Not To Be Used for Personnel Protection

**Never use this product as a sensing device for personnel protection. Doing so could lead to serious injury or death.** This product 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.



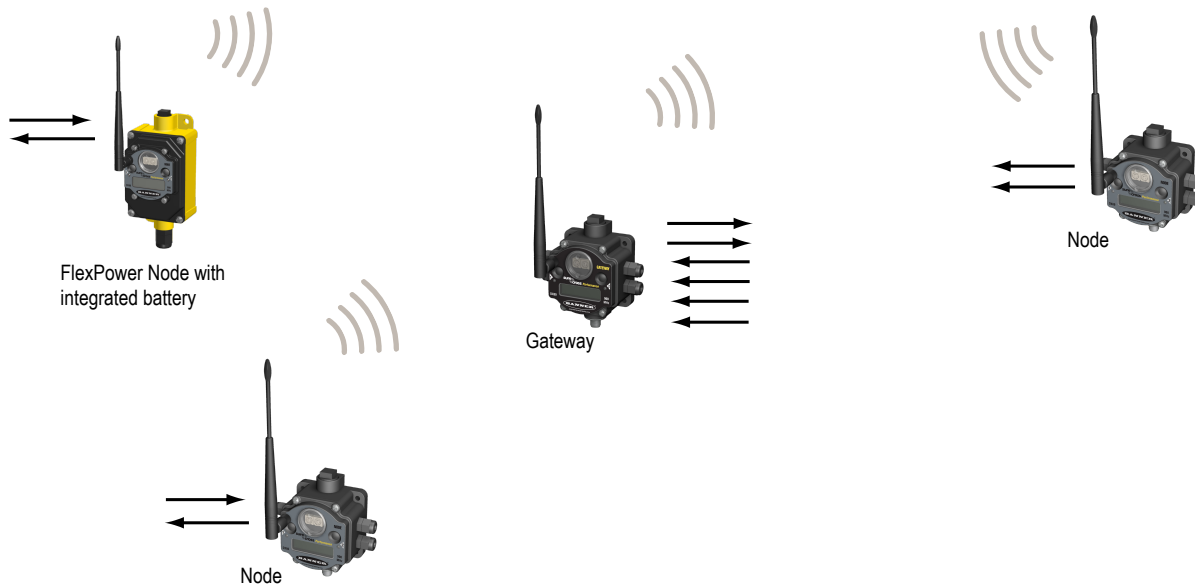
## Important: Never Operate 1 Watt Radios Without Antennas.

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 the burden of wiring or conduit installation. The SureCross wireless network can operate 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 inputs and outputs that may be all discrete, all analog, or a mix of discrete and analog I/O.



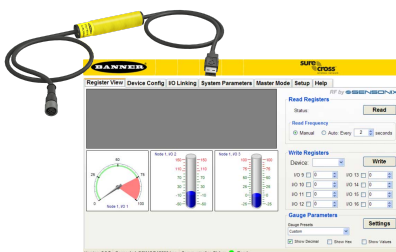
The SureCross® Performance network is a deterministic system—the network identifies when the radio signal is lost and drives relevant outputs to user-defined conditions. Once the radio signal is reacquired, the network returns to normal operation.

## SureCross® Performance Gateways and Nodes

A **Gateway** is the master device within each radio network. Every wireless network must have one Gateway that schedules communication traffic and controls the I/O configuration for the network. A radio network contains only one Gateway, but can contain many Nodes. 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 and 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. Each Node device can be connected to sensors or output devices and reports I/O status to the Gateway.

## SureCross User Configuration Tool



The User Configuration Tool (UCT) offers an easy way to link I/O points in your wireless network, view I/O register values graphically, and set system communication parameters when a host system is not part of the wireless network.

The UCT requires a special USB to RS-485 (model number BWA-HW-006) converter cable to pass information between your computer and the Gateway. Download the most recent revisions of the UCT software from Banner Engineering's website: <http://www.bannerengineering.com/wireless>.

## Setting Up Your Wireless Network

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

1. Configure the DIP switches of all devices.
2. Connect the sensors to the SureCross devices.
3. Apply power to all devices.
4. Form the wireless network. For binding instructions, refer to the product manual.
5. Observe the LED behavior to verify the devices are communicating with each other.
6. Conduct a site survey between the Gateway and Nodes. For site survey instructions, refer to the product manual.
7. Install your wireless sensor network components. For installation instructions, refer to the product manual.

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: Banner part number [128185](#)
- SureCross Wireless I/O Network Manual: [132607](#)
- Web Configurator Manual (used with "Pro" and DX83 models): [134421](#)
- Host Configuration Manual [132114](#)

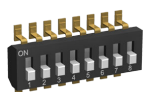
## Configuring the DIP Switches

Before making any changes to the DIP switch positions, disconnect the power. For devices with batteries integrated into the housing, remove the battery for at least one minute. DIP switch changes will not be recognized if power isn't cycled to the device.

### 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. For integrated battery models (no ribbon cable) and Class I, Division 2 certified devices (ribbon cable is glued down), skip this step.
4. Remove the black cover plate from the bottom of the device's cover.  
The DIP switches are located behind the rotary dials.



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

### DIP Switch Settings

Device Settings	Switches							
	1	2	3	4	5	6	7	8
Transmit power level: 1 Watt (30 dBm)	OFF*							
Transmit power level: 250 mW (24 dBm), DX80 compatibility mode	ON							
Host or UCT configured (overrides switches 5-8)		OFF*						
Use DIP switches 5-8 for I/O configuration		ON						
12 inputs, 0 outputs					OFF*	OFF*	OFF*	OFF*
11 inputs, 1 output					OFF	OFF	OFF	ON
10 inputs, 2 outputs					OFF	OFF	ON	OFF
9 inputs, 3 outputs					OFF	OFF	ON	ON
8 inputs, 4 outputs					OFF	ON	OFF	OFF
7 inputs, 5 outputs					OFF	ON	OFF	ON
6 inputs, 6 outputs					OFF	ON	ON	OFF
5 inputs, 7 outputs					OFF	ON	ON	ON
4 inputs, 8 outputs					ON	OFF	OFF	OFF
3 inputs, 9 outputs					ON	OFF	OFF	ON

Switches								
Device Settings	1	2	3	4	5	6	7	8
2 inputs, 10 outputs					ON	OFF	ON	OFF
1 input, 11 outputs					ON	OFF	ON	ON
0 inputs, 12 outputs					ON	ON	OFF	OFF
6 inputs, 6 outputs (non bit-packed)					ON	ON	OFF	ON
8 bit-packed inputs, 4 non bit-packed outputs					ON	ON	ON	OFF
4 non bit-packed inputs, 8 bit-packed outputs					ON	ON	ON	ON

\* Default configuration

For the 6 IN/6 OUT non bit-packed configuration, the discrete INs use I/O points 1 through 6 and the discrete OUTs use I/O points 9 through 14. For the 8 bit-packed IN/4 non bit-packed OUT configuration, all discrete INs use I/O point 1 and the discrete OUTs use I/O points 9 through 12. For the 4 non bit-packed IN/8 bit-packed output configuration, the discrete INs use I/O points 1 through 4 and all bit-packed outputs use I/O point 9.

#### Host or UCT Configured vs Use DIP Switches for I/O Configuration

In the OFF position, this device is configured for six discrete inputs and six discrete outputs (non-bit packed) for products built after May 2011. For products built before May 2011, this default position configures the device for 12 inputs and zero outputs (bit packed). In the OFF position, users can send commands directly from the host system to the devices to select custom I/O configuration. Users may also use the UCT to write custom configuration

In the ON position, use DIP switches 5 through 8 to select one of the pre-programmed discrete I/O configurations shown in the DIP Switch Settings table.

#### 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.

#### User Defined Configuration of Discrete I/O on the 12 I/O Devices

The 12 I/O device can be configured into any combination of 12 discrete inputs or outputs. Inputs are stored in a bit packed form in I/O point 1, device register 1. Outputs are stored in a bit packed form in I/O point 9, device register 9. (See Modbus Register Block table on previous page.)

#### Defining Inputs and Outputs

To define which of the 12 I/O points are inputs, adjust the bit field stored as I/O 1's threshold parameter [15:0]. Set bit 0 of the 16-bit parameter data word to define I/O 1 as an input, set bit 1 to define I/O 2 as an input, et cetera. Each bit position of the parameter is associated to a I/O point. In the example below, the first five I/O points are defined as inputs.

Input Pa- rameter	Bit 15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Input Point #					12	11	10	9	8	7	6	5	4	3	2	1
Parameter Data					0	0	0	0	0	0	0	1	1	1	1	1

Define outputs the same way by adjusting the bit field stored in I/O 9's threshold parameter [15:0]. Verify the bit pattern for outputs does not overlap the input pattern. In the example below, I/O points 6-12 are set as outputs.

Input Pa- rameter	Bit 15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Input Point #					12	11	10	9	8	7	6	5	4	3	2	1

Input Parameter	Bit 15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Parameter Data					1	1	1	1	1	1	1	0	0	0	0	0

For inputs, the first I/O point selected as an input is placed in bit position 0 in register 1. The second input point is in bit position 1, et cetera. Likewise, for outputs, the first I/O point selected as an output is placed in bit position 0 in register 9, the second input point is in bit position 2. The bit-packed values are stored in right-justified format.

Input Parameter	Bit 15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Input Point #					0	0	0	0	0	0	0	IN 5	IN 4	IN 3	IN 2	IN 1
Parameter Data					0	0	0	0	0	OUT 7	OUT 6	OUT 5	OUT 4	OUT 3	OUT 2	OUT 1

### Defining Inputs and Outputs Using the UCT

To configure either a Gateway or Node, select the Gateway or specific Node from the dropdown list. To configure a DX85 Remote I/O model, set the DX85's Slave ID to 01 and select the Gateway from the dropdown list.

To define which of the 12 I/O points are inputs for the selected device, adjust the threshold parameter for I/O point 1. Set bit 0 of the 16-bit parameter data word to define I/O 1 as an input, set bit 1 to define I/O 2 as an input, et cetera. Each bit position of the parameter is associated to a I/O point. In the example below, the first five I/O points are defined as inputs (0000 0001 1111 = 0x001F = 0031).

**BANNER** **sure cross** wireless network

Register View Device Config I/O Linking System Parameters Master Mode Setup Help

Device Parameters Device Information Device Restore Site Survey Load/Save

RF by SENSONIX

**Device Parameters**

Show Value as: ☒ Integer ☐ Hexadecimal

Get Send

Device	I/O Number	Parameter	Value
Gateway	1	Threshold	31

**Threshold (bits 15:0).** The trigger point or threshold for an analog input. When an analog input is greater than or equal to the threshold value, a ON or 1 event is reported (if not inverted). If the analog input does not reach the active threshold value, no change of state is reported. If the threshold parameter is 0, there is no threshold and the analog input will report based on the delta rate. Value range: 0 (disable, default) through 65535 (two-byte value). (Parameter number 0x08).

Supported in Gateway RF Firmware Version 2.7 and above.  
Supported in Node RF Firmware Version 1.0 and above.

Version: 2.3.7 Connected: COM15@19200 bps Communication Status: ● Ready

To define which of the 12 I/O points are outputs for the selected device, adjust the threshold parameter for I/O point 9. In the example below, bits 11 through 5 are used to set seven outputs (1111 1110 0000 = 0x0FE0 = 4064)

The screenshot shows the Banner SureCross Performance Node software interface. At the top, there's a yellow banner with the Banner and SureCross logos. Below it, a navigation bar includes tabs like Register View, Device Config, I/O Linking, System Parameters, Master Mode, Setup, and Help. The 'Device Config' tab is active, and within it, 'Device Parameters' is selected. The interface shows a 'Device Parameters' section with a 'Show Value as' dropdown set to 'Integer' and buttons for 'Get' and 'Send'. A table displays the current configuration: Device 'Gateway', I/O Number '9', Parameter 'Threshold', and Value '4064'. Below the table, a detailed description of the 'Threshold (bits 15:0)' parameter is provided, explaining its function as a trigger point for analog inputs. At the bottom, a status bar indicates 'Version: 2.3.7', 'Connected: COM15@19200 bps', and 'Communication Status: Ready'.

## Wiring Your SureCross® Device

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

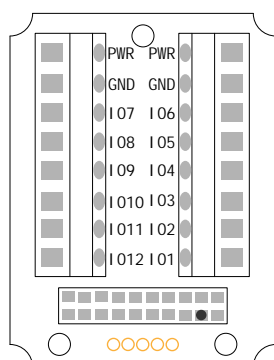
### 5-pin Euro-Style Wiring (Nodes)

Wiring the 5-pin Euro-style connector depends on the model and power requirements of the device.

	Wire No.	Wire Color	10 to 30V dc Powered Nodes	Battery Powered Nodes
	1	Brown	10 to 30V dc	
	2	White		
	3	Blue	dc common (GND)	dc common (GND)
	4	Black		
	5	Gray		3.6 to 5.5V dc

Connecting dc power to the communication pins will cause permanent damage. For FlexPower devices, do not apply more than 5.5V to the gray wire.

### Terminal Blocks and Wiring (12 Sourcing I/O Models)



IOx. Input or output (depending on configuration)

GND. Ground/dc common connection.

PWR. Power, 10 to 30V dc power connection.

For the default configuration of 6 IN and 6 OUT, use IO 1 through 6 to wire the inputs and IO 7 through 12 to wire the outputs.

When using the DIP switches to configure the input and output selection, wire the inputs beginning with IO1. After all inputs are wired, begin using the remaining IOx as outputs. For example, if you are using 10 inputs and 2 outputs, use terminals IO1 through 10 for the inputs and terminals IO 11 and 12 for the outputs.

## 12 I/O Sourcing Models

### Discrete Input Wiring for PNP Sensors Discrete Output Wiring (PNP)



The DIx and DOx of these wiring diagrams correspond to the IOx on the terminal block.

### DX80...C Wiring

Wiring power to the DX80...C models varies depending on the power requirements of the model.

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

\* Connecting dc power to the communication pins will cause permanent damage.

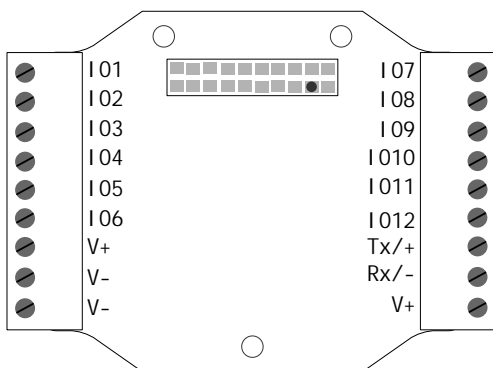
\*\* For FlexPower devices, do not apply more than 5.5V to the gray wire.

### Terminal Blocks (IP20 Base)

This is the wiring board for the DX80\*\*X6S-P8C IP20 models.

For the default configuration of 6 IN and 6 OUT, use IO 1 through 6 to wire the inputs and IO 7 through 12 to wire the outputs.

When using the DIP switches to configure the input and output selection, wire the inputs beginning with IO1. After all inputs are wired, begin using the remaining IOx as outputs. For example, if you are using 10 inputs and 2 outputs, use terminals IO1 through 10 for the inputs and terminals IO 11 and 12 for the outputs.



IOx. Input or output (depending on configuration)

Rx/-. Serial comms line

Tx/+. Serial comms line

V+. Power, 10 to 30V dc power connection.




V-. Ground/dc common connection.

### LED Behavior for the Nodes

After powering up and binding the Gateway and its Nodes, verify all devices are communicating properly. A Node will not sample its inputs until it is communicating with the Gateway to which it is bound. When testing communication between the Gateway and Node, verify all radios and antennas are at least two meters apart or the communications may fail. This table lists the LED behavior for the Node models with two LEDs.

LED 1	LED 2	Node Status
 (green flashing, 1/sec)		Radio Link Ok



LED 1	LED 2	Node Status
 (red flashing)	 (red flashing, 1/sec)	Device Error
	 (red flashing, 1 per 3 sec)	No Radio Link

## Modbus Register Table

I/O Point	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation		Terminal Block Labels
	Gateway or DX85	Any Node		Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)	
1	1	1 + (Node# × 16)	Bit-Packed Discrete IN	0	1	0	1	IO1 to IO12
2	2	2 + (Node# × 16)	Non Bit-Packed Discrete IN (depending on DIP switch configuration)					
3	3	3 + (Node# × 16)						
4	4	4 + (Node# × 16)						
5	5	5 + (Node# × 16)						
6	6	6 + (Node# × 16)						
7	7	7 + (Node# × 16)	Reserved					
8	8	8 + (Node# × 16)	Device Message					
9	9	9 + (Node# × 16)	Bit-Packed Discrete OUT	0	1	0	1	IO1 to IO12
10	10	10 + (Node# × 16)	Non Bit-Packed Discrete OUT (depending on DIP switch configuration)					
11	11	11 + (Node# × 16)						
12	12	12 + (Node# × 16)						
13	13	13 + (Node# × 16)						
14	14	14 + (Node# × 16)						
15	15	15 + (Node# × 16)	Control Message					
16	16	16 + (Node# × 16)	Reserved					

## 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	General
<p><b>Range</b>            900 MHz (1 Watt): Up to 9.6 kilometers (6 miles) *            2.4 GHz: Up to 3.2 kilometers (2 miles) *</p> <p><b>Transmit Power</b>            900 MHz (1 Watt): 30 dBm conducted (up to 36 dBm EIRP)            2.4 GHz: 18 dBm conducted, less than or equal to 20 dBm EIRP</p> <p><b>900 MHz Compliance (1 Watt Radios)</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            Node: Defined by Gateway</p> <p>* 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.</p>	<p><b>Power*</b>            Requirements: +10 to 30V dc (For European applications: +10 to 24V dc, <math>\pm 10\%</math>). (See UL section below for any applicable UL specifications)            900 MHz Consumption: Maximum current draw is &lt;40 mA and typical current draw is &lt;30 mA at 24V dc. (2.4 GHz consumption is less.)</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 in·lbf)</p> <p><b>Antenna Connection</b>            Ext. Reverse Polarity SMA, 50 Ohms            Max Tightening Torque: 0.45 N·m (4 in·lbf)</p> <p><b>Interface</b>            Indicators: Two bi-color LEDs            Buttons: Two            Display: Six character LCD</p> <p><b>Wiring Access</b>            DX80 models: Four PG-7, One 1/2-inch NPT, One 5-pin Euro-style male connector            DX80...C models: External terminals</p> <p>* For European applications, power the DX80 from a Limited Power Source as defined in EN 60950-1.</p>

Inputs	Outputs
<p><b>Discrete Inputs</b>            Rating: 3 mA max current at 30V dc            Sample Rate: 62.5 milliseconds            Report Rate: On change of state            ON Condition (PNP): Greater than 8V            OFF Condition (PNP): Less than 5V</p>	<p><b>Discrete Outputs</b>            Update Rate: Up to 62.5 milliseconds            ON Condition (PNP): Supply minus 2V            OFF Condition (PNP): Less than 2V            Output State Following Timeout: OFF</p> <p><b>Discrete Output Rating (PNP)</b>            100 mA max current at 30V dc            ON-State Saturation: Less than 3V at 100 mA            OFF-state Leakage: Less than 10 <math>\mu</math>A</p>

Environmental
<p><b>Rating</b>            DX80 models: IEC IP67; NEMA 6; (See UL section below for any applicable UL specifications)            DX80...C models: IEC IP20; NEMA 1</p> <p><b>Conditions</b>            Operating Temperature: -40 to +85° C (Electronics); -20 to +80° C (LCD)</p>
<p><b>Shock and Vibration</b>            IEC 68-2-6 and IEC 68-2-7            Shock: 30g, 11 millisecond half sine wave, 18 shocks            Vibration: 0.5 mm p-p, 10 to 60 Hz</p>

## Environmental

Operating Humidity: 95% max. relative (non-condensing)  
 Radiated Immunity: 10 V/m, 80-2700 MHz  
 (EN61000-6-2)

Refer to the SureCross® DX80 Wireless I/O Network product manual, Banner p/n 132607, for installation and waterproofing instructions. Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

## Included with Model

The following items ship with the DX80 radios.

- BWA-HW-002: DX80 Access Hardware Kit, containing four PG-7 plastic threaded plugs, four PG-7 nylon gland fittings, four PG-7 hex nuts, one 1/2-inch NPT plug, and one 1/2-inch nylon gland fitting. (Not included with IP20 DX80...C models)
- BWA-HW-001: Mounting Hardware Kit, containing four M5-0.8 x 25mm SS screws, four M5-0.8 x 16mm SS screws, four M5-0.8mm SS hex nuts, and four #8-32 x 3/4" SS bolts
- BWA-HW-003: PTFE tape
- BWA-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-HW-011: IP20 Screw Terminal Headers (2 pack) (Included only with the IP20 DX80...C models)

## 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. Contact the Factory for more information.

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