

# SureCross Performance Gateway

Configurable Gateway with discrete and analog I/O



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 four selectable discrete inputs, four sourcing discrete sourcing outputs, two universal analog inputs, and two 0 to 20 mA analog outputs
- 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
- Modbus serial interface
- 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, 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	Environmental Rating	I/O
DX80G9M6S-P2	900 MHz ISM Band	IP67, NEMA 6	<b>Inputs:</b> Four selectable discrete, two 0–20 mA or 0–10V analog <b>Outputs:</b> Four sourcing discrete, two 0–20mA analog
DX80G2M6S-P2	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: DX80G9M6S-P2C.



## 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.



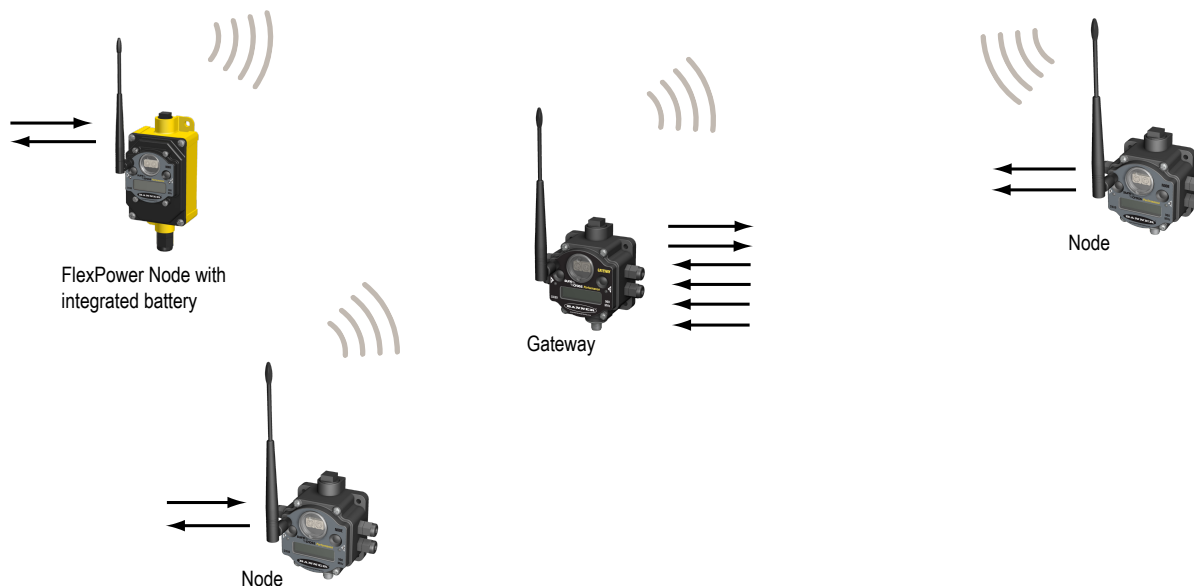
## Important: Never Operate 1 Watt Radios Without Antennas.

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.



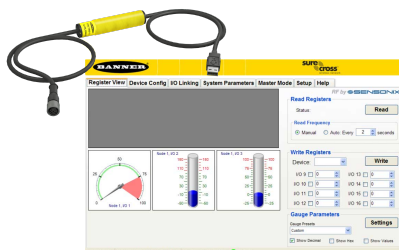
The SureCross® Performance network is a deterministic system—the network identifies when the radio signal is lost and drives relevant outputs to user-defined conditions. Once the radio signal is reacquired, the network returns to normal operation.

### 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](#)

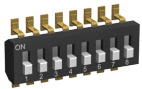
## Configuring the DIP Switches

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

Switches								
Device Settings	1	2	3	4	5	6**	7	8
900 MHz transmit power level: 1 Watt (30 dBm)	OFF*							
900 MHz transmit power level: 250 mW (24 dBm), DX80 compatibility mode	ON							
Host configured (overrides switches 3-8)		OFF*						
Use switch settings		ON						
Inputs sourcing (PNP)			OFF*					
Inputs sinking (NPN)			ON					
Link loss output: zero				OFF*	OFF*			
Link loss output: one				OFF	ON			
Link loss output: hold last state				ON	OFF			
Link loss output: user configuration				ON	ON			

Switches								
Device Settings	1	2	3	4	5	6**	7	8
0–20 mA scale **						OFF*		
4–20 mA scale **						ON		

\* Default configuration

\*\* Not used when configured for 0-10V I/O.

### Analog Input and Output Scale

Use the DIP switch to select which current scale to use for all the device's analog inputs and outputs: 0 to 20 mA or 4 to 20 mA. When using a 4-20 mA sensor with a 0-20 mA input, the sensor uses the 4-20 mA section of the total range. Using a 4-20 mA with a 0-20 mA input allows you to determine when you have an error condition with the sensor. A normal input reading between 4 and 20 mA indicates a functioning sensor whereas a value below 4 mA indicates an error condition, such as a broken wire or loose connection. This DIP switch is used only on the 0 to 20 mA models, not the 0 to 10V models.

### Discrete Input Type

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

### Host Configured

Selecting “Host Configured (override switches)” uses the factory’s default configuration for this device or allows a host system to set parameters. If the host configured option is not selected, use the DIP switches to configure the device parameters.

### Link Loss Outputs

The SureCross DX80 wireless devices use a deterministic radio link time-out method to address RF link interruption or failure. When a radio link fails, all pertinent wired outputs are sent to defined states until the link is recovered, ensuring that disruptions in the communications link result in predictable system behavior.

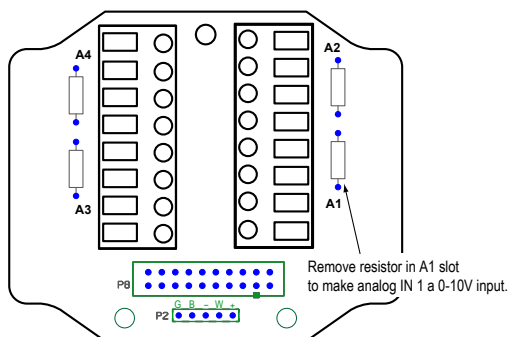
Following a radio link time-out, all outputs linked to the Node in question are set to de-energize (discrete outputs to zero, analog outputs to 0 mA or 4 mA), energize (discrete outputs to one, analog outputs to 20 mA), or to hold the last stable state/value. Use the DIP switches to select the link loss output state.

### 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.

### Configuring Universal Analog Inputs for mA or V

To configure inputs to use 0 to 10V instead of 0 to 20mA, remove the installed resistors from the marked locations on the wiring board. For example, to make analog input 1 a 0 to 10V input, follow these instructions.



Step 1. Cut out the resistor installed in the A1 (analog 1) slot. (Your wiring board may differ slightly from the board shown. Use the board's labels to confirm you have selected the correct resistor to cut.)

Step 2. Launch the User Configuration Tool software.

Step 3. Change the units parameter for this particular input on this device (Gateway or Node) to use voltage instead of milliamps. Refer to the Modbus Register table for the I/O number for each analog input. Writing a four (4) to the Units parameter defines the units as 0 to 10V. Writing a two (2) to the Units parameter defines the units as 0 to 20 mA.

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
Node 1	5	Units	4

**Units (bits 7:0).** The parameter defines the range and/or type of value associated with the I/O point. The devices use this parameter to correctly interpret the I/O point data. (Parameter number 0x0C). (See tables in Appendix for units descriptions.)

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

Note that a 220 ohm 0.1% resistor must be installed for a 0 to 20mA input. The resistor must be removed for an input defined as a 0 to 10V input.

### 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)

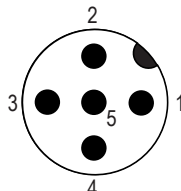
For more detailed instructions about setting up your wireless network, refer to the Quick Start Guide, Banner document number 128185. For more information about using Performance and non-Performance radios within the same network, refer the technical note titled *Mixing Performance Radios and 150 mW Radios in the Same Network* listed on the FAQ/Knowledgebase section of Banner's Wireless Sensor Networks website.

### Wiring Your SureCross® Device

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

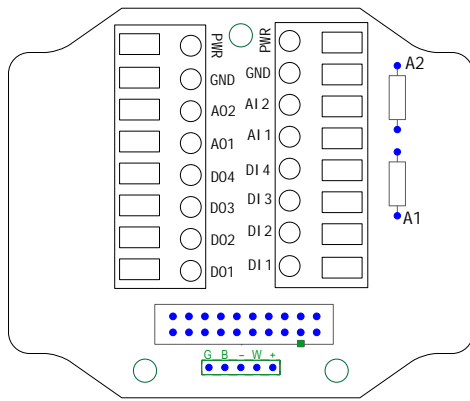
#### 5-pin Euro-Style Hookup

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 30V dc
	2	White	RS485 / D1 / B / +
	3	Blue	dc common (GND)
	4	Black	RS485 / D0 / A / -
	5	Gray	Comms Gnd

#### Terminal Block (IP67)

This is the terminal block for the DX80\*\*M6S-P2 models.



AIx or Ax. Analog IN x.

AOx. Analog OUT x.

DIx. Discrete IN x.

DOx. Discrete OUT x.

GND. Ground/dc common connection.

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

## DX80...C Wiring

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

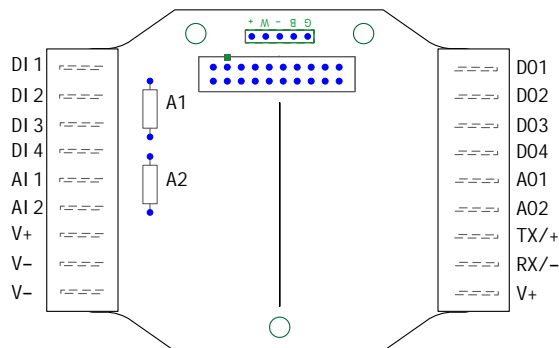
Terminal Label	Gateway, DX85 *	10 to 30V dc Powered Nodes	Battery Powered Nodes **
V+	10 to 30V dc	10 to 30V dc	
Tx/+	RS485 / D1 / B / +		
V-	dc common (GND)	dc common (GND)	dc common (GND)
Rx/-	RS485 / D0 / A / -		
B+			3.6 to 5.5V dc

\* 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 Block (IP20)

This is the terminal block for the DX80\*\*M6S-P2C models.



AIx or Ax. Analog IN x.

AOx. Analog OUT x.

DIx. Discrete IN x.

DOx. Discrete OUT x.

GND. Ground/dc common connection.

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

RX/-. Serial comms line

TX/+. Serial comms line

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

V-. Ground/dc common connection.

## Wiring Diagrams for Discrete Inputs

Connecting dc power to the communication pins will cause permanent damage. For the DX8x...C models, PWR in the wiring diagram refers to V+ on the wiring board and GND in the wiring diagram refers to V- on the wiring board.

### Discrete Input Wiring for PNP Sensors

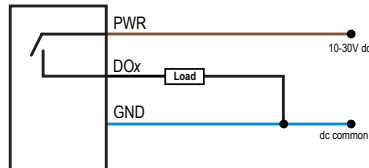
### Discrete Input Wiring for NPN Sensors



## Wiring Diagrams for Discrete Outputs

Connecting dc power to the communication pins will cause permanent damage. For the DX8x...C models, PWR in the wiring diagram refers to V+ on the wiring board and GND in the wiring diagram refers to V- on the wiring board.

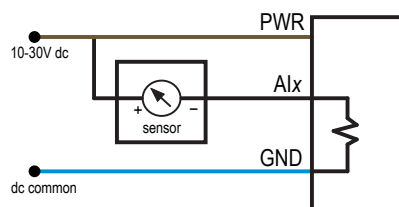
### Discrete Output Wiring (PNP)



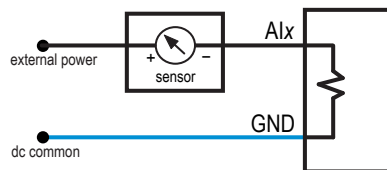
## Wiring Diagrams for Analog Inputs

Connecting dc power to the communication pins will cause permanent damage. Do not exceed analog input ratings for analog inputs. Only connect sensor outputs to analog inputs.

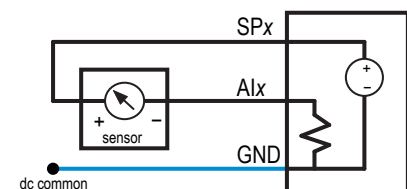
### Analog Input Wiring (10 to 30V dc Power)



### Analog Input Wiring (4–20mA, 2-Wire, Externally Powered Sensors)



### Analog Input Wiring (4–20mA, 2-Wire, Switch Powered Sensors)

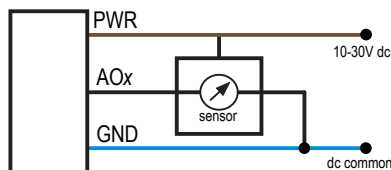


(Only possible in models with switch power (SPx) outputs)

## Wiring Diagrams for Analog Outputs






Connecting dc power to the communication pins will cause permanent damage. Do not exceed analog input ratings for analog inputs. Only connect sensor outputs to analog inputs.

### Analog Output Wiring



## LED Behavior for the Gateways

After powering up and binding the Gateway and its Nodes, verify all devices are communicating properly. 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 Gateway models with two LEDs.

LED 1	LED 2	Gateway Status
 (green on)		Power ON
 (red flashing)	 (red flashing)	Device Error
	 (yellow flashing)	Modbus Communication Active
	 (red flashing)	Modbus Communication Error

For Gateway and Ethernet Bridge systems, active Modbus communication refers to the communication between the Gateway and the Ethernet Bridge. For GatewayPro systems, the Modbus communication LEDs refer to the communication internal to the Gateway Pro. For Gateway only systems, the Modbus communication LEDs refer to the communication between the Gateway and its host system (if applicable).

## Modbus Register Table

I/O	Modbus Holding Register		I/O Type	Units	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)	Discrete IN 1	-	0	1	0	1	DI1
2	2	2 + (Node# × 16)	Discrete IN 2	-	0	1	0	1	DI2
3	3	3 + (Node# × 16)	Discrete IN 3	-	0	1	0	1	DI3
4	4	4 + (Node# × 16)	Discrete IN 4	-	0	1	0	1	DI4
5	5	5 + (Node# × 16)	Analog IN 1	mA V	0.0 0.0	20.0 10.0	0	65535	AI1
6	6	6 + (Node# × 16)	Analog IN 2	mA V	0.0 0.0	20.0 10.0	0	65535	AI2
7	7	7 + (Node# × 16)	Reserved						
8	8	8 + (Node# × 16)	Device Message						
9	9	9 + (Node# × 16)	Discrete OUT 1	-	0	1	0	1	DO1
10	10	10 + (Node# × 16)	Discrete OUT 2	-	0	1	0	1	DO2
11	11	11 + (Node# × 16)	Discrete OUT 3	-	0	1	0	1	DO3
12	12	12 + (Node# × 16)	Discrete OUT 4	-	0	1	0	1	DO4
13	13	13 + (Node# × 16)	Analog OUT 1	mA	0.0	20.0	0	65535	AO1
14	14	14 + (Node# × 16)	Analog OUT 2	mA	0.0	20.0	0	65535	AO2
15	15	15 + (Node# × 16)	Control Message						
16	16	16 + (Node# × 16)	Reserved						

## Specifications

Radio	General
Radio Range	Power*



Radio	General
<p>900 MHz (1 Watt): Up to 9.6 kilometers (6 miles) *</p> <p>2.4 GHz: Up to 3.2 kilometers (2 miles) *</p> <p><b>Radio Transmit Power</b></p> <p>900 MHz (1 Watt): 30 dBm conducted (up to 36 dBm EIRP)</p> <p>2.4 GHz: 18 dBm conducted, less than or equal to 20 dBm EIRP</p> <p><b>900 MHz Compliance (1 Watt Radios)</b></p> <p>FCC ID UE3RM1809: This device complies with FCC Part 15, Subpart C, 15.247</p> <p>IC: 7044A-RM1809</p> <p><b>2.4 GHz Compliance</b></p> <p>FCC ID UE300DX80-2400 - This device complies with FCC Part 15, Subpart C, 15.247</p> <p>ETSI/EN: In accordance with EN 300 328: V1.7.1 (2006-05)</p> <p>IC: 7044A-DX8024</p> <p><b>Spread Spectrum Technology</b></p> <p>FHSS (Frequency Hopping Spread Spectrum)</p> <p><b>Link Timeout</b></p> <p>Gateway: Configurable</p> <p>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>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)</p> <p>900 MHz Consumption: Maximum current draw is &lt;100 mA and typical current draw is &lt;50 mA at 24V dc. (2.4 GHz consumption is less.)</p> <p><b>Housing</b></p> <p>Polycarbonate housing and rotary dial cover; polyester labels; EDPM rubber cover gasket; nitrile rubber, non-sulphur cured button covers</p> <p>Weight: 0.26 kg (0.57 lbs)</p> <p>Mounting: #10 or M5 (SS M5 hardware included)</p> <p>Max. Tightening Torque: 0.56 N·m (5 in·lbf)</p> <p><b>Antenna Connection</b></p> <p>Ext. Reverse Polarity SMA, 50 Ohms</p> <p>Max Tightening Torque: 0.45 N·m (4 in·lbf)</p> <p><b>Interface</b></p> <p>Indicators: Two bi-color LEDs</p> <p>Buttons: Two</p> <p>Display: Six character LCD</p> <p><b>Wiring Access</b></p> <p>DX80 models: Four PG-7, One 1/2-inch NPT, One 5-pin Euro-style male connector</p> <p>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></p> <p>Four, DIP switch selectable between sourcing/PNP and sinking/NPN</p> <p>Rating: 3 mA max current at 30V dc</p> <p>Sample Rate: 62.5 milliseconds</p> <p>Report Rate: On change of state</p> <p><b>Discrete Input ON Condition</b></p> <p>PNP: Greater than 8V</p> <p>NPN: Less than 0.7V</p> <p><b>Discrete Input OFF Condition</b></p> <p>PNP: Less than 5V</p> <p>NPN: Greater than 2V or open</p> <p><b>Analog Inputs</b></p> <p>Two, 0 to 20mA (default) or 0 to 10V (user configurable)</p> <p>Rating (mA): 24 mA</p> <p>Rating (V): 10V</p> <p>Impedance: 220 Ohms</p> <p>Sample Rate: 62.5 milliseconds</p> <p>Report Rate: 1 second or On Change of State (1% change in value)</p> <p>Accuracy: 0.2% of full scale +0.01% per °C</p>	<p><b>Discrete Outputs</b></p> <p>Four sourcing/PNP</p> <p>Update Rate: 125 milliseconds</p> <p>ON Condition: Supply minus 2V</p> <p>OFF Condition: Less than 2V</p> <p>Output State Following Timeout: OFF</p> <p><b>Discrete Output Rating (PNP)</b></p> <p>100 mA max current at 30V dc</p> <p>ON-State Saturation: Less than 3V at 100 mA</p> <p>OFF-state Leakage: Less than 10 <math>\mu</math>A</p> <p><b>Analog Outputs</b></p> <p>Two, 0 to 20 mA</p> <p>Update Rate: 125 milliseconds</p> <p>Accuracy: 0.1% of full scale +0.01% per °C</p> <p>Resolution: 12-bit</p>

Inputs	Outputs
Resolution: 12-bit	
Communication	Environmental
<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 <b>Protocol</b> Modbus RTU 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.	<b>Ratings</b> Rating for DX80 models: IEC IP67; NEMA 6; (See UL section below for any applicable UL specifications) Rating for DX80...C models: IEC IP20; NEMA 1 Operating Temperature: -40 to +85° C (Electronics); -20 to +80° C (LCD) 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 68-2-7 Shock: 30g, 11 millisecond half sine wave, 18 shocks Vibration: 0.5 mm p-p, 10 to 60 Hz

## 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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