

# SureCross Performance FlexPower Node

Configurable FlexPower Node with RTD inputs



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 3-wire Pt100 RTDs; other types available with configuration
- 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
- FlexPower® power options allows for +10 to 30V dc, solar, and battery power sources for low power applications.
- 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	Power	Housing	I/O
DX80N9X2S-P4	900 MHz ISM Band	10 to 30V dc or battery supply module	IP67, NEMA 6	<b>Inputs:</b> Four 3-wire RTDs
DX80N9X1S-P4E		10 to 30V dc or integrated battery	IP54, NEMA 4	
DX80N2X1S-P4E	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: DX80N9X2S-P4C.

The integrated battery models are also available without batteries. If you purchase a model without the battery, Banner Engineering recommends using the XENO XL-205F battery or equivalent. For DX99 models, only a XENO XL-205F battery is certified.



## 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.



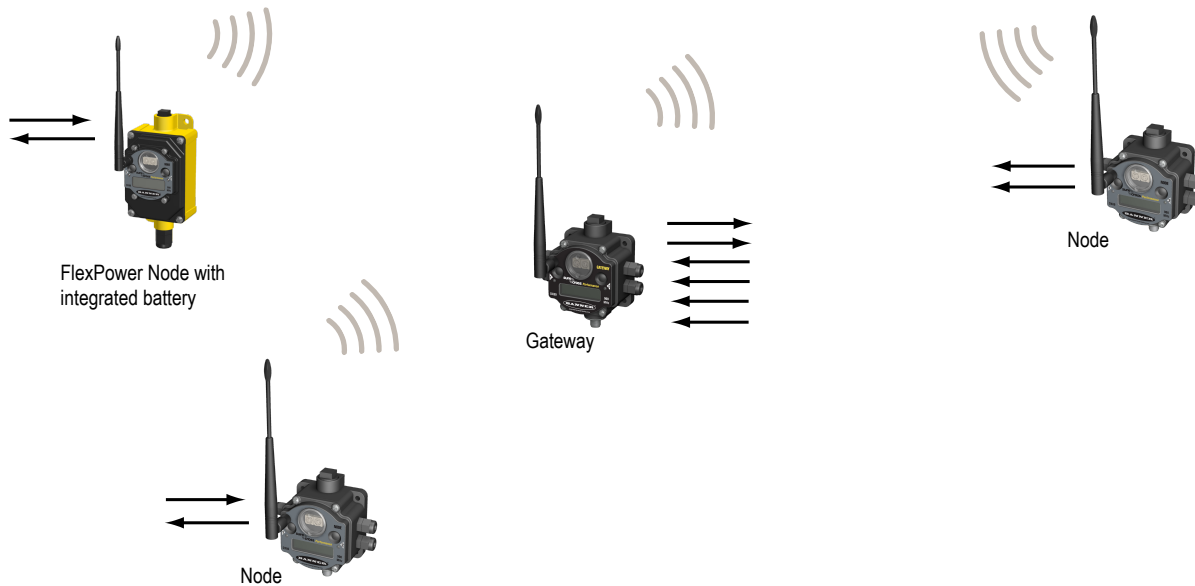
## Important: Never Operate 1 Watt Radios Without Antennas.

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.



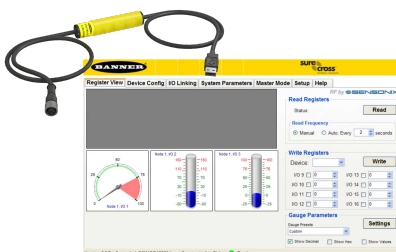
The SureCross® Performance network is a deterministic system—the network identifies when the radio signal is lost and drives relevant outputs to user-defined conditions. Once the radio signal is reacquired, the network returns to normal operation.

## 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](#)

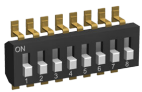
## Configuring the DIP Switches

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 (RTD)

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 configured (override switches)		OFF*						
Use switch settings		ON						
Temp °Fahrenheit			OFF*					
Temp °Celsius			ON					
High resolution (0.1 degree) **				OFF*				
Low resolution (1 degree)				ON				
Platinum, 100 ohm (European, DIN 43760)					OFF*	OFF*	OFF*	
Unused					OFF	OFF	ON	
Copper, 10 ohm (alpha = 0.00427)					OFF	ON	OFF	
Unused					OFF	ON	ON	
Unused					ON	OFF	OFF	
Unused					ON	OFF	ON	

Switches								
Device Settings	1	2	3	4	5	6	7	8
Unused					ON	ON	OFF	
Unused					ON	ON	ON	

\* Default configuration

\*\* In high resolution mode, the temperature = (Modbus register value) ÷ 20. In low resolution mode, the temperature = (Modbus register value) ÷ 2.

### 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.

### RTD Type

Use DIP switches 5, 6, and 7 to select the RTD type. The default position is the OFF position for all switches, setting the RTD to a Platinum 100 ohm type.

### Temperature Resolution

When set to high resolution, temperature values are stored to the nearest tenth (0.1) of a degree (default position). To measure temperatures above 1600 degrees Fahrenheit or 1600 degrees Celsius, switch the DIP switch to the ON position and use low resolution mode. In high resolution, the device cannot store values larger than 1600.

### Temperature Units

Use the DIP switch to specify if the temperature is stored in degrees Fahrenheit or Celsius. The default position is OFF, setting the temperature to Fahrenheit. For Celsius measurements, set this switch to the ON position.

### 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.

### 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)

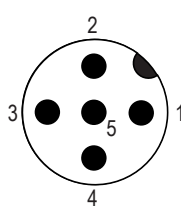
For more detailed instructions about setting up your wireless network, refer to the Quick Start Guide, Banner document number 128185. For more information about using Performance and non-Performance radios within the same network, refer the technical note titled *Mixing Performance Radios and 150 mW 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.

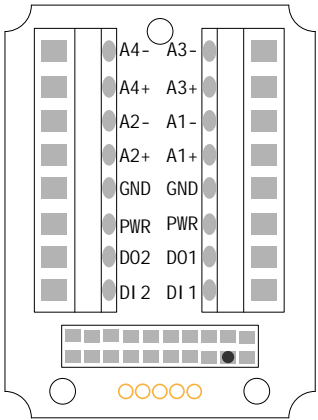
#### 5-pin Euro-Style Wiring (Nodes)

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.

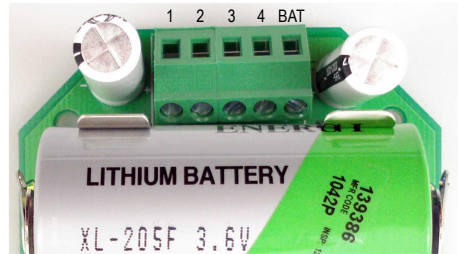
Terminal Block (IP67)



- Ax+ and Ax-. Analog IN x. Analog inputs for devices requiring more than one connection, such as thermocouples or RTDs. When there is no Ax-, use Ax+ as an analog input.
- DIx. Discrete IN x.
- DOx. Discrete OUT x.
- GND. Ground/dc common connection.
- PWR. Power, 10 to 30V dc power connection.

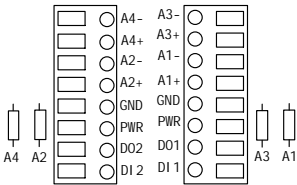
Wiring for DX80...E Radios

Connecting dc power to the communication pins will cause permanent damage. The integrated battery DX80...E radios may also be powered by 10 to 30V dc. The power for the sensors can be supplied by the radio's SPx terminals or from the 10 to 30V dc used to power the radio.

	Integrated battery (RS-485) (P1E, M-H1E Models)	Integrated battery (RS-232) (P3E, P4E, M-H3E, M-H4E Models)
	1 10 to 30V dc (optional)	10 to 30V dc (optional)
	2 RS-485 / D1 / B / +	RS-232 Tx
	3 dc common (GND)	dc common (GND)
	4 RS-485 / D0 / A / -	RS-232 Rx

The BAT connection is a low voltage connection to the internal battery. Remove the internal battery if a low voltage source is connected to the BAT terminal. When powering the device from the integrated battery, the BAT connection must remain open.

Terminal Block (IP54)



- Ax+ and Ax-. Analog IN x. Analog inputs for devices requiring more than one connection, such as thermocouples or RTDs. When there is no Ax-, use Ax+ as an analog input.
- 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.

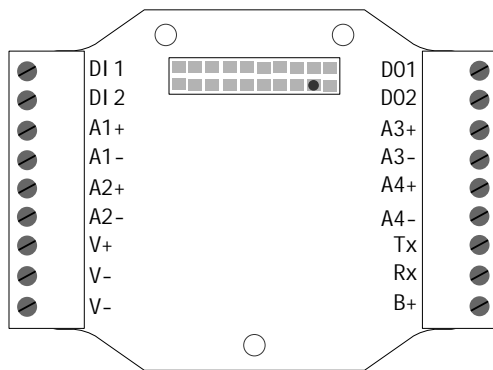
Terminal Label	Gateway, DX85 *	10 to 30V dc Powered Nodes	Battery Powered Nodes **
V+	10 to 30V dc	10 to 30V dc	
Tx/+	RS485 / D1 / B / +		
V-	dc common (GND)	dc common (GND)	dc common (GND)
Rx/-	RS485 / D0 / A / -		
B+			3.6 to 5.5V dc

\* 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)

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.



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.

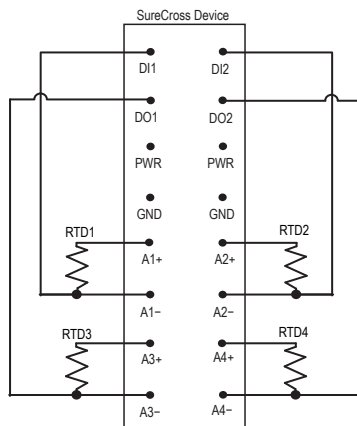
V-. Ground/dc common connection.

Ax+ and Ax-. Analog IN x. Analog inputs for devices requiring more than one connection, such as thermocouples or RTDs. When there is no Ax-, use Ax+ as an analog input.

B+. 3.6 to 5.5V dc (for battery powered models only).

### Wiring Diagram for RTD Inputs

#### Input Wiring for RTDs



### Supported RTD Types





The RTD Node supports up to four 30wire RTD inputs by default. Additional types are available with configuration.

Thermocouple	Range °F	Range °C
Pt100 (DIN 0.00385)	-328 to 900 °F	-200 to 482 °C
Cu 10 Ohm (alpha = 0.00427)	-328 to 500 °F	-200 to 260 °C

\* For the copper RTD, the best accuracy is when measuring between -50 to +150° C (-58 to +302° F). Below this range, expect errors approaching 3% of reading. Above this range, expect errors approaching 0.5% of reading.

### 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
 (red flashing)	 (red flashing, 1/sec)	Device Error
	 (red flashing, 1 per 3 sec)	No Radio Link

### Modbus Register Table (High Resolution Mode)

I/O	Modbus Holding Register		I/O Type	Units	I/O Range		Holding Register Representation		Terminal Block Labels
	Gateway	Any Node			Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)	
1	1	1 + (Node# × 16)							
2	2	2 + (Node# × 16)							
3	3	3 + (Node# × 16)	RTD 1	°F/°C	-1638.3	+1638.4	-32768	32767	A1+/A1-/DI1
4	4	4 + (Node# × 16)	RTD 2						A2+/A2-/DI2
5	5	5 + (Node# × 16)	RTD 3						A3+/A3-/DO1
6	6	6 + (Node# × 16)	RTD 4						A4+/A4-/DO2
7	7	7 + (Node# × 16)	Reserved						
8	8	8 + (Node# × 16)	Device Message						
		...							
15	15	15 + (Node# × 16)	Control Message						
16	16	16 + (Node# × 16)	Reserved						

In high resolution mode, the temperature = (Modbus register value) ÷ 20. In low resolution mode, the temperature is (Modbus register value) ÷ 2.

Temperature values are stored as signed values in the Modbus register. A 0 in the register is interpreted as 0°; and -32767 (65535 unsigned) in the register (0xFFFF) is interpreted as -1 ÷ 20 = -0.05° in high resolution mode and -1 ÷ 2 = -0.5° in low resolution mode.

### Storage Mode and Sleep Mode

While in **storage mode**, the radio does not operate. All SureCross® radios powered from an integrated battery ship from the factory in storage mode to conserve the battery. To wake the device, press and hold button 1 for five seconds. To put any FlexPower® or integra-



ted battery SureCross radio into storage mode, press and hold button 1 for five seconds. The radio is in storage mode when the LEDs stop blinking, but in some models, the LCD remains on for an additional minute after the radio enters storage mode. After a device has entered storage mode, you must wait one minute before waking it.

During normal operation, the SureCross radio devices enter **sleep mode** after 15 minutes of operation. The radio continues to function, but the LCD goes blank. To wake the device, press any button.

## Integrated Battery Replacement (DX80...E Models)



For outside or high humidity environments, conductive grease may be applied to the battery terminals to prevent moisture and corrosion buildup. To replace the lithium "D" cell battery in any integrated housing model, follow these steps.

1. Remove the four screws mounting the face plate to the housing and remove the face plate. Do not remove the radio cover from the face plate.
2. Remove the discharged battery and replace with a new battery. Only use a 3.6V lithium battery from Xeno, model number XL-205F.
3. Verify the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case. Caution: There is a risk of explosion if the battery is replaced incorrectly.
4. After replacing the battery, allow up to 60 seconds for the device to power up.

Properly dispose of your used battery according to local regulations by taking it to a hazardous waste collection site, an e-waste disposal center, or other facility qualified to accept lithium batteries. As with all batteries, these are a fire, explosion, and severe burn hazard. Do not burn or expose them to high temperatures. Do not recharge, crush, disassemble, or expose the contents to water.

Replacement battery model number: BWA-BATT-001. For pricing and availability, contact Banner Engineering.

## Specifications

Radio	General
<b>Radio Range</b> 900 MHz (1 Watt): Up to 9.6 kilometers (6 miles) * 2.4 GHz: Up to 3.2 kilometers (2 miles) *	<b>Power*</b> DX80 and DX80...C Model Requirements: +10 to 30V dc or 3.6 to 5.5V dc low power option (For European applications: +10 to 24V dc, $\pm 10\%$ or 3.6 to 5.5V dc low power option) DX80...E Model Requirements: 3.6V dc low power option from an internal battery or 10 to 30V dc 900 MHz Consumption: Maximum current draw is <40 mA and typical current draw is <30 mA at 24V dc. (2.4 GHz consumption is less.)
<b>Radio 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	<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) DX80 and DX80...C Mounting: #10 or M5 (SS M5 hardware included) DX80... E Mounting: 1/4-inch or M7 (SS M7 hardware included) Max. Tightening Torque: 0.56 N·m (5 in·lbf)
<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	<b>Antenna Connection</b> Ext. Reverse Polarity SMA, 50 Ohms Max Tightening Torque: 0.45 N·m (4 in·lbf)
<b>2.4 GHz Compliance</b> FCC ID UE300DX80-2400 - This device complies with FCC Part 15, Subpart C, 15.247 ETSI/EN: In accordance with EN 300 328: V1.7.1 (2006-05) IC: 7044A-DX8024	<b>Interface</b>
<b>Spread Spectrum Technology</b> FHSS (Frequency Hopping Spread Spectrum)	
<b>Link Timeout</b> Gateway: Configurable Node: Defined by Gateway	



Radio	General
* 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>Indicators: Two bi-color LEDs</p> <p>Buttons: Two</p> <p>Display: Six character LCD</p> <p><b>Wiring Access</b></p> <p>DX80: Four PG-7, One 1/2-inch NPT, One 5-pin Euro-style male connector</p> <p>DX80...C: External terminals</p> <p>DX80...E: Two 1/2-inch NPT</p> <p>* For European applications, power the DX80 from a Limited Power Source as defined in EN 60950-1.</p>

## Inputs

### RTD Inputs

Sample Rate: 1 second  
 Report Rate: 16 seconds  
 Accuracy: 0.1% of full scale  
 Resolution: 0.1° C, 15-bit

## Environmental

### Rating

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

Rating for DX80...E models: IEC IP54; NEMA 4

Operating Temperature for P4 and P4C models: -40 to +85° C (Electronics); -20 to +80° C (LCD)

Operating Temperature for P4E models: -40 to +65° C

Operating Humidity: 95% max. relative (non-condensing)

Radiated Immunity: 10 V/m, 80-2700 MHz (EN61000-6-2)

### Shock and Vibration

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

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.

## Certifications



## 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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