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Find the *Banner Engineering DX80N9X6S-P8* at our website: ***Click HERE***

Sure Cross® Performance Node

Datasheet

The Sure Cross® wireless system is a radio frequency network with integrated I/O that operates in most environments to 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 for 900 MHz models and 65 mW for 2.4 GHz models
- 10 to 30 V 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, updated documentation, and a list of accessories, refer to Banner Engineering's website, *www.bannerengineering.com/wireless*.

WARNING: Not To Be Used for Personnel **Protection**

Never use this device as a sensing device for personnel **protection.** Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

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

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

CAUTION: **Electrostatic** Discharge (ESD)

ESD **Sensitive** Device. This product uses semiconductors that can be damaged by electrostatic discharge (ESD). When performing maintenance, care must be taken so the device is not damaged. Disconnect power from the device when accessing the internal DIP switches. Proper handling procedures include wearing anti-static wrist straps. Damage from inappropriate handling is not covered by warranty.

Models

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.

Configuration Instructions

Setting Up Your Wireless Network

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

Disconnect the power from your Sure Cross devices.

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1. Configure the DIP switches of all devices.
2. If your device has I/O, connect the sensors to the Sure Cross devices. If your device does not have I/O, skip this step.
3. Refer to the wiring diagrams to apply power to all devices.
   - For two LED models, the Gateway's LED 1 is solid green and the Node's LED 2 flashes red to indicate there is no radio link to the Gateway.
   - For one LED models, the Gateway's LED is solid green and the Node's LED flashes red to indicate there is no radio link to the Gateway.
4. Form the wireless network by binding the Nodes to the Gateway. If the binding instructions are not included in the datasheet, refer to the product manual for binding instructions.
5. Observe the LED behavior to verify the devices are communicating with each other.
   - For two LED models, the Gateway's LED 1 is solid green and the Node's LED 1 flashes green to indicate it is communicating with the Gateway.
   - For one LED models, the Gateway's LED is solid green and the Node's LED flashes green to indicate it is communicating with the Gateway.
6. Configure any I/O points to use the sensors connected to the Sure Cross devices.
7. 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.
8. Install your wireless sensor network components. If installation instructions are not included in this datasheet, refer to the product manual for detailed installation instructions.

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

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

Configure the DIP Switches

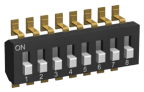
Before changing DIP switch positions, disconnect the power. DIP switch changes are not recognized until after power is cycled to the device.

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

Accessing the Internal DIP Switches

To access the internal DIP switches, follow these steps:

1. Unscrew the four screws that mount the cover to the bottom housing.
2. Remove the cover from the housing without damaging the ribbon cable or the pins the cable plugs into.
3. Gently unplug the ribbon cable from the board mounted into the bottom housing.
4. Remove the black cover plate from the bottom of the device's cover.
   The DIP switches are located behind the rotary dials.



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

DIP Switch **Settings**

* Default configuration

Device **Settings**	DIP Switches	
	1	2
Transmit power level: 1 Watt (30 dBm)	OFF*	
Transmit power level: 250 mW (24 dBm), DX80 compatibility mode	ON	
Modbus or UCT configured (overrides switches 5-8)		OFF*
DIP switch configured (Uses 5-8 for I/O configuration)		ON

When DIP switch 2 is in its default position (OFF), the I/O is set to 6 discrete inputs and 6 discrete outputs, non–bit-packed. DIP switches 5 through 8 are ignored.

For this 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.

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Device **Settings**	DIP Switches			
	5	6	7	8
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
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

For DIP switches 5 through 8 to be recognized, DIP switch 2 must be in the ON position.

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.

Modbus/UCT **Configured** or DIP Switch **Configured** 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 User Configuration Tool (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 transmit at 1 Watt (30 dBm) or 250 mW (24 dBm). While the Performance radios operate in 1 Watt mode, they cannot communicate with the older 150 mW radios. To communicate with 150 mW radios, operate this radio in 250 mW mode. For 2.4 GHz models, this DIP switch is disabled. The transmit power for 2.4 GHz is fixed at about 65 mW EIRP (18 dBm), making the 2.4 GHz Performance models automatically compatible with older 2.4 GHz models.

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.

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 Parameter	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 Parameter	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					1	1	1	1	1	1	1	0	0	0	0	0

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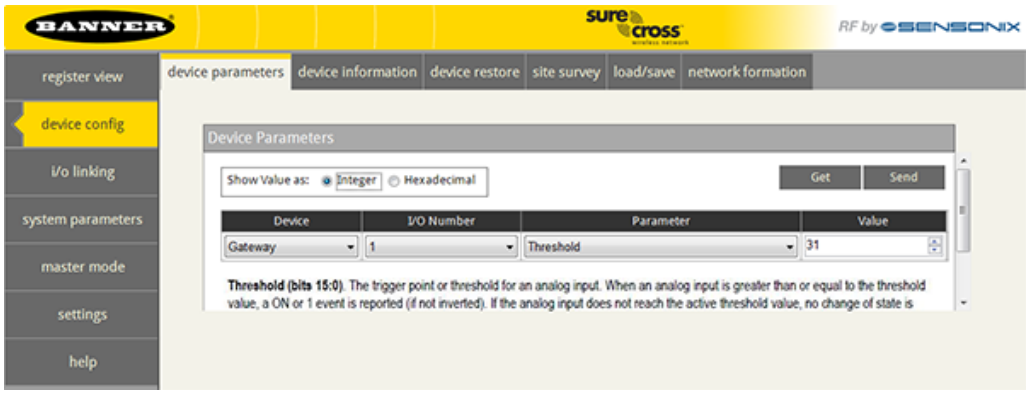
For inputs, the first I/O point selected as an input is placed in bit position 0 in register 1. The second input point is in bit position 1, et cetera. Likewise, for outputs, the first I/O point selected as an output is placed in bit position 0 in register 9, the second input point is in bit position 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

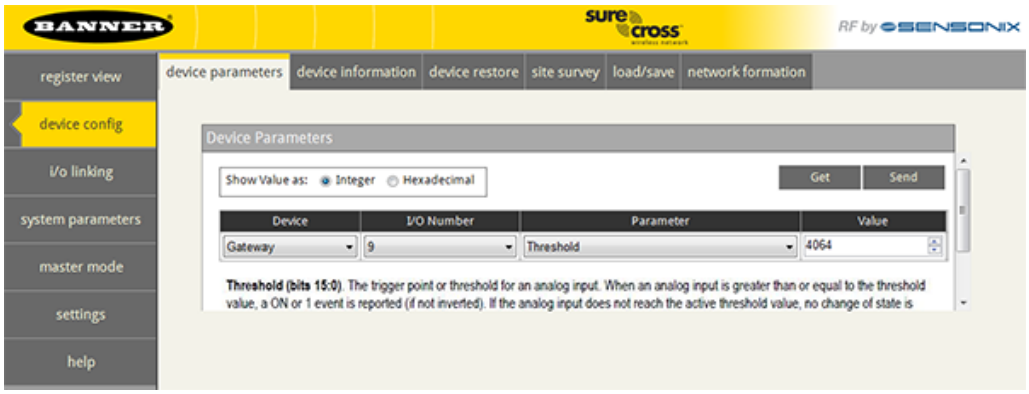
Defining Inputs and Outputs Using the UCT

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



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)



Using Performance and Non-Performance Radios in the Same Network

To comply with federal regulations, the 150 mW radios and 1 Watt radios communicate differently. To mix Performance radios with non-Performance radios:

- Operate Performance radios in 250 mW mode to communicate with non-Performance radios (DIP switch 1 ON)
- Set non-Performance radios to use Extended Address Mode to communicate with Performance radios (DIP switch 1 ON)

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

Wiring Your Sure Cross® Device

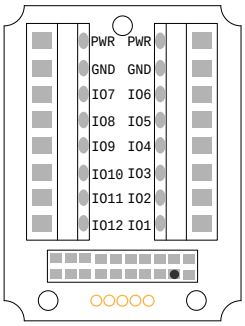
Use the following wiring diagrams to first wire the sensors and then apply power to the Sure Cross devices.

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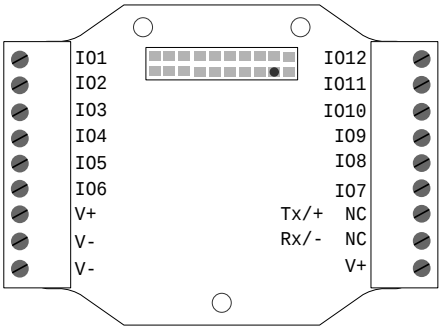
Terminal Blocks and Wiring

Refer to the Class I Division 2/Zone 2 control drawings (p/n *143086*) for wiring specifications or limitations.

IP67 Wiring Board (P8 Models)



IP20 Wiring Board (P8C Models)

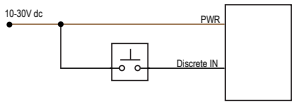


IOx. Input or output (depending on configuration)
GND. Ground/dc common connection
PWR. 10 to 30 V dc power connection
RX/-. Serial communication line for the Gateway. No connection for Nodes
TX/+. Serial communication line for the Gateway; no connection for Nodes
V+. 10 to 30 V dc power connection
V–. Ground/dc common connection

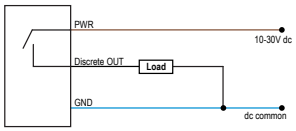
When using the DIP switches to configure the input and output selection, wire the inputs beginning with IO1. After all inputs are wired, begin using the remaining IOx as outputs. For example, if you are using 10 inputs and 2 outputs, use terminals IO1 through IO10 for the inputs and terminals IO11 and IO12 for the outputs.

For the default configuration of 6 IN and 6 OUT, use IO1 through IO6 to wire the inputs and IO7 through IO12 to wire the outputs.

Discrete Input Wiring for PNP Sensors



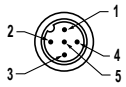
Discrete Output Wiring (PNP)



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

5-Pin M12/Euro-style Male Quick Disconnect

Integral 5-pin M12/Euro-style male quick disconnect (QD) wiring depends on the model and power requirements of the device. Not all models can be powered by 10 to 30 V dc and not all models can be powered by 3.6 to 5.5 V dc. Refer to *Specifications* to verify the power requirements of your device. For *Flex*Power devices, do not apply more than 5.5 V to the gray wire.

5-pin M12/Euro-style (male)	Pin	Wire Color	Powered by 10 to 30 V dc	Powered by **Battery** or **Battery** Pack
	1	Brown	10 to 30 V dc	
	2	White		
	3	Blue	dc common (GND)	dc common (GND)
	4	Black		
	5	Gray		3.6 to 5.5 V dc

DX80...C Wiring

Wiring power to the DX80...C models varies depending the power requirements of the model. Connecting dc power to the communication pins (Tx/Rx) causes permanent damage. For *Flex*Power devices, do not apply more than 5.5 V to the B+ terminal.

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

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LED Behavior for the Nodes

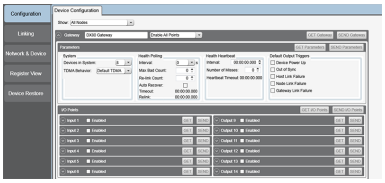
Nodes do not sample inputs until they are communicating with the Gateway. The radios and antennas must be a minimum distance apart to function properly. Recommended minimum distances are:

2.4 GHz 65 mW radios: 1 foot
900 MHz 150 mW and 250 mW radios: 6 feet
900 MHz 1 Watt radios: 15 feet

LED 1	LED 2	Node Status
Flashing green		Radio Link Ok
Flashing red	Flashing red	Device Error
	Flashing red, 1 per 3 sec	No Radio Link

Sure Cross® 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, and set system communication parameters when a host system is not part of the wireless network. The software runs on any computer with the Windows Vista, Windows 7, Windows 8, or Windows 10 operating system.



Use a USB to RS-485 adapter cable to connect a standalone DX80 Gateway to the computer. For DXM Controllers with an internal DX80 radio, connect a computer to the DXM Controller using a USB or Ethernet connection. Download the most recent revisions of the UCT software from Banner Engineering's website: *www.bannerengineering.com/wireless*.

The USB to RS-485 adapter cable is not required for the DXM Controller. For standalone DX80 Gateway devices use:

- USB to RS-485 adapter cable model BWA-UCT-900 for 1 Watt radios
- USB to RS-485 adapter cable model BWA-HW-006 for all other radios

Installing Your Sure Cross® Radios

Please refer to one of the following instruction manuals for details about successfully installing your wireless network components.

- DX80 and Performance Wireless I/O Network Instruction Manual: *132607*

Holding Registers

Modbus Registers		EIP Registers		I/O Type		Holding Register **Representation** (Dec.)	
Gateway / DX85	Node	Node		Bit-Packed	Non Bit-Packed (default **configuration**)	Min.	Max.
1	1 + (Node# × 16)	0 + (Node# × 8)	Instance 100 / N7	Bit-Packed Discrete IN (IO1–IO12)	Discrete IN 1 (IO1)	0	4095
2	2 + (Node# × 16)	1 + (Node# × 8)			Discrete IN 2 (IO2)	0	1
3	3 + (Node# × 16)	2 + (Node# × 8)			Discrete IN 3 (IO3)	0	1
4	4 + (Node# × 16)	3 + (Node# × 8)			Discrete IN 4 (IO4)	0	1
5	5 + (Node# × 16)	4 + (Node# × 8)			Discrete IN 5 (IO5)	0	1
6	6 + (Node# × 16)	5 + (Node# × 8)			Discrete IN 6 (IO6)	0	1
7	7 + (Node# × 16)	6 + (Node# × 8)		Reserved			
8	8 + (Node# × 16)	7 + (Node# × 8)		Device Message			
9	9 + (Node# × 16)	0 + (Node# × 8)	Instance 112 / N14	Bit-Packed Discrete OUT (IO1–IO12)	Discrete OUT 1 (IO7)	0	4095
10	10 + (Node# × 16)	1 + (Node# × 8)			Discrete OUT 2 (IO8)	0	1
11	11 + (Node# × 16)	2 + (Node# × 8)			Discrete OUT 3 (IO9)	0	1
12	12 + (Node# × 16)	3 + (Node# × 8)			Discrete OUT 4 (IO10)	0	1
13	13 + (Node# × 16)	4 + (Node# × 8)			Discrete OUT 5 (IO11)	0	1
14	14 + (Node# × 16)	5 + (Node# × 8)			Discrete OUT 6 (IO12)	0	1
15	15 + (Node# × 16)	6 + (Node# × 8)		Control Message			

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Modbus Registers		EIP Registers		I/O Type		Holding Register **Representation** (Dec.)	
Gateway / DX85	Node	Node		Bit-Packed	Non Bit-Packed (default **configuration)**	Min.	Max.
16	16 + (Node# × 16)	7 + (Node# × 8)		Reserved			

For other non bit-packed configurations, the inputs begin at I/O point 1 and the outputs begin after the last input.

For DIP switches 5 through 8 to be recognized, DIP switch 2 must be in the ON position.

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.

Specifications

Radio Range[1]
900 MHz, 1 Watt: Up to 9.6 km (6 miles)
2.4 GHz, 65 mW: Up to 3.2 km (2 miles)

Minimum **Separation** Distance
900 MHz, 1 Watt: 4.57 m (15 ft)
2.4 GHz, 65 mW: 0.3 m (1 ft)

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

900 MHz Compliance (1 **Watt)**
FCC ID UE3RM1809: This device complies with FCC Part 15, Subpart C, 15.247
IC: 7044A-RM1809

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

Spread Spectrum Technology
FHSS (Frequency Hopping Spread Spectrum)

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

Discrete Inputs
Rating: 3 mA max current at 30 V dc
Sample Rate: 62.5 milliseconds
Report Rate: On change of state
ON Condition (PNP): Greater than 4.5 V
OFF Condition (PNP): Less than 4 V

Operating Conditions[3]
–40 °C to +85 °C (–40 °F to +185 °F) (Electronics); –20 °C to +80 °C (–4 °F to +176 °F) (LCD)
95% maximum relative humidity (non-condensing)
Radiated Immunity: 10 V/m (EN 61000-4-3)

Environmental **Ratings**[4]
DX80 models: IEC IP67; NEMA 6
"C" Housing Models/External wiring terminals: IEC IP20; NEMA 1

Shock and **Vibration**
IEC 68-2-6 and IEC 68-2-27
Shock: 30g, 11 millisecond half sine wave, 18 shocks
Vibration: 0.5 mm p-p, 10 to 60 Hz

Supply Voltage
10 V dc to 30 V dc (Outside the USA: 12 V dc to 24 V dc, ±10%). [2]
900 MHz Consumption: Maximum current draw is < 40 mA and typical current draw is < 30 mA at 24 V dc. (2.4 GHz consumption is less.)

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

Interface
Indicators: Two bi-color LEDs
Buttons: Two
Display: Six character LCD

Wiring Access
DX80 models: Four PG-7, One 1/2-inch NPT, One 5-pin threaded M12/Euro-style male quick disconnect
DX80...C models: External terminals

Antenna **Connection**
Ext. Reverse Polarity SMA, 50 Ohms
Max Tightening Torque: 0.45 N·m (4 lbf·in)

Discrete Outputs
Update Rate: Up to 62.5 milliseconds
ON Condition (PNP): Supply minus 2 V
OFF Condition (PNP): Less than 2 V
Output State Following Timeout: OFF

Discrete Output **Rating** (PNP)
100 mA max current at 30 V dc
ON-State Saturation: Less than 3 V at 100 mA
OFF-state Leakage: Less than 10 µA

Certifications

Certifications for DX8x...C (External Wiring Terminal) and DX8x...E Models

CSA: Class I Division 2 Groups ABCD, Class I Zone 2 AEx/Ex nA II T4 — Certificate: 1921239

ATEX: II 3 G Ex nA IIC T4 Gc (Group IIC Zone 2) — Certificate LCIE 10 ATEX 1012 X

Refer to the Class I Division 2/Zone 2 control drawings (p/n *143086*) for wiring specifications or limitations. All battery-powered devices must only use the lithium battery manufactured by Xeno, model XL-205F.

1 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. Always verify your wireless network's range by performing a Site Survey.
2 For European applications, power this device from a Limited Power Source as defined in EN 60950-1.
3 Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.
4 Refer to the *Sure Cross® Wireless I/O Networks Instruction Manual* (p/n 132607) for installation and waterproofing instructions.

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Warnings

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

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

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