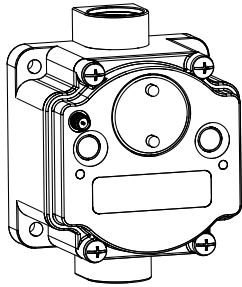


Datasheet

The Sure Cross® 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 one configurable discrete input, one configurable analog input, one thermistor input, one asynchronous counter input, one SDI-12 input, and one switch power output
- Selectable transmit power levels of 250 mW or 1 Watt for 900 MHz models and 65 mW for 2.4 GHz models
- 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
- Field-wireable terminals for wiring I/O

Model	Frequency	Inputs and Outputs	
DX80N9X1S-P14	900 MHz ISM Band	Discrete Mode	Analog Mode
DX80N2X1S-P14	2.4 GHz ISM Band	Inputs: One configurable discrete, one thermistor, one asynchronous counter Switch Power Outputs: One	Inputs: One configurable discrete, one configurable analog, one thermistor, one asynchronous counter Switch Power Outputs: One

This model can be configured to supply continuous power. For more information and detailed instructions, refer to the technical note "[Configuring for Continuous Switch Power or Host Controlled Switch Power](#)," part number b_3099584.

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 Class I Division 1/Zone 0 and Class I Division 2/Zone 2 environments, only a XENO XL-205F battery is certified.



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.



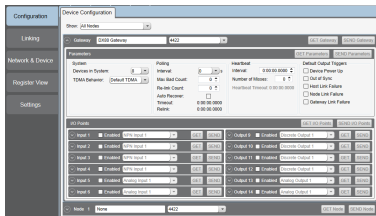
CAUTION: Electrostatic Discharge (ESD)

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.



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 graphically, and set system communication parameters when a host system is not part of the wireless network.



The User Configuration Tool (UCT) software runs on any computer with the 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: <http://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

Setting Up Your Wireless Network

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

Disconnect the power from your Sure Cross devices.

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. 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.
7. 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 making any changes to the DIP switch positions, disconnect the power. DIP switch changes will not be recognized if power isn't cycled to the device.

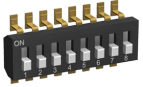
For parameters not set via DIP switches, use the User Configuration Tool (UCT) to make configuration changes. For parameters set using the DIP switches, the DIP switch positions override any changes made using the User Configuration Tool.

Accessing the Internal DIP Switches

To access the internal DIP switches, follow these steps:

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.

- Remove the black cover plate from the bottom of the device's cover.
The DIP switches are located behind the rotary dials.



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

DIP Switch Settings

Device Settings	Switches	
	1	2
Transmit power level: 1 Watt (30 dBm)	OFF*	
Transmit power level: 250 mW (24 dBm), DX80 compatibility mode	ON	
Analog configuration		OFF*
Discrete configuration		ON

* Default configuration

Analog or Discrete Configuration

Select between an analog configuration or a discrete configuration using the DIP switch specified in the table. The default switch settings for this device are all in the OFF position.

Transmit Power Levels

The 900 MHz radios can be operated 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 the older 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.

Analog Configuration (Switch 2 OFF)

Select between an analog configuration or a discrete configuration using DIP switch 2.

For analog configuration, DIP switch 2 is in the OFF position (factory default). The analog configuration pairs the switch power output with the analog input and is programmable using switches four through eight. The discrete input is active in this configuration and its input type is defined using switch 3.

Analog Configuration, Switch 2 OFF	DIP Switches					
	3	4	5	6	7	8
Discrete Sinking (NPN)	OFF*					
Discrete Sourcing (PNP)	ON					
Boost Voltage: 10 V (to Analog IN 1)		OFF*				
Boost Voltage: 15 V (to Analog IN 1)		ON				
Warm-up Time 10 milliseconds			OFF*			
Warm-up Time 500 milliseconds			ON			
Modbus or UCT Configured (Overrides DIP Switches)				OFF	OFF	OFF
Sample/Report Rate 15 minutes				OFF	OFF	ON
Sample/Report Rate 5 minutes				OFF	ON	OFF
Sample/Report Rate 64 seconds				OFF	ON	ON
Sample/Report Rate 16 seconds				ON	OFF	OFF
Sample/Report Rate 4 seconds				ON	OFF	ON
Sample/Report Rate 2 seconds				ON	ON	OFF
Sample/Report Rate 1 second				ON	ON	ON

Discrete Configuration (DIP Switch 2 ON)

The discrete configuration pairs the switch power output with the discrete input. The discrete configuration is selected when switch 2 is in the ON position.

Discrete Configuration, Switch 2 ON	DIP Switches					
	3	4	5	6	7	8
Discrete Sinking (NPN)	OFF*					
Discrete Sourcing (PNP)	ON					
Boost Voltage: 5 V		OFF*				
Boost Voltage: 10 V		ON				
Warm-up Time 4 milliseconds			OFF*			
Warm-up Time 10 milliseconds			ON			
Modbus or UCT Configured (Overrides DIP Switches)				OFF	OFF	OFF
Sample/Report Rate 16 seconds				OFF	OFF	ON
Sample/Report Rate 4 seconds				OFF	ON	OFF
Sample/Report Rate 1 second				OFF	ON	ON
Sample/Report Rate 500 milliseconds				ON	OFF	OFF
Sample/Report Rate 250 milliseconds				ON	OFF	ON
Sample/Report Rate 125 milliseconds				ON	ON	OFF
Sample/Report Rate 62.5 milliseconds				ON	ON	ON

Boost Voltage

The boost voltage is the power supplied by the Node to the sensor.

Discrete Input Type

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

Modbus/User Configuration Tool (UCT) or DIP Switch Configured

In Modbus/UCT Configured mode, the device parameters are changed using the User Configuration Tool (UCT) or a Modbus command. All DIP switch positions are ignored. In DIP Switch Configured mode, use the DIP switches to configure the parameters listed in the table.

Sample and Report Rates

The sample interval, or rate, defines how often the Sure Cross device samples the input. For battery-powered applications, setting a slower rate extends the battery life.

The report rate defines how often the Node communicates the I/O status to the Gateway. Change of state reporting sets the system to report only when the value crosses the threshold setting. For *FlexPower*® applications, setting the report rate to a slower rate extends the battery life.

Warm-Up Time

The warm-up time defines how long the device must power up the sensor before a stable sensor reading is taken.

Wiring Your Sure Cross® Device

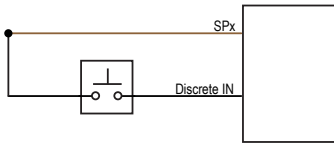
Use the following wiring diagrams to first wire the sensors and then apply power to the Sure Cross devices.

Wiring Diagrams

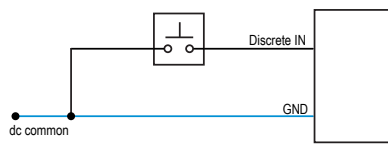
Do not exceed analog input ratings for analog inputs. Only connect sensor outputs to analog inputs.

	Pin	Jumper Position	Description
	1	J1 set to 5	Discrete Input (NPN or PNP)
	1	J1 set to 8	SDI-12 Data
	2		Ground
	3		Switch Power 1 (3.6 to 24 V)
	4	J2 set to C	Analog Current Input (0-20 mA)
	4	J2 set to V	Analog Voltage Input (0-10 V)
	5		Ground
	6	J3 set to 3	Counter Input
	6	J3 set to 4	Thermistor Input

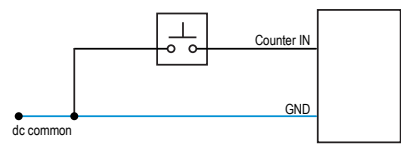
Discrete Input Wiring for PNP Sensors



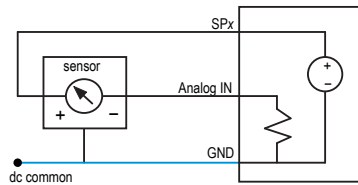
Discrete Input Wiring for NPN Sensors



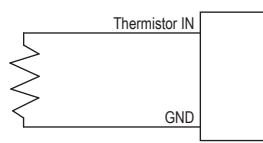
Counter Input Wiring



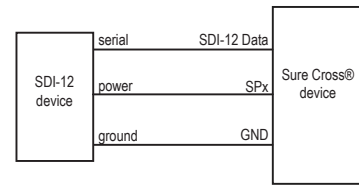
Analog Input Wiring



Thermistor Input Wiring



Input Wiring for SDI-12 Sensors



Switch power 1 (SP1) is active for this device.

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

Modbus Register Table

I/O	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Discrete IN 1	0	1	0	1

I/O	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)
2	2	2 + (Node# × 16)	Analog IN 1 (mA / V)	0.0	20.0 / 10.0	0	65535
3	3	3 + (Node# × 16)	32-bit Event Counter High Word	0	65535	0	65535
4	4	4 + (Node# × 16)	32-bit Event Counter Low Word	0	65535	0	65535
5	5	5 + (Node# × 16)	Thermistor IN 4 (°F/°C)	-1638.3	+1638.4	-32768	32767
6	6	6 + (Node# × 16)					
7	7	7 + (Node# × 16)	Reserved				
8	8	8 + (Node# × 16)	Device Message				
9	9	9 + (Node# × 16)					
		...					
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

The temperature = (Modbus register value) ÷ 20. 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 $-1 \div 20 = -0.05^\circ$ in high resolution mode and $-1 \div 2 = -0.5^\circ$ in low resolution mode.

Storage and Sleep Modes

Storage Mode (applies to battery-powered models only)—While in storage mode, the radio does not operate. All Sure Cross® 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 5 seconds. To put any *FlexPower*® or integrated battery Sure Cross radio into storage mode, press and hold button 1 for 5 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 1 minute before waking it.

Sleep Mode (applies to both battery and 10–30 V dc powered models)—During normal operation, the Sure Cross 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.

Replacing the Integrated Battery (DX80 Models)

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.
2. Remove the discharged battery by pressing the battery toward the negative terminal to compress the spring. Pry up on the battery's positive end to remove from the battery holder.
3. Replace with a new battery. Only use a 3.6 V lithium battery from Xeno, model number XL-205F.
4. Verify the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case. The negative end is toward the spring.
Caution: There is a risk of explosion if the battery is replaced incorrectly.
5. After replacing the battery, allow up to 60 seconds for the device to power up.
6. 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 Range

- 900 MHz, 1 Watt: Up to 9.6 km (6 miles)¹
- 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

Operating Conditions

- 40 °C to +85 °C (-40 °F to +185 °F) (Electronics); -20 °C to +80 °C (-4 °F to +176 °F) (LCD)²
- 95% maximum relative humidity (non-condensing)
- Radiated Immunity: 10 V/m (EN 61000-4-3)

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

Discrete I Input

- Rating: 3 mA max current at 30 V dc
- Sample / Report Rates: DIP switch configurable

Discrete I Input ON Condition

- PNP: Greater than 8 V
- NPN: Less than 0.7 V

Discrete I Input OFF Condition

- PNP: Less than 5 V
- NPN: Greater than 2 V or open

Analog I Inputs

- Rating in 0–20 mA mode: 24 mA
- Rating in 0–10 V mode: 10 V
- Impedance: Approximately 220 Ohms
- Analog Input 1 Sample/Report Rates: DIP switch configurable
- Accuracy: 0.2% of full scale +0.01% per °C
- Resolution: 12-bit

Supply Voltage

- 3.6 V dc low power option from an internal battery

Current Draw at 3.6 V dc

- 900 MHz, 1 Watt: Approximately 1 mA
- 900 MHz, 250 mW: Approximately 0.5 mA
- 2.4 GHz, 65 mW: Approximately 0.3 mA

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)

Antenna Connection

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

Interface

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

Wiring Access

- Two 1/2-inch NPT

Environmental Ratings

- IEC IP67; NEMA 6³

Certifications



Switch Power Outputs

- Analog configuration: one (SP1)
- Discrete configuration: one (SP1)

Thermistor I Input

- Model: 44006, 44016, or 44031 family of 10 kOhm thermistors
- Sample Rate: 16 seconds
- Report Rate: 64 seconds
- Accuracy: 0.4 °C (10 °C to 50 °C); Up to 0.8 °C (-40 °C to 85 °C)

Counter I Input

- Event Counter: Input rating 1 Hz to 10 kHz (For battery powered devices, the recommended input rating is less than 1 kHz)
- Rate (Frequency) Counter: 1 Hz to 25 kHz
- Threshold: 1.7 V

Included with Model

The following items ship with the M-H14 and P14 radios.

- BWA-HW-059: DX80 Access Hardware Kit, containing one 1/2-inch NPT strain relief fitting with o-ring, and one 1/2-inch NPT plastic vent plug.
- 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.
- Quick Start Guide (128185 for DX80 Gateways or 152653 for MultiHop models)
- BWA-BATT-001: Replacement battery, 3.6 V lithium "D" cell

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 Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

³ Refer to the *Sure Cross® Wireless I/O Networks Instruction Manual* (p/n 132607) for installation and waterproofing instructions.

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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