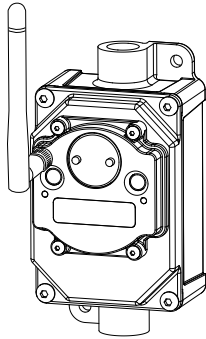


Datasheet

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 two configurable asynchronous counter inputs and four NMOS outputs
- 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



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

Model	Frequency	Inputs and Outputs
DX80N9X1S-P16E	900 MHz ISM Band	Inputs: Two configurable asynchronous counters
DX80N2X1S-P16E	2.4 GHz ISM Band	Outputs: Four NMOS

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.

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.



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.

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

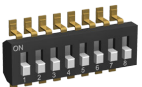
Before changing DIP switch positions, disconnect the power. DIP switch changes are not recognized until after power is cycled to the device.

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

When DIP switch 2 is ON:

- DIP switches 3 through 8 are used; and
- DIP switches 5 and 6 may still be set to ON to use the User Configuration Tool (UCT) to define the sample and report rate.

Device Settings	DIP Switches							
	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							
Modbus or UCT Configured (overrides DIP Switches 3-8)		OFF*						
DIP Switch Configured		ON						
Counter Discrete Value Input Type: NPN			OFF*	OFF*				
Counter Discrete Value Input Type: PNP			OFF	ON				
Counter Discrete Value Input Type: Float, 1 V Threshold			ON	OFF				
Counter Discrete Value Input Type: Float, 300 mV Threshold			ON	ON				
Sample/Report Rate: 64 Seconds					OFF*	OFF*		
Sample/Report Rate: 16 Seconds					OFF	ON		
Sample/Report Rate: 4 Seconds					ON	OFF		
Sample/Report Rate: Modbus or UCT Configured					ON	ON		
Debounce Enabled							OFF*	
Debounce Disabled							ON	
Counter 2 Input Type: Event								OFF*
Counter 2 Input Type: Frequency								ON

* Default configuration

Counter Discrete Value Input Types

Type	Description
NPN	Switch to ground
PNP	Switch to a voltage greater than 10 V
Float, 1 V Threshold	Digital signal above 1 V
Float, 300 mV Threshold	Digital signal above 300 mV

Counter Input Type

Select from the two types of counters:

- Frequency (rate) counter—Calculates the frequency of the input signal, in Hz
- Event counter—Counts the total number of times an input signal changes to the OFF/0 state for NPN input type or ON/1 for PNP or Float input types

The counter values are saved in EEPROM every hour. After power up, the saved value is restored as the beginning count. Setting the counter using the preset or clear functions saves the preset value or zeroes in EEPROM. The counter increments on the falling edge of an input signal when the signal level crosses the threshold.

Debounce

When a signal changes state using a mechanical switch or relay, the signal can oscillate briefly before stabilizing to the new state. The debounce filter examines the signal's transitions to determine the signal's state.

Enable debounce to prevent switch noise. Disable debounce for high frequency signals.

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

In Modbus/UCT Configured mode, use the User Configuration Tool (UCT) or a Modbus command to change the device parameters. DIP switch positions 3 through 8 are ignored. In DIP Switch Configured mode, use the DIP switches to configure the parameters listed in the table.

Sample and Report Rates

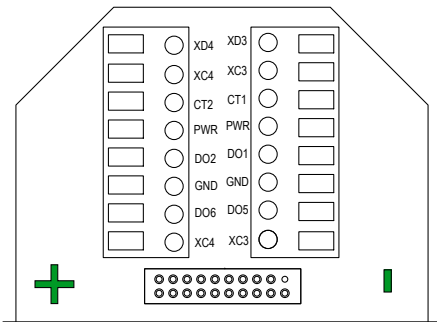
The sample interval, or rate, defines how often the Sure Cross device samples the input. For battery-powered applications, setting a slower rate extends the battery life.

The report rate defines how often the Node communicates the I/O status to the Gateway. For *FlexPower*® applications, setting the report rate to a slower rate extends the battery life.

Transmit Power Levels

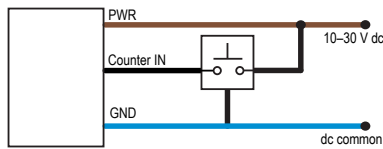
The 900 MHz radios transmit at 1 Watt (30 dBm) or 250 mW (24 dBm). While the Performance radios operate in 1 Watt mode, they cannot communicate with the older 150 mW radios. To communicate with 150 mW radios, operate this radio in 250 mW mode. For 2.4 GHz models, this DIP switch is disabled. The transmit 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.

Wire for Power and I/O

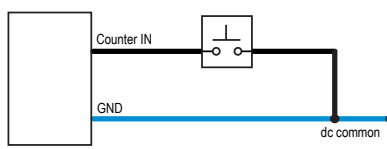


- CT1. Counter input 1
- CT2. Counter input 2
- DO1. NMOS output 1
- DO2. NMOS output 2
- DO5. NMOS output 5
- DO6. NMOS output 6
- PWR. Power for sensors

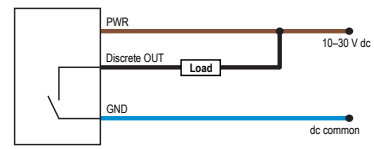
Counter Input Wiring for PNP Sensors



Counter Input Wiring for NPN Sensors



Discrete Output Wiring (NPN or NMOS)



Wiring for DX80...E Radios

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

	Integrated battery (RS-485) for P1E, M-H1E, M-H12E, and P16E Models	Integrated battery (RS-232) for P3E, P4E, M-H3E, and M-H4E Models
	1 10 V dc to 30 V dc (optional)	10 V dc to 30 V 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

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:

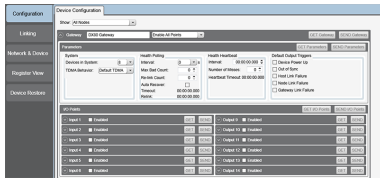
- 2.4 GHz 65 mW radios: 1 foot
- 900 MHz 150 mW and 250 mW radios: 6 feet
- 900 MHz 1 Watt radios: 15 feet

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 User Configuration Tool (UCT) 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

Clearing the Event Counter

When using a host-controlled system, clear the counter by sending a control message on Node register 15. Control messages on Node register 15 are acknowledged with the same value echoed to Node register 7.

1. Write 5121 (0x1401) to clear counter 1.
2. Write 5122 (0x1402) to clear counter 2.
3. Write 5123 (0x1403) to clear counters 1 and 2.

When you are not using a host-controlled system, a transition from 0 to 1 on the Node's output registers is needed to clear the counter. Use this method on Gateway IO mapping to map inputs, such as a push button, to clear counter values.

1. Write output register 13 from 0 to 1 to clear counter 1.
2. Write output register 14 from 0 to 1 to clear counter 2.

Event Counter Presets from a Host-Controlled System

The event counter input can be preset from a host system using Advanced Control Messages. From the host system, each device has allocated Node registers 7, 15, and 16 that send preset data to the event counter. When power is applied to the Node, the counter value is reset to the last saved value. Setting the counter using the preset or clear functions saves the preset value or zeroes.

The event counter input is a 32-bit value that can be preset using the parameter control codes 143 (0x8F) and 144 (0x90). Parameter control code 143 writes the lower half [15:0] of the counter and code 144 writes the upper half [31:16] of the counter.

Defining the Counter Select Mask using the second bit position selects the counter. Set Modbus register 16 to the high or low data value. Read Modbus register 7 for the transfer acknowledgment.

Node Reg 15	143 or 144 (0x8F or 0x90)	Counter Select Mask
Node Reg 16	Low or High Value	
Node Reg 7	Acknowledge Code 143 or 144	Acknowledge Counter Select Mask

Preset the Counter to 20,567,001

To preset the counter to the value 20,567,001 (hex 0139 D3D9), follow these steps:

1. Write the upper word to the counter using control code 144 (0x90).

Node Reg 15	0x90	2
Node Reg 16	0139	
Node Reg 7	0x90	2

2. Write the lower word to the counter using control code 143 (0x8F).

Node Reg 15	0x8F	2
-------------	------	---

Node Reg 16	D3D9	
Node Reg 7	0x8F	2

The counter has been preset to 20,567,001 (0x0139 D3D9).

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

Counter 2 is DIP switch selectable between a rate or an event (default) counter. The rate counter uses I/O 5. The event counter uses I/O 5 and 6.

Modbus Registers		EIP Registers		I/O Type	I/O Range		Holding Register Representation (Dec)	
Gateway	Node	Node			Min.	Max.	Min.	Max.
1	1 + (Node# × 16)	0 + (Node# × 8)	Instance 100 / N7	Counter 1 Discrete Value	0	1	0	1
2	2 + (Node# × 16)	1 + (Node# × 8)		Counter 2 Discrete Value	0	1	0	1
3	3 + (Node# × 16)	2 + (Node# × 8)		Counter 1 High Word	0	65535	0	65535
4	4 + (Node# × 16)	3 + (Node# × 8)		Counter 1 Low Word	0	65535	0	65535
5	5 + (Node# × 16)	4 + (Node# × 8)		Counter 2 High Word / Frequency	0	65535	0	65535
6	6 + (Node# × 16)	5 + (Node# × 8)		Counter 2 Low Word	0	65535	0	65535
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	NMOS OUT 1	0	1	0	1
10	10 + (Node# × 16)	1 + (Node# × 8)		NMOS OUT 2	0	1	0	1
11	11 + (Node# × 16)	2 + (Node# × 8)		NMOS OUT 5	0	1	0	1
12	12 + (Node# × 16)	3 + (Node# × 8)		NMOS OUT 6	0	1	0	1
13	13 + (Node# × 16)	4 + (Node# × 8)		Clear Counter 1	0	1	0	1
14	14 + (Node# × 16)	5 + (Node# × 8)		Clear Counter 2	0	1	0	1
15	15 + (Node# × 16)	6 + (Node# × 8)		Control Message				
16	16 + (Node# × 16)	7 + (Node# × 8)		Reserved				

Replacing the Integrated **Battery** (DX80...E 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. 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.

For outside or high humidity environments, conductive grease may be applied to the battery terminals to prevent moisture and corrosion buildup.

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)

Discrete Input

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

Discrete Input ON Condition

PNP: Greater than 10 V
NPN: Less than 0.7 V

Discrete Input OFF Condition

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

Link Timeout

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

Operating Conditions

-40 °C to +65 °C (-40 °F to +149 °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)

Supply Voltage

10 V dc to 30 V dc (Outside the USA: 12 V dc to 24 V dc, ±10%). with integrated battery backup

Current Draw at 3.6 V dc

900 MHz, 1 Watt: Average Runtime 320 µA
900 MHz, 250 mW: Average Runtime 270 µA
2.4 GHz, 65 mW: Average Runtime 250 µA

Housing

Polycarbonate housing and rotary dial cover; polyester labels; EDPM rubber cover gasket; nitrile rubber, non-sulphur cured button covers
Mounting: 1/4-inch or M7 (SS M7 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

Counter 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 10 kHz
Debounce select will filter the higher frequencies
Thresholds:
PNP/NPN: See Discrete Input Conditions
Float: Selectable (1 V / 300 mV)

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

Environmental Ratings

IEC IP65; NEMA 4X³

Certifications



Included with Device (DX80...E Models)

The following items ship with the DX80...E (NEMA 4) models.

- Mounting hardware kit
- 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)

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.

- BWA-BATT-001: Replacement battery, 3.6 Volt, "D" Lithium Cell
- BWA-HW-032: Access Hardware for "E" Housing (One each of 1/2-inch plug, 1/2-inch gland)

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.

Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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