SureCross DX80 Gateway

Configurable Gateway with 4 discrete inputs and 8 discrete outputs

IP67 Base
2.4 GHz

IP20 Base
900 MHz

For additional information, updated documentation, and accessories, refer to Banner Engineering's website, *www.banner-engineering.com/surecross*.

The SureCross® wireless system is a radio frequency network with integrated I/O that can operate in most environments and eliminate the need for wiring runs. Wireless networks are formed around a Gateway, which acts as the wireless network master device, and one or more Nodes.

- Wireless industrial I/O device with four selectable discrete inputs and eight sourcing discrete outputs
- 10 to 30V dc power input
- DIP switches for user configuration
- Modbus serial interface
- Site Survey analyzes the network's signal strength and reliability and displays the results on the Gateway's LCD
- Frequency Hopping Spread Spectrum (FHSS) technology and Time Division Multiple Access (TDMA) control architecture ensure reliable data delivery within the unlicensed Industrial, Scientific, and Medical (ISM) band
- Transceivers provide bidirectional communication between the Gateway and Node, including fully acknowledged data transmission
- Lost RF links are detected and relevant outputs set to user-defined conditions
- The DX80...C models are certified for use in Class I, Division 2, Group A, B, C, D; Zone 2 (Category 3G) Hazardous Locations when properly installed in accordance with the National Electrical Code, the Canadian Electrical Code, or applicable local codes/regulations (see Specifications)

| Models	Frequency	Environmental Rating	I/O
DX80G9M6S4P8	900 MHz ISM Band	IP67, NEMA 6	**Inputs**: Four selectable discrete **Outputs**: Eight sourcing discrete (When your wireless network does not include a host system, the four input/eight output Gateway must be mapped to the eight input/four output Node.)
DX80G2M6S4P8	2.4 GHz ISM Band		
DX80G9M6S4P8C	900 MHz ISM Band	IP20, NEMA 1 Class I, Division 2, Group A, B, C, D Hazardous Locations (see *Specifications*)	
DX80G2M6S4P8C	2.4 GHz ISM Band		

Internal antenna models are also available, but are not UL Listed. For more information, contact your local Banner Engineering Corp. representative.

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.

The SureCross® DX80 Wireless Network

FlexPower Node
and Battery Supply Module

Gateway

Node

Node
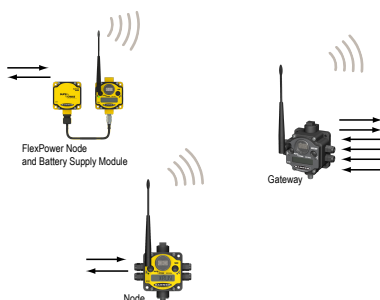
The SureCross® DX80 wireless I/O network provides reliable monitoring without wiring or conduit installation. The SureCross wireless network operates independently or in conjunction with a host system, PLC, and/or PC software.

Each wireless network system consists of one Gateway and one or more Nodes. Devices ship with factory-defined discrete, analog, or a mix of discrete and analog inputs and outputs.

The SureCross® DX80 network is a deterministic system—the network identifies when the radio signal is lost and drives relevant out-

puts to user-defined conditions. After the radio signal is reacquired, the network returns to normal operation.

SureCross® DX80 Gateways and Nodes

A **Gateway** is the master device within each radio network. Every wireless network must have one Gateway, which schedules communication traffic and controls the I/O configuration for the network, and one or more 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. 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.

SureCross User Configuration Tool
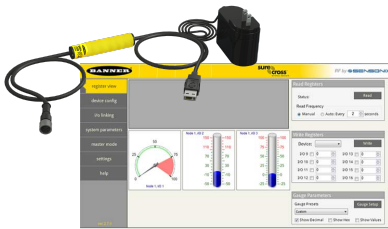
The User Configuration Tool (UCT) offers an easy way to link I/O points in your wireless network, view I/O register values graphically, and set system communication parameters when a host system is not part of the wireless network.

The UCT requires a special USB to RS-485 (model number BWA-UCT-900 for 1 Watt radios, BWA-HW-006 can be used for all other radios) 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 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.
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.

- 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*

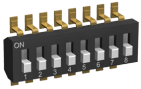## Configuring the DIP Switches

Before making any changes to the DIP switch positions, disconnect the power. 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.
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

Device Settings	Switches							
	1	2	3	4	5	6	7	8
Rotary switch address mode	OFF*							
Extended address mode	ON							
Modbus or UCT configured (overrides DIP switches 3-8)		OFF*						
DIP switch configured		ON						
Inputs sourcing (PNP)			OFF*					
Inputs sinking (NPN)			ON					
Link loss output: zero				OFF*	OFF*			
Link loss output: one				OFF	ON			
Link loss output: hold last state				ON	OFF			
Link loss output: user configuration				ON	ON			

* Default configuration

Address Mode
The SureCross wireless devices may use one of two types of addressing modes: rotary dial addressing or extended addressing. In **rotary dial** address mode, the left rotary dial establishes the network ID and the right rotary dial sets the device ID. The wireless network is restricted to a maximum of 16 devices.

Extended address mode uses a security code to "bind" Nodes to a specific Gateway. Bound Nodes can only send and receive information from the Gateway to which they are bound. In extended address mode, wireless networks may contain up to 48 radio devices. For more information on extended address mode, refer to the SureCross™ Wireless I/O Network product manual.

The device ships in rotary dial address mode by default, with the DIP switch in the OFF position. To use extended address mode, change the DIP switch to the ON position.

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

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

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

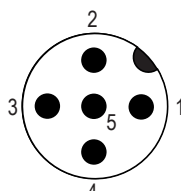**Modbus/User Configuration Tool (UCT) or DIP Switch Configured**

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.

Wiring Your SureCross® Device

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

5-pin Euro-Style Hookup

Wiring the 5-pin Euro-style connector depends on the model and power requirements of the device. Connecting dc power to the communication pins will cause permanent damage.
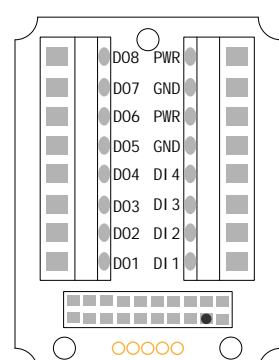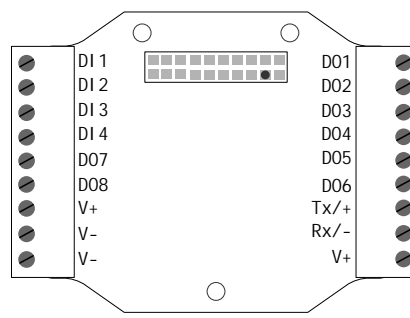

Wire No.	Wire Color	Description
1	Brown	10 to 30V dc
2	White	RS485 / D1 / B / +
3	Blue	dc common (GND)
4	Black	RS485 / D0 / A / –
5	Gray	Comms Gnd

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) will cause permanent damage. For FlexPower devices, do not apply more than 5.5V to the gray wire.
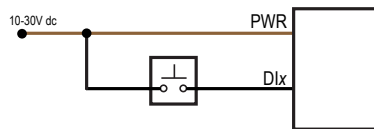
Terminal Label	Gateway, DX85	10 to 30V dc Powered Nodes	Battery Powered Nodes
V+	10 to 30V dc	10 to 30V dc	
Tx/+	RS485 / D1 / B / +		
V-	dc common (GND)	dc common (GND)	dc common (GND)
Rx/-	RS485 / D0 / A / -		
B+			3.6 to 5.5V dc

Terminal Blocks

IP67 Housing	IP20 Housing

DI*x*. Discrete IN *x*.

DO*x*. Discrete OUT *x*.

GND. Ground/dc common connection.

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

RX/-. Serial comms line

TX/+. Serial comms line

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

V-. Ground/dc common connection.

Wiring Diagrams for Discrete Inputs

Connecting dc power to the communication pins will cause permanent damage. For the DX8*x*...C models, PWR in the wiring diagram refers to V+ on the wiring board and GND in the wiring diagram refers to V- on the wiring board.

Discrete Input Wiring for PNP Sensors	Discrete Input Wiring for NPN Sensors
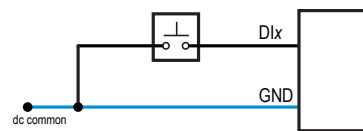
Wiring Diagrams for Discrete Outputs

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

Discrete Output Wiring (PNP)
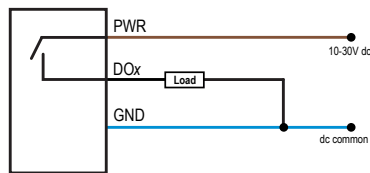
LED Behavior for the Gateways

After powering up and binding the Gateway and its Nodes, verify all devices are communicating properly. When testing communication between the Gateway and Node, all radios and antennas should be at least two meters apart or the communications may fail.

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

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

Modbus Register Table

When your wireless network does not include a host system, the four input/eight output Node must be mapped to the eight input/four output Gateway.

I/O Point	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation		Terminal Block Labels
	Gateway/ DX85	Any Node		Min.	Max.	Min. (Dec.)	Max. (Dec.)	
1	1	1 + (Node# × 16)	Discrete IN 1	0	1	0	1	DI1
2	2	2 + (Node# × 16)	Discrete IN 2	0	1	0	1	DI2
3	3	3 + (Node# × 16)	Discrete IN 3	0	1	0	1	DI3
4	4	4 + (Node# × 16)	Discrete IN 4	0	1	0	1	DI4
	...							

I/O Point	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation		Terminal Block Labels
	Gateway/ DX85	Any Node		Min.	Max.	Min. (Dec.)	Max. (Dec.)	
7	7	7 + (Node# × 16)	Reserved					
8	8	8 + (Node# × 16)	Device Message					
9	9	9 + (Node# × 16)	Discrete OUT 1–8	0	**	0	255	DO1
		...						
15	15	15 + (Node# × 16)	Control Message					
16	16	16 + (Node# × 16)	Reserved					

The lower eight bits of the 16-bit unsigned register represent each of the eight digital outputs. Therefore, if all outputs are OFF (0) the register contains 0x0000; if all outputs are ON (1) the register contains 0x00FF (255).

```
15  14  13  12  11  10  9   8   7   6   5   4   3   2   1   0
┌───┬───┬───┬───┬───┬───┬───┬───┬───┬───┬───┬───┬───┬───┬───┬───┐
│   │   │   │   │   │   │   │   │   │   │   │   │   │   │   │   │
└───┴───┴───┴───┴───┴───┴───┴───┴───┴───┴───┴───┴───┴───┴───┴───┘
                            ↓                       ↓       ↓
                                                        Output 1
                         Output 8              Output 2
```
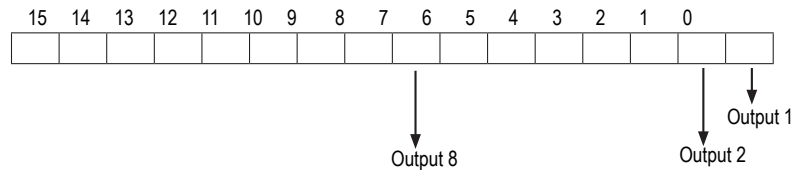
Specifications

Radio and General

Range

900 MHz: Up to 4.8 kilometers (3 miles)

2.4 GHz: Up to 3.2 kilometers (2 miles)

Transmit Power

900 MHz: 21 dBm (150 mW) conducted

2.4 GHz: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP

900 MHz Compliance (150 mW Radios)

FCC ID TGUDX80 - This device complies with FCC Part 15, Subpart C, 15.247

IC: 7044A-DX8009

2.4 GHz Compliance

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

Spread Spectrum Technology

FHSS (Frequency Hopping Spread Spectrum)

Link Timeout

Gateway: Configurable

Node: Defined by Gateway

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. To determine the range of your wireless network, perform a Site Survey.

Power

Requirements: +10 to 30V dc (Outside the USA: +12 to 24V dc, ±10%). (See UL section below for any applicable UL specifications)

Consumption: Less than 1.4 W (60 mA) at 24V dc

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

Four PG-7, One 1/2-inch NPT, One 5-pin Euro-style male connector

For European applications, power the DX80 from a Limited Power Source as defined in EN 60950-1.

Inputs and Outputs	
Discrete Inputs	**Discrete Outputs**
Rating: 3 mA max current at 30V dc	Update Rate: 125 milliseconds
Sample Rate: 62.5 milliseconds	ON Condition: Supply minus 2V
Report Rate: On change of state	OFF Condition: Less than 2V
Discrete Input ON Condition	Output State Following Timeout: OFF
PNP: Greater than 8V	**Discrete Output Rating (PNP)**
NPN: Less than 0.7V	100 mA max current at 30V dc
Discrete Input OFF Condition	ON-State Saturation: Less than 3V at 100 mA
PNP: Less than 5V	OFF-state Leakage: Less than 10 µA
NPN: Greater than 2V or open	

Communication and Environmental	
Hardware (RS-485)	**Rating**
Interface: 2-wire half-duplex RS-485	DX80 Models:IEC IP67; NEMA 6; (See UL section below for any applicable UL specifications)
Baud rates: 9.6k, 19.2k (default), or 38.4k	DX80...C Models: IEC IP20; NEMA 1 (In a suitable enclosure: Class I, Division 2, Group A, B, C, D; T4 −40 to 80 °C)
Data format: 8 data bits, no parity, 1 stop bit	**Operating Environment**
Protocol	Temperature: −40 to +85 °C (Electronics); −20 to +80 °C (LCD)
Modbus RTU	Humidity: 95% max. relative (non-condensing)
Shock and Vibration	Radiated Immunity: 10 V/m, 80-2700 MHz (EN61000-6-2)
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* (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	
DX8x...C (External Wiring Terminal Models)	**UL Listing**
CSA: Class I, Division 2, Groups A, B, C, D (Ex/A Ex nA II T4); Certificate: 1921239	Maximum ambient temperature: 70 °C
	Mounting instructions: See document 132607
LCIE/ATEX: Zone 2 (II 3G / Ex nA IIC); Certificate: LCIE 10 ATEX 1012 X	Power rating: 10 to 30V dc, UL Class 2
	Enclosure environmental rating: UL Type 1
CE	IND. CONT. EQ. 447Y

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-9O2-C (900 MHz) or BWA-2O2-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

Antenna Installations. 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 SureCross® device or any equipment connected to the SureCross device during a thunderstorm.

Exporting SureCross 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 SureCross 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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