

# SureCross DX80 FlexPower Counter Node



more sensors, more solutions

Configurable Node with an integrated battery, 1 selectable counter input, 1 selectable discrete input, and 1 discrete NMOS output



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 one selectable discrete input, one selectable counter input (rate or event; sinking, sourcing, or self-energized), and one NMOS discrete output
- User selectable 10 kHz event counter or 25 kHz rate counter
- FlexPower® technology driven by one lithium primary battery integrated into the housing
- 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 accessories, refer to Banner Engineering's website, [www.bannerengineering.com/surecross](http://www.bannerengineering.com/surecross).

Models	Frequency	Environmental Rating	I/O
DX80N9X1S2A1	900 MHz ISM Band	IP67, NEMA 6	<b>Inputs:</b> One selectable discrete, one selectable counter <b>Outputs:</b> One NMOS sinking discrete
DX80N2X1S2A1	2.4 GHz ISM Band		

Internal antenna models are also available. 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.

## 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.



- 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.
- Observe the LED behavior to verify the devices are communicating with each other.
- 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.
- 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

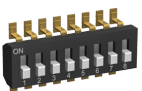
Before making any changes to the DIP switch positions, disconnect the power. DIP switch changes will not be recognized if power isn't cycled to the device. For devices with batteries integrated into the housing, remove the battery for at least one minute.

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:

- Unscrew the four screws that mount the cover to the bottom housing.
- Remove the cover from the housing without damaging the ribbon cable or the pins the cable plugs into.
- Gently unplug the ribbon cable from the board mounted into the bottom housing. For integrated battery models (no ribbon cable) and Class I, Division 2 certified devices (ribbon cable is glued down), skip this step.
- 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 dial address mode	OFF*							
Extended address mode	ON							
Modbus or UCT configured (overrides switches 3-8)		OFF*						
DIP switch configured		ON						
Discrete IN Sinking (NPN)					OFF*			
Discrete IN Sourcing (PNP)					ON			
Counter type: rate (frequency) counter							OFF*	
Counter type: event counter							ON	
Report Rate 16 seconds								OFF*

Switches								
Device Settings	1	2	3	4	5	6	7	8
Report Rate 1 second								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.

**Counter Input Type**

For the selectable counter input, select from the two types of counters: frequency (rate) or event. By default this selectable counter input is defined as a frequency (rate) counter.

The **frequency counter** calculates the frequency of the input signal, in Hz. The **event counter** counts the total number of times an input signal changes to the high/ON/1 state. 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.

**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.

**Report Rate**

The report rate defines how often the device reports inputs to the Gateway. For FlexPower™ applications, setting the report rate/interval to longer intervals extends the battery life.

**DIP Switch Settings - Counter DIP Switches (Integrated Battery Devices)**

The counter input DIP switches define the characteristics of the counter inputs.

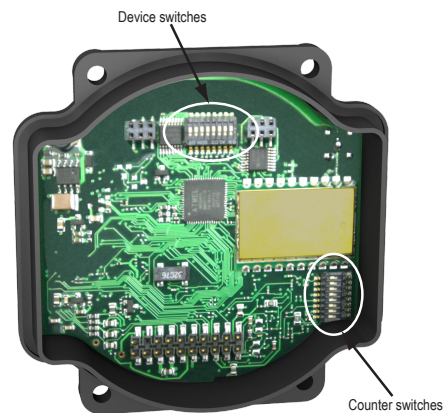
Counter Input 2 DIP Switches				
Device Settings	5	6	7	8
Debounce enabled	OFF*			
Debounce disabled	ON			
Self-energized input (e.g. mag pickup)		OFF*	OFF*	
Enable PNP (sourcing)		OFF	ON	
Enable NPN (sinking)		ON	OFF	
Low threshold (0.25V)				OFF*
High threshold (1.5V)				ON

\* Default configuration

**Debounce.** Debounce establishes how to examine a signal's transitions. The factory default setting is to activate the input filtering to compensate for unclean state transitions. To turn off the input filtering, set the switch to the ON position.

**Inputs.** Counter switches 6 and 7 define the inputs as self-energized, sinking (NPN), or sourcing (PNP). A self-energized input does not require pull-up or pull-down devices for proper operation. A magnetic pick-up is a self-energized input. The input threshold can be adjusted to compensate for low amplitude signals.

**Threshold.** The counter has a selectable input threshold of 0.25V or 1.5V. For sinking (NPN) or sourcing (PNP) inputs, set the threshold to 1.5V.



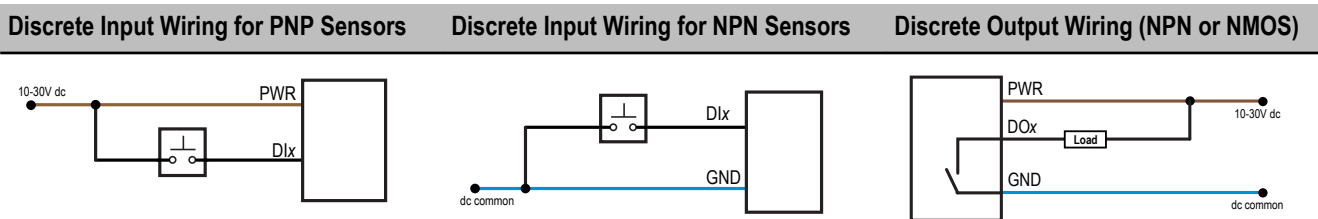
### Storage Mode and Sleep Mode

While in **storage mode**, the radio does not operate. All SureCross® radios powered from an integrated battery ship from the factory in storage mode to conserve the battery. To wake the device, press and hold button 1 for five seconds. To put any FlexPower® or integrated battery SureCross radio into storage mode, press and hold button 1 for five seconds. The radio is in storage mode when the LEDs stop blinking, but in some models, the LCD remains on for an additional minute after the radio enters storage mode. After a device has entered storage mode, you must wait one minute before waking it.

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

### Wiring for Integrated Battery Counter Models

5-Pin M12 Euro-style Connection	Pin #	Description
	1	brown, open (+10 to 30V dc)
	2	white, counter
	3	blue, dc common (GND)
	4	black, NMOS Discrete OUT (DO1)
	5	gray, Discrete IN (DI1)



### LED Behavior for the Nodes

After powering up and binding the Gateway and its Nodes, verify all devices are communicating properly. A Node will not sample its inputs until it is communicating with its Gateway. 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	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 Point	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Nodes		Min.	Max.	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Discrete IN 1	0	1	0	1
		...					
5	5	5 + (Node# × 16)	Rate Count (Hz) or Event Count IN (high word)**	0	65535	0	65535
6	6	6 + (Node# × 16)	Event Count IN (low word)**	0	65535	0	65535
7	7	7 + (Node# × 16)	Reserved				
8	8	8 + (Node# × 16)	Device Message				
9	9	9 + (Node# × 16)	Discrete OUT 1	0	1	0	1
		...					
13	13	13 + (Node# × 16)	Clear Counter	0	1	0	1
14	14	14 + (Node# × 16)					
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

\*\* DIP switch selectable between rate (default) and event counter. The rate counter uses I/O 5; the event counter uses I/O 5 and 6.

### Event Counter Presets (Integrated Battery Models)

The event counter input can be preset from the Node menu system or from a host system using Advanced Control Messages. The LCD menu system on the Node allows the user to preset event counter values on each available counter input. 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. The counter value is saved every hour.

Setting the counter using the preset or clear functions saves the preset value or zeroes in EEPROM.

#### Host Control Counter Preset

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 acknowledgement.

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

Example: 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

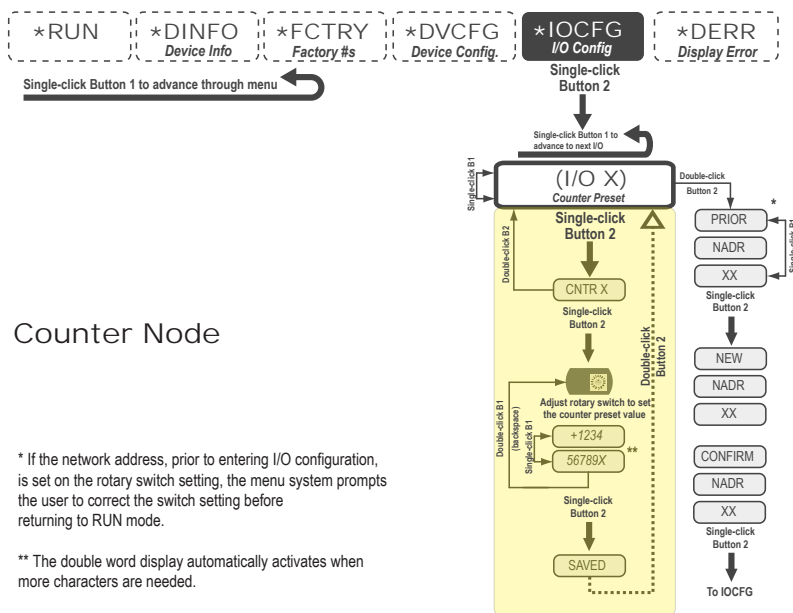
The counter has been preset to 20,567,001 (0x0139 D3D9)

### Preset Using the Node's Menu System

To manually enter a counter preset, follow the LCD menu flow using the diagram shown.

1. Single click button 1 to move across the top level menus. Click button 1 until the display shows IOCFG.
2. Click button 2 to enter the I/O Configuration submenu structure.
3. Single click button 1 to move across the I/O points. Single click button 2 to enter the preset configuration for the desired I/O point. I/O 5 is the event counter or the rate counter, depending on the DIP switch configuration.
4. The screen displays the counter number. Single click button 2 to move down the menu structure.
5. Use the right rotary switch to begin setting the counter preset. Digit selection begins with the least significant digit (the right-most digit). After selecting the least significant digit of the counter preset, single click button 1 to advance left to the next significant digit.
6. Use the right rotary switch to select the second digit. Single click button 1 to advance to the next digit.
7. When the counter preset has been entered, single click button 2 to save the value. The second screen of counter preset digits displays only when more than four digits are necessary. The preset counter may be set from zero to 4,000,000,000.
8. Double click button 2 to exit this menu. If you try to leave this menu without resetting the rotary switch back to its network address position, the menu system prompts you to correct the switch setting before returning to RUN mode. The prior network address setting displays.
9. Single click button 2 to enter the new network address. The new address is confirmed.
10. Single click button 2 to save the network address and return to the IOCFG menu and RUN mode.

### Counter Node Menu Structure



### Clearing the Event Counter (Integrated Battery Models)

The counter Nodes can clear the counter values from a mapped input signal or from a host system writing to a Modbus register. For example, a push button on a Gateway can be mapped to Node register 13 to clear the counter when the button is pressed. Setting the counter using the preset or clear functions saves the preset value or zeroes in EEPROM.

### 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 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. The negative end is toward the spring. 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.



When removing the battery, press the battery towards the negative terminal to compress the spring. Pry up on the battery's positive end to remove from the battery holder. 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 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 conducted
- 2.4 GHz: 18 dBm conducted, less than or equal to 20 dBm 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: 3.6V dc low power option from an internal battery
- 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: 0.30 kg (0.65 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

- 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

### Counter Inputs

Threshold: 1.5V or 0.25V (Sinking or sourcing selected inputs require the 1.5V threshold setting)  
 Debouce: DIP Switch Selectable. Enable debounce to filter a noisy input signal that may lead to false triggers.  
 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 (sinking counter on Performance and Multi-Hop models) : 1.7V

### Discrete Inputs

One, selectable  
 Rating: 3 mA max current at 30V dc  
 Sample/Report Rates: 125 milliseconds

### Discrete Input ON Condition

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

### Discrete Input OFF Condition

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

### Discrete Outputs

Update Rate: 1 second  
 ON Condition: Less than 0.7V  
 OFF Condition: Open  
 Output State Following Timeout: OFF

### Discrete Output Rating (NMOS)

Less than 10 mA max current at 30V dc  
 ON-State Saturation: Less than 0.7V at 20 mA

## Environmental and Certifications

### Rating

IEC IP67; NEMA 6; (See UL section below for any applicable UL specifications)

### Operating Conditions

Operating Temperature: -40 to +85 °C (Electronics);  
 -20 to +80 °C (LCD)  
 Operating Humidity: 95% max. relative (non-condensing)  
 Radiated Immunity: 10 V/m, 80-2700 MHz  
 (EN61000-6-2)

### Shock and Vibration

IEC 68-2-6 and IEC 68-2-7  
 Shock: 30g, 11 millisecond half sine wave, 18 shocks  
 Vibration: 0.5 mm p-p, 10 to 60 Hz



Refer to the [SureCross DX80 Wireless I/O Network Product Manual](#) (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.

### Included with Device (Integrated Battery)

- 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-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)

## 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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