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 industrial I/O device with two selectable discrete inputs, two NMOS discrete outputs, and two thermistor inputs when configured for discrete mode; two selectable discrete inputs, two NMOS discrete outputs, two analog inputs, and two thermistor inputs when configured for analog mode; switch power outputs in each mode
- Selectable transmit power levels of 250 mW or 1 Watt for 900 MHz models and 65 mW for 2.4 GHz models
- FlexPower® power options allow for 10 V DC to 30 V DC, solar, and battery power sources for low power applications
- DIP switches for user configuration
- Frequency Hopping Spread Spectrum (FHSS) technology ensures 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

**Important:** Please download the complete Performance Gateway or Node technical documentation, available in multiple languages, from www.bannerengineering.com for details on the proper use, applications, Warnings, and installation instructions of this device.

**WARNING:**
- Do not use this device for personnel protection
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

**Important:**
- Never operate a 1 Watt radio without connecting an antenna
- Operating 1 Watt radios without an antenna connected will damage the radio circuitry.
- To avoid damaging the radio circuitry, never apply power to a Sure Cross® Performance or Sure Cross MultiHop (1 Watt) radio without an antenna connected.

**Important:**
- Electrostatic discharge (ESD) sensitive device
- ESD can damage the device. Damage from inappropriate handling is not covered by warranty.
- Use proper handling procedures to prevent ESD damage. Proper handling procedures include leaving devices in their anti-static packaging until ready for use; wearing anti-static wrist straps; and assembling units on a grounded, static-dissipative surface.

### Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Freq.</th>
<th>Power</th>
<th>Housing</th>
<th>Inputs and Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX80N9X2S-P1</td>
<td>900 MHz ISM Band</td>
<td>10 V DC to 30 V DC or battery supply module</td>
<td>IEC IP67; NEMA 6</td>
<td>Discrete Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Inputs: Two selectable discrete and two</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>thermistor</td>
</tr>
<tr>
<td>DX80N8X1S-P1E</td>
<td>10 V DC to 30 V DC or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>integrated battery</td>
<td></td>
<td></td>
<td>Switch Power: Two</td>
</tr>
<tr>
<td>DX80N2X2S-P1</td>
<td>2.4 GHz ISM Band</td>
<td>10 V DC to 30 V DC or battery supply module</td>
<td>IEC IP67; NEMA 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Outputs: Two NMOS/sinking discrete</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Switch Power: One</td>
</tr>
<tr>
<td>DX80N2X1S-P1E</td>
<td>10 V DC to 30 V DC or</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>integrated battery</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Important:** 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.
DX80...C (IP20; NEMA 1) models are also available. To order this model with an IP20 housing, add a C to the end of the model number: DX80N9X2S-P1C.

To order an integrated battery model without the battery, add a -NB to the model number. If you purchase a model without the battery, Banner Engineering recommends battery mode BWA-BATT-001. For Class I Division 1/Zone 0 and Class I Division 2/Zone 2 environments, only battery BWA-BATT-001 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.

1. Disconnect the power from your Sure Cross devices.
2. Configure the DIP switches of all devices.
3. 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.
4. Refer to the wiring diagrams to apply power to all devices.
   - For housed 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 board-level 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.
5. 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.
6. Observe the LED behavior to verify the devices are communicating with each other.
   - For housed 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 board-level models, the Gateway’s LED is solid green and the Node’s LED flashes green to indicate it is communicating with the Gateway.
7. Configure any I/O points to use the sensors connected to the Sure Cross devices.
8. 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.
9. 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 (p/n 126185)
- Sure Cross® Wireless I/O Network Instruction Manual (p/n 132607)

#### Configure the DIP Switches

Before changing DIP switch positions, disconnect the power. For devices with batteries integrated into the housing, remove the battery(ies) for at least one minute to reboot the device. You may also triple-click button 2, then double-click button 2 to reset the device without removing the battery. Any changes made to the DIP switches are not recognized until after power is cycled to the device.

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

#### Access the Internal DIP Switches

Follow these steps to access the internal DIP switches.

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. For integrated battery models (no ribbon cable), C housing models (ribbon cable is glued down), and Class I, Division 2 certified devices (ribbon cable is glued down), skip this step.
4. Remove the black cover plate from the bottom of the device’s cover.
   - The DIP switches are located behind the rotary dials.
5. Make the necessary changes to the DIP switches.
6. Place the black cover plate back into position and gently push into place.
7. If necessary, plug the ribbon cable in after verifying that the blocked hole lines up with the missing pin.
8. Mount the cover back onto the housing.
DIP Switch Settings

<table>
<thead>
<tr>
<th>Device Settings</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmit power level: 1 Watt (30 dBm)</td>
<td>OFF*</td>
<td></td>
</tr>
<tr>
<td>Transmit power level: 250 mW (24 dBm), DX80 compatibility mode</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>Analog configuration</td>
<td>OFF*</td>
<td></td>
</tr>
<tr>
<td>Discrete configuration</td>
<td>ON</td>
<td></td>
</tr>
</tbody>
</table>

* 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 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.

DIP Switch Settings for 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). Analog configuration has analog IN 1 linked to switch power 1 (SP1) and is programmable using switches four through eight. Sample and report rates for analog input 2 (not available in the integrated battery model) are listed in the specifications. Discrete inputs 1 and 2 are also active in this configuration and the input types are defined using switch 3. Two sinking discrete outputs are active for this configuration.

<table>
<thead>
<tr>
<th>Analog Configuration, Switch 2 OFF</th>
<th>DIP Switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptions</td>
<td>3</td>
</tr>
<tr>
<td>Discrete Sinking (NPN)</td>
<td>OFF*</td>
</tr>
<tr>
<td>Discrete Sourcing (PNP)</td>
<td>ON</td>
</tr>
<tr>
<td>Boost Voltage: 10V (to Analog IN 1)</td>
<td>OFF*</td>
</tr>
<tr>
<td>Boost Voltage: 15V (to Analog IN 1)</td>
<td>ON</td>
</tr>
<tr>
<td>Warm-up Time 10 milliseconds</td>
<td>OFF*</td>
</tr>
<tr>
<td>Warm-up Time 500 milliseconds</td>
<td>ON</td>
</tr>
<tr>
<td>Sample/Report Rate 1 second</td>
<td>OFF</td>
</tr>
<tr>
<td>Sample/Report Rate 2 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>Sample/Report Rate 4 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>Sample/Report Rate 16 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>Sample/Report Rate 64 seconds</td>
<td>ON</td>
</tr>
<tr>
<td>Sample/Report Rate 5 minutes</td>
<td>ON</td>
</tr>
<tr>
<td>Modbus or UCT configured (overrides DIP switches)</td>
<td>ON</td>
</tr>
<tr>
<td>Sample/Report Rate 15 minutes</td>
<td>ON</td>
</tr>
</tbody>
</table>

Analog IN 2 (not available in integrated battery model), Discrete 1, and Discrete 2 are not powered from switched power terminals. In this configuration, SP2 is disabled. If you need SP2, contact the factory.

DIP Switch Settings for Discrete Configuration (DIP Switch 2 ON)
The discrete configuration matches the switch power outputs (SP1, SP2) with the discrete inputs. The discrete configuration is selected when switch 2 is in the ON position. Two sinking discrete outputs are active for this configuration.

<table>
<thead>
<tr>
<th>Discrete Configuration, Switch 2 ON</th>
<th>DIP Switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptions</td>
<td>3</td>
</tr>
<tr>
<td>Discrete Sinking (NPN)</td>
<td>OFF*</td>
</tr>
<tr>
<td>Discrete Sourcing (PNP)</td>
<td>ON</td>
</tr>
<tr>
<td>Boost Voltage: 5V</td>
<td>OFF*</td>
</tr>
<tr>
<td>Boost Voltage: 10V</td>
<td>ON</td>
</tr>
<tr>
<td>Warm-up Time 4 milliseconds</td>
<td>OFF*</td>
</tr>
<tr>
<td>Warm-up Time 10 milliseconds</td>
<td>ON</td>
</tr>
<tr>
<td>Sample/Report Rate 62.5 milliseconds</td>
<td>OFF</td>
</tr>
<tr>
<td>Sample/Report Rate 125 milliseconds</td>
<td>OFF</td>
</tr>
<tr>
<td>Sample/Report Rate 250 milliseconds</td>
<td>OFF</td>
</tr>
<tr>
<td>Sample/Report Rate 500 milliseconds</td>
<td>OFF</td>
</tr>
<tr>
<td>Sample/Report Rate 1 second</td>
<td>ON</td>
</tr>
</tbody>
</table>
Discrete Configuration, Switch 2 ON

<table>
<thead>
<tr>
<th>DIP Switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
</tr>
<tr>
<td>Sample/Report Rate 2 seconds</td>
</tr>
<tr>
<td>Modbus or UCT configured (overrides DIP switches)</td>
</tr>
<tr>
<td>Sample/Report Rate 16 seconds</td>
</tr>
</tbody>
</table>

Discrete IN 1 uses switched power 1 (SP1). Discrete IN 2 uses switched power 2 (SP2).

Sensor Switched Power Voltage

The sensor switched power 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/Software or DIP Switch Configured

In Modbus/Software Configured mode, use the User Configuration Software 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.

Warm-Up Time

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

Mixing Performance and Non-Performance (150 mW) Radios in the Same Network

To comply with federal regulations, the 150 mW radios and 1 Watt radios communicate differently. All Performance models offer the ability to select between 250 mW and 1 Watt operation using the DIP switches. To mix Performance radios with non-Performance radios, refer to the product datasheet and:

- Operate Performance radios in 250 mW mode, not 1 Watt mode
- Set non-Performance (150 mW) radios to use Extended Address Mode

The 150 mW, 250 mW, and 1 Watt networks operate when collocated, but verify the antenna separation distance between a Gateway and Node or between two Gateways is at least 10 feet apart. For more detailed instructions about setting up your wireless network, refer to the following documents:

- DX80 Performance Quick Start Guide (p/n 128185)
- DX80 Performance Wireless I/O Network Instruction Manual (p/n 132607)

Wire Your Sure Cross® Device

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

Assign Power to the Node

Integral 5-pin M12/Euro-style male quick disconnect wiring depends on the model and power requirements of the device. Not all models can be powered by 10 to 30 V DC and not all models can be powered by 3.6 to 5.5 V DC. Refer to Specifications on p. 8 to verify the power requirements of your device. For FlexPower devices, do not apply more than 5.5 V to the gray wire.

<table>
<thead>
<tr>
<th>5-pin M12/Euro-style (male)</th>
<th>Pin</th>
<th>Wire Color</th>
<th>Nodes Powered by 10 to 30 V DC</th>
<th>Nodes Powered by Battery or Battery Pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>10 to 30 V DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>White</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
<td>DC common (GND)</td>
<td>DC common (GND)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Black</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Gray</td>
<td>3.6 to 5.5 V DC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Wiring Boards

These are the wiring board for the DX80**M6S-P1, -P1C, and -P1E models. Refer to the Class I Division 2/Zone 2 control drawings (p/n 143086) for wiring specifications and limitations.
DX80...C Wiring

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

<table>
<thead>
<tr>
<th>Terminal Label</th>
<th>Gateway and DX80</th>
<th>10 to 30 V DC Powered Nodes</th>
<th>Battery Powered Nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>V+</td>
<td>10 V DC to 30 V DC</td>
<td>10 V DC to 30 V DC</td>
<td></td>
</tr>
<tr>
<td>Tx/Rx</td>
<td>RS485 / D1 / B / +</td>
<td>DC common (GND)</td>
<td></td>
</tr>
<tr>
<td>V–</td>
<td>DC common (GND)</td>
<td>DC common (GND)</td>
<td></td>
</tr>
<tr>
<td>Rx/–</td>
<td>RS485 / D0 / A / -</td>
<td>DC common (GND)</td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>3.6 to 5.5 V DC</td>
<td>3.6 to 5.5 V DC</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Integrated battery (RS-485) for P1E, M-H1E, M-H12E, and P16E Models</th>
<th>Integrated battery (RS-232) for P3E, P4E, M-H3E, and M-H4E Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 10 V DC to 30 V DC (optional)</td>
<td>10 V DC to 30 V DC (optional)</td>
</tr>
<tr>
<td>2 RS-485 / D1 / B / +</td>
<td>RS-232 Tx</td>
</tr>
<tr>
<td>3 dc common (GND)</td>
<td>dc common (GND)</td>
</tr>
<tr>
<td>4 RS-485 / D0 / A / -</td>
<td>RS-232 Rx</td>
</tr>
</tbody>
</table>

Wiring Diagrams

Connecting power to the communication pins will cause permanent damage. Do not exceed analog input ratings for analog inputs. Only connect sensor outputs to analog inputs.

**Discrete Input Wiring for PNP Sensors**

**Discrete Input Wiring for NPN Sensors**

**Analog Input Wiring (10–30 V DC Power)**

To power the sensor using the switch power output (SPx), replace the PWR with SPx in these wiring diagrams.

**Thermistor Input Wiring**

**Discrete Output Wiring (NPN or NMOS)**

Use AX1 or AX2 for the thermistor input wiring.
Configure the Universal Analog IO by Setting Jumpers

For models with universal analog configuration jumpers, by default, the analog input jumpers are set to use current (0–20 mA). To use the voltage (0–10 V) analog input, follow these steps.

![Diagram of jumpers](image)

1. Disconnect the power from the device.
2. Open the housing and access the wiring board.
3. Move the jumper for the desired analog input (shown are analog 2 and analog 4) from the C position (shown) to the V position. For the board models with two pins instead of three, remove the jumper to select 0–10 V configuration.
4. Close the housing and reconnect the power.
5. With the Gateway connected to your computer, launch the User Configuration Software.
6. From the Device > Configuration Settings menu, select Comm Port and click Connect.
7. Go to the Configuration > Device Configuration screen.
8. Click the arrow next to the Node number to view its parameters.
9. Click GET Node.
10. From the Units drop-down list, select 0–10V.
11. Click SEND to send the changes to this Node’s configuration back to the Gateway.

Configure the Universal Analog I/O by Cutting Resistors

For models without the analog configuration jumpers, you must remove the installed resistors to configure inputs to use 0 to 10 V instead of 0 to 20 mA. For example, to make analog input 1 a 0 to 10 V input, follow these instructions.

![Diagram of resistor cutting](image)

Remove resistor in A1 slot to make Analog IN 1 a 0–10V input.

1. Cut out the resistor installed in the A1 (analog 1) slot.
2. Launch the User Configuration Software.
3. After connecting to your network, go to the Configuration > Device Configuration screen.
4. Click on the arrow next to your device. For this example, we’re using Node 1.
5. The inputs and outputs for Node 1 display.
6. Click GET Node to download the existing configuration for your Node.
7. The existing configuration for your Node is downloaded and loaded into the software.
8. For the input or output you are configuring, click on the arrow next to the I/O point. For this example, we’re configuring Input 1.

Note that a 220 ohm 0.1% resistor must be installed for a 0 to 20 mA input. Remove the resistor to configure the input as a 0 to 10 V input.

1. Cut out the resistor installed in the A1 (analog 1) slot.
2. Your wiring board may differ slightly from the board shown. Use the board’s labels to confirm you have selected the correct resistor to cut.
3. Launch the User Configuration Software.
4. After connecting to your network, go to the Configuration > Device Configuration screen.
5. Click on the arrow next to your device. For this example, we’re using Node 1.
6. The inputs and outputs for Node 1 display.
7. Click GET Node to download the existing configuration for your Node.
8. The existing configuration for your Node is downloaded and loaded into the software.
9. For the input or output you are configuring, click on the arrow next to the I/O point. For this example, we’re configuring Input 1.
The I/O point’s parameters display.

7. Verify the I/O point is enabled, then from the Units drop-down list, select 0-10V.
8. Click **SEND Node** for the Node you configured.

The configuration changes are uploaded back to your network.

**LED Behavior for the Gateways**

Verify all devices are communicating properly. The radios and antennas must be a minimum distance apart to function properly. Recommended minimum distances are:

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

<table>
<thead>
<tr>
<th>LED 1</th>
<th>LED 2</th>
<th>Gateway Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid green</td>
<td></td>
<td>Power ON</td>
</tr>
<tr>
<td>Flashing red</td>
<td>Flashing red</td>
<td>Device Error</td>
</tr>
<tr>
<td>Flashing amber</td>
<td>Flashing red</td>
<td>Modbus Communication Active</td>
</tr>
<tr>
<td></td>
<td>Flashing red</td>
<td>Modbus Communication Error</td>
</tr>
</tbody>
</table>

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).

**Sure Cross® User Configuration Software**

The User Configuration Software offers an easy way to link I/O points in your wireless network, view I/O register values, and set system communication parameters when a host system is not part of the wireless network. The software runs on any computer with the Windows Vista, Windows 7, Windows 8, or Windows 10 operating system.

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

**Installing Your Sure Cross® Radios**

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

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

**Holding Registers**

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 ÷ 20 = −0.05° in high resolution mode and −1 ÷ 2 = −0.5° in low resolution mode.

<table>
<thead>
<tr>
<th>Modbus Registers</th>
<th>EIP Registers</th>
<th>I/O Type</th>
<th>I/O Range</th>
<th>Holding Register Representation (Dec.)</th>
<th>Terminal Labels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gateway</td>
<td>Node</td>
<td>Instance 100 / N7</td>
<td>Min.</td>
<td>Max.</td>
<td>Min.</td>
</tr>
<tr>
<td>1</td>
<td>1 + (Node# × 16)</td>
<td>0 + (Node# × 8)</td>
<td>Discrete IN 1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2 + (Node# × 16)</td>
<td>1 + (Node# × 8)</td>
<td>Discrete IN 2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Gateway</td>
<td>Node</td>
<td>I/O Type</td>
<td>I/O Range</td>
<td>Holding Register Representation (Dec.)</td>
<td>Terminal Labels</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
<td>----------</td>
<td>-----------</td>
<td>----------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>3</td>
<td>3 + (Node# × 16)</td>
<td>2 + (Node# × 8)</td>
<td>Analog IN 1 (mA or V)</td>
<td>0.0</td>
<td>20.0 / 10.0</td>
</tr>
<tr>
<td>4</td>
<td>4 + (Node# × 16)</td>
<td>3 + (Node# × 8)</td>
<td>Analog IN 2 (mA or V)</td>
<td>-1638.3</td>
<td>+1638.4</td>
</tr>
<tr>
<td>5</td>
<td>5 + (Node# × 16)</td>
<td>4 + (Node# × 8)</td>
<td>Thermistor IN 1 (°F/°C)</td>
<td>Reserved</td>
<td>Reserved</td>
</tr>
<tr>
<td>6</td>
<td>6 + (Node# × 16)</td>
<td>5 + (Node# × 8)</td>
<td>Thermistor IN 2 (°F/°C)</td>
<td>Reserved</td>
<td>Reserved</td>
</tr>
<tr>
<td>7</td>
<td>7 + (Node# × 16)</td>
<td>6 + (Node# × 8)</td>
<td>Analog IN 3</td>
<td>0</td>
<td>20.0 / 10.0</td>
</tr>
<tr>
<td>8</td>
<td>8 + (Node# × 16)</td>
<td>7 + (Node# × 8)</td>
<td>Analog IN 4</td>
<td>0</td>
<td>20.0 / 10.0</td>
</tr>
<tr>
<td>9</td>
<td>9 + (Node# × 16)</td>
<td>0 + (Node# × 8)</td>
<td>Device Message</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>10 + (Node# × 16)</td>
<td>1 + (Node# × 8)</td>
<td>Device Message</td>
<td>0</td>
<td>1</td>
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<tr>
<td>...</td>
<td>Instance 112 / N14</td>
<td>Instance 112 / N14</td>
<td>Control Message</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>15 + (Node# × 16)</td>
<td>6 + (Node# × 8)</td>
<td>Device Message</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>16 + (Node# × 16)</td>
<td>7 + (Node# × 8)</td>
<td>Device Message</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Install or Replace the Battery on a DX80E Model**

To replace the lithium “D” cell battery or batteries in any DX80E model with the battery integrated into the housing, 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 or batteries.
3. Install the new battery or batteries.
4. Verify the positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case.
5. Allow up to 60 seconds for the device to power up.
6. Properly dispose of used batteries 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.

**CAUTION:** There is a risk of explosion if the battery is replaced incorrectly.

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

For non-hazardous locations, the replacement battery is model BWA-BATT-011. For non-hazardous or hazardous locations, the replacement battery is Xeno model XL-205F, Banner model BWA-BATT-001. For pricing and availability, contact Banner Engineering.

**Specifications**

**Performance Radio Specifications**

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

- **Antenna 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; 36 dBm EIRP
  - 2.4 GHz, 65 mW: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP

- **Spread Spectrum Technology**
  - FHSS (Frequency Hopping Spread Spectrum)

- **900 MHz Compliance (1 Watt)**
  - FCC ID UE3RM1809: FCC Part 15, Subpart C, 15.247
  - IC: 7044A-RM1809
  - IFT: RCPBARM13-2283

- **2.4 GHz Compliance**
  - FCC ID UE300DX80-2400: FCC Part 15, Subpart C, 15.247
  - IC: 7044A-DX8024

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

- **Link Timeout**
  - Gateway: Configurable via User Configuration Software
  - Node: Defined by Gateway

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*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.*
Environmental Specifications

Operating Conditions
-40 °C to +85 °C (–40 °F to +185 °F) (Electronics); –20 °C to +80 °C (–4 °F to +176 °F) (LCD)
95% maximum relative humidity (non-condensing)
Shock and Vibration
All models meet IEC 60068-2-6 and IEC 60068-2-27 testing criteria
Shock: 30G 11 ms duration, half sine wave per IEC 60068-2-27
Vibration: 10 Hz to 55 Hz, 0.5 mm peak-to-peak amplitude per IEC 60068-2-6

Environmental Ratings
IEC IP67; NEMA 6
Refer to the Sure Cross® Wireless I/O Networks Instruction 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.

Environmental Specifications for the C Housings

Operating Conditions
-40 °C to +85 °C (–40 °F to +185 °F) (Electronics); –20 °C to +80 °C (–4 °F to +176 °F) (LCD)
95% maximum relative humidity (non-condensing)
Shock and Vibration
All models meet IEC 60068-2-6 and IEC 60068-2-27 testing criteria
Shock: 30G 11 ms duration, half sine wave per IEC 60068-2-27
Vibration: 10 Hz to 55 Hz, 0.5 mm peak-to-peak amplitude per IEC 60068-2-6

Environmental Ratings
“C” Housing Models/External wiring terminals: IEC IP20; NEMA 1
Refer to the Sure Cross® Wireless I/O Networks Instruction 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.

Environmental Specifications for the E Housing

Operating Conditions
-40 °C to +85 °C (–40 °F to +185 °F) (Electronics); –20 °C to +80 °C (–4 °F to +176 °F) (LCD)
95% maximum relative humidity (non-condensing)
Shock and Vibration
All models meet IEC 60068-2-6 and IEC 60068-2-27 testing criteria
Shock: 30G 11 ms duration, half sine wave per IEC 60068-2-27
Vibration: 10 Hz to 55 Hz, 0.5 mm peak-to-peak amplitude per IEC 60068-2-6

Environmental Ratings
IEC IP66
Refer to the Sure Cross® Wireless I/O Networks Instruction 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.

Specifications for the P1 Node

Supply Voltage
DX80 and “C” Housing Models: 10 V DC to 30 V DC or 3.6 V DC to 5.5 V DC low power option
Outside the USA: 12 V DC to 24 V DC, ±10% or 3.6 V DC to 5.5 V DC (LCD)
95% maximum relative humidity (non-condensing)
Shock and Vibration
All models meet IEC 60068-2-6 and IEC 60068-2-27 testing criteria
Shock: 30G 11 ms duration, half sine wave per IEC 60068-2-27
Vibration: 10 Hz to 55 Hz, 0.5 mm peak-to-peak amplitude per IEC 60068-2-6

Current Draw at 24 V dc
Approximately 4 mA
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

Interface
Two bi-color LED indicators, Two buttons, Six character LCD

Wiring Access
DX80 Models: Four PG-7, One 1/2-inch NPT, One 5-pin threaded M12/Euro-style male quick disconnect
“C” Housing Models: External terminals
“E” Housing Models: Two 1/2-inch NPT

Discrete Output Rating (Performance NMOS)
Less than 1 A max current at 30 V DC
ON-State Saturation: Less than 0.7 V at 20 mA

Discrete Output Update Rate: 1 second
ON Condition: Less than 0.7 V
OFF Condition: Open
Output State Following Timeout: De-energized (OFF)

Switch Power Outputs
Analog configuration: one (SP1)
Discrete configuration: two (SP1 and SP2)
Host configuration: up to four

Thermistor Input
Model: Omega’s 44006 or 44031 family of 10 kOhm thermistors
Sample Rate: 1 second
Report Rate: 16 seconds
Accuracy: 0.4 °C (10 °C to 50 °C); Up to 0.8 °C (<–40 °C to 85 °C)

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

- CE
- NOM
- NYCE (NOM approval only applies to 900 MHz models

For European applications, power this device from a Limited Power Source as defined in EN 60950-1.
Accessories

Mounting Brackets

**BWA-BK-020**
- Includes two 80-lb pull rare-earth magnet mounts and two #10-32 x 1 inch screw mounts
- Used on multiple mounting brackets
- 31.75 mm (1.25 inch) diameter

Thermistor Probes

**BWA-THERMISTOR-PROBE-001**
- Temperature sensor with thermistor PS103G2
- Beta Value(K) 0–50°C: 3575
- Base thermistor accuracy of 0.2%
- Operating Temperature Range: -20 °C to +105 °C
- Maximum Power Rating: 30 mW at 25 °C; derated to 1 mW at 125 °C
- Dissipation Constant: 1 mW/°C
- Plated nickel finish; PVC insulation

Included with the DX80 and DX80...C Models
- **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-202-C (2.4 GHz)**: Antenna, 2 dBi Omni, Rubber Swivel RP-SMA Male. (Not included with Internal antenna 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)
- Product datasheet and product family Quick Start Guide (128185 for DX80 Gateways or 152653 for MultiHop models)

Included with the DX80...E Models
- Mounting hardware kit
- **BWA-HW-003**: PTFE tape
- **BWA-9O2-C (900 MHz) or BWA-202-C (2.4 GHz)**: Antenna, 2 dBi Omni, Rubber Swivel RP-SMA Male. (Not included with Internal antenna models)
- **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)
- Product datasheet and product family Quick Start Guide (128185 for DX80 Gateways or 152653 for MultiHop models)

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 loop connections with 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. The Sure Cross wireless products were certified for use in these countries using the antennas that ship with the product. When using other antennas, verify you are not exceeding the transmit power levels allowed by local governing agencies. This device has been designed to operate with the antennas listed on Banner Engineering’s website and having a maximum gain of 9 dBm. Antennas not included in this list or having a gain greater than 9 dBm are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen such that the equivalent isotropically radiated power (EIRP) is not more than that permitted for successful communication. 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.

This Limited Warranty is exclusive and in lieu of all other warranties whether express or implied (including, without limitation, any warranty of merchantability or fitness for a particular purpose), and whether arising under course of performance, course of dealing or trade usage.

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp. Any misuse, abuse, or improper application or installation of this product or use of the product for personal protection applications when the product is identified as not intended for such purposes will void the product warranty. Any modifications to this product without prior express approval by Banner Engineering Corp will void the product warranties. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. Specifications and product information in English supersede that which is provided in any other language. For the most recent version of any documentation, refer to: www.bannerengineering.com.

For patent information, see www.bannerengineering.com/patents.

Notas Adicionales

Información México: La operación de este equipo está sujeta a las siguientes dos condiciones: 1) es posible que este equipo o dispositivo no cause interferencia perjudicial y 2) este equipo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

Banner es una marca registrada de Banner Engineering Corp. y podrán ser utilizadas de manera indistinta para referirse al fabricante. "Este equipo ha sido diseñado para operar con las antenas tipo Omnidireccional para una ganancia máxima de antena de 6 dBi y Yagi para una ganancia máxima de antena 10 dBi que en seguida se enlistan. También se incluyen aquellas con aprobación ATEX tipo Omnidireccional siempre que no excedan una ganancia máxima de antena de 6dBi. El uso con este equipo de antenas no incluidas en esta lista o que tengan una ganancia mayor que 6 dBd en tipo omnidireccional y 10 dBd en tipo Yagi, quedan prohibidas. La impedancia requerida de la antena es de 50 ohms."

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<tr>
<th>Antenas SMA</th>
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<th>Antenas Tipo-N</th>
<th>Modelo</th>
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<tr>
<td>Antena, Omni 902-928 MHz, 2 dBi, junta de caucho, RP-SMA Macho</td>
<td>BWA-9O2-C</td>
<td>Antena, Omni 902-928 MHz, 6 dBi, fibra de vidrio, 1800mm, N Hembra</td>
<td>BWA-9O6-A</td>
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<td>Antena, Yagi, 900 MHz, 10 dBi, N Hembra</td>
<td>BWA-9Y10-A</td>
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</table>

Mexican Importer

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