

Datasheet

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. DX99 wireless networks are formed around a Gateway, which acts as the wireless network master device, and one or more Intrinsically Safe Nodes.



- Wireless industrial I/O device with either one RS-485 input and boost voltage, or two analog inputs and boost voltage
- 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
- DX99 Metal housings are certified for use in Class I, Division 1, Groups A, B, C, D; Class II, Division 1, Groups E, F, G; Class III, Division 1; and Zone 0 (Category 1G) and Zone 20 (Category 1D) when properly installed in accordance with the National Electrical Code, the Canadian Electrical Code, or applicable local codes/regulations

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

Models	Frequency	Boost Voltage	I/O
DX99N9X1S1S0V2X0D4	900 MHz ISM Band	13 V	Inputs (Modbus Mode): One RS-485
DX99N2X1S1S0V2X0D4	2.4 GHz ISM Band		Inputs (Voltage Mode): Two analog

Internal antenna models are also available. To order an internal antenna model, replace the "S" with a "W". For example, DX99N9X1W1S0V2X0D4 is the internal antenna version of the 900 MHz, 13V Boost Voltage model.

These models ship with the battery disconnected. To install the battery, refer to the DX99 Battery Replacement instructions in this datasheet.



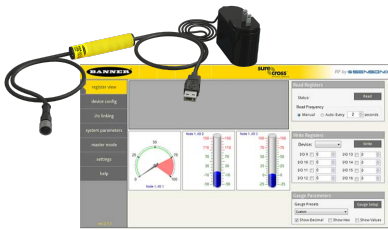
WARNING: Not To Be Used for Personnel Protection

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) software runs on any Windows machine and uses a converter cable to connect your Gateway to the computer.



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. Download the most recent revisions of the UCT software from Banner Engineering's website: <http://www.bannerengineering.com/wireless>.

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.

Setting Up Your Wireless Network

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

Disconnect the power from your SureCross devices.

1. Configure the DIP switches of all devices.
2. Connect the sensors to the SureCross devices.
3. Apply power to all devices.
 - For two LED models, the Gateway's LED 1 is solid green and the Node's LED 2 flashes red to indicate there is no radio link to the Gateway.
 - For one LED models, the Gateway's LED is solid green and the Node's LED flashes red to indicate there is no radio link to the Gateway.
4. Form the wireless network by binding the Nodes to the Gateway. If the binding instructions are not included in the datasheet, refer to the product manual for binding instructions.
5. Observe the LED behavior to verify the devices are communicating with each other.
 - For two LED models, the Gateway's LED 1 is solid green and the Node's LED 1 flashes green to indicate it is communicating with the Gateway.
 - For one LED models, the Gateway's LED is solid green and the Node's LED flashes green to indicate it is communicating with the Gateway.
6. Conduct a site survey between the Gateway and Nodes. If the site survey instructions are not included in this datasheet, refer to the product manual for detailed site survey instructions.
7. Install your wireless sensor network components. If installation instructions are not included in this datasheet, refer to the product manual for detailed installation instructions.

For additional information, including installation and setup, weatherproofing, device menu maps, troubleshooting, and a list of accessories, refer to one of the following product manuals.

- SureCross Wireless I/O Network Instruction Manual: [132607](#)
- Web Configurator Instruction Manual (used with "Pro" and DX83 models): [134421](#)
- Host Controller Systems Instruction Manual: [132114](#)

Configure the DIP Switches

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

Accessing the DIP Switches (Metal Housing)

The DIP switches are located behind the rotary dials. Mount the radio cover back onto the pins attached to the screw terminal board.

To access the DIP switches, follow these steps:

1. Unscrew and remove the top of the DX99 metal housing. The top section is the section with the glass window.
2. Pull the radio cover section off the screw terminal board base. The radio cover is held to the screw terminal board using two pins.

DIP Switch Settings (RS-485 Boost)

* 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 (NID) and the right rotary dial sets the device address. 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 they are bound to.

DIP Switches	
1	Device Settings
OFF *	Rotary dial address mode
ON	Extended address mode

Modbus/UCT Configuration or DIP Switch Configuration Mode

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.

DIP Switches	
2	Device Settings
OFF *	Modbus or UCT configured (overrides DIP switches)
ON	DIP switch configured

Modbus or Voltage Input Mode

When operating in Modbus mode, this DX99 device is configured to work with the Siemens Tank Monitoring Level Sensor, Model 2100. When operating in Modbus input configuration mode, DIP switches 4 and 5 are ignored.

To use other sensors, configure this device to operate in voltage input mode. While operating in voltage input mode, use DIP switches 4 and 5 to configure the voltage range for your inputs and the number of inputs available.

DIP Switches			
3	4	5	Device Settings
OFF *			Modbus input configuration mode
ON			Voltage input mode
	OFF *		0–10V inputs
	ON		0–5V inputs
		OFF *	One voltage input
		ON	Two voltage inputs

Warm-Up Time and Sample/Report Rate

The warm-up time defines how long the device must power up the sensor before a stable sensor reading is taken. The sample/report rate defines how often the sensor is sampled and the values transmitted to the Gateway.

DIP Switches			
6	7	8	Device Settings
OFF *	OFF *	OFF *	10 ms warm-up every 250 ms (sample/report rate)
OFF	OFF	ON	10 ms warm-up every 1 second (sample/report rate)

DIP Switches			
6	7	8	Device Settings
OFF	ON	OFF	10 ms warm-up every 4 seconds (sample/report rate)
OFF	ON	ON	250 ms warm-up every 4 seconds (sample/report rate)
ON	OFF	OFF	10 ms warm-up every 16 seconds (sample/report rate)

Modbus Register Table for Modbus Input Mode

This model is designed to work with Siemens Tank Monitoring Level Sensor, Model 2100. The registers listed in this table are specific to that sensor. If a Modbus timeout is detected, I/O points 1 through 5 are set to 65535.

I/O	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min.	Max.	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Float 1, Reg 43991	0	65535	0	65535
2	2	2 + (Node# × 16)	Float 2, Reg 43992	0	65535	0	65535
3	3	3 + (Node# × 16)	Temperature, Reg 43997	0	65535	0	65535
4	4	4 + (Node# × 16)	Error, Reg 44006	0	65535	0	65535
5	5	5 + (Node# × 16)	Warning, Reg 44007	0	65535	0	65535
6	6	6 + (Node# × 16)					
7	7	7 + (Node# × 16)	Reserved				
8	8	8 + (Node# × 16)	Device Message				
		...					
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

Modbus Register Table for Voltage Input Mode

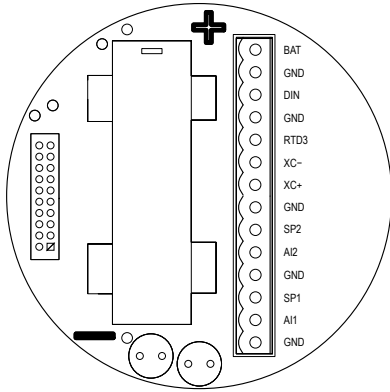
I/O	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min.	Max.	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Analog IN 1	0	65535*	0	65535 *
2	2	2 + (Node# × 16)	Analog IN 2	0	65535 *	0	65535 *
		...					
7	7	7 + (Node# × 16)	Reserved				
8	8	8 + (Node# × 16)	Device Message				
		...					
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

* When using the 0–5V analog scale, the minimum and maximum register values are represented by 0 (0.00 Volts) to 32786 (5.00 Volts).

Terminal Blocks and Wiring

Wiring Diagrams. For CSA C/US and LCIE/ATEX approved wiring procedures and to check the Entity Parameters (Safety Parameters), refer to the complete control drawing, document [141513](#) at www.bannerengineering.com. In the control drawings, this device is the RS-485 Vin model.

DX99..D Terminal Block



- AIx or Ax. Analog IN x
- BAT. Internal battery connection
- DIx. Discrete IN x
- GND. Ground/dc common connection
- SPx. Switch Power; provides variable power sources for external devices
- XC- and XC+. RS-485 connection. See Control Drawings.

The GND connection can be considered the same as the housing ground when using a stainless steel antenna feedthrough (model BWA-HW-016 or BWA-HW-017). When the stainless steel antenna feedthroughs are not used, the GND connection is isolated from the metal housing.

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 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

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 5 seconds. To put any FlexPower® or integrated battery SureCross 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.

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.

Assembly

Follow these steps to assemble your DX99..D Metal Housing with Dome Antenna model. The DX99 unit ships as a complete unit, including the radio core, housing, and integrated battery. One terminal header is also included in the shipment. To unpack and wire the unit:

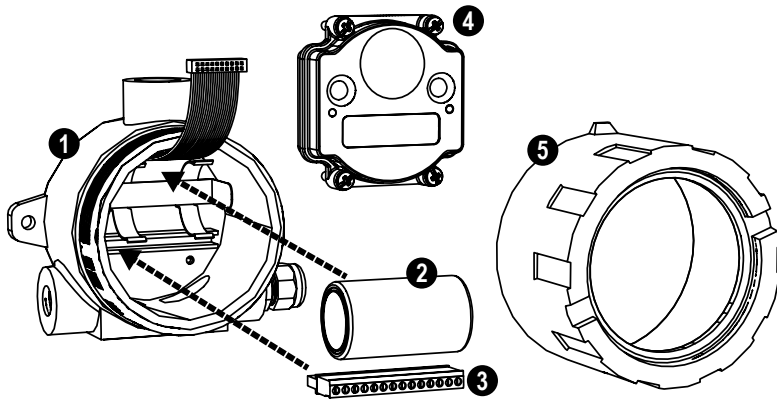


Figure 1. Installing the Battery and Terminal Header

Step 1. Open the end with the glass window (5) and gently lift the radio core unit (4) and the space frame it sits on up. The core unit connects to the space frame using two pins and the radio core is connected to the wiring board with a ribbon cable.

Step 2. Disconnect the ribbon cable from the radio.

Step 3. Insert the battery (2) into the battery holder, verifying the position and negative poles of the battery are positioned according to the markings on the board.

Step 4. Install the terminal header (3) onto the terminal pins.

Step 5. Insert your sensor wires through a cable gland and one of the two 1/2-inch NPT ports. Wire the sensor wires into the terminal header (3) according to the control drawings, p/n 141513. Use a cable gland certified for your region and environment. For a waterproof seal, refer to the waterproofing instructions in Banner document 132607.

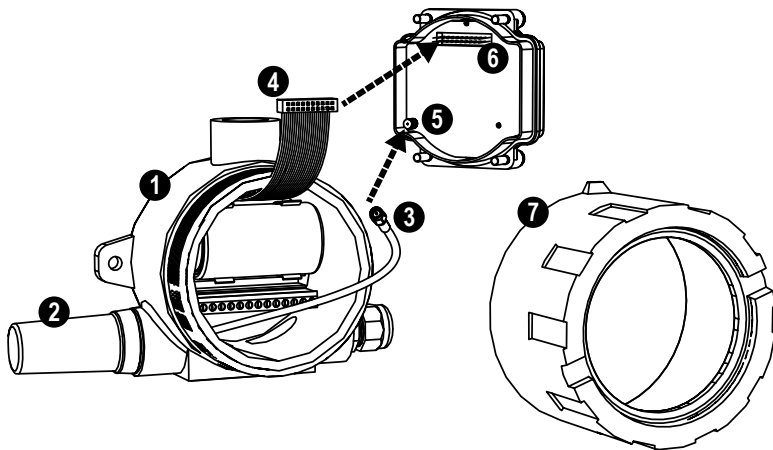


Figure 2. Installing and Connecting the Antenna

Step 6. To install the dome antenna (2), thread the antenna cable through the 1/2-inch NPT port and screw the dome antenna to the 1/2-inch NPT port.

Step 7. Connect the antenna cable (3) to the radio unit's antenna connector (5). (You may need to separate the space frame from the radio to do this.)

Step 8. Gently install the ribbon cable (4) into the ribbon cable pins (6), verifying the ribbon cable is seated on both rows of pins.

Step 9. Reconnect the space frame (not shown) to the radio core unit.

Step 10. Place the radio unit into the housing and gently push down until the spacer frame pin holes rest on the edge of the metal housing.

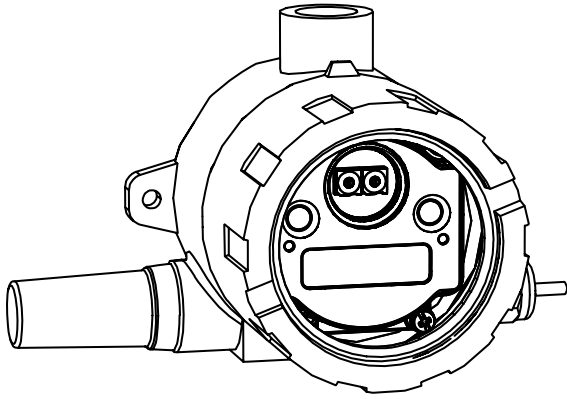


Figure 3. Final Assembly

Step 11. Close the metal cover firmly and lock closed using the set screw.

Replacing the Battery (DX99...D Models)

To replace the lithium "D" cell battery in the metal housings, follow these steps.

1. Unscrew the lid of the metal enclosure.
2. Disconnect the radio by unplugging the ribbon cable from the radio board.
The radio board is mounted inside the metal lid.
3. Remove the discharged battery by pressing the battery towards the negative terminal to compress the spring. Pry up on the battery's positive end to remove from the battery holder.
4. Replace with a new battery. Only use a 3.6 V lithium battery from Xeno, model number XL-205F.
5. 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.
6. Wait two minutes.
7. Plug the ribbon cable back into the radio board.
8. Screw on the lid and tighten.
9. After replacing the battery, allow up to 60 seconds for the device to power up.
10. 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.

The battery may be replaced in explosive gas atmospheres. Replacement battery model number: BWA-BATT-001. For pricing and availability, contact Banner Engineering.

Battery Replacement Warnings



WARNING:

- Do not replace battery when an explosive dust atmosphere may be present.
- The replacement battery **MUST** be a Banner approved battery, model number BWA-BATT-001. Use of a different battery will **VOID** the intrinsic safety rating of this device and may result in an explosion!
- When replacing the battery, the negative end of the battery holder is the side with the spring terminal. This side is marked with a minus (–) sign.
- Do not attempt to recharge the battery. These batteries are not rechargeable. Recharging may cause serious injury to personnel or damage the equipment. Replace only with factory recommended batteries.

Specifications

Radio Range¹

900 MHz, 150 mW: Up to 4.8 km (3 miles)
2.4 GHz, 65 mW: Up to 3.2 km (2 miles)

Minimum Separation Distance

900 MHz (150 mW): 2 m (6 ft)
2.4 GHz (65 mW): 0.3 m (1 ft)

Transmit Power

900 MHz, 150 mW: 21 dBm (150 mW) conducted
2.4 GHz, 65 mW: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP

900 MHz Compliance (150 mW)

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)

RS-485 Inputs

Interface: 2-wire half-duplex RS-485
Baud Rates: 9.6k, 19.2k (default), or 38.4k
Data Format: 8 data bits, no parity, 1 stop bit (even and odd parity selection are available)

Siemens Tank Monitoring Level Sensor Inputs

Float 1, Float 2, and Temp Sample Rate: 2 minutes
Float 1, Float 2, and Temp Report Rate: 2 minutes
Float 1, Float 2, and Temp Warmup Time: 250 ms
Error and Warning Sample Rate: 15 minutes
Error and Warning Report Rate: 15 minutes
Error and Warning Warmup Time: 250 ms

Analog Inputs

Rating for 0-10V inputs: 10 V
Rating for 0-5V inputs: 5V
Sample Rate: 250 milliseconds
Report Rate: 250 milliseconds
Accuracy: 0.1% of full scale +0.01% per °C
Resolution: 15-bit

The RS-485 inputs were designed to be used with Siemens Tank Monitoring Level Sensor, model 2100.

Supply Voltage

3.6 V dc low power option from an internal battery

Power Consumption

Consumption: Application dependant

Housing

Glass and cast aluminium w/ chromating and chemically resistant paint (outside only)

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 ports, one 3/4-inch NPT port (internal threads)

Environmental Rating

IEC IP68²

Operating Conditions³

–40 °C to +65 °C (–40 °F to +149 °F) (Electronics); –20 °C to +80 °C (–4 °F to +176 °F) (LCD)
95% maximum relative humidity (non-condensing)
Radiated Immunity: 10 V/m, 80-2700 MHz (EN61000-6-2)

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

Certifications



CSA: Class I, Division 1, Groups A, B, C, D; Class II, Division 1, Groups E, F, G; Class III, Division 1 (Ex ia IIC T4 / AEx ia IIC T4)
Certificate: 2008243



LCIE/ATEX: Zone 0 (Category 1G) and 20 (Category 1D),
Temperature Class T4 (II 1 GD / Ex ia IIC T4 / Ex iaD 20 IP68 T82°C)
Certificate: LCIE 08 ATEX 6098 X

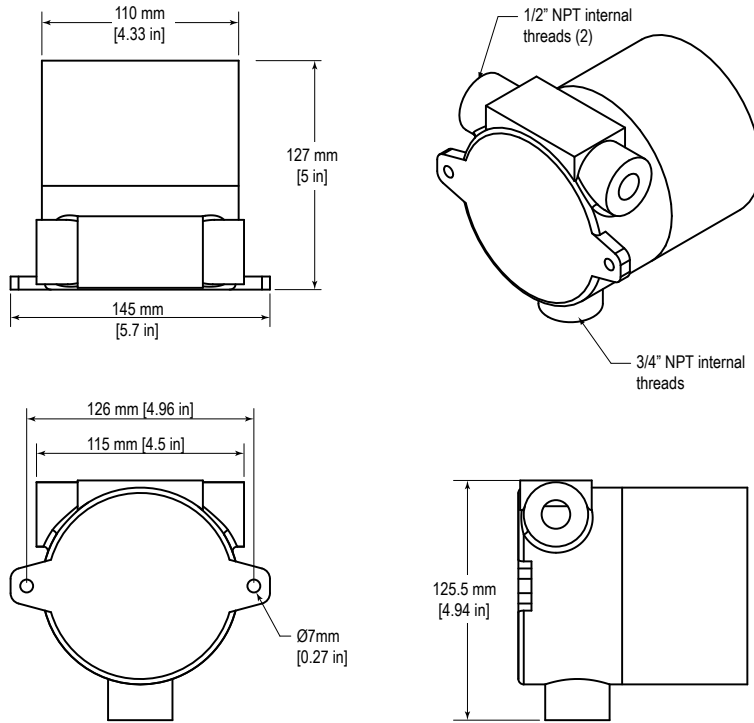
Special Conditions for Safe Use imposed by Intrinsic Safety Certificate LCIE 08 ATEX 6098 X: Ambient temperature range is –40 to 70 °C. SureCross® DX99 FlexPower devices can only be connected to Intrinsically Safe certified equipment or simple apparatus as defined by EN 60079-11. All connected equipment must comply with the Entity Parameters (Safety Parameters) listed in the [Control Drawings](#) (p/n 141513). The device must only use a lithium battery manufactured by XENO, type XL-205F.

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

² Refer to the [SureCross Wireless I/O Networks Instruction Manual](#) (p/n 132607) for installation and waterproofing instructions.

³ Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

Metal Housing Dimensions



Included with Device (Metal Housing with Dome Antenna)

	Model	Qty	Item
Dome Antenna	BWA-9O2-001, or BWA-2O2-001	1	Dome Antenna, 902-928 MHz, 2 dBd Omni, 1/2-inch NPT, 18" cable, or Dome Antenna, 2.4 GHz, 2 dBd Omni, 1/2-inch NPT, 18" cable
BWA-HW-024	14547	1	Terminal strip header, 14 position

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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more sensors, more solutions