SureCross DX80 Gateway with Discrete I/O

DIP Switch Configurable Gateway for the M-GAGE™ Node

Features

IP67 Base
2.4 GHz

IP20 Base
900 MHz

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

- Gateway's discrete inputs are mapped to baseline two M-GAGE™ Nodes; M-GAGE inputs are mapped to the Gateway's outputs
- Switch configurable to allow for user programmability of two M-GAGE Nodes
- 10 to 30V dc power input
- Modbus serial interface
- Site Survey analyzes the network's signal strength and reliability
- Frequency Hopping Spread Spectrum (FHSS) technology and Time Division Multiple Access (TDMA) control architecture combine to 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 link outputs on the Gateway
- The DX80...C models are certified for use in Class I, Division 2, Group A, B, C, D; Zone 2 (Group IIC) Hazardous Locations when properly installed in accordance with the National Electrical Code, the Canadian Electrical Code, LCIE/ATEX, or applicable local codes/regulations (see Specifications)

For additional information, the most recent version of all documentation, and a complete list of accessories, refer to Banner Engineering's website, *www.bannerengineering.com/surecross*.

Models

Model	Frequency	Environmental Rating	I/O
DX80G9M6S6P6ZP	900 MHz ISM Band	IP67, NEMA 6	**Inputs**: Selectable discrete **Outputs**: Sourcing discrete
DX80G2M6S6P6ZP	2.4 GHz ISM Band		
DX80G9M6S6P6ZPC	900 MHz ISM Band	IP20, NEMA 1 Class I, Division 2, Group A, B, C, D Hazardous Locations (see *Specifications*)	
DX80G2M6S6P6ZPC	2.4 GHz ISM Band		

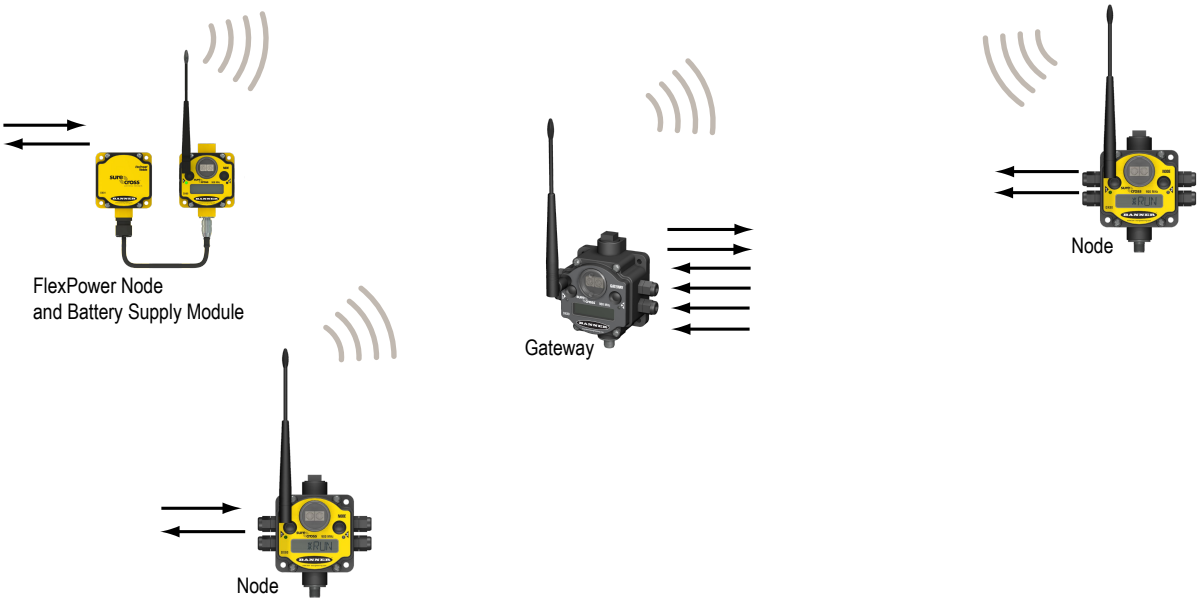
Internal antenna models are also available, but are not UL Listed. For more information, contact your local Banner Engineering Corp. representative.

WARNING: Not To Be Used for Personnel Protection
Never use this product as a sensing device for personnel protection. Doing so could lead to serious injury or death. This product 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

The SureCross DX80 wireless I/O network provides reliable monitoring without the burden of wiring or conduit installation. The SureCross wireless network can operate 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 inputs and outputs that may be all discrete, all analog, or a mix of discrete and analog I/O.



The SureCross DX80 network is a deterministic system—the network identifies when the radio signal is lost and drives relevant outputs to user-defined conditions. Once the radio signal is reacquired, the network returns to normal operation.

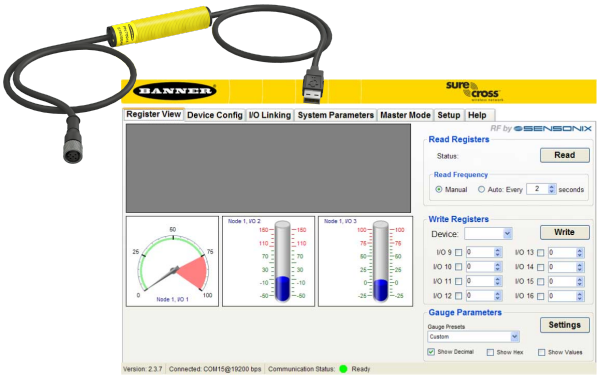
SureCross DX80 Gateways and Nodes

A **Gateway** acts as the master device within each radio network, initiates communication and reporting with the Nodes, and controls the timing for the entire network.

The Gateway also holds the configuration for the network. Every wireless network must have one Gateway that schedules communication traffic and controls the I/O configuration for the network. A radio network contains only one Gateway, but can contain many 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 central control process.

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. Each Node device can be connected to sensors or output devices and reports I/O status to the Gateway.

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-HW-006) 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*.

Wiring Diagrams

M-GAGE™ Gateway I/O Mapping

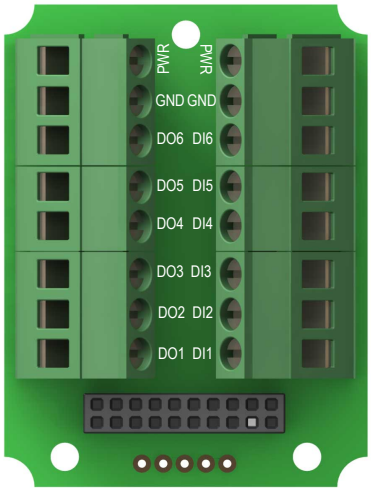
I/O	Terminal Label	M-GAGE Gateway		M-GAGE Node	I/O
1	DI1	Discrete IN 1	to	Device 1, Baseline	14
2	DI2	Discrete IN 2	to	Device 2, Baseline	14
3	DI3	Not used		Not used	
4	DI4	Not used		Not used	
5	DI5	DIP Switch Settings	to	Programmable Config, Node 1	14
6	DI5	DIP Switch Settings	to	Programmable Config, Node 2	14
9	DO1	Discrete OUT 1	from	M-GAGE Sensor, Node 1	1
10	DO2	Discrete OUT 2	from	M-GAGE Sensor, Node 2	1
11	DO3	Not used		Not used	
12	DO4	Not used		Not used	
13	DO5	Link Loss, Node 1		Not used	
14	DO6	Link Loss, Node 2		Not used	

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

Terminal Block (IP67 Base)



DI*x*. Discrete IN *x*.
DO*x*. Discrete OUT *x*.
GND. Ground/dc common connection.
PWR. Power, 10 to 30V dc power connection.

DX80...C Wiring

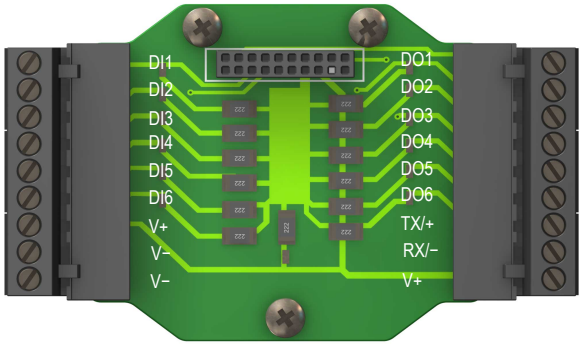
Wiring power to the DX80...C models varies depending the power requirements of the model.

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

* Connecting dc power to the communication pins will cause permanent damage.

** For FlexPower devices, do not apply more than 5.5V to the gray wire.

Terminal Block (IP20 Base)



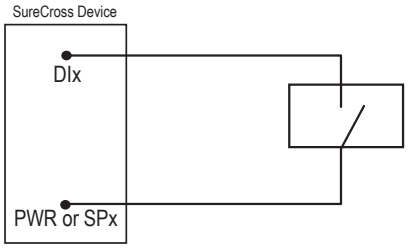
DI*x*. Discrete IN *x*.
DO*x*. Discrete OUT *x*.
RX/-. Serial comms line
TX/+. Serial comms line
V+. Power, 10 to 30V dc power connection.
V-. Ground/dc common connection.

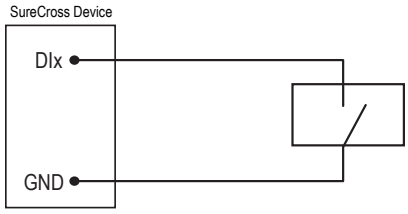
Wiring Diagrams for Discrete Inputs

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 (PNP)

Discrete Input Wiring (NPN)

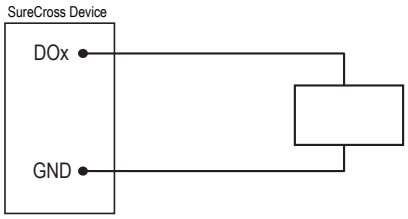




Wiring Diagrams for Discrete Outputs

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 Output Wiring (PNP)



Additional Information

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*

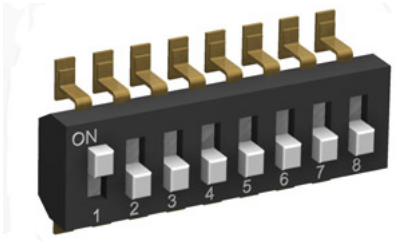
Modbus Register Table

I/O Point	Modbus Holding Register		I/O Type	Units	I/O Range		Holding Register Representation		Terminal Block Labels
	Gateway	Any Node			Min. Value	Max. Value	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)							
4	4	4 + (Node# × 16)							
5	5	5 + (Node# × 16)	DIP Switch	-			0	65535	DI5
6	6	6 + (Node# × 16)	DIP Switch	-			0	65535	DI6
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	DO1
10	10	10 + (Node# × 16)	Discrete OUT 2	-	0	1	0	1	DO2
11	11	11 + (Node# × 16)							
12	12	12 + (Node# × 16)							

I/O Point	Modbus Holding Register		I/O Type	Units	I/O Range		Holding Register Representation		Terminal Block Labels
	Gateway	Any Node			Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)	
13	13	13 + (Node# × 16)	Link Loss, ND 1	-	0	1	0	65535	DO5
14	14	14 + (Node# × 16)	Link Loss, ND 2	-	0	1	0	65535	DO6
15	15	15 + (Node# × 16)	Control Message						
16	16	16 + (Node# × 16)	Reserved						

Device Configuration

DIP Switch Changes



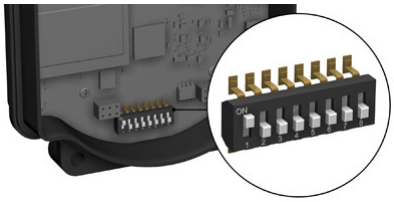
Before making any changes to the DIP switch positions, disconnect the power. For devices with batteries integrated into the housing, remove the battery for at least one minute.

DIP switch changes will not be recognized if power isn't cycled to the device.

Accessing the DIP Switches

To access the 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. For integrated battery models (no ribbon cable) 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. 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

	Switches							
Device Settings	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Rotary dial address mode	OFF*							
Extended address mode	ON							
Inputs sourcing (PNP)		OFF*						
Inputs sinking (NPN)		ON						
Node 1 baseline filter OFF			OFF*					

	Switches							
Device Settings	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Node 1 baseline filter ON			ON					
Node 1: threshold = 100, hysteresis = 30				OFF*	OFF*			
Node 1: threshold = 150, hysteresis = 30				OFF	ON			
Node 1: threshold = 200, hysteresis = 30				ON	OFF			
Node 1: threshold = 50, hysteresis = 15				ON	ON			
Node 2 baseline filter OFF						OFF*		
Node 2 baseline filter ON						ON		
Node 2: threshold = 100, hysteresis = 30							OFF*	OFF*
Node 2: threshold = 150, hysteresis = 30							OFF	ON
Node 2: threshold = 200, hysteresis = 30							ON	OFF
Node 2: threshold = 50, hysteresis = 15							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.

Baseline Threshold/Filter (M-GAGE)

Under normal conditions, the ambient magnetic field fluctuates. When the magnetic field readings drift below a baseline threshold setting, the baseline or drift filter uses an algorithm to slowly match the radio device's baseline to the ambient magnetic field.

Discrete Input Type

Select the discrete input type: sourcing (PNP) or sinking (NPN).

Threshold and Hysteresis (M-GAGE)

Threshold and hysteresis work together to establish the ON and OFF points for analog inputs. Setting a threshold establishes an ON point. Hysteresis defines how far below the threshold the analog input is required to be before the input is considered OFF. A typical hysteresis value is 10% to 20% of the unit's range.

The M-GAGE Node's threshold and hysteresis ranges are 0 to 65,535. The factory default threshold setting is 100 and default hysteresis is 30 (the sensor detects an OFF condition at threshold minus hysteresis, or 100 - 30 = 70). With the default settings, once the magnetic field reading is above 100, an ON or "1" is stored in the lowest significant bit (LSB) in the Modbus register. When the M-GAGE reading drops below the OFF point (threshold minus hysteresis), the LSB of the Modbus register is set to "0." To determine your threshold, take M-GAGE readings of the test objects at the distance they are likely to be from the sensor. For example, if a car reads 100, a bicycle 15, and a truck reads 200, setting the threshold to 150 will detect only trucks of a specific size. Magnetic field fluctuations vary based on the amount of ferrous metal present and the distance from the sensor.

Verify Communications

After powering up and binding the Gateway and its Nodes, verify all devices are communicating properly. Verify LED 1 is green. Until communication is established with the Gateway, the Node's LED 2 flashes red. When communication is established, the Node's LED 1 flashes green.

A Node will not sample its inputs until it is communicating with the Gateway to which it is bound.

LED 1	LED 2	Gateway Status	Node Status
(green on)		Power ON	
(green flashing)			RF Link OK
(red flashing)	(red flashing)	Device Error	Device Error
	(yellow flashing)	Modbus Communication Active	
	(red flashing)	Modbus Communication Error	No radio link (when flashing once every three seconds)

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 Gateway Pro. For Gateway only systems, the Modbus communication LEDs refer to the communication between the Gateway and its host system (if applicable).

When testing the Gateway and Node, verify all radios and antennas are at least two meters apart or the communications may fail.

Specifications

Radio

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)

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

Link Timeout
Gateway: Configurable
Node: Defined by Gateway

* 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.

General

Power*
Requirements: +10 to 30V dc (For European applications: +10 to 24V dc, ± 10%). (See UL section below for any applicable UL specifications)

Interface
Indicators: Two bi-color LEDs
Buttons: Two
Display: Six character LCD

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

Housing

Polycarbonate
Weight: 0.26 kg (0.57 lbs)
Mounting: #10 or M5 (M5 hardware included)
Max. Tightening Torque: 0.56 N·m (5 in·lbf)

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

Rating: 3 mA max current at 30V dc
Sample Rate: 62.5 milliseconds
Report Rate: On change of state

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: 125 milliseconds
ON Condition: Supply minus 2V
OFF Condition: Less than 2V
Output State Following Timeout: OFF

Discrete Output Rating (PNP)

100 mA max current at 30V dc
ON-State Saturation: Less than 3V at 100 mA
OFF-state Leakage: Less than 10 µA

Communication

Hardware (RS-485)

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

Environmental

Rating

DX80 Models:IEC IP67; NEMA 6; (See UL section below for any applicable UL specifications)
DX80...C Models: IEC IP20; NEMA 1

Operating Environment

Temperature: −40 to +85° C (Electronics); −20 to +80° C (LCD)
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, Banner 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)

CSA: Class I, Division 2, Groups A, B, C, D (Ex/A Ex nA II T4); Certificate: 1921239

LCIE/ATEX: Zone 2 (II 3G / Ex nA IIC); Certificate: LCIE 10 ATEX 1012 X

CE

UL Listing

Maximum ambient temperature: 70°C
Mounting instructions: See document 132607
Power rating: 10 to 30V dc, UL Class 2
Enclosure environmental rating: UL Type 1

Included with Device

The following items ship with the DX80 radios.

Included with Device	Model	Qty	Item
DX80 Access Hardware Kit *	BWA-HW-002	4	Plastic threaded plugs, PG-7
		4	Nylon gland fittings, PG-7
		4	Hex nuts, PG-7
		1	Plug, 1/2" NPT
		1	Nylon gland fitting, 1/2" NPT
Mounting Hardware Kit	BWA-HW-001	4	Screw, M5-0.8 x 25mm, SS
		4	Screw, M5-0.8 x 16mm, SS
		4	Hex nut, M5-0.8mm, SS
		4	Bolt, #8-32 x 3/4", SS
PTFE Tape	BWA-HW-003	1	
Antenna **	BWA-9O2-C, or BWA-2O2-C	1	Antenna, 902-928 MHz, 2 dBd Omni, Rubber Swivel RP-SMA Male, or Antenna, 2.4 GHz, 2 dBd Omni, Rubber Swivel RP-SMA Male
SureCross Literature CD	79685	1	
SureCross Quick Start Guide	128185	1	(Ships with Gateways)
Cable *	MQDC1-506	1	Cable, 5-Euro (single ended), Straight, 2m
IP20 Screw Terminal Headers (2 pack) ***	BWA-HW-011	1	

* Not included with IP20 DX80...C models.

** Internal antenna devices do not ship with this antenna.

*** Not included with IP67 DX80 models.

Warnings

The manufacturer does not take responsibility for the violation of any warning listed in this document.

Make no modifications to this product. Any modifications to this product not expressly approved by Banner Engineering could void the user's authority to operate the product. Contact the Factory for more information.

All specifications published in this document are subject to change. Banner reserves the right to modify the specifications of products without notice. Banner Engineering reserves the right to update or change documentation at any time. For the most recent version of any documentation, refer to our website: *www.bannerengineering.com*.

Antenna Installation

Always 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.

Always 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 *Agency 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 if the destination country is not on this list.

Limited Warranty

Banner 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 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.

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