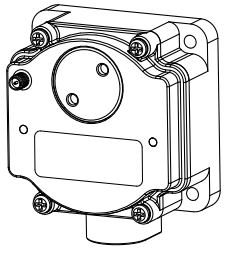
Sure Cross® Serial Data Radio

Datasheet



Sure Cross® serial data radios are wireless industrial communication devices used to extend the range of a serial communication network.

- Serial communication style (RS-232 or RS-485) is user selectable
- Star or tree network topology configuration
- DIP switches select operational modes
- Frequency Hopping Spread Spectrum (FHSS) technology ensures reliable data delivery

For additional information, updated documentation, and a list of accessories, refer to Banner Engineering's website, www.bannerengineering.com.

Models

Models	Frequency	Compliance	Transmit Power
DX80SR9M-H	900 MHz ISM Band	North American	1 Watt
DX80SR2M-H	2.4 GHz ISM Band	International	65 mW (100 mW EIRP)
DX80SR2ME-H		European Radio Equipment Directive (RED)	

Configuration Instructions

Setting Up Your Serial Data Radio Network

To set up and install your wireless Serial Data Radio network, follow these steps:

1. Before installing your serial data radios, verify that your serial devices work. Connect your serial devices using a serial cable. Note the baud rate and parity of your serial devices so that you can use the DIP switches to configure the serial data radios to use these parameters. Set your serial devices to 8 data bits and 1 stop bit.
2. Configure the DIP switches of all devices.
3. Apply power to all devices.
4. Form the wireless network by binding the repeater and peripheral radios to the controller/primary radio.
5. Observe the LED behavior to verify the devices are communicating with each other.
6. Install your wireless sensor network components. For more details about installing your radios, refer to the Sure Cross Installation Guide (p/n 151514) downloadable from the Wireless Reference Library at www.bannerengineering.com.

Configure the DIP Switches

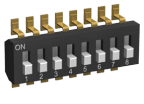
Before changing DIP switch positions, disconnect the power. Any changes made to the DIP switches are not recognized until after power is cycled to the device.

For devices powered by batteries integrated into the housing, triple-click button 2, then double-click button 2 to reset the device without removing the battery.

For parameters not set using the DIP switches, use the configuration software to make configuration changes. For parameters set using the DIP switches, the DIP switch positions override any changes made using the 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. Skip this step if there is no ribbon cable (integrated battery models) or the ribbon cable is glued down (C housing models).
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.

ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

DIP Switch Settings (Serial Data Radio)

	Switches							
Device Settings	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Software default (19200)	OFF *	OFF *	OFF *					
Serial baud 1200	OFF	OFF	ON					
Serial baud 2400	OFF	ON	OFF					
Serial baud 9600	OFF	ON	ON					
Serial baud 19200	ON	OFF	OFF					
Serial baud 38400	ON	OFF	ON					
Serial baud 57600	ON	ON	OFF					
Serial baud 115200	ON	ON	ON					
Parity: none				OFF *	OFF *			
Parity: odd				OFF	ON			
Parity: even				ON	OFF			
Parity: none				ON	ON			
Broadcast mode						OFF *		
Routed mode (Controller to peripheral; Repeater/peripheral to controller)						ON		
Repeater							OFF *	OFF *
Star configuration controller radio							OFF	ON
Peripheral radio							ON	OFF
MultiHop configuration controller radio							ON	ON

* Default configuration

Baud Rate and Parity

Use the Baud Rate and Parity setting DIP switches to configure the radio's serial port. These settings must match the device wired to the radio's serial port. A faster baud rate setting may improve system response time. Changing the baud rate does NOT change the radio transmission rate.

The Software default (OFF, OFF, OFF) also provides the ability to set custom baud rate and timing parameter settings via AT commands. For more information, contact the factory.

Routed vs Broadcast Messages

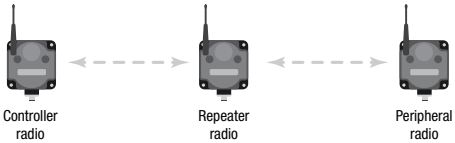
Use **routed messaging** when using a point-to-point or point-to-point-with-repeater topology. Routing is more robust and faster than broadcast messaging.

Broadcast messaging allows for more flexible radio layouts and is used in the star and MultiHop tree topologies. These topologies are much more flexible but they are slower. When using broadcast mode, a small percentage of data packets will not be reach their destination. Broadcast mode requires the application layer to automatically retry packets that time out. In networks with multiple peripheral radios, the controller/primary radio must use broadcast mode, but the peripheral radios can use routing mode to route their data packets back to the controller radio.

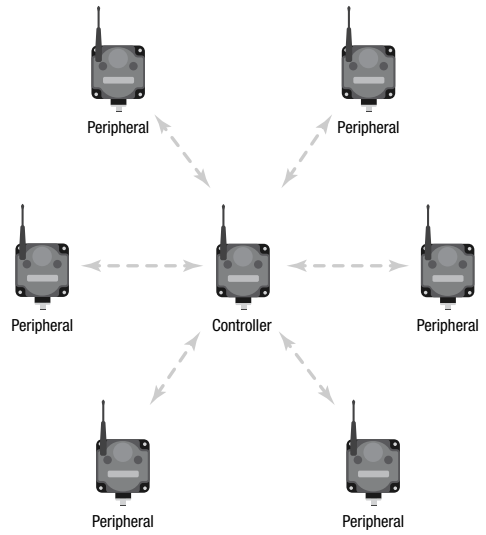
Network Topologies

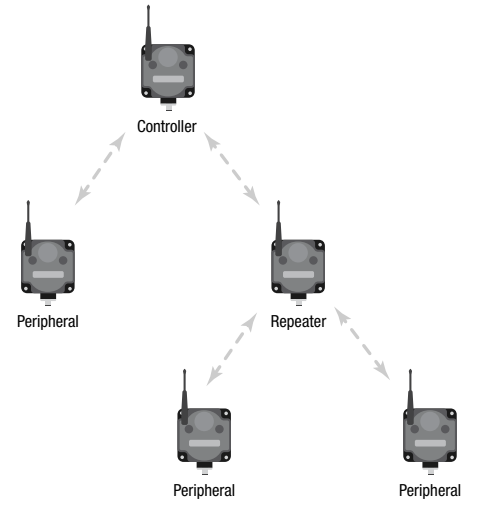
Point-to-Point Network	Controller Radio Configuration	Peripheral Radio Configuration
	Route to peripheral radio: DIP switches 6 ON, 7 OFF, 8 ON.	Route to controller/primary radio: DIP switches 6 ON, 7 ON, 8 OFF.

In this simple cable replacement application with no repeater radio, the radio system knows all data originating at one end must be transmitted to the other end. This allows the radio system to automatically correct for transmission problems and it also provides the greatest throughput. This is the fastest configuration.

Point-to-Point Network	Controller Radio Configuration	Repeater Configuration	Peripheral Radio Configuration
	Route to peripheral radio: DIP switches 6 ON, 7 ON, 8 ON.	DIP switches 6 OFF, 7 OFF, 8 OFF.	Route to controller/ primary radio: DIP switches 6 ON, 7 ON, 8 OFF.

In this simple cable replacement application with a repeater radio, the radio system still knows all data originating at one end must be transmitted to the other end. The system still corrects for transmission problems, but it takes time to repeat the message. The network delay is double that of a system with no repeater.

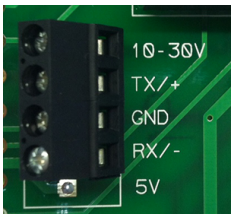
Broadcast Mode Configuration - Star Network	Controller Radio Configuration	Peripheral Radio Configuration
	DIP switches 6 OFF, 7 OFF, 8 ON.	Route to controller/primary radio: DIP switches 6 ON, 7 ON, 8 OFF.
	In this more complex topology, the controller/primary radio at the center of the network can communicate to many peripheral radios. A common example would be a PLC at the center communicating with many remote I/O systems. The star topology is slower than a point-to-point network, but faster than a tree network.	

Broadcast Mode Configuration - Tree Network	Controller Radio Configuration	Repeater Configuration	Peripheral Radio Configuration
	DIP switches 6 OFF, 7 ON, 8 ON.	DIP switches 6 OFF, 7 OFF, 8 OFF.	Broadcast: DIP switches 6 OFF, 7 ON, 8 OFF.
	A tree network using MultiHop radios is the most powerful wireless system possible; many repeaters and peripheral radios can be combined to cover vast areas and get around hills or buildings. In the other networks, the wireless "hops" are minimized. In this system you can "hop" as much as you need to, but the trade-off is speed. This is the slowest of the network layouts.		

Important:
Star and tree topologies use a Broadcast radio technique. Broadcasting allows for many radios and large complex systems but also introduces a small chance that a data packet can be lost. These networks topologies require the control system to automatically resend missing data packets. Most control protocols (like Modbus) will work fine. Other serial stream based protocols may not be as tolerant and should only be used with point-to-point topologies.

Wiring for Serial Data Radios

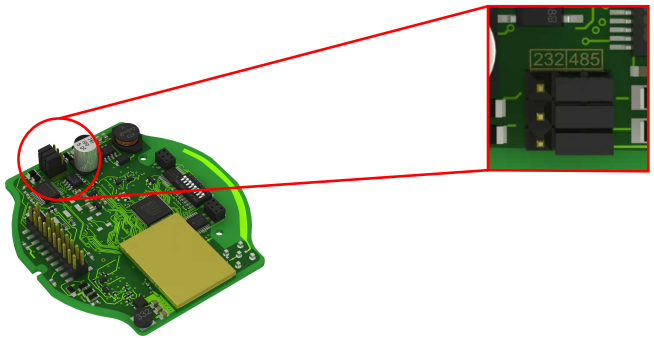
Refer to the Class I Division 2/Zone 2 control drawings (p/n 143086) for wiring specifications and limitations.

	Terminals	Description for RS-485 Comms	Description for RS-232 Comms
	10-30V	Power source, 10 V DC to 30 V DC (Outside the USA: 12 V DC to 24 V DC, ± 10%)	Power source, 10 V DC to 30 V DC (Outside the USA: 12 V DC to 24 V DC, ± 10%)
	Tx / +	+	Tx
	GND	DC Common (GND)	DC Common (GND)
	Rx / -	-	Rx

Configuring for RS-485 or RS-232 Communication

To change the radio's serial port from an RS-485 physical layer (default) to an RS-232 physical layer, change the position of the three jumpers (shown).

Normally all devices within the entire network will have the same physical layer. Using different physical layers is possible but will increase complexity and be more difficult to troubleshoot.

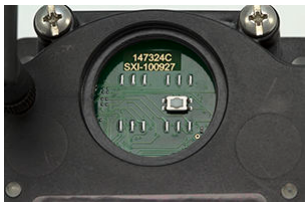


Bind the Serial Data Radios to Form Networks

To create your network, bind the repeater and peripheral radios to the designated controller/primary radio.

Binding the serial data radios ensures all radios within a network communicate only with the other radios within the same network. The serial data primary radio automatically generates a unique binding code when it enters binding mode. This code is transmitted to all radios within range that are also in binding mode. After a repeater/peripheral is bound, the repeater/peripheral radio accepts data only from the primary radio to which it is bound. The binding code defines the network, and all radios within a network must use the same binding code.

1. Apply power to all radios and place the radios configured as peripheral or repeater radios at least two meters away from the controller/ primary radio.
2. Remove the round access cover from the top of the radio to expose the button using a spanner wrench (Banner model EZA-SW-1).



3. Triple click the button to put the primary radio into binding mode.
   Both LEDs flash red.
4. Triple click the button to put the repeater or peripheral radio into binding mode.
   The child radio enters binding mode and searches for any primary radio in binding mode. While searching for the primary radio, the two red LEDs flash alternately. When the child radio finds the primary radio and is bound, both red LEDs are solid for four seconds, then both red LEDs flash simultaneously four times.
5. On the repeater or peripheral radio, install the round access cover to protect the button. Gently tighten using the spanner wrench to ensure a water-resistant seal.
6. Repeat steps 3 through 5 for as many peripheral or repeater radios as are needed for your network.
7. When all radios are bound, double click the button to exit binding mode on the primary radio.
   The network begins to form after the primary data radio exits binding mode.
8. On the primary radio, install the round access cover to protect the button. Gently tighten using the spanner wrench to ensure a water-resistant seal.

Child Radios Synchronize to the Parent Radios

The synchronization process enables a Sure Cross radio to join a wireless network formed by a primary radio. A simple point-to-point network with one primary radio and one peripheral radio synchronizes quickly after power up; larger MultiHop networks may take a few minutes to synchronize. First, all radios within range of the primary data radio wirelessly synchronize to the primary radio. These radios may be peripheral radios or repeater radios.

After repeater radios are synchronized to the primary radio, any radios that are not in sync with the primary but can "hear" the repeater radio will synchronize to the repeater radios. Each repeater “family” that forms a wireless network path creates another layer of synchronization process. When testing the devices before installation, verify the radio devices are at least two meters apart or the communications may fail.

Controller/Primary Radio LED Behavior

All bound serial radios set to operate as controler radios follow this LED behavior after powering up.

Process Steps	Response	LED 1	LED 2
1	Apply power to the controller/primary radio	-	Solid amber
2	The controller/primary radio enters RUN mode.	Flashes green	-
	Serial data packets begin transmitting between the controller/primary and its children radios.	-	Flashes amber
	In binding mode	Flashes red	Flashes red

Peripheral and Repeater Radio LED Behavior

All bound radios set to peripheral or repeater modes follow this LED behavior after powering up.

Process Steps	Response	LED 1	LED 2
1	Apply power to the radio	-	Solid amber (briefly)
2	The peripheral/repeater searches for a parent device.	Flashes red	-
3	A parent device is detected. The peripheral/repeater searches for other parent radios within range.	Solid red	-
4	The peripheral/repeater selects a suitable parent.	-	Solid amber
5	The peripheral/repeater attempts to synchronize to the selected parent.	-	Solid red
6	The peripheral/repeater is synchronized to the parent.	Flashes green	-
7	The peripheral/repeater enters RUN mode.	Solid green, then flashes green	
	Serial data packets begin transmitting between the peripheral/repeater and its parent radio.	-	Flashes amber
	In binding mode	Flashes red	Flashes red

Installing Your Sure Cross® Radios

Please refer to one of these instruction manuals to install your wireless network components.

- DX80 Performance Wireless I/O Network Instruction Manual: 132607
- MultiHop Data Radio Instruction Manual: 151317

Specifications

MultiHop SRM-H and HL Radio Specifications

Radio Range
900 MHz, 1 Watt: Up to 3.2 km (2 miles) with line of sight (internal antenna)
2.4 GHz, 65 mW: Up to 1000 m (3280 ft) with line of sight (internal antenna)

Antenna Minimum Separation Distance
900 MHz, 150 mW and 250 mW: 2 m (6 ft)
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 (up to 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)

Radio Packet Size (SRM-H and HL)
1500 bytes, maximum

900 MHz Compliance
Radio module is indicated by the product label marking
Contains FCC ID: UE3RM7023: FCC Part 15, Subpart C, 15.247
Contains IC: 7044A-RM7023

2.4 GHz Compliance (SR2M-H Models)
Radio module is indicated by the product label marking
Contains FCC ID: UE300DX80-2400: FCC Part 15, Subpart C, 15.247
Contains IC: 7044A-DX8024

2.4 GHz Compliance (SR2ME-H Models)
Radio module is indicated by the product label marking
Contains FCC ID: UE300DX80-2400: FCC Part 15, Subpart C, 15.247
Radio Equipment Directive (RED) 2014/53/EU
Contains IC: 7044A-DX8024
ANATEL: 15966-21-04042 Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para maiores informações, consulte o site da ANATEL www.gov.br/anatel/pt-br/

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Communication Specifications for SRM-H Serial Data Radios

Communication Hardware (Serial Data Radio SRxM-H)
Interface: 2-wire half-duplex RS-485 (default) or RS-232
Baud rates: 1200, 2400, 9600, 19.2k (default), 38.4k, 57.6k, 115.2k
Data format: 8 data bits, 1 stop bit, no parity (default), even parity, odd parity

Radio Data Transfer Rate (MultiHop Serial and MultiHop Ethernet Data Radios)
900 MHz: 300 kbps
2.4 GHz: 250 kbps

SRxM-H Specifications

Supply Voltage
10 V DC to 30 V DC (Outside the USA: 12 V DC to 24 V DC, ± 10%) [1]

Average Current for 900 MHz Radios (1500 byte packets at 50 ms intervals)
Master Mode: 0.12 A at 12 V; 0.06 A at 24 V
Slave Mode: 0.03 A at 12 V; 0.017 A at 24 V

Average Current for 2.4 GHz Radios (1500 byte packets at 50 ms intervals
Master Mode: 0.035 A at 12 V; 0.02 A at 24 V
Slave Mode: 0.022 A at 12 V; 0.014 A at 24 V

Housing
Polycarbonate housing and rotary dial cover; polyester labels; EDPM rubber cover gasket; nitrile rubber, non-sulphur cured button covers
Weight: 0.26 kg (0.57 lbs)
Mounting: #10 or M5 (SS M5 hardware included)
Max. Tightening Torque: 0.56 N·m (5 lbf·in)

Interface
Two bi-color LED indicators
One button (under the small round cover)

Wiring Access
4 position terminal

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

Certifications

CSA Certification: DX80SR9M-H and DX80SR2M-H only

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

Refer to the Class I Division 2/Zone 2 control drawings (p/n 143086) for wiring specifications and limitations. Install the device in a suitable enclosure with provision for connection of Division 2 / Zone 2 wiring methods in accordance with local codes, as acceptable to the local inspection authority having jurisdiction. All battery-powered devices must only use the lithium battery manufactured by Xeno, model XL-205F (Banner model number **BWA-BATT-001**).

Banner Engineering Europe Park Lane, Culliganlaan 2F bus 3, 1831 Diegem, BELGIUM (CE/UKCA approval only applies to 2.4 GHz models)

Turck Banner LTD Blenheim House, Blenheim Court, Wickford, Essex SS11 8YT, Great Britain

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)
Radiated Immunity: 10 V/m (EN 61000-4-3)

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

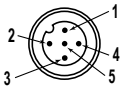
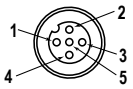
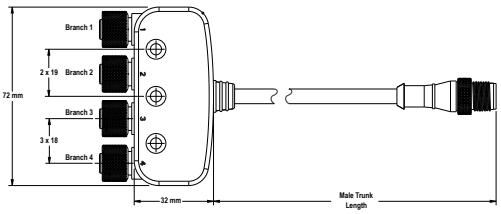
Environmental Ratings

IEC IP67; NEMA 6
For installation and waterproofing instructions, go to www.bannerengineering.com and search for the complete instruction manual (p/n 151317)

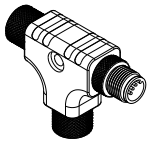
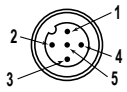
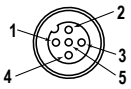
Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

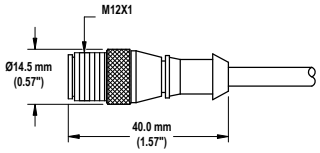
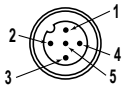
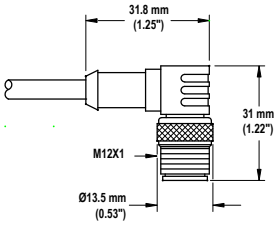
Accessories

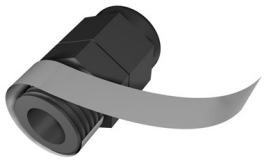
5-Pin Threaded M12 Splitter Cordset with Flat Junction—Double Ended

Model	Trunk (Male)	Branches (Female)	Pinout (Male)	Pinout (Female)
CSB4-M1251M1250	0.3 m (0.98 ft)	Four (no cable)		
			1 = Brown 2 = White 3 = Blue	4 = Black 5 = Gray

5-Pin Threaded M12 Splitter Tee

Model	Description		Pinout (Male)	Pinout (Female)
CSB-M1250M1250-T	Female trunk, 1 female branch, 1 male branch		 1 = Brown 2 = White 3 = Blue	 4 = Black 5 = Green/Yellow

5-Pin Threaded Male M12 Cordsets—Single Ended				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Male)**
MQDMC-501	0.3 m (1 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
MQDMC-506	2.04 m (6.69 ft)			
MQDMC-515	5.04 m (16.5 ft)			
MQDMC-530	9.04 m (29.7 ft)			
MQDMC-550	15 m (49.2 ft)			
MQDMC-506RA	2 m (6.56 ft)	Right-Angle		
MQDMC-515RA	5 m (16.4 ft)			
MQDMC-530RA	9 m (29.5 ft)			

Cable Glands	
BWA-CG.5-1 • Cable Gland • 1/2-inch NPT Cordgrip • For cable diameters 0.17 to 0.45 inch • Qty 1	
BWA-CG.5-10 • Cable Gland • 1/2-inch NPT Cordgrip • For cable diameters 0.17 to 0.45 inch • Qty 10	

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 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 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 antenna that ships 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 that 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.

Important: Please download the complete Sure Cross® MultiHop Data Radio technical documentation, available in multiple languages, from www.bannerengineering.com for details on the proper use, applications, Warnings, and installation instructions of this device.

Important: Por favor descargue desde www.bannerengineering.com toda la documentación técnica de los Sure Cross® MultiHop Data Radio, disponibles en múltiples idiomas, para detalles del uso adecuado, aplicaciones, advertencias, y las instrucciones de instalación de estos dispositivos.

Important: Veuillez télécharger la documentation technique complète des Sure Cross® MultiHop Data Radio sur notre site www.bannerengineering.com pour les détails sur leur utilisation correcte, les applications, les notes de sécurité et les instructions de montage.

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.

FCC Part 15 Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Industry Canada

This device contains licence-exempt transmitters(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil contient des émetteurs/récepteurs exemptés de licence conformes à la norme Innovation, Sciences, et Développement économique Canada. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage.
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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.

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