Sure Cross® MultiHop H3 Data Radio

Datasheet

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 MultiHop data radio networks are formed around a MultiHop master and one or more slaves and extend the range of a Modbus or other serial communication network.

900 MHz

900 MHz E Housing

- Wireless industrial I/O device with four thermocouple inputs, two NPN discrete inputs, one thermistor input, and two NMOS discrete outputs
- Selectable transmit power levels of 250 mW or 1 Watt for 900 MHz models and 65 mW for 2.4 GHz models
- *Flex*Power® power options allow for 10 V DC to 30 V DC, solar, and battery power sources for low power applications.
- Self-healing, auto-routing radio frequency network with multiple hops extends the network's range and improves radio link performance
- Serial and I/O communication on a Modbus platform
- Message routing improves link performance
- DIP switches select operational modes: master, repeater, or slave
- Built-in site survey mode enables rapid assessment of a location's RF transmission properties
- Frequency Hopping Spread Spectrum (FHSS) technology ensures reliable data delivery

Models

Models	Frequency	Power	Housing	I/O
DX80DR9M-H3	900 MHz ISM Band	10 to 30 V dc or battery supply module	IEC IP67; NEMA 6	**Inputs**: Two NPN discrete, four thermocouple, one thermistor (internal) **Outputs**: Two NMOS discrete **Serial interface**: RS-232
DX80DR9M-H3E		10 to 30 V dc or integrated battery	IEC IP65; NEMA 4X	
DX80DR2M-H3	2.4 GHz ISM Band	10 to 30 V dc or battery supply module	IEC IP67; NEMA 6	
DX80DR2M-H3E		10 to 30 V dc or integrated battery	IEC IP65; NEMA 4X	

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: DX80DR9M-H3C.

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 lithium D cell battery **BWA-BATT-001**.

Configuration Instructions

Setting Up Your MultiHop Network

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

1. If your radios have DIP switches, configure the DIP switches of all devices.
2. Connect the sensors to the MultiHop radios if applicable.
3. Apply power to all devices.
4. If your MultiHop radio has rotary dials, set the MultiHop Radio (Slave) ID. If your MultiHop radio has no rotary dials, continue to the next step.
5. Form the wireless network by binding the slave and repeater radios to the master radio. If the binding instructions are not included in this datasheet, refer to the quick start guide or product manual.
6. Observe the LED behavior to verify the devices are communicating with each other.
7. Configure any I/O points to use the sensors connected to the Sure Cross devices.
8. Conduct a site survey between the MultiHop radios. If the site survey instructions are not included in this datasheet, refer to the product manual.
9. Install your wireless sensor network components. If the installation instructions are not included in this datasheet, refer to the product manual.

For additional information, refer to one of the following documents:
- MultiHop Data Radio Quick Start Guide: 152653
- MultiHop Data Radio Instruction Manual: 151317

- MultiHop Register Guide: 155289

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.
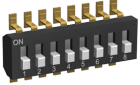
1. Unscrew the four screws that mount the cover to the bottom housing.
2. Remove the cover from the housing without damaging the ribbon cable or the pins the cable plugs into.
3. Gently unplug the ribbon cable from the board mounted into the bottom housing. Skip this step if there is no ribbon cable (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.

DIP Switch Settings (MultiHop)

	Switches							
Device Settings	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Serial line baud rate 19200 OR User defined receiver slots	OFF [1]	OFF [1]						
Serial line baud rate 38400 OR 32 receiver slots	OFF	ON						
Serial line baud rate 9600 OR 128 receiver slots	ON	OFF						
Serial line baud rate Custom OR 4 receiver slots	ON [2]	ON [2]						
Parity: None			OFF [1]	OFF [1]				
Parity: Even			OFF	ON				
Parity: Odd			ON	OFF				
Disable serial (low power mode) and enable the receiver slots select for switches 1-2			ON [2]	ON [2]				

Transmit power
 	
  900 MHz radios: 1.00 Watt (30 dBm)
  2.4 GHz radios: 0.065 Watts (18 dBm) and 60 ms frame
					OFF [1]			

Transmit power
 	
  900 MHz radios: 0.25 Watts (24 dBm)
  2.4 GHz radios: 0.065 Watts (18 dBm) and 40 ms frame
					ON			

Application mode: Modbus						OFF [1]		
Application mode: Transparent						ON		
MultiHop radio setting: Repeater							OFF [1]	OFF [1]
MultiHop radio setting: Master							OFF	ON
MultiHop radio setting: Slave							ON [2]	OFF [2]
MultiHop radio setting: Reserved							ON	ON

[1] Default configuration

[2] Default configuration for the E housing models only

Application Mode

The MultiHop radio operates in either Modbus mode or transparent mode. Use the internal DIP switches to select the mode of operation. All MultiHop radios within a wireless network must be in the same mode.

Modbus mode uses the Modbus protocol for routing packets. In Modbus mode, a routing table is stored in each parent device to optimize the radio traffic. This allows for point to point communication in a multiple data radio network and acknowledgement/retry of radio packets. To access a radio's I/O, the radios must be running in Modbus mode.

In **transparent** application mode, all incoming packets are stored, then broadcast to all connected data radios. The data communication is packet based and not specific to any protocol. The application layer is responsible for data integrity. For one to one data radios it is possible to enable broadcast acknowledgement of the data packets to provide better throughput. In transparent mode, there is no access to the radio's I/O.

Baud Rate and Parity

The baud rate (bits per second) is the data transmission rate between the device and whatever it is physically wired to. Set the parity to match the parity of the device you are wired to.

Disable Serial

Disable an unused local serial connection to reduce the power consumption of a data radio powered from the solar assembly or from batteries. All radio communications remain operational.

Receiver Slots

The number of receiver slots indicates the number of times out of 128 slots/frames the radio can transmit to its parent radio. Setting a slave's receiver slots to four reduces the total power consumption by establishing that the slave can only transmit to its parent four times per 128 slots.

Transmit Power Levels/Frame Size

The 900 MHz data radios can be operated at 1 watt (30 dBm) or 0.250 watt (24 dBm). For most models, the default transmit power is 1 watt.

For 2.4 GHz radios, the transmit power is fixed at 0.065 watt (18 dBm) and DIP switch 5 is used to set the frame timing. The default position (OFF) sets the frame timing to 60 milliseconds. To increase throughput, set the frame timing to 40 milliseconds. For battery-powered devices, increasing the throughput decreases battery life.

Important: Prior to date code 15341 and radio firmware version 3.6, the frame timing was 40 ms (OFF) or 20 ms (ON).

Wire Your Sure Cross® Device

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

Terminal Block (IP67 and C Housing)

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

IP67 Housing	C Housing
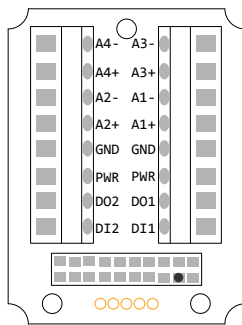
Ax+ and Ax–. Analog IN *x*. Analog inputs for devices requiring more than one connection, such as thermocouples or RTDs. When there is no Ax–, use Ax+ as an analog input.
DIx. Discrete IN *x*
DOx. Discrete OUT *x*
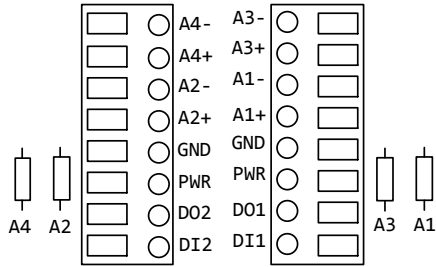GND. Ground/DC common connection
PWR. 10 V DC to 30 V DC power connection
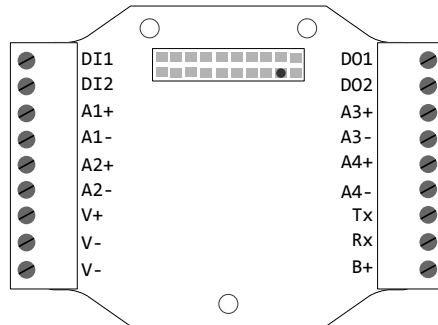
B+. 3.6 V DC to 5.5 V DC (use for battery powered models only)
RX/-. Serial communication line for the Gateway. No connection for Nodes
TX/+. Serial communication line for the Gateway; no connection for Nodes
V+. 10 V DC to 30 V DC power connection
V–. Ground/DC common connection

Terminal Block (E Housing)

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

Ax+ and Ax–. Analog IN x. Analog inputs for devices requiring more than one connection, such as thermocouples or RTDs. When there is no Ax–, use Ax+ as an analog input.
DIx. Discrete IN x
DOx. Discrete OUT x
GND. Ground/DC common connection
PWR. 10 V DC to 30 V DC power connection

Wiring the Inputs and Outputs

Connecting power to the communication pins will cause permanent damage. For the DX8x...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. To power the sensor using the switch power output (SPx), replace the PWR with SPx in these wiring diagrams.

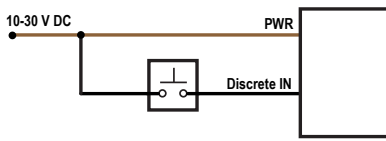*Figure 1. Discrete Input Wiring for PNP Sensors*

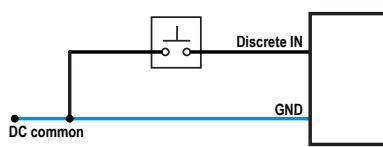*Figure 2. Discrete Input Wiring for NPN Sensors*

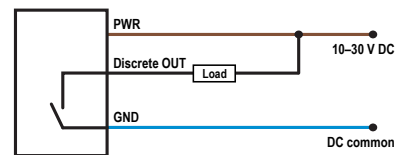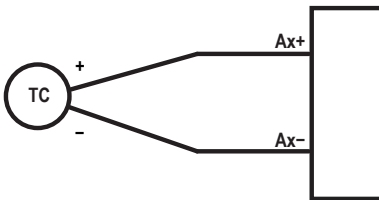*Figure 3. Discrete Output Wiring (NPN or NMOS)*

Figure 4. Thermocouple Input Wiring

Thermocouple: When wiring the thermocouple, x is the same number. For example, a thermocouple is wired to A1+ and A1-.

Apply Power to the RS-232 MultiHop Radios

Connecting power to the communication pins will cause permanent damage. For *Flex*Power devices, do not apply more than 5.5 V to the gray wire. The FlexPower Multihop radios operate equally well when powered from the brown or gray wire; it is not necessary to supply both. 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.

5-pin M12 Male Quick Disconnect Connector	Pin	Wire Color	Description
	1	Brown	10 V DC to 30 V DC
	2	White	RS-232 Tx
	3	Blue	DC common (GND)
	4	Black	RS-232 Rx
	5	Gray	3.6 V DC to 5.5 V DC

Apply Power to the DX80...M-HxC RS-232 MultiHop Models

Connecting power to the communication pins will cause permanent damage. For *Flex*Power devices, do not apply more than 5.5 V to the gray wire. The FlexPower MultiHop radios operate equally well when powered from the brown or gray wire; it is not necessary to supply both. 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.

Label	Description	Label	Description
V+	10 V DC to 30 V DC	Rx	RS-232 Rx
Tx	RS-232 Tx	B+	3.6 V DC to 5.5 V DC

Label	Description	Label	Description
V–	DC common (GND)		

Apply Power to the 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.

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

Set the MultiHop Radio (Slave) ID

The slave ID is an identifying number used for devices within a Modbus system. When using more than one Modbus slave, assign each slave a unique ID number.

For MultiHop radios with rotary dials, use the rotary dials to set the device's MultiHop Radio ID. The left dial sets the left digit and the right dial sets the right digit.
- Modbus Slave IDs 01 through 10—Reserved for slaves directly connected to the host (local I/O). Polling messages addressed to these devices are not relayed over the wireless link.
- Modbus Slave IDs 11 through 60—Use for MultiHop master, repeater, and slave radios. Up to 50 devices (local slaves and remote slaves) may be used in this system.

If your MultiHop radio does not have rotary dials, you must use the master radio to set the Slave ID during the binding process.

MultiHop Configuration Software

Use Banner's MultiHop Configuration Software to view your MultiHop radio network and configure the radio and its I/O.

Figure 5. MultiHop Configuration Software Network and Device Overview screen
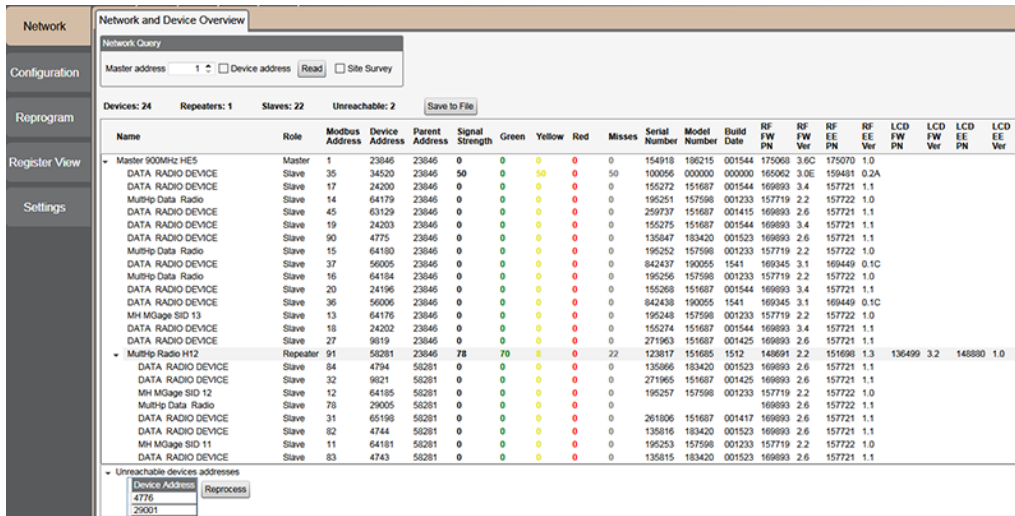
The software connects to a MultiHop master radio using one of four methods.
- Serial; using a USB to RS-485 (for RS-485 radios) or a USB to RS-232 (for RS-232 radios) converter cable.
- Modbus TCP; using an Ethernet connection to an Ethernet radio master.
- Serial DXM; using a USB cable to a DXM Controller to access a MultiHop master radio.
- TCP DXM: using an Ethernet connection to a DXM Controller to access a MultiHop master radio.

For MultiHop DX80DR9* models, Banner recommends using **BWA-UCT-900**, an RS-485 to USB adapter cable with a wall plug that can power your 900 MHz 1 Watt MultiHop radio while you configure it. The adapter cable is not required when connecting to a DXM Controller.

Download the most recent software revision from the Wireless Reference Library on Banner Engineering's website: www.bannerengineering.com.

Installing Your Sure Cross® Radios

Please refer to one of these instruction manuals to install your wireless network components.
- Performance Wireless I/O Network Instruction Manual: 132607
- MultiHop Data Radio Instruction Manual: 151317

Modbus Register Configuration

Change the factory default settings for the inputs, outputs, and device operations using the device Modbus registers. To change parameters, set the data radio network to Modbus mode and assign the data radio a valid Modbus slave ID.

Generic input or output parameters are grouped together based on the device input or output number: input 1, input 2, output 1 etc. Operation type specific parameters (discrete, counter, analog 4 to 20 mA) are grouped together based on the I/O type number: analog 1, analog 2, counter 1, etc. Not all inputs or outputs may be available for all models. To determine which specific I/O is available on your model, refer to the Modbus Input/Output Register Maps listed in the device's datasheet. For more information about registers, refer to the MultiHop Product Instruction Manual (p/n 151317).

Modbus Registers

Register (4xxxx)	Input #	Input Type	Units	I/O Range		Terminals
				Min. Value	Max. Value	
1	1	Discrete IN 1	-	0	1	DI1
2	2	Discrete IN 2	-	0	1	DI2
3	3	Thermocouple IN 1	°F/°C	−1638.3	+1638.4	A1+/–
4	4	Thermocouple IN 2	°F/°C	−1638.3	+1638.4	A2+/–
5	5	Thermocouple IN 3	°F/°C	−1638.3	+1638.4	A3+/–
6	6	Thermocouple IN 4	°F/°C	−1638.3	+1638.4	A4+/–
7	7					
8	8	Thermistor IN 1 (internal)	°F/°C	−1638.3	+1638.4	Internal

In low resolution mode, the minimum and maximum values are −16383 and +16384.

The easiest way to configure a MultiHop radio is to use the MultiHop Configuration Tool. This software tool allows you to configure each input and output, including setting the type of thermocouple. You may also use Modbus commands to configure the inputs. For more information on using Modbus commands, refer to the MultiHop Product Manual (p/n 151317) or the MultiHop Register Guide (p/n 155289). Both manuals are available for download from Banner Engineering's website (www.bannerengineering.com)

Register (4xxxx)	Output #	Output Type	Units	I/O Range		Terminals
				Min. Value	Max. Value	
501	1	Discrete OUT 1	-	0	1	DO1
502	2	Discrete OUT 2	-	0	1	DO2

Temperature Parameters

The following parameters are used to configure analog inputs involving temperature and are typically used to configure thermocouple or RTD inputs.

Registers for Analog Parameters (4xxxx)				Parameters
IN 1 (3301-3320)	IN 2 (3321-3340)	IN 3 (3341-3360)	IN 4 (3361-3380)	
3304	3324	3344	3364	Temperature Degrees C/F
3305	3325	3345	3365	Temperature Scaling
3306	3326	3346	3366	Thermocouple Type
3307	3327	3347	3367	Temperature Resolution

Temperature Degrees C/F

Set to 1 to represent temperature units in degrees Fahrenheit, and set to 0 (default) to represent temperature units in degrees Celsius.

Temperature Resolution

Thermocouples and RTDs may record temperatures in either high resolution (tenths of a degree) or low resolution (whole degree).

Write a 0 to select high resolution (default) or a 1 to select low resolution. Choosing high or low resolution changes the range of temperatures that can be written to the register.

Temperature Scaling

Set to 1 to store temperatures the same way as the DX80 devices (measured temp × 20) represent temperature.

Set to 0 (default) to store temperature values in tenths of a degree (measured temp × 10).

For example, if the measured temperature is 20.5 degrees, using temperature scaling set to 1 would store the temperature value as 410; using temperature scaling set to 0 would store the temperature as 205.

Thermocouple Type

Write the listed value to this register to select a thermocouple type. The default configuration is set to a Type B thermocouple (0).

Value	Thermocouple Type	Value	Thermocouple Type	Value	Thermocouple Type
0	B	5	J	10	P
1	C	6	K	11	R
2	D	7	L	12	S
3	E	8	M	13	T
4	G	9	N	14	U

Modbus Addressing Convention

All Modbus addresses refer to Modbus holding registers. When writing your own Modbus scripts, use the appropriate commands for interfacing to holding registers. Parameter description headings refer to addresses in the range of 40000 as is customary with Modbus convention.

Factory Default Configuration

Discrete Inputs (NPN)

Enable	Sample	Boost Enable	Boost Warmup	Boost Voltage	Extended Input Read	NPN/PNP	Sample High	Sample Low
ON	40 ms	OFF	OFF	OFF	OFF	NPN	OFF	OFF

Thermocouple Inputs

Enable	Sample	Analog Max	Analog Min	Enable Fullscale
ON	5 sec	16384	−16383	ON
ON	5 sec	16384	−16383	ON
ON	5 sec	16384	−16383	ON
ON	5 sec	16384	−16383	ON

Thermistor Inputs

Enable	Sample	Analog Max	Analog Min	Enable Fullscale	Enable Deg F	Temp Scaling
ON	5 sec	16383	−16384	OFF	Deg F	× 20

Storage and Sleep Modes

Storage Mode (applies to battery-powered models only)—While in **storage mode**, the radio does not operate. To put any integrated battery Sure Cross® radio into storage mode, press and hold button 1 for five seconds. To wake the device, press and hold button 1 for five seconds. The radio is in storage mode when the LEDs stop blinking, but in some models, the LCD remains on for an additional minute after the radio enters storage mode. After a device has entered storage mode, you must wait one minute before waking it.

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.

Install or Replace the Battery on a DX80E Model

To replace the lithium "D" cell battery or batteries in any DX80E model, follow these steps.

1. Remove the four screws mounting the face plate to the housing and remove the face plate. If there is a radio cover on the faceplate, do not remove the radio cover from the face plate.

2. If applicable, 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

MultiHop Radio Specifications

Radio Range [1]
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, 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)

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

Radio Packet Size (MultiHop)
900 MHz: 175 bytes (85 Modbus registers)
2.4 GHz: 75 bytes (37 Modbus registers)

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

NOM ⬆ NYCE ®

(NOM approval only applies to 900 MHz models)

2.4 GHz Compliance (MultiHop)
FCC ID UE300DX80-2400: FCC Part 15, Subpart C, 15.247
Radio Equipment Directive (RED) 2014/53/EU
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/

RS-232 Communication Specifications

Communication Hardware (MultiHop RS-232)
Interface: 2-wire RS-232
Baud rates: 9.6k, 19.2k (default), or 38.4k via DIP switches; 1200 and 2400 via the MultiHop Configuration Software
Data format: 8 data bits, no parity, 1 stop bit

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[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. Always verify your wireless network's range by performing a Site Survey.

MultiHop H3 Specifications

Supply Voltage

FlexPower 10 V DC to 30 V DC (Outside the USA: 12 V DC to 24 V DC, ±10%) on the brown wire, or 3.6 V DC to 5.5 V DC low power option on the gray wire [2]
E Housings: Integrated Battery or 10 to 30 V DC

Power Consumption

Master radio consumption (900 MHz): Maximum current draw is < 100 mA and typical current draw is < 30 mA at 24 V DC. (2.4 GHz consumption is less.)
Repeater/slave radio consumption (900 MHz): Maximum current draw is < 40 mA and typical current draw is < 20 mA at 24 V DC. (2.4 GHz consumption is less.)

Interface

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

Discrete Inputs

Rating: 3 mA max current at 30 V DC
Sample Rate: 40 milliseconds
ON Condition (NPN): Less than 0.7 V
OFF Condition (NPN): Greater than 2 V or open

Thermocouple Inputs (MultiHop)

Sample Rate: 8 seconds
Accuracy: 0.1% of full scale reading + 0.8 °C
0.1 °C, 24-bit A/D converter

Thermistor Input (MultiHop)

Model: Omega's 44006 or 44031 family of 10 kOhm thermistors
Sample Rate: 1 second
Accuracy: 0.4 °C (10 °C to 50 °C); Up to 0.8 °C (−40 °C to 85 °C)

Certifications

Banner Engineering Europe Park Lane, Culliganlaan 2F bus 3, 1831 Diegem, BELGIUM

(CE approval only applies to 2.4 GHz models)

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

CSA: Class I Division 2 Groups ABCD, Class I Zone 2 AEx/Ex nA II T4 — Certificate: 1921239

ATEX: II 3 G Ex nA IIC T4 Gc (Group IIC Zone 2) — Certificate LCIE 10 ATEX 1012 X

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**).

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)
M-Hx and "C" Housing Models: Mounting: #10 or M5 (SS M5 hardware included)
"E" Housing Models: Mounting: 1/4-inch or M7 (SS M7 hardware included)
Max. Tightening Torque: 0.56 N·m (5 lbf·in)

Wiring Access

M-Hx models: Four PG-7, one 1/2-inch NPT, one 5-pin M12 male quick-disconnect connector
"C" Housing Models: External terminals
"E" Housing Models: Two 1/2-inch NPT

Thermocouple Notes

Each thermocouple input must be isolated from ground and shielded for proper operation.

Discrete Outputs

ON Condition: Less than 0.7 V
OFF Condition: Open

Discrete Output Rating (MultiHop NMOS)

Less than 1 A max current at 30 V DC
ON-State Saturation: Less than 0.7 V at 20 mA

Required Overcurrent Protection

⚠️ **WARNING:** Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.
Supply wiring leads < 24 AWG shall not be spliced.
For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

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.

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

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)
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
"C" Housing Models/External wiring terminals: IEC IP20; NEMA 1
Refer to the Sure Cross® DX80 Performance (p/n 132607) or the Sure Cross® MultiHop (p/n 151317) instruction manual 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)
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
IP65
Refer to the Sure Cross® DX80 Performance (p/n 132607) or the Sure Cross® MultiHop (p/n 151317) instruction manual for installation and waterproofing instructions.

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

Accessories

Thermistor Probes

BWA-THERMISTOR-PROBE-003

- 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 (–4 °F to +221 °F)
- Maximum Power Rating: 30 mW at 25 °C; derated to 1 mW at 125 °C
- Dissipation Constant: 1 mW/°C
- 316 stainless steel finish; PVC insulation
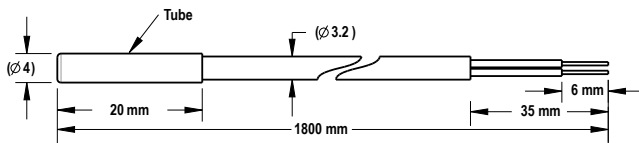
Included with the DX80 and DX80...C Models

- **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 × 25mm SS screws, four M5-0.8 × 16 mm SS screws, four M5-0.8 mm SS hex nuts, and four #8-32 × 3/4" SS bolts
- **BWA-HW-003**: PTFE tape
- **BWA-9O2-C** (900 MHz) or **BWA-2O2-C** (2.4 GHz): Antenna, 2 dBd Omni, Rubber Swivel RP-SMA Male (not included with internal antenna models)
- **MQDC1-506**: 5-pin M12 (single ended) straight cordset, 2 m (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 Performance models 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-2O2-C (2.4 GHz): Antenna, 2 dBd 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 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.

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.**

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