

Datasheet



(Internal Battery Model)



(10 to 30 V dc Model)

Sure Cross® MultiHop data radios are wireless industrial communication devices that extend the range of a Modbus or other serial communication network.

- Wireless industrial I/O device with a 1-wire serial interface for one 1-wire serial sensing device
- Selectable transmit power levels of 250 mW or 1 Watt for 900 MHz models and 65 mW for 2.4 GHz models
- Self-healing, auto-routing RF network with multiple hops extends the network's range
- Serial and I/O communication on a Modbus platform
- Message routing improves link performance
- Built-in site survey mode enables rapid assessment of a location's RF transmission properties
- FHSS radios operate and synchronize automatically

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



WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.



CAUTION: Never Operate 1 Watt Radios Without Antennas

To avoid damaging the radio circuitry, never power up Sure Cross® Performance or Sure Cross MultiHop (1 Watt) radios without an antenna.



CAUTION: Electrostatic Discharge (ESD)

ESD Sensitive Device. This product uses semiconductors that can be damaged by electrostatic discharge (ESD). When performing maintenance, care must be taken so the device is not damaged. Disconnect power from the device when accessing the internal DIP switches. Proper handling procedures include wearing anti-static wrist straps. Damage from inappropriate handling is not covered by warranty.





Models

Models	Frequency	Power	I/O
DX80DR9M-H6	900 MHz ISM Band	Battery integrated into the housing	Inputs: 1-Wire serial interface for one 1-wire serial sensing device
DX80DR2M-H6	2.4 GHz ISM Band		
DX80DR9M-H6L	900 MHz ISM Band	10 to 30 V dc	
DX80DR2M-H6L	2.4 GHz ISM Band		

Sensors with a Serial Interface

The following sensors are designed to be used with any of the 1-Wire Serial Interface Nodes.



Models	Description	Datasheet	
M12FTH4Q	Temperature and Humidity Sensor, $\pm 2\%$ Accuracy, 1-wire serial interface (Requires a 5-pin threaded M12/Euro-style double-ended cordset less than 3 meters long, such as model DEE2R-5xD.)	162669	
M12FT4Q	Temperature Sensor with 1-wire serial interface (Requires a 5-pin threaded M12/Euro-style double-ended cordset less than 3 meters long, such as model DEE2R-5xD.)		
QS30WEQ	WORLD-BEAM Photoelectric Emitter, QS30 (Max Range: 100 feet, 10x excess gain at 50 feet), 1-wire serial interface	140987	
QS30WRQ	WORLD-BEAM Photoelectric Receiver, QS30 (Max Range: 100 feet, 10x excess gain at 50 feet), 1-wire serial interface		
QM42VT1	Vibration and Temperature Sensor with 1-wire serial interface	186209	
K50UX1RA	U-GAGE Ultrasonic Sensor with 1-wire serial interface	191599	

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. Conduct a site survey between the MultiHop radios. If the site survey instructions are not included in this datasheet, refer to the product manual.
8. Install your wireless sensor network components. If the installation instructions are not included in this datasheet, refer to the product manual.

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:

- MultiHop Data Radio Quick Start Guide: [152653](#)
- MultiHop Data Radio Instruction Manual: [151317](#)
- MultiHop Register Guide (End User Edition): [155289](#)

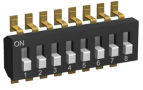
Configure the DIP Switches

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

Accessing the Internal DIP Switches

To access the internal 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 (MultiHop M-H6 Model)

Device Settings	Switches							
	1	2	3	4	5	6	7	8
Serial line baud rate 19200 OR User defined receiver slots	OFF	OFF						
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 *	ON *						
Parity: None			OFF	OFF				
Parity: Even			OFF	ON				
Parity: Odd			ON	OFF				
Disable serial (low power mode) and enable the receiver slots select for switches 1-2			ON *	ON *				
Transmit power 900 MHz radios: 1.00 Watt (30 dBm) 2.4 GHz radios: 0.065 Watts (18 dBm) and 60 ms frame					OFF *			
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 *		
Application mode: Reserved						ON		
MultiHop radio setting: Repeater							OFF	OFF
MultiHop radio setting: Master							OFF	ON
MultiHop radio setting: Slave							ON *	OFF *
MultiHop radio setting: Reserved							ON	ON

* Default configuration

Application 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.

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

If the local serial connection is not needed, disable it 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 4 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. Note that increasing the throughput decreases the battery life.

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

Wiring Your Sure Cross® Device

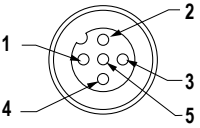
Use the following wiring diagrams to first wire the sensors and then apply power to the Sure Cross devices.

Control Drawings

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

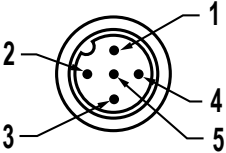
5-Pin M12/Euro-style Female Quick Disconnect

This female quick disconnect fitting interfaces with a 1-wire serial sensor. The following information defines the wires and the appropriate connection points in the Sure Cross radio.

5-pin M12/Euro-style Female Quick Disconnect	Pin	Wire Color	Description
	1	Brown	Power out + (to sensor)
	2	White	Device select
	3	Blue	dc common (GND)
	4	Black	Device output
	5	Gray	Serial comms

5-Pin M12/Euro-Style Male Quick Disconnect

Integral 5-pin M12/Euro-style male quick disconnect (QD)s are wired for 10 to 30 V dc power as shown.

5-pin M12/Euro-style (male)	Pin	Wire Color	Description
	1	Brown	10 to 30 V dc
	2	White	
	3	Blue	dc common (GND)
	4	Black	
	5	Gray	

Set the MultiHop Radio (Slave) ID

On a MultiHop radio, use the rotary dials to set the device's MultiHop Radio ID.

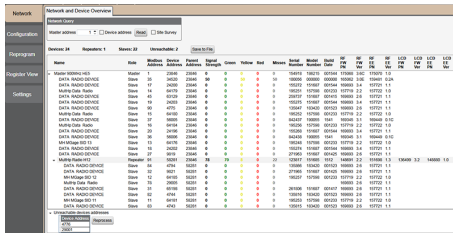
Modbus Slave IDs 01 through 10 are reserved for slaves directly connected to the host (local I/O). Polling messages addressed to these devices are not relayed over the wireless link. Use Modbus Slave IDs 11 through 60 for MultiHop master, repeater, and slave radios. Up to 50 devices (local slaves and remote slaves) may be used in this system.



With the left dial acting as the left digit and the right dial acting as the right digit, the MultiHop Radio ID can be set from 01 through 60.

MultiHop Configuration Tool

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



The MultiHop Configuration Tool 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 DX80DR* models, Banner recommends using BWA-UCT-900, an RS-485 to USB adapter cable with a wall plug that can power your 1 Watt MultiHop radio while you are configuring it. The adapter cable is not required when connecting to a DXM controller.

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

Installing Your Sure Cross® Radios

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

- MultiHop Data Radio Instruction Manual: [151317](#)

Modbus Register Table

Serial Inputs (General). At every sample interval, a message is sent to the serial sensor to request sensor data. By default, registers are updated every five minutes. Use the MultiHop Configuration Tool to change the sensors sample times.

Register (4xxxx)	Input #	I/O Type
101	1	Primary IN 1
102	2	Primary IN 2
103	3	Primary IN 3
104	4	Primary IN 4
105	5	Primary IN 5
106	6	Primary IN 6

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.

Replacing the Integrated Battery (DX80 Models)

To replace the lithium "D" cell battery in any integrated housing model, follow these steps.

1. Remove the four screws mounting the face plate to the housing and remove the face plate.
2. Remove the discharged battery by pressing the battery toward the negative terminal to compress the spring. Pry up on the battery's positive end to remove from the battery holder.
3. Replace with a new battery. Only use a 3.6 V lithium battery from Xeno, model number XL-205F.
4. Verify the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case. The negative end is toward the spring.

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

5. After replacing the battery, allow up to 60 seconds for the device to power up.
6. Properly dispose of your used battery according to local regulations by taking it to a hazardous waste collection site, an e-waste disposal center, or other facility qualified to accept lithium batteries.



As with all batteries, these are a fire, explosion, and severe burn hazard. Do not burn or expose them to high temperatures. Do not recharge, crush, disassemble, or expose the contents to water.

Replacement battery model number: BWA-BATT-001. For pricing and availability, contact Banner Engineering.

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 Manual](#) (p/n 151317).

Specifications

Radio Range¹

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

Minimum Separation Distance

900 MHz, 1 Watt: 4.57 m (15 ft)
2.4 GHz, 65 mW: 0.3 m (1 ft)

Radio Transmit Power

900 MHz, 1 Watt: 30 dBm (1 W) conducted (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

900 MHz Compliance (1 Watt)

FCC ID UE3RM1809: This device complies with FCC Part 15, Subpart C, 15.247
IC: 7044A-RM1809

2.4 GHz Compliance (MultiHop)

FCC ID UE300DX80-2400 - This device complies with FCC Part 15, Subpart C, 15.247
ETSI EN 300 328: V1.8.1 (2012-04)
IC: 7044A-DX8024

Antenna Connection

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

Spread Spectrum Technology

FHSS (Frequency Hopping Spread Spectrum)

Communication Hardware (MultiHop RS-485)

Interface: 2-wire half-duplex RS-485
Baud rates: 9.6k, 19.2k (default), or 38.4k via DIP switches; 1200 and 2400 via the MultiHop Configuration Tool
Data format: 8 data bits, no parity, 1 stop bit

Environmental Ratings

IEC IP67; NEMA 6³

Operating Conditions⁴

-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

IEC 68-2-6 and IEC 68-2-27
Shock: 30g, 11 millisecond half sine wave, 18 shocks
Vibration: 0.5 mm p-p, 10 to 60 Hz

Supply Voltage

Integrated battery models: 3.6 V dc low power option from an internal battery²
Non-battery models: 10 to 30 V dc (Outside the USA: 12 to 24 V dc, ±10%).

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

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

Wiring Access

Integrated battery models: One 5-pin threaded M12/Euro-style female quick disconnect
Non-battery models: One 5-pin threaded M12/Euro-style female quick disconnect and One 5-pin threaded M12/Euro-style male quick disconnect

Packet Size (MultiHop)

900 MHz: 175 bytes (85 Modbus registers)
2.4 GHz: 75 bytes (37 Modbus registers)

Intercharacter Timing (MultiHop)

3.5 milliseconds

Certifications



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 or limitations. All battery-powered devices must only use the lithium battery manufactured by Xeno, model XL-205F.

Included with Device

- BWA-HW-001: Mounting Hardware Kit, containing four M5-0.8 x 25mm SS screws, four M5-0.8 x 16mm SS screws, four M5-0.8mm SS hex nuts, and four #8-32 x 3/4" SS bolts
- BWA-902-C (900 MHz) or BWA-202-C (2.4 GHz): Antenna, 2 dBd Omni, Rubber Swivel RP-SMA Male. (Not included with Internal antenna models)
- Quick Start Guide (128185 for DX80 Gateways or 152653 for MultiHop models)

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.

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

³ Refer to the [Sure Cross® MultiHop Product Instruction Manual](#) (p/n 151317) for installation and waterproofing instructions.

⁴ Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

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. A list of approved countries appears in the *Radio Certifications* section of the product manual. 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. Consult with Banner Engineering Corp. if the destination country is not on this list.

Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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