SureCross MultiHop Radio with Thermocouple I/O

Configurable FlexPower MultiHop Radio with thermocouple and discrete I/O

900 MHz

DX80...E 900 MHz Model

SureCross® MultiHop data radios are wireless industrial communication devices used to extend the range of a Modbus or other serial communication network.

- Wireless industrial I/O device with four thermocouple inputs, two sinking discrete inputs, one thermistor input, and two NMOS discrete outputs
- Selectable transmit power levels of 250 mW or 1 Watt and license-free operation up to 4 watt EIRP, with a high-gain antenna, in the U.S. and Canada for 900 MHz
- *Flex*Power® power options allows for +10 to 30V dc, solar, and battery power sources for low power applications.
- 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
- DIP switches select operational modes: master, repeater, or slave
- Built-in site survey mode enables rapid assessment of a location's RF transmission properties
- FHSS radios operate and synchronize automatically; selectable network IDs reduce interference from collocated networks

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	Frequency	Power	Housing	Transmit Power	I/O
DX80DR9M-H3	900 MHz ISM Band	10 to 30V dc or battery supply module	IP67, NEMA 6	250 mW or 1 Watt (DIP switch selectable)	**Inputs**: Two sinking discrete, four thermocouple, one thermistor (internal) **Outputs**: Two NMOS discrete **Serial interface**: RS-232
DX80DR9M-H3E		10 to 30V dc or integrated battery	IP54, NEMA 4		
DX80DR2M-H3	2.4 MHz ISM Band	10 to 30V dc or battery supply module	IP67, NEMA 6	65 mW (100 mW EIRP)	
DX80DR2M-H3E		10 to 30V dc or integrated battery	IP54, NEMA 4		

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.

The integrated battery models are also available without batteries. If you purchase a model without the battery, Banner Engineering recommends using the XENO XL-205F battery or equivalent. For DX99 models, only a XENO XL-205F battery is certified.

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.

Important: Never Operate 1 Watt Radios Without Antennas.
To avoid damaging the radio circuitry, never power up SureCross Performance or SureCross MultiHop (1 Watt) radios without an antenna.

MultiHop Radio Overview

MultiHop networks are made up of one master radio and many repeater and slave radios.

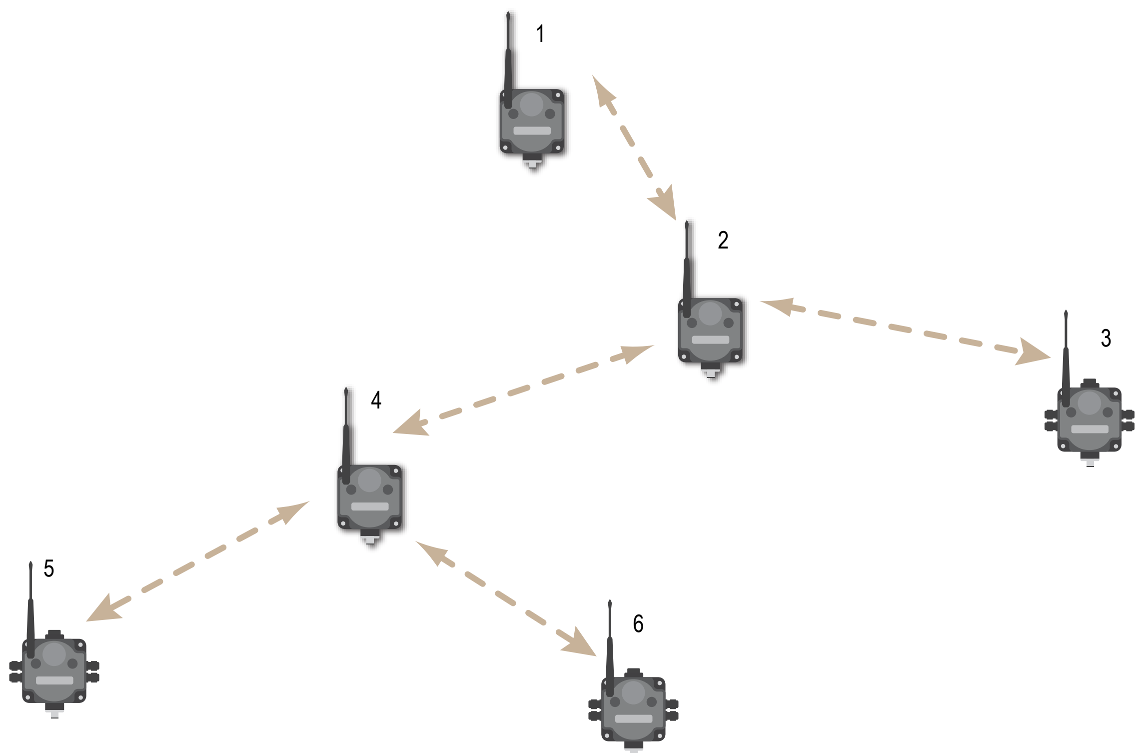
The MultiHop networks are self-forming and self-healing networks constructed around a parent-child communication relationship. The MultiHop Radio architecture creates a hierarchical network of devices to solve the most challenging wireless applications. A MultiHop Radio is either a master radio, a repeater radio, or a slave radio.

- The single master device controls the overall wireless network.
- The repeater mode allows for range extension of the wireless network.
- The slave radios are the end point of the wireless network.

At the root of the wireless network is the master radio. All repeater or slave radios within range of the master radio connect as children of the master radio, which serves as their parent. After repeater radios synchronize to the master radio, additional radios within range of the repeater can join the network. The radios that synchronize to the repeater radio form the same parent/child relationship the repeater has with the master radio: the repeater is the parent and the new radios are children of the repeater.

The network formation continues to build the hierarchical structure until all MultiHop radios connect to a parent radio. A MultiHop radio can only have one designated parent radio. If a radio loses synchronization to the wireless network it may reconnect to the network through a different parent radio.

For the simple example network shown below, the following relationships exist:



- Radio 1 is the master radio and is parent to radio 2 (repeater).
- Radio 2 (repeater) is child to radio 1 (master), but is parent to radios 3 (slave) and 4 (repeater).
- Radio 4 (repeater) is child to radio 2 (repeater), but is parent to radios 5 and 6 (both slaves).

On the LCD of each device, the parent device address (PADR) and local device address (DADR) are shown.

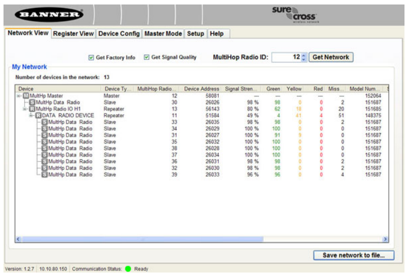
MultiHop Master Radio. Within a network of MultiHop data radios, there is only one master radio. The master radio controls the overall timing of the network and is always the parent device for other MultiHop radios. The host system connects to this master radio.

MultiHop Repeater Radio. When a MultiHop radio is set to repeater mode, it acts as both a parent and a child. The repeater receives data packets from its parent, then re-transmits the data packet to the children within the repeater's network. The incoming packet of information is re-transmitted on both the radio link and the local serial link.

MultiHop Slave Radio. The slave radio is the end device of the MultiHop radio network. A radio in slave mode does not re-transmit the data packet on the radio link, only on the local serial (wired) bus.

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 requires that you connect your master radio to your computer using either a USB to RS-485 (for RS-485 radios) or a USB to RS-232 (for RS-232 radios) converter cable. For RS-485 models, Banner recommends using cable model 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.

If you use an adapter cable that does not also supply 10-30V dc to your radio, use the DIP switches to set the MultiHop Radio to transmit at 250 mW.

When the MultiHop Configuration Tool launches, it automatically checks to see if a newer version of the software is available. If a newer version is available, a dialog box displays on the screen to ask you if you want to download the new version or ignore the new version. If you select download, the newer version automatically downloads, installs, and relaunches the program for you.

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. For binding instructions, refer to the 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. For site survey instructions, refer to the product manual.
8. Install your wireless sensor network components. For installation instructions, 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 Radio Quick Start Guide: *152653*
- MultiHop Radio Product Manual:*151317*
- MultiHop Register Guide (End User Edition): *155289*

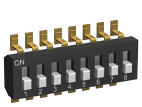
Configuring the DIP Switches

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 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)

	Switches							
Device Settings	**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				
900 MHz: 1.00 Watt (30 dBm) transmit power ** 2.4 GHz models: 40 ms frame					OFF*			
900 MHz: 0.25 Watts (24 dBm) transmit power ** 2.4 GHz models: 20 ms frame					ON			
Application mode: Modbus						OFF*		
Application mode: Transparent						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

** For 2.4 GHz radios, the transmit power is fixed at 0.065 Watts (18 dBm). DIP switch 5 is used instead to set the frame timing.

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

Use the DIP switches to select the baud rate and the parity. The options for baud rate are: 19200, 38400, or 9600. For parity, select None, Even, or Odd.

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 40 milliseconds. To increase throughput, set the frame timing to 20 milliseconds. Note that increasing the throughput decreases the battery life.

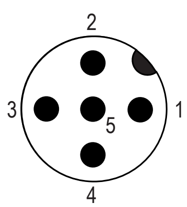
Wiring Your SureCross® Device

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

Wiring for RS-232 MultiHop Radios

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.

The FlexPower Multihop radios will 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 to 30V dc used to power the radio.



Wire No.	Wire Color	FlexPower (RS-232)
1	Brown	10 to 30V dc
2	White	RS-232 Tx
3	Blue	dc common (GND)
4	Black	RS-232 Rx
5	Gray	3.6 to 5.5V dc

Wiring for DX80...M-HxC RS-232 MultiHop Models

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.

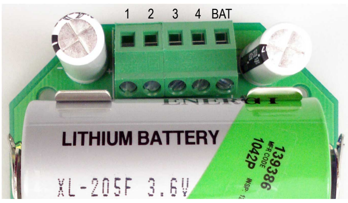
The FlexPower Multihop radios will operate equally well when powered from the brown or gray wire. It is not necessary to supply both. The power for the sensors can be supplied by the radio's SPx terminals or from the 10 to 30V dc used to power the radio.

Wire No.	FlexPower (RS-232)
V+	10 to 30V dc
Tx	RS-232 Tx
V-	dc common (GND)
Rx	RS-232 Rx
B+	3.6 to 5.5V dc

Wiring for DX80...E Radios

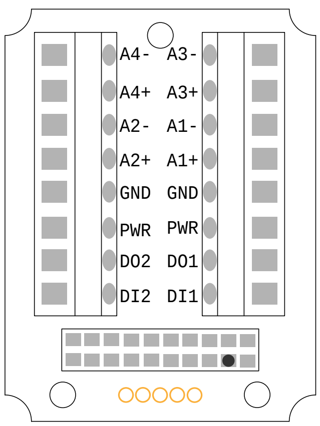
Connecting dc power to the communication pins will cause permanent damage.

The integrated battery DX80...E radios may also be powered by 10 to 30V dc. The power for the sensors can be supplied by the radio's SPx terminals or from the 10 to 30V dc used to power the radio.

		Integrated battery (RS-485) (P1E, M-H1E Models)	Integrated battery (RS-232) (P3E, P4E, M-H3E, M-H4E Models)
	1	10 to 30V dc (optional)	10 to 30V 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

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.

Terminal Block (IP67)



A*x*+ and A*x*-. Analog IN *x*. Analog inputs for devices requiring more than one connection, such as thermocouples or RTDs. When there is no A*x*-, use A*x*+ as an analog input.

DI*x*. Discrete IN *x*.

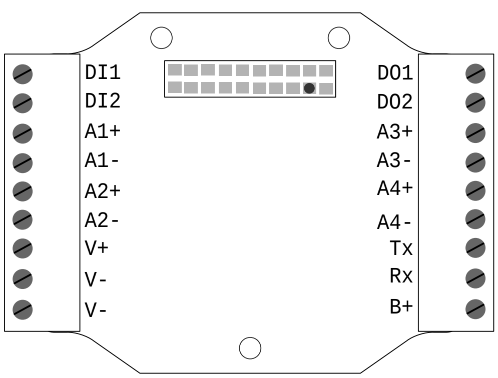
DO*x*. Discrete OUT *x*.

GND. Ground/dc common connection.

PWR. Power, 10 to 30V dc power connection.

Terminal Block (IP20)

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.



DI*x*. Discrete IN *x*.

DO*x*. Discrete OUT *x*.

GND. Ground/dc common connection.

PWR. Power, 10 to 30V dc power connection.

RX/-. Serial comms line

TX/+. Serial comms line

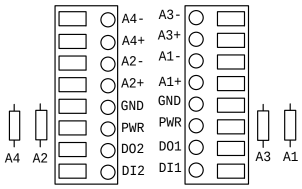
V+. Power, 10 to 30V dc power connection.

V-. Ground/dc common connection.

A*x*+ and A*x*-. Analog IN *x*. Analog inputs for devices requiring more than one connection, such as thermocouples or RTDs. When there is no A*x*-, use A*x*+ as an analog input.

B+. 3.6 to 5.5V dc (for battery powered models only).

Terminal Block (IP54)



A*x*+ and A*x*-. Analog IN *x*. Analog inputs for devices requiring more than one connection, such as thermocouples or RTDs. When there is no A*x*-, use A*x*+ as an analog input.

DI*x*. Discrete IN *x*.

DO*x*. Discrete OUT *x*.

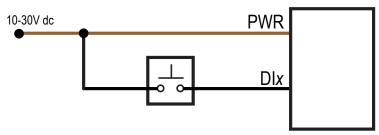
GND. Ground/dc common connection.

PWR. Power, 10 to 30V dc power connection.

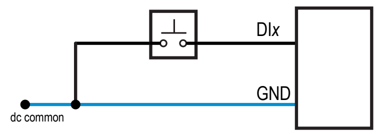
Wiring Diagrams for Discrete Inputs

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 for PNP Sensors



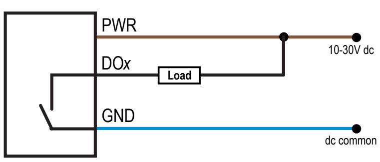
Discrete Input Wiring for NPN Sensors



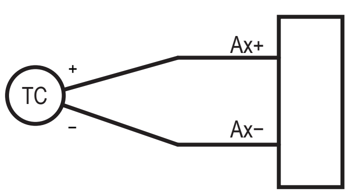
Wiring Diagrams for Discrete Outputs

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 (NPN or NMOS)



Wiring Diagram for Thermocouple Inputs

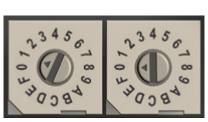


Thermocouple: When wiring the thermocouple, x is the same number. For example, a thermocouple is wired to A1+ and A1-.

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 61 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 61.

Modbus Register Maps

Inputs

Register (4xxxx)	Input #	I/O Type	Units	I/O Range		Terminal Block Labels
				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
9	9					

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 the literature library page of Banner Engineering's website (*http://www.bannerengineering.com/en-US/wireless/surecross_web_productmanuals*)

Outputs

Register (4xxxx)	Output #	I/O Type	Units	I/O Range		Terminal Block Labels
				Min. Value	Max. Value	
501	1	Discrete OUT 1	-	0	1	DO1
502	2	Discrete OUT 2	-	0	1	DO2
503	3					

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				Parameters
IN 1 43301-43320	IN 2 43321-43340	IN 3 43341-43360	IN 4 43361-43380	
43304	43324	43344	43364	Temperature Degrees C/F
43305	43325	43345	43365	Temperature Scaling
43306	43326	43346	43366	Thermocouple Type
43307	43327	43347	43367	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. (Because Modbus numbering begins at 1, users need to subtract 1 from the register address given to form the numeric value entered into the “address” field of the Modbus RTU protocol command string.) Parameter description headings refer to addresses in the range of 40000 as is customary with Modbus convention.

Modbus Register Configuration

The factory default settings for the inputs, outputs, and device operations can be changed by the user through the device Modbus registers.

To change parameters, the data radio network must be set to Modbus mode and the data radio must be assigned 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 data sheet.

For more information about registers, refer to the MultiHop Product Manual, Banner part number 151317.

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 Full-scale	Enable Deg F	Temp Scaling
ON	5 sec	16383	-16384	OFF	Deg F	× 20

Integrated Battery Replacement (DX80...E Models)

For outside or high humidity environments, conductive grease may be applied to the battery terminals to prevent moisture and corrosion buildup. 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. Do not remove the radio cover from the face plate.
2. Remove the discharged battery and replace with a new battery. Only use a 3.6V lithium battery from Xeno, model number XL-205F.
3. Verify the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case. Caution: There is a risk of explosion if the battery is replaced incorrectly.
4. After replacing the battery, allow up to 60 seconds for the device to power up.

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.

Specifications

Radio

Radio Range
900 MHz: Up to 9.6 kilometers (6 miles) *
2.4 GHz: Up to 3.2 kilometers (2 miles) *

Radio Transmit Power
900 MHz: 30 dBm conducted (up to 36 dBm EIRP)
2.4 GHz: 18 dBm conducted, less than or equal to 20 dBm EIRP

900 MHz Compliance (1 Watt Radios)
FCC ID UE3RM1809: This device complies with FCC Part 15, Subpart C, 15.247
IC: 7044A-RM1809

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 lbf·in)

* With the 2 dB antenna that ships with the product. High-gain antennas are available, but the range depends on the environment

General

Power Requirements*
FlexPower Requirements: +10 to 30V dc (For European applications: +10 to 24V dc, ± 10%) on the brown wire, or 3.6 to 5.5V on the gray wire
Integrated Battery Requirements: 3.6V dc low power option from an internal batteryor 10 to 30V dc

Power Consumption
Master radio consumption (900 MHz): Maximum current draw is <100 mA and typical current draw is <30 mA at 24V 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 24V dc. (2.4 GHz consumption is less.)

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 M-HxC Mounting: #10 or M5 (SS M5 hardware included)
M-HxE Mounting: 1/4-inch or M7 (SS M7 hardware included)
Max. Tightening Torque: 0.56 N·m (5 lbf·in)

Interface
Indicators: Two bi-color LEDs

Radio	General
and line of sight. To determine the range of your wireless network, perform a Site Survey.	Buttons: Two Display: Six character LCD **Wiring Access** M-Hx models: Four PG-7, One 1/2-inch NPT, One 5-pin Euro-style male connector M-HxC models: External terminals M-HxE models: Two 1/2-inch NPT * For European applications, power the DX80 from a Limited Power Source as defined in EN 60950-1.

Notice: This equipment must be professionally installed. The output power must be limited, through the use of firmware or a hardware attenuator, when using high-gain antennas such that the +36 dBm EIRP limit is not exceeded.

Inputs	Outputs
Discrete Inputs Rating: 3 mA max current at 30V dc Sample Rate: 40 milliseconds ON Condition (NPN): Less than 0.7V OFF Condition (NPN): Greater than 2V 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 (MultiHop)** Model: Omega's 44006 or 44031 families of 10 kOhm Sample: 1 second Accuracy: 0.4° C (10 to 50° C); Up to 0.8° C (−40 to +85° C)	**Discrete Outputs** ON Condition: Less than 0.7V OFF Condition: Open **Discrete Output Rating (MultiHop NMOS)** Less than 1 A max current at 30V dc ON-State Saturation: Less than 0.7V at 20 mA

Communication	Environmental
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 Tool Data format: 8 data bits, no parity, 1 stop bit **Packet Size (MultiHop)** 900 MHz: 175 bytes (85 Modbus registers) 2.4 GHz: 125 bytes (60 Modbus registers) **Intercharacter Timing (MultiHop)** 3.5 milliseconds	**Rating** M-Hx Models: IEC IP67; NEMA 6; (See UL section below for any applicable UL specifications) M-HxC Models: IEC IP20; NEMA 1 M-HxE Models: IEC IP54; NEMA 4 **Conditions** Operating Temperature, M-Hx and M-HxC models: −40 to +85° C (Electronics); −20 to +80° C (LCD) Operating Temperature, M-HxE models: −40 to +65° C Operating 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® MultiHop product manual, Banner p/n 151317, for installation and waterproofing instructions. Operating

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

Certifications
CE

Included with Model

The following items ship with the DX80 radios.

- 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 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-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)
- Quick Start Guide (128185 for DX80 Gateways or 152653 for MultiHop models)
- MQDC1-506: 5-Euro (single ended) straight cable, 2m (Not included with FlexPower devices)
- BWA-HW-011: IP20 Screw Terminal Headers (2 pack) (Included only with the IP20 DX80...C models)

Included with Device (DX80...E Models)

The following items ship with the DX80...E (NEMA 4) 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)
- Quick Start Guide (128185 for DX80 Gateways or 152653 for MultiHop 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.

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