Introducing the Sure Cross® Wireless Product Families

Sure Cross Wireless Product Families

DXM Wireless Controller Series

The DXM Wireless Controller/Gateway/Edge device product family enables end-to-end IIoT solutions, connecting Banner sensors to Banner's Cloud Data Services (CDS) cloud platform. The DXM can push data to Banner CDS where it can be easily consumed with intuitive, customizable dashboards; it can log data for immediate or long-term analysis; and it can send instant alerts and alarms when corrective actions are needed.

- DXM Controllers integrate Banner's ISM radio, cellular connectivity, and local I/O
- Users can program the DXM using action rules and ScriptBasic language, which can execute concurrently
- Log data on the Micro SD card
- Automation protocols include Modbus RTU, Modbus/TCP, and EtherNet/IP for communications with PLC's, HMI's, or other local hosts
- Interactive programmable user interface with LCD and LED indicators
- Industry standard RS-485, Ethernet, and USB communication ports
- Easily interfaces with Banner CDS and other web-based service providers

The DXM products facilitate Ethernet connectivity and Industrial Internet of Things (IIoT) applications, including:

- Predictive Maintenance Monitoring: monitor equipment to detect problems early and avoid additional damage and unplanned downtime
- Environmental Monitoring: minimize material loss by monitoring temperature and humidity in climate-controlled areas
- Productivity Solutions: create call-for-parts/service and pick-to-light systems to increase productivity and reduce error

The DXM100-Bx and DXM150-Bx models can provide visual indication, email or text notifications, and collect and transmit data to a host system or to the cloud. As a communications gateway, the DXM100-Bx and DXM150-Bx series interfaces local serial ports, local I/O ports, and local ISM radio devices to the Internet using either a cellular connection or a wired Ethernet network connection.

The DXM100-Sx and DXM150-Sx Modbus Slaves can connect directly to an RS-485 serial bus or to a wireless ISM network as a remote Modbus Slave device.

Figure 1. DXM700 Wireless Controller

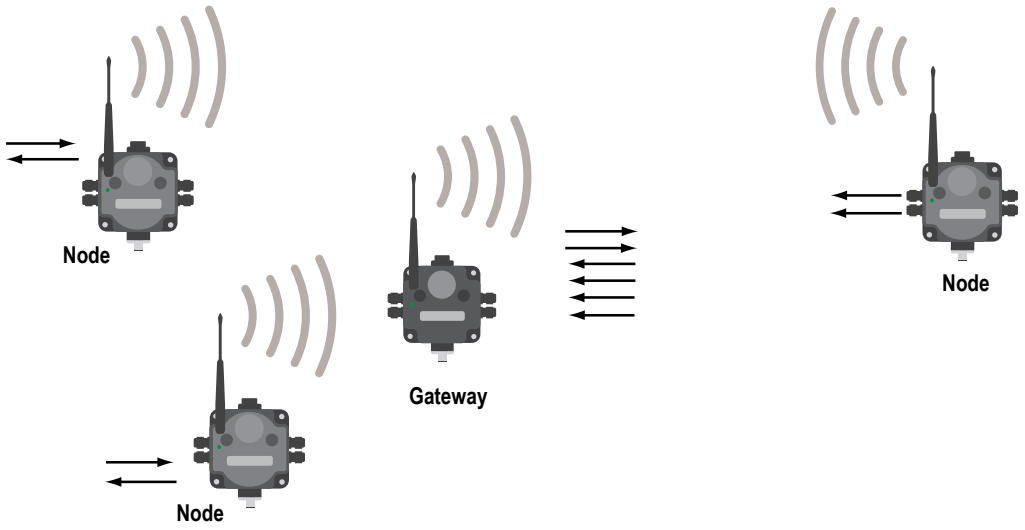
Figure 2. Banner Cloud Data Services (CDS)

Sure Cross® DX80 Performance Wireless Networks

The Sure Cross® Performance wireless I/O network provides reliable monitoring without wiring or conduit installation. The network operates independently or in conjunction with a host system, PLC, and/or PC software. Each wireless network system consists of one Gateway and one or more Nodes, and devices ship with factory-defined discrete, analog, or a mix of discrete and analog inputs and outputs.

The Sure Cross® Performance network is a deterministic system—the network identifies when the radio signal is lost and drives relevant outputs to user-defined conditions. After the radio signal is reacquired, the network returns to normal operation.

Figure 3. Sure Cross® Performance wireless network



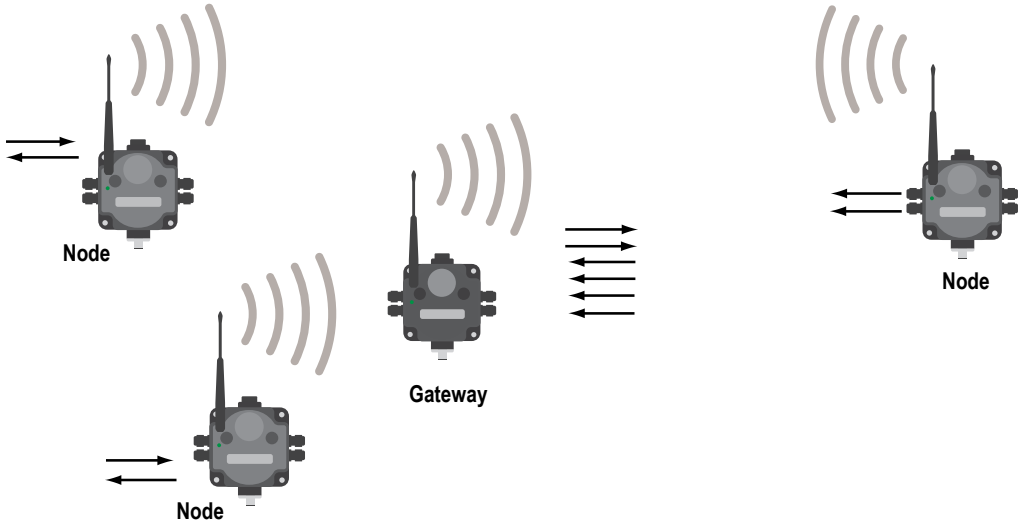
Gateways and Nodes

Every wireless network must have one Gateway, which schedules communication traffic and controls the I/O configuration for the network, and one or more Nodes.

A **Gateway** is the master device within each radio network. Similar to how a gateway device on a wired network acts as a "portal" between networks, the Sure Cross Gateway acts as the portal between the wireless network and the host controller. When the Gateway, using its Modbus RTU RS-485 connection, is a Modbus slave to a Modbus RTU host controller, the wireless network may contain up to 47 Nodes in a single wireless network. The Gateway holds the Modbus registers of all wireless devices within the network.

A **Node** is a wireless network end-point device used to provide sensing capability in a remote area or factory. The Node collects data from sensors and communicates the data back to the Gateway. Nodes are available in a wide variety of power or input/output options.

Figure 4. Gateways and Nodes



DX85 Modbus RTU I/O Slaves

Use the DX85 Modbus RTU I/O devices to expand the I/O of a Modbus master device. DX85s are hardwired to Modbus master devices using RS-485 and use Modbus RTU to exchange data. DX85s are available with discrete, analog, or a mix of discrete and analog I/O.

What is FlexPower®?

Banner's FlexPower technology supplies a true wireless solution by allowing the device to operate using either 10 to 30 V dc, 3.6 V lithium D cell batteries, or solar power. This unique power management system can operate a FlexPower Node and an optimized sensing device for up to five years on a single lithium D cell.

- FlexPower Nodes may be powered from 10 to 30 V dc and use an external battery supply module to provide a battery back-up solution.
- When a FlexPower Node receives 10 to 30 V dc, it operates like a standard 10 to 30 V dc Node.
- Good applications for FlexPower devices operating from batteries include sensors that require no or very little power, including dry contacts, RTDs, and thermocouples.

The following FlexPower options are available:

- DX81-LITH, a single battery supply module;
- DX81P6, a 6-pack of lithium batteries;
- DX81H, a single battery supply module designed specifically to power the DX99 Intrinsically Safe devices with polycarbonate housings; and
- BWA-SOLAR PANEL 3W, 5W, or 20W, solar panel assemblies.

DX81-LITH: Single battery supply module

DX81H: Single battery supply module designed specifically to power the DX99 Intrinsically Safe devices with polycarbonate housings

DX81P6: Six-pack battery supply module

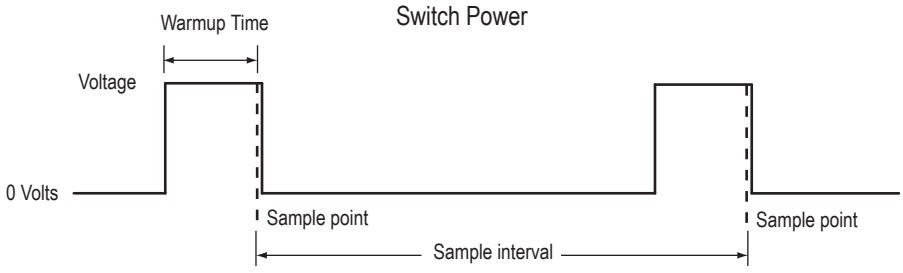
BWA-SOLAR PANEL 3W, BWA-SOLAR PANEL 5W, or BWA-SOLAR PANEL 20W: Includes 3 W, 5 W, or 20 W solar panel.

Order the solar controller (model BWA-Solar CNTRL-12V) separately when you are not using the solar panel with a DXM Wireless Controller. For more information about solar power solutions, see *Sure Cross® Solar Solutions*.

Switch Power

Efficient power management technology enables some FlexPower devices to include an internal power supply, called switch power (SP), that briefly steps up to power sensors that require more than 3.6 V dc power, such as 4 to 20 mA loop-powered sensors. When the switch power output cycles on, the voltage is stepped up to power the sensor for a specific time. The warmup time denotes how long the sensor must be powered before a reliable reading can be taken. After the warmup time has passed, the input reads the sensor, then the switch power shuts off to prolong battery life. The switch power voltage, warm-up time, and sample interval are configurable parameters.

- To reduce power consumption and extend battery life, use slower sample and reporting rates. Faster sample and report rates can be configured, but decrease battery life. For details, refer to the DIP switch configurable parameters for your device.
- The FlexPower switched power management system can operate a radio and most sensing devices for up to five years on a single lithium D cell.



Sure Cross® Solar Power Solutions

Banner's solar supply panels can supply power to two radio devices, including any Node, Gateway, or data radio.

When used with a Sure Cross Node and sensors, the solar assembly supplies enough power to run most sensors at higher sample and report rates than a single battery can reasonably support. The solar panel recharges the battery pack that powers the devices.

Available models are: BWA-SOLAR PANEL 3W (supplies 12 V, 3 W), BWA-SOLAR PANEL 5W (supplies 12 V, 5 W), or BWA-SOLAR PANEL 20W (supplies 12 V, 20 W). When using a proper charge controller, the charge rate depends on the panel size and solar efficiencies.

When using the solar panels with Performance or MultiHop radios, a solar controller is required (ordered separately). When you power Performance or MultiHop radios, use solar controller BWA-SOLARCNTRL-12V. When you power a DXM Wireless Controller, the DXM acts as the solar controller.

For more information on dimensions and mounting these solar panels, refer to the Accessories List.

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. A MultiHop Radio is either a master radio, a repeater radio, or a slave radio.

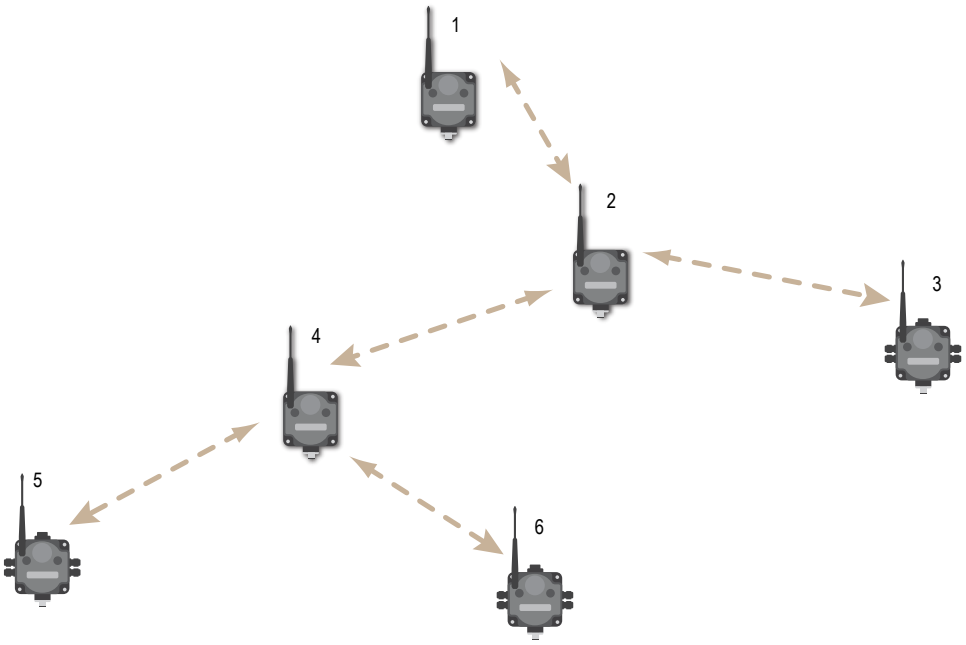
- The master radio controls the overall wireless network.
- The repeater radios extend the range of the wireless network.
- The slave radios are the end point of the wireless network.

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).

Figure 5. MultiHop radio network



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 Application Modes

The MultiHop radios operate in 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

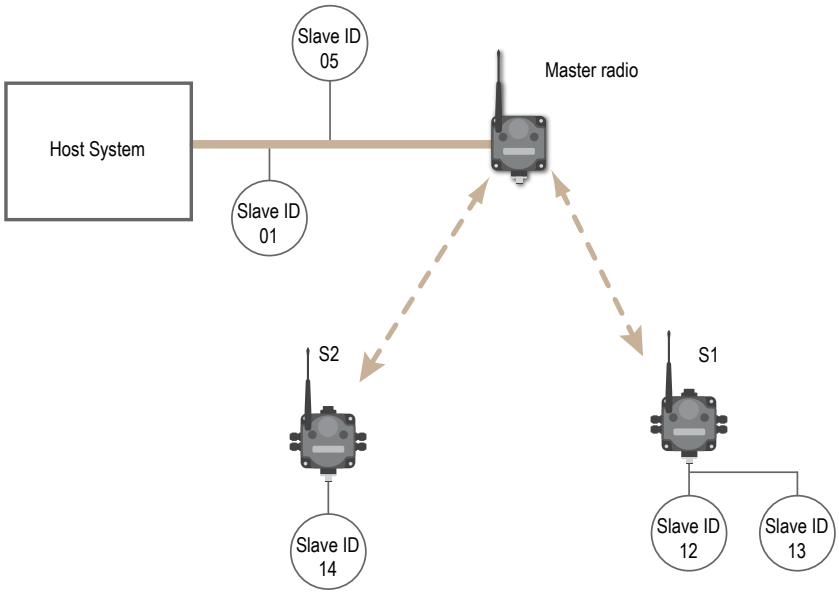
Modbus application mode provides additional functionality to optimize RF packet routing performance and allows register-based access and configuration of various parameters on the MultiHop radio. Modbus application mode requires that the system host device be running a Modbus master program and that the master radio is connected directly to the host.

Packet Routing—In Modbus application mode, the master radio first discovers all connected Modbus slaves in the network, then uses the Modbus slave ID contained in the incoming Modbus message to wirelessly route the packet only to the radio attached to the target Modbus slave. The packet is then passed via the radio's serial interface to the Modbus device where it is processed. This is entirely transparent to the user. Direct packet by packet routing offers an advantage over broadcast addressing with MultiHop paths because each hop in the path can be retried independently in the event of a packet error. This results in significantly more reliable packet delivery over MultiHop paths.

Modbus Slave IDs 01 through 10 are reserved for slaves directly connected to the host (local I/O). As such, polling messages addressed to these devices are not relayed over the wireless link. Use Modbus Slaves IDs 11 through 60 for remote Modbus slaves — devices serially connected to a data radio — allowing a maximum of 50 attached devices.

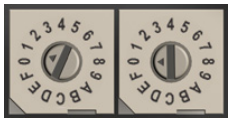
Shown is a basic wireless network operating in Modbus application mode. Slave devices may be any Modbus slaves, including Banner's DX85 Modbus RTU Remote I/O devices or DX80 Gateways.

Figure 6. Wireless network operating in Modbus application mode



MultiHop Radio Registers and Radio IDs—The Modbus application mode also enables the host to access a radio's internal Modbus registers to access radio configuration and status information.

To enable access of a radio's internal Modbus registers, the radio itself must be assigned a Modbus Slave ID, or MultiHop Radio ID, using the rotary dials on the front of the device. The left rotary dial acts as the tens unit while the right rotary dial acts as the ones unit. To set the slave ID to 12, set the left dial to 1 and the right dial to 2.



When a Modbus message is received by the radio, the packet's slave ID is compared to its own rotary dial address. If it matches, the radio accesses its internal Modbus registers. If it does not match, the radio delivers the packet to the serial interface thereby interrogating a connected Modbus slave. The range of acceptable Modbus Slave/MultiHop Radio IDs is from 11 to 60; a Slave ID setting of 0xFF disables access to the MultiHop radio's internal registers but still delivers addressed messages to Modbus slaves that are serially connected to the radio. Detailed information about the contents and functions of the radio's Modbus registers is provided in table 2.

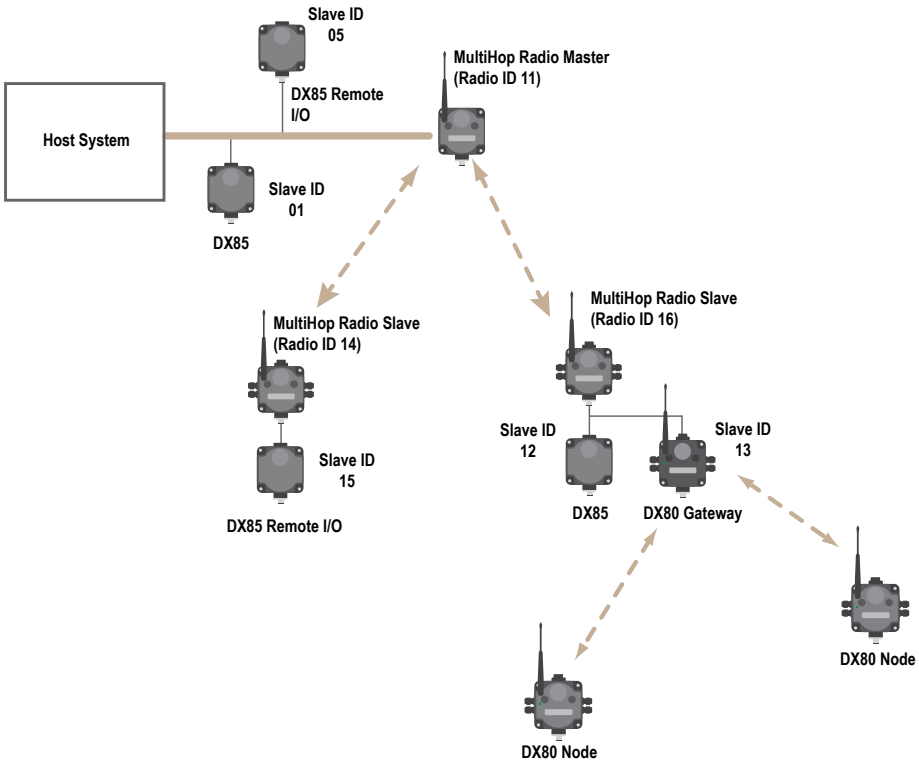
All MultiHop Radio internal registers are defined as 16-bit holding registers (4xxxx). To access the internal registers, set the radio to operate in Modbus mode (using the DIP switches) and set a valid MultiHop Radio ID (11 through 60).

*Note: The radio's rotary dial address must not be a duplicate of an attached Modbus slave ID.

- Rotary dial positions 11 through 60—Valid wireless Modbus Slave IDs or MultiHop Radio IDs
- Rotary dial position FF—Devices set to FF are not directly addressed by the Modbus host system but can deliver the message to the serially connected Modbus slaves

This example host system is connected to three hardwired devices: DX85 Remote I/O Modbus slave 01, DX85 Remote I/O Modbus slave 05, and the master MultiHop Radio. Host messages for Modbus slaves 01 through 10 are ignored by the master radio. Messages for Modbus Slaves or MultiHop Radios 11 through 60 are sent out the wireless network.

Figure 7. Example host system



Transparent Mode

Use transparent mode for communication protocols other than Modbus.

In transparent mode, the MultiHop radio packetizes data received from the hardwired serial connection and transmits the packet to all radios within range. Because the recipient is not known, there is no acknowledgement of sent messages.

A wireless system by definition is a lossy link. It is up to the host system protocol to guarantee the data integrity. For reliable packet transmission, follow all rules for packet size and inter-character timing listed in the specifications and allow sufficient time between packets to avoid overloading the MultiHop radio network. The time between packets varies based on the size of the network.

Example: Force a Single Route in Transparent Mode

Use the Destination Address parameter to create a single end-to-end route while in transparent mode. Set the Destination Address parameter using the LCD menu system on the MultiHop radios (*DVCFG > DEST) or write to Modbus register 46403.

For a MultiHop master radio at 54321, a repeater radio at 43210, and a slave radio at 32109, follow these instructions.

1. Set the destination address on the MultiHop radio master to 32109.
2. Set the destination address on the MultiHop radio slave to 54321.

Now routing retries and acknowledgements take affect.

For more information about Transparent Mode and forced routing, see Forced Routing with MultiHop Radios.