

Introducing the SureCross Wireless Product Families

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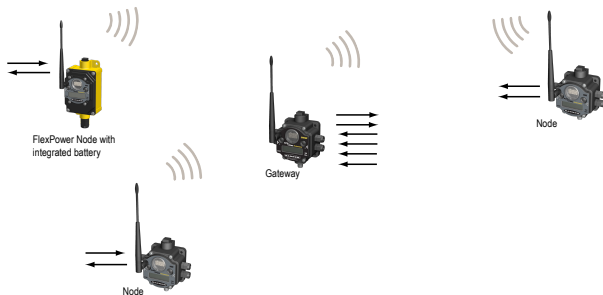


Contents

SureCross DX80 and Performance Products	3
The SureCross® Performance Wireless Network	3
SureCross® Performance Gateways and Nodes	3
DX85 Modbus RTU I/O Slaves	3
Host Systems	3
What is FlexPower®?	4
SureCross MultiHop Products	7
MultiHop Radio Overview	7
MultiHop Application Modes	7

SureCross DX80 and Performance Products

The SureCross® Performance Wireless Network



The SureCross® Performance wireless I/O network provides reliable monitoring without wiring or conduit installation. The SureCross wireless 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. Devices ship with factory-defined discrete, analog, or a mix of discrete and analog inputs and outputs.

The SureCross® 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.

SureCross® Performance Gateways and Nodes

A **Gateway** is the master device within each radio network. 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. Similar to how a gateway device on a wired network acts as a “portal” between networks, the SureCross 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.

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.

Host Systems

Host-connected systems collect I/O data for logging, controlling other devices, or performing calculations.

Host-connected systems can contain up to 15 Nodes (when using Rotary Dial Addressing Mode) or 47 Nodes (when using Extended Addressing Mode) within a single network. Inputs from Nodes within the network are transmitted to the Gateway, which communicates the information to a host device for processing. While the Gateway is the master device within the radio network, the Gateway may be a slave to the Modbus network.

Host-connected DX80 wireless systems are configured using an Ethernet network connection and a common Web page browser. An Ethernet connection can be established from a DX80 GatewayPro device or a DX83 Ethernet Bridge device serially connected to the DX80 Gateway.

SureCross® Performance GatewayPro

The SureCross® Performance GatewayPro combines the function of a SureCross® Performance Gateway with the ability to interface to Ethernet using Modbus/TCP or EtherNet/IP™ protocols. The GatewayPro has a serial port and an industrial Ethernet port. There are two basic models of the GatewayPro:

- **DX80P*T6***. The T6 model acts as a protocol converter only, offering the Modbus/TCP or EtherNet/IP communication protocols.

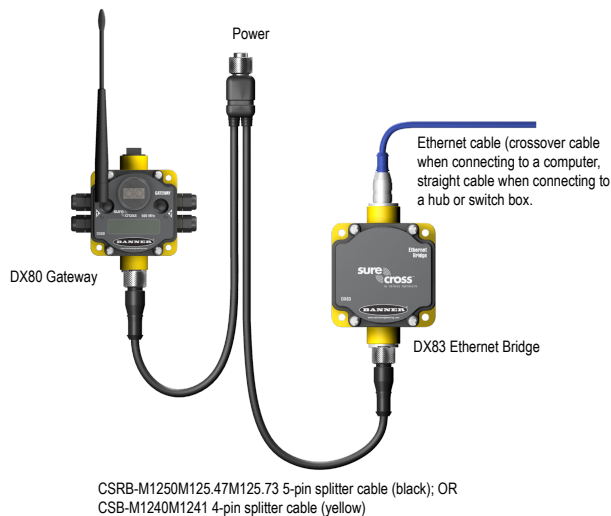
- **DX80P*A6***. The A6 model includes DX80 wireless network configuration, Modbus RTU master, Modbus/TCP client/server, Script Basic, e-mail, data logging, and trending.

Connect a host system to the GatewayPro using its industrial Ethernet connection. To connect the GatewayPro to the host system without using an Ethernet switchbox/hub, some host systems may require a crossover cable. By default, the GatewayPro is configured to use Modbus/TCP server. To use EtherNet/IP, connect the GatewayPro to a managed switch. For more information, see [SureCross Wireless I/O Product Manual](#) or [Host Configuration Manual](#).

DX83 Ethernet Bridge Overview

The DX83 Ethernet Bridge adds the Web page configuration ability to a Gateway-Node wireless network as well as the ability to interface to Ethernet using Modbus/TCP or EtherNet/IP protocols. A DX83 Ethernet Bridge connected to a DX80 Gateway functions like a DX80 GatewayPro while allowing the Gateway to have I/O points. There are two basic DX83 models:

- DX83T. The T model acts as a protocol converter only, offering the Modbus/TCP or EtherNet/IP communication protocols.
- DX83A. The A model includes DX80 wireless network configuration, Modbus RTU master, Modbus/TCP client/server, Script Basic, e-mail, data logging, and trending.



Connect a DX83 Ethernet Bridge to a host system using the industrial Ethernet connection on the DX83. To connect the DX83 directly to the host system without using an Ethernet switchbox/hub, some host systems may require a crossover cable.

By default, the DX83 is configured to use Modbus/TCP. To use EtherNet/IP, you must connect the DX83 to a managed switch and you must use the Web Configuration tool to select EtherNet/IP (see [SureCross Wireless I/O Product Manual](#) or [Host Configuration Manual](#)).

What is FlexPower®?

Banner's FlexPower technology supplies a true wireless solution by allowing the device to operate using either 10 to 30V dc, 3.6V 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.

- The FlexPower Node may be powered from 10 to 30V dc and use an external battery supply module to provide a battery back-up solution.
- When a FlexPower Node receives 10 to 30V dc, it operates like a standard 10 to 30V 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, 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-001, a solar power assembly that includes the solar panel, rechargeable batteries, and solar power controller.



DX81: 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

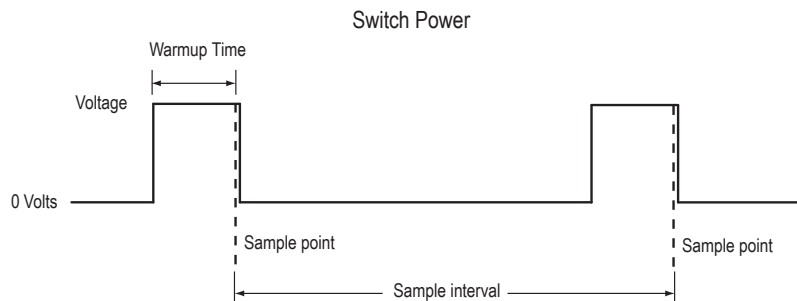


BWA-SOLAR-001: Solar supply; includes solar panel, rechargeable batteries, and controller.

Switch Power (with FlexPower)

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 requiring 5, 10, or 15V power (ideally, 4 to 20 mA loop-powered sensors). When the switch power output cycles on, the voltage is boosted to the voltage needed to power the sensor for a specific warmup time. This 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, slower sample and reporting rates are used. Faster sample and report rates can be configured, but this will decrease the battery's life. For details, refer to the included table of DIP switch configurable parameters.
- The FlexPower switched power management system can operate a FlexPower Node and a sensing device for up to five years on a single lithium D cell.



FlexPower® Solar Supply

Banner's FlexPower® Solar Supply Assembly can be used to power up to two radio devices, including a FlexPower Node, a FlexPower Gateway, or a data radio.

When used with a FlexPower 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. Rechargeable batteries power the devices while the solar panel recharges the batteries.



SureCross MultiHop Products

MultiHop Radio Overview

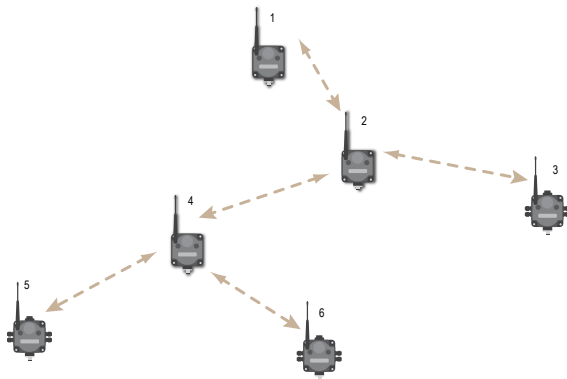
MultiHop networks are made up of one master radio and many repeater and slave radios.

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).

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.

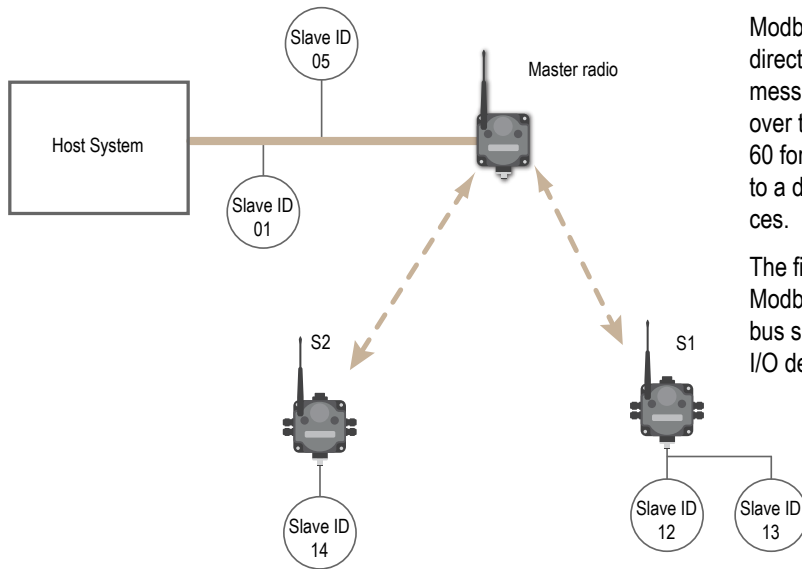
Modbus Mode

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.

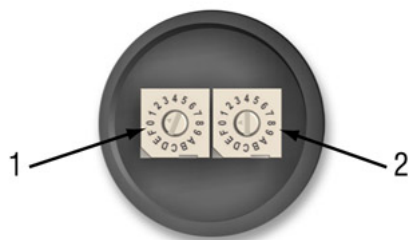
The figure illustrates a basic wireless network operating in Modbus application mode. Slave devices may be any Modbus slaves, including Banner's DX85 Modbus RTU Remote I/O devices or DX80 Gateways.

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.

SureCross Radio Rotary Dials



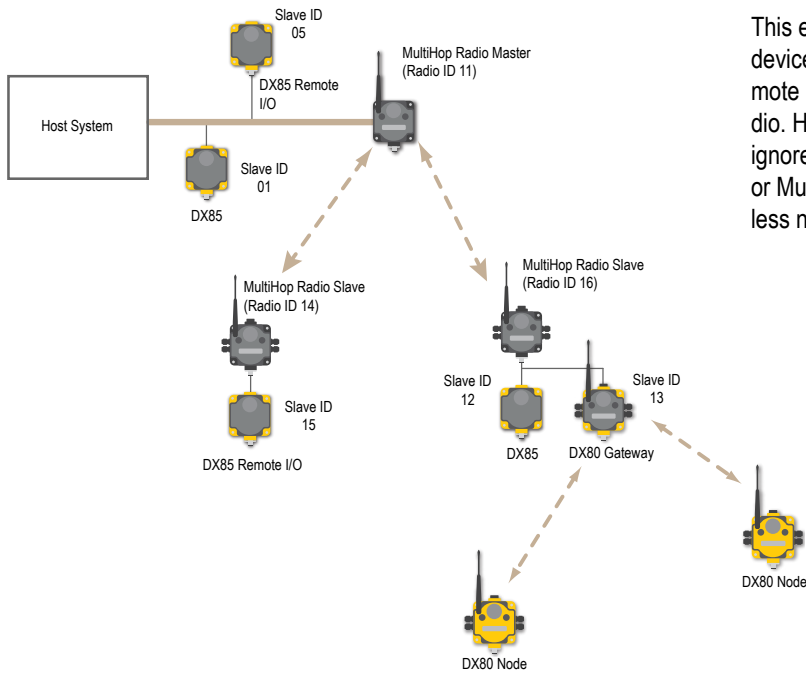
- 1 Left dial - Represents the tens unit of the slave or device ID.
- 2 Right dial - Represents the ones unit of the slave or device ID.

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.

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. 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.

Index

B

battery life 5
battery pack 4–6

C

child radio 7–9

F

FlexPower 4–6

I

inter-character timing 9

M

master radio 7–9
Modbus mode 7, 8
Modbus Slave IDs 7, 8
MultiHop Radio ID 7, 8

N

network formation 7–9

P

packet routing 7, 8

packet size 9
parent radio 7–9
power
 battery pack 4–6
 FlexPower 4–6
 solar 6
 switch 5

R

repeater radio 7–9

S

slave radio 7–9
solar power 6
switch power 5

T

transparent mode 9

W

warmup time 5