# Sure Cross® DX80 Gateway for Wireless Q45 Sensors

more sensors, more solutions

## Datasheet

Configurable DX80 Gateway that uses DIP switches to map inputs from up to six Nodes (or Wireless Q45 Sensors) to the Gateway's outputs

The Sure Cross® wireless system is a radio frequency network with integrated I/O that operates in most environments and eliminates the need for wiring runs. Systems are built around a Gateway, which acts as the wireless network master device, and one or more Wireless Q45 Sensors.

- Wireless industrial I/O device with six discrete (sourcing) inputs and six discrete (sourcing) outputs
- DIP switches allow the user to select one of eight defined I/O mapping configurations to automatically map the Nodes' inputs to this Gateway's outputs
- Frequency Hopping Spread Spectrum (FHSS) technology ensures reliable data delivery within the unlicensed Industrial, Scientific, and Medical (ISM) band
- Transceivers provide bidirectional communication between the Gateway and Node, including fully acknowledged data transmission
- Site Survey analyzes the network's signal strength and reliability and displays the results on the Gateway's LCD
- LCD shows I/O status, Site Survey results, and network status information
- Lost RF links are detected and relevant outputs set to user-defined conditions

DX80 Model

DX80...C Model

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

⚠️ **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.

## Models

| Model | Frequency | Environmental Rating | I/O |
|---|---|---|---|
| DX80G2M6-Q | 2.4 GHz ISM Band | IP67, NEMA 6 | **Inputs**: Six sourcing discrete |
| DX80G2M6-QC | | IP20, NEMA 1 | **Outputs**: Six sourcing discrete |

## Configure and Install Your Q45 Network

Follow these steps to set up and install your Wireless Q45 network.

1. On the Wireless Q45 Sensor Node:
   a) Configure the DIP switches (if applicable).
   b) Apply power.
2. On the Gateway or DXM:
   a) Configure the DIP switches (if applicable).
   b) Wire the I/O.
   c) Apply power.
3. Bind the Q45 to the master radio.
4. Observe the LED behavior to verify the devices are communicating to each other.
5. Using the configuration software, configure the I/O mapping between the Q45 and its master radio.
6. Conduct a Site Survey between the Gateway and the Wireless Q45.
7. Install your devices.

## Configure the Gateway

## 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 parameters not set using the DIP switches, use the User Configuration Software to make configuration changes. For parameters set using the DIP switches, the DIP switch positions override any changes made using the User Configuration Software.

## Access the Internal DIP Switches

Follow these steps to access the internal DIP switches.
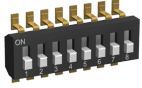


1. Unscrew the four screws that mount the cover to the bottom housing.
2. Remove the cover from the housing without damaging the ribbon cable or the pins the cable plugs into.
3. Gently unplug the ribbon cable from the board mounted into the bottom housing. Skip this step if there is no ribbon cable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

At this time, DIP switch 1 is not used.

**Modbus/UCT Configured or DIP Switch Configured**— In Modbus/Software Configured mode, use the User Configuration Software or a Modbus command to change the device parameters. DIP switch positions 3 through 8 are ignored. In DIP Switch Configured mode, use the DIP switches to configure the parameters listed in the table. By default, this Gateway uses the DIP switches to configure the device.

| DIP Switch | |
|---|---|
| 2 | **Modbus/UCT Configured or DIP Switch Configured** |
| OFF * | DIP switch configured |
| ON | Modbus or UCT configured (DIP switches 3-8 are ignored) |

**Output State During a Radio Link Loss**— The Sure Cross® wireless devices use a deterministic radio link time-out method to address RF link interruption or failure. When a radio link fails, all pertinent wired outputs are set to defined states until the link is recovered, ensuring that disruptions in the communications link result in predictable system behavior. Select the state the outputs are changed to during a link loss.

| DIP Switches | | |
|---|---|---|
| 3 | 4 | **Output State During a Radio Link Loss** |
| OFF * | OFF * | Off (discrete) or 0 mA (analog) |
| OFF | ON | On (discrete) or 20 mA (analog) |
| ON | OFF | Hold last stable state |
| ON | ON | Reserved |

* Default configuration

**Heartbeat**—In heartbeat mode, the Nodes send "heartbeat" messages to the Gateway at specific intervals to indicate the radio link is active. The heartbeat is always initiated by the Node and is used only to verify radio communications. In this network, the Wireless Q45 Sensors act as Nodes.

| DIP Switch | |
|---|---|
| 5 | **Heartbeat Settings** |
| OFF * | 30 seconds (30 to 60 second link loss timeout) |
| ON | 5 seconds (5 to 10 second link loss timeout) |

* Default configuration

**I/O and Link Loss Alarm Mapping - Wireless Q45 Sensors**—The link loss alarm is set to zero (0) when the radio link is working and set to one (1) when the radio link is lost.

| Six Wireless Q45 Sensors to One Gateway | DIP Switches | | |
|---|---|---|---|
| | 6 = OFF* | 7 = OFF* | 8 = OFF* |
|  | Six Q45 Wireless Sensors:<br>Q45 1 → Gateway OUT 1<br>Q45 2 → Gateway OUT 2; etc. | | |

\* Default configuration. To use up to 47 Nodes or Wireless Q45 Sensors with this Gateway, you must use a Modbus host controller system. For more information about using a host controller system, refer to the *Host Configuration* manual, Banner document part number 132114.
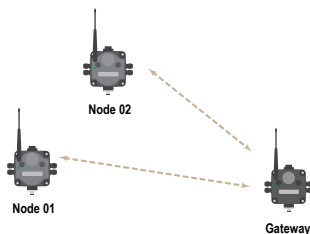
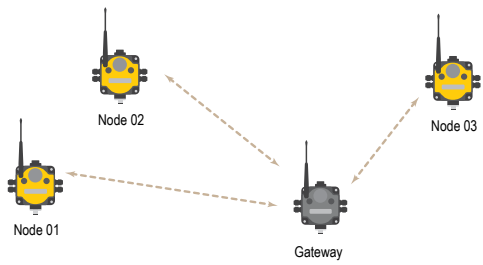| Three Wireless Q45 Sensors to One Gateway | DIP Switches | | |
|---|---|---|---|
| | 6 = OFF | 7 = OFF | 8 = ON |
|  | Three Wireless Q45 Sensors and three link loss:<br>Q45 1 → Gateway OUT 1; Link loss alarm for Q45 1 → Gateway OUT 2<br>Q45 2 → Gateway OUT 3; Link loss alarm for Q45 2 → Gateway OUT 4<br>Q45 3 → Gateway OUT 5; Link loss alarm for Q45 3 → Gateway OUT 6 | | |

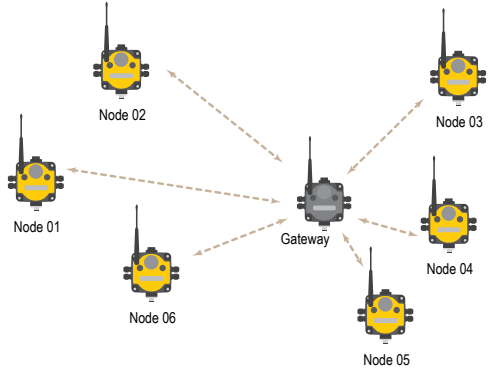| Three Wireless Q45 Sensors to One Gateway | DIP Switches | | |
|---|---|---|---|
| | 6 = OFF | 7 = ON | 8 = OFF |
|  | Three Wireless Q45 Sensors, two inputs each:<br>Q45 1, IN 1 → Gateway OUT 1; Q45 1, IN 2 → Gateway OUT 2<br>Q45 2, IN 1 → Gateway OUT 3; Q45 2, IN 2 → Gateway OUT 4<br>Q45 3, IN 1 → Gateway OUT 5; Q45 3, IN 2 → Gateway OUT 6 | | |

| Two Wireless Q45 Sensors to One Gateway | DIP Switches | | |
|---|---|---|---|
| | 6 = OFF | 7 = ON | 8 = ON |
|  | Two Wireless Q45 Sensors, two inputs each, with link loss:<br>Q45 1, IN 1 → Gateway OUT 1<br>Q45 1, IN 2 → Gateway OUT 2<br>Link loss alarm for Q45 1 → Gateway OUT 3<br>Q45 2, IN 1 → Gateway OUT 4<br>Q45 2, IN 2 → Gateway OUT 5<br>Link loss alarm for Q45 2 → Gateway OUT 6 | | |

**I/O and Link Loss Mapping - Nodes and Gateways**

| One Node to One Gateway | DIP Switches | | |
|---|---|---|---|
| | 6 = ON | 7 = OFF | 8 = OFF |
|  Node 01    Gateway | One SureCross DX80 Node with 6 inputs and 6 outputs:<br>Node 1, IN 1 → Gateway OUT 1; Gateway IN 1 → Node 1, OUT 1<br>Node 1, IN 2 → Gateway OUT 2; Gateway IN 2 → Node 1, OUT 2<br>Node 1, IN 3 → Gateway OUT 3; Gateway IN 3 → Node 1, OUT 3<br>Node 1, IN 4 → Gateway OUT 4; Gateway IN 4 → Node 1, OUT 4<br>Node 1, IN 5 → Gateway OUT 5; Gateway IN 5 → Node 1, OUT 5<br>Node 1, IN 6 → Gateway OUT 6; Gateway IN 6 → Node 1, OUT 6 | | |

| Two Nodes to One Gateway | DIP Switches | | |
|---|---|---|---|
| | 6 = ON | 7 = OFF | 8 = ON |
|  Node 02  Node 01  Gateway | Two SureCross DX80 Nodes, each with 3 inputs and 3 outputs<br>Node 1, IN 1 → Gateway OUT 1; Gateway IN 1 → Node 1, OUT 1<br>Node 1, IN 2 → Gateway OUT 2; Gateway IN 2 → Node 1, OUT 2<br>Node 1, IN 3 → Gateway OUT 3; Gateway IN 3 → Node 1, OUT 3<br>Node 2, IN 1 → Gateway OUT 4; Gateway IN 4 → Node 2, OUT 1<br>Node 2, IN 2 → Gateway OUT 5; Gateway IN 5 → Node 2, OUT 2<br>Node 2, IN 3 → Gateway OUT 6; Gateway IN 6 → Node 2, OUT 3 | | |

| Three Nodes to One Gateway | DIP Switches | | |
|---|---|---|---|
| | 6 = ON | 7 = ON | 8 = OFF |
|  Node 02  Node 03  Node 01  Gateway | Three SureCross DX80 Nodes, each with 2 inputs and 2 outputs<br>Node 1, IN 1 → Gateway OUT 1; Gateway IN 1 → Node 1, OUT 1<br>Node 1, IN 2 → Gateway OUT 2; Gateway IN 2 → Node 1, OUT 2<br>Node 2, IN 1 → Gateway OUT 3; Gateway IN 3 → Node 2, OUT 1<br>Node 2, IN 2 → Gateway OUT 4; Gateway IN 4 → Node 2, OUT 2<br>Node 3, IN 1 → Gateway OUT 5; Gateway IN 5 → Node 3, OUT 1<br>Node 3, IN 2 → Gateway OUT 6; Gateway IN 6 → Node 3, OUT 2 | | |

| Six Nodes to One Gateway | DIP Switches | | |
|---|---|---|---|
| | 6 = ON | 7 = ON | 8 = ON |
|  Node 02  Node 03  Node 01  Gateway  Node 04  Node 06  Node 05 | Six SureCross DX80 Nodes, each with 1 input and 1 output<br>Node 1, IN 1 → Gateway OUT 1; Gateway IN 1 → Node 1, OUT 1<br>Node 2, IN 1 → Gateway OUT 2; Gateway IN 2 → Node 2, OUT 1<br>Node 3, IN 1 → Gateway OUT 3; Gateway IN 3 → Node 3, OUT 1<br>Node 4, IN 1 → Gateway OUT 4; Gateway IN 4 → Node 4, OUT 1<br>Node 5, IN 1 → Gateway OUT 5; Gateway IN 5 → Node 5, OUT 1<br>Node 6, IN 1 → Gateway OUT 6; Gateway IN 6 → Node 6, OUT 1 | | |

## Wire the Gateway's I/O
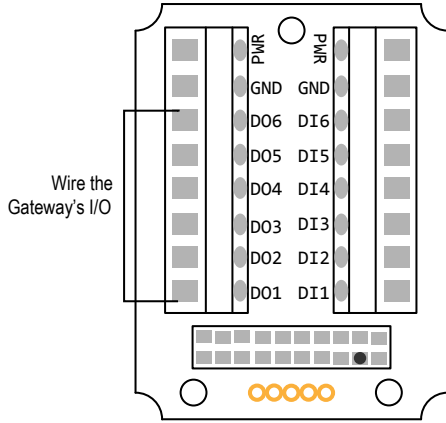


DI*x*. Discrete IN *x*
DO*x*. Discrete OUT *x*
GND. Ground/DC common connection
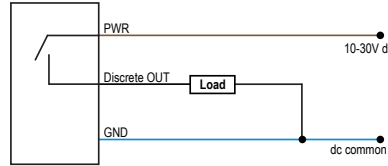PWR. 10 to 30 V DC power connection
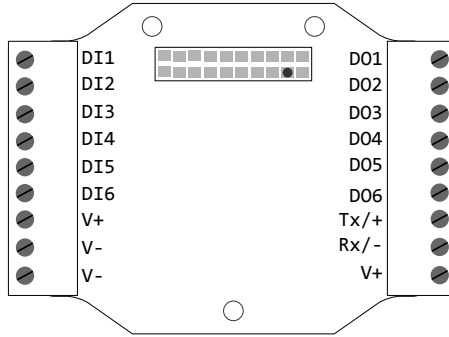
RX/-. Serial communication line for the Gateway. No connection for Nodes
TX/+. Serial communication line for the Gateway; no connection for Nodes
V+. 10 to 30 V DC power connection
V–. Ground/DC common connection

### Discrete Input Wiring for PNP Sensors
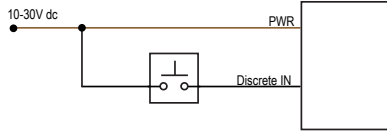


### Discrete Output Wiring (PNP)



## Modbus Register Table for the Gateway with Switch-Based Mapping

| I/O | Modbus Holding Register (Gateway) | I/O Type | I/O Range | | Holding Register Representation | | Terminal Block Labels |
|-----|-----------------------------------|----------|-----------|-----|---------------------------------|-----------|-----------------------|
| | | | Min. | Max. | Min. (Dec.) | Max. (Dec.) | |
| 1 | 1 | Discrete IN 1 | 0 | 1 | 0 | 1 | DI1 |
| 2 | 2 | Discrete IN 2 | 0 | 1 | 0 | 1 | DI2 |
| 3 | 3 | Discrete IN 3 | 0 | 1 | 0 | 1 | DI3 |
| 4 | 4 | Discrete IN 4 | 0 | 1 | 0 | 1 | DI4 |
| 5 | 5 | Discrete IN 5 | 0 | 1 | 0 | 1 | DI5 |
| 6 | 6 | Discrete IN 6 | 0 | 1 | 0 | 1 | DI6 |
| 7 | 7 | Reserved | | | | | |
| 8 | 8 | Device Message | | | | | |
| 9 | 9 | Discrete OUT 1 | 0 | 1 | 0 | 1 | DO1 |
| 10 | 10 | Discrete OUT 2 | 0 | 1 | 0 | 1 | DO2 |
| 11 | 11 | Discrete OUT 3 | 0 | 1 | 0 | 1 | DO3 |
| 12 | 12 | Discrete OUT 4 | 0 | 1 | 0 | 1 | DO4 |
| 13 | 13 | Discrete OUT 5 | 0 | 1 | 0 | 1 | DO5 |
| 14 | 14 | Discrete OUT 6 | 0 | 1 | 0 | 1 | DO6 |
| 15 | 15 | Control Message | | | | | |
| 16 | 16 | Reserved | | | | | |

## Discrete Bit-Packed Registers

Discrete bit-packed registers include the discrete status registers, discrete inputs, and discrete outputs.

Bit packing involves using a single register, or range of contiguous registers, to represent I/O values.

When networks use similar Nodes to gather data using the same I/O registers for each Node, discrete data from multiple Nodes can be bit packed into a single register on the Gateway. The bit-packed data is arranged by I/O point starting at Modbus register 6601. For example, Discrete IN 1 for all the Nodes in the network is stored in three contiguous 16-bit registers.

The most efficient way to read (or write) discrete data from a Sure Cross® DX80 Gateway is by using these bit-packed registers because users can read or write registers for all devices using one Modbus message. The following registers contain discrete bit-packed I/O values for the Gateway and all Nodes. Values are stored first for the Gateway, then for each Node in order of Node address.

**Bit-Packed Device Status Registers**

| Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 6601 | Node 15 | Node 14 | Node 13 | Node 12 | Node 11 | Node 10 | Node 9 | Node 8 | Node 7 | Node 6 | Node 5 | Node 4 | Node 3 | Node 2 | Node 1 | Gateway |
| 6602 | Node 31 | Node 30 | Node 29 | Node 28 | Node 27 | Node 26 | Node 25 | Node 24 | Node 23 | Node 22 | Node 21 | Node 20 | Node 19 | Node 18 | Node 17 | Node 16 |
| 6603 | Node 47 | Node 46 | Node 45 | Node 44 | Node 43 | Node 42 | Node 41 | Node 40 | Node 39 | Node 38 | Node 37 | Node 36 | Node 35 | Node 34 | Node 33 | Node 32 |

**Bit-Packed Discrete Input 1**

| Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 6611 | Node 15 | Node 14 | Node 13 | Node 12 | Node 11 | Node 10 | Node 9 | Node 8 | Node 7 | Node 6 | Node 5 | Node 4 | Node 3 | Node 2 | Node 1 | Gateway |
| 6612 | Node 31 | Node 30 | Node 29 | Node 28 | Node 27 | Node 26 | Node 25 | Node 24 | Node 23 | Node 22 | Node 21 | Node 20 | Node 19 | Node 18 | Node 17 | Node 16 |
| 6613 | Node 47 | Node 46 | Node 45 | Node 44 | Node 43 | Node 42 | Node 41 | Node 40 | Node 39 | Node 38 | Node 37 | Node 36 | Node 35 | Node 34 | Node 33 | Node 32 |

**Bit-Packed Discrete Output 1**

| Register Address | Bit Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 6691 | Node 15 | Node 14 | Node 13 | Node 12 | Node 11 | Node 10 | Node 9 | Node 8 | Node 7 | Node 6 | Node 5 | Node 4 | Node 3 | Node 2 | Node 1 | Gateway |
| 6692 | Node 31 | Node 30 | Node 29 | Node 28 | Node 27 | Node 26 | Node 25 | Node 24 | Node 23 | Node 22 | Node 21 | Node 20 | Node 19 | Node 18 | Node 17 | Node 16 |
| 6693 | Node 47 | Node 46 | Node 45 | Node 44 | Node 43 | Node 42 | Node 41 | Node 40 | Node 39 | Node 38 | Node 37 | Node 36 | Node 35 | Node 34 | Node 33 | Node 32 |

| Inputs | | Outputs | |
|---|---|---|---|
| **Modbus Register Address (Decimal)** | **Description (Inputs)** | **Modbus Register Address (Decimal)** | **Description (Outputs)** |
| 6601–6603 | Status for all devices | | |
| 6611–6613 | Input 1 from all devices | 6691–6693 | Output 1 from all devices |
| 6621–6623 | Input 2 from all devices | 6701–6703 | Output 2 from all devices |
| 6631–6633 | Input 3 from all devices | 6711–6713 | Output 3 from all devices |
| 6641–6643 | Input 4 from all devices | 6721–6723 | Output 4 from all devices |
| 6651–6653 | Input 5 from all devices | 6731–6733 | Output 5 from all devices |
| 6661–6663 | Input 6 from all devices | 6741–6743 | Output 6 from all devices |
| 6671–6673 | Input 7 from all devices | 6751–6753 | Output 7 from all devices |
| 6681–6683 | Input 8 from all devices | | |

**Status registers** (6601–6603) contain a bit-packed representation defining the devices that are operational in the wireless system. Each bit indicates Node in Sync (1) or Node Not in Sync (0).

A one (1) written to the Discrete Status Register area indicates the device is active within the wireless system. A zero (0) indicates the device is not active within the wireless network.

**Input registers** from all devices use Modbus registers 6611 through 6683 to organize the least significant bit into a sequential array of registers. The first register contains the least significant bit from the input values for the Gateway through Node 15. The second register contains the input values for Node 16 through Node 31, and the third register contains the input values for Nodes 32 through 47.
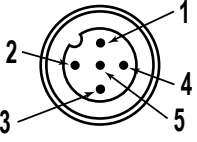
For discrete inputs, only the least significant bit is used. For analog inputs, the least significant bit indicates if the analog value is above or below the selected threshold value (when using the threshold parameter configured in the User Configuration Software). For example, a least significant bit of one (1) indicates the analog value is above the selected threshold value. A least significant bit of zero (0) indicates the analog value is below the threshold value.

**Output registers** from all devices use Modbus registers 6691 through 6753 to organize the least significant bit into a sequential array of registers. Output 8 (I/O point 16) cannot be written using the discrete format.

## Apply Power to the Gateway

## 5-pin M12/Euro-style Wiring for Gateways and DX85s

Wiring the 5-pin M12/Euro-style connector depends on the model and power requirements of the device. Connecting power to the communication pins will cause permanent damage.

| 5-pin M12/Euro-style Connector (male) | Pin | Wire Color | Description |
|---|---|---|---|
| | 1 | Brown (bn) | 10 to 30 V DC |
| | 2 | White (wh) | RS485 / D1 / B / + |
| | 3 | Blue (bu) | DC common (GND) |
| | 4 | Black (bk) | RS485 / D0 / A / − |
| | 5 | Gray (gy) | Comms Gnd |

## DX80...C Wiring

Wiring power to the DX80...C models varies depending the power requirements of the model. Connecting DC power to the communication pins (Tx/Rx) causes permanent damage. For *Flex*Power devices, do not apply more than 5.5 V to the B+ terminal.

| Terminal Label | Gateway and DX85 | 10 to 30 V DC Powered Nodes | Battery Powered Nodes |
|---|---|---|---|
| V+ | 10 V DC to 30 V DC | 10 V DC to 30 V DC | |
| Tx/+ | RS485 / D1 / B / + | | |
| V− | DC common (GND) | DC common (GND) | DC common (GND) |
| Rx/− | RS485 / D0 / A / - | | |
| B+ | | | 3.6 to 5.5 V DC |

## Bind to the Gateway and Assign the Node Address

Before beginning the binding procedure, apply power to all the devices. Separate the devices by two meters when running binding procedure. Put only one Gateway into binding at a time to prevent binding to the wrong Gateway.

1. On the Gateway: Enter binding mode.
   - For housed DX80 Gateways, triple-click button 2 on the Gateway. Both LEDs flash red.
   - For Gateway board modules, triple-click the button. The green and red LED flashes.
2. Assign the DX80 a Node address using the Gateway's rotary dials. Use the left rotary dial for the left digit and the right rotary dial for the right digit. For example, to assign your DX80 to Node 10, set the Gateway's left dial to 1 and the right dial to 0. Valid Node addresses are 01 through 47.
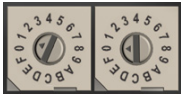
3. On the Q45: Loosen the clamp plate on the top of the DX80 and lift the cover.
4. Enter binding mode on the DX80 by triple-clicking the DX80's button.
   The red and green LEDs flash alternately and the sensor searches for a Gateway in binding mode. After the DX80 is bound, the LEDs stay solid momentarily, then they flash together four times. The DX80 exits binding mode.
5. Label the sensor with the DX80's Node address number for future reference.
6. Repeat steps 2 through 5 for as many DX80s as are needed for your network.
7. On the Gateway: After binding all DX80s, exit binding mode.
   - For housed DX80 Gateways, double-click button 2.
   - For board-level DX80 Gateways, double-click the button.

For Gateways with single-line LCDs: After binding your DX80 to the Gateway, make note of the binding code displayed under the Gateway's *DVCFG menu, XADR submenu on the LCD. Knowing the binding code prevents having to re-bind all DX80s if your Gateway is ever replaced.

## Verify Communication Between the Gateway and the Wireless Q45 Sensors

After powering up and binding the Wireless Q45 Sensors to the Gateway, verify all devices are communicating properly. Verify the Gateway's LED 1 is green. Until communication is established with the Gateway, the Q45's red LED flashes. After communication is established, the Q45's green LED flashes.

When testing the Gateway and Wireless Q45 Sensors, verify all radios are at least two meters apart or the communications may fail.

## Conducting a Site Survey (Gateway and Nodes)

A Site Survey, also known as a Radio Signal Strength Indication (RSSI), analyzes the radio communications link between the Gateway and any Node within the network by analyzing the radio signal strength of received data packets and reporting the number of missed packets that required a retry.

Perform a Site Survey before permanently installing the radio network to ensure reliable communication. Activate Site Survey mode from either the Gateway buttons or the Gateway Modbus holding register 15. Only the Gateway can initiate a Site Survey, and the Site Survey analyzes the radio communications link with one Node at a time.
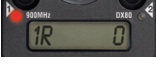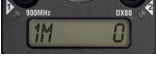
### Conduct a Site Survey Using the Menu System

Initiate a Site Survey using the Gateway's buttons and menu system.

1. Remove the Gateway's rotary dial access cover.
2. Set the Gateway's rotary dials to the desired Node number.

    For example, to check the status of Node 1, set the Gateway's left rotary dial to 0 and the right rotary dial to 1. To check the status of Node 32, set the Gateway's left rotary dial to 3 and the right rotary dial to 2.

    The Gateway is now enabled to read the status of the selected Node. The display scrolls through the Node's I/O status.
3. Single-click button 1 to scroll across the menu levels until reaching the Site Survey (SITE) menu.
4. Single-click button 2 to enter the Site Survey menu.
5. Single-click button 2 to begin conducting a Site Survey with the Node selected in step 2.
    The Gateway analyzes the quality of the signal from the selected Node by counting the number of data packets it receives from the Node.
6. Examine reception readings (M, R, Y, G) of the Gateway at various locations.

    Site survey results display as a percentage. M represents the percent of missed packets while R, Y, and G represent the percent of received packets at a given signal strength.

    M = Percent of missed packets; R = RED marginal signal; Y = YELLOW good signal; G = GREEN excellent signal. Record the results if you need troubleshooting assistance from the factory.
7. Change the Gateway's rotary dials to conduct a Site Survey with another Node and repeat steps 2 through 6.
8. To end the Site Survey, double-click the Gateway's button 2.
9. Change the Gateway's rotary dials back to 0.
    The LCD displays the device readings for the Gateway.
10. Double-click button 2 to move back to the top level menu.
11. Single-click button 1 to return to RUN mode.
12. Install the rotary dial access cover, referring to the Installation section of the manual to create an IP67 seal.

### Interpreting the Site Survey Results

Site Survey results are listed as a percentage of data packets received and indicate the signal strength of the received signal.

| | Result | Description |
|---|---|---|
|  | Green | Packets received at a strong signal strength. A strong signal strength is greater than –90 dBm at the receiver. |
|  | Yellow | Packets received at a good signal strength. A good signal is between –90 and –100 dBm at the receiver. |
|  | Red | Packets received at a weak signal strength. A weak signal is less than –100 dBm at the receiver. |
|  | Missed | Packets not received on the first transmission and requiring a retry. |

Judging if the reliability of a network's signal meets the needs of the application is not just a matter of green, yellow, and red packets received. In normal operating mode, when data packets are not received, the transmitter re-sends the packet until all data is received.

For slow monitoring applications such as a tank farm, where data is required in terms of seconds or minutes, receiving most of the data in the 'red' range, indicating a weak but reliable signal, transmits enough data for accurate monitoring. Nodes positioned near the outside range of the radio signal may have 90% of the data packets received in the red zone, again indicating a weak, but reliable signal.

We recommend keeping the missed packets average to less than 25%. When the network misses more than 25% of the data packets, the signal is usually too unreliable or obstacles may be interfering with the signal. When Site Survey reports the missed packets are 25% or higher, improve the radio system performance by:

- **Mounting the network's antennas higher** to clear obstacles in the area and improve the line of sight between Sure Cross® devices

- **Using higher gain antennas** to focus the energy of the radio signal in a specific direction and extend the signal's range
- **Adding data radios to the network** to extend the range of a radio network. For more information on data radios, please refer to Banner's white paper on range extension on www.bannerengineering.com/wireless.

## Specifications

### Performance 2.4 GHz Radio Specifications

**Radio Range** [1]
2.4 GHz, 65 mW: Up to 3.2 km (2 miles)

**Antenna Minimum Separation Distance**
2.4 GHz, 65 mW: 0.3 m (1 ft)

**Radio Transmit Power**
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)

**2.4 GHz Compliance**
FCC ID UE300DX80-2400: FCC Part 15, Subpart C, 15.247
Radio Equipment Directive (RED) 2014/53/EU
IC: 7044A-DX8024

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

**Link Timeout**
Gateway: Configurable via User Configuration Software
Node: Defined by Gateway

### RS-485 Communication Specifications

**Communication Hardware (RS-485)**
Interface: 2-wire half-duplex RS-485
Baud rates: 9.6k, 19.2k (default), or 38.4k
Data format: 8 data bits, no parity, 1 stop bit

### Gateway Q Specifications

**Supply Voltage**
10 V DC to 30 V DC; Outside the USA: 12 V DC to 24 V DC, ± 10%
For European applications, power this device from a Limited Power Source as defined in EN 60950-1.
Consumption: Less than 1.4 W (60 mA) at 24 V DC

**Discrete Inputs**
Rating: 3 mA max current at 30 V DC
Sample Rate: 62.5 milliseconds
Report Rate: On change of state
ON Condition (PNP): Greater than 8 V
OFF Condition (PNP): Less than 5 V

**Discrete Outputs**
Update Rate: 125 milliseconds
ON Condition: Supply minus 2 V
OFF Condition: Less than 2 V
Output State Following Timeout: OFF

**Discrete Output Rating (PNP)**
100 mA max current at 30 V DC
ON-State Saturation: Less than 3 V at 100 mA
OFF-state Leakage: Less than 10 µA

**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: Red/Green Power LED, Red/Yellow Signal LED

**Wiring Access**
Two 1/2-inch NPT

**Certifications**

C E

### 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
Refer to the Sure Cross® Wireless I/O Networks Instruction Manual (p/n 132607) for installation and waterproofing instructions.

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

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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.