Sure Cross® Gateway Module for Wireless Q45 Sensors

Datasheet

Configurable Gateway radio module that maps inputs from up to four Nodes or two Wireless Q45 Sensors to the Gateway's outputs

Sure Cross® embeddable board radio modules were specifically designed for the needs of industrial users to provide connectivity where traditional wired connections are not possible or cost prohibitive. Wireless networks are formed around a Gateway, which acts as the wireless network master device, and one or more Nodes. Sure Cross embeddable board radio modules communicate with all Sure Cross radios.

- Wireless industrial I/O device with two sourcing discrete inputs and two sourcing discrete outputs
- 10 to 30 V dc power input
- 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
- Site Survey analyzes the network's signal strength and reliability and conveys the results using the two-color LED
- Frequency Hopping Spread Spectrum (FHSS) technology and Time Division Multiple Access (TDMA) control architecture ensure 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
- Lost RF links are detected and relevant outputs set to user-defined conditions

For additional information, updated documentation, and accessories, refer to Banner Engineering's website, *www.bannerengineering.com/surecross*.

Models	Frequency	Inputs and Outputs
DX80G2M6-B2Q	2.4 GHz ISM Band	Inputs: Two sourcing discrete Outputs: Two sourcing discrete

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

⚠ **CAUTION: Electrostatic Discharge (ESD)**
ESD Sensitive Device. Use proper handling procedures to prevent ESD damage to these devices. The module does not contain any specific ESD protection beyond the structures contained in its integrated circuits. Proper handling procedures should include leaving devices in their anti-static packaging until ready for use; wearing anit-static wrist straps; and assembling units on a grounded, static-dissipative surface.

Setting Up and Installing a Wireless Q45

To set up and install your Gateway and Wireless Q45, follow these steps.

1. Configure the Gateway and Wireless Q45 I/O Mapping
2. Wire the Gateway's I/O
3. Apply power to the Gateway
4. Bind the Wireless Q45 to the Gateway
5. Observe the LED behavior to verify the devices are communicating to each other
6. Conduct a Site Survey between the Gateway and the Wireless Q45
7. Install your devices

Configure the DIP Switches

Before making any changes to the DIP switch positions, disconnect the power. DIP switch changes will not be recognized if power isn't cycled to the device.

For parameters not set via DIP switches, use the User Configuration Tool (UCT) to make configuration changes. For parameters set using the DIP switches, the DIP switch positions override any changes made using the User Configuration Tool.

DIP Switch Settings

Transmit Power

The 900 MHz radios can be operated at 1 watt (30 dBm) or 250 mW (24 dBm). While the Performance radios operate in 1 Watt mode, they cannot communicate with the older 150 mW radios. To communicate with the older 150 mW radios, operate this radio in 250 mW mode. For 2.4 GHz models, this DIP switch is disabled. The transmit power for 2.4 GHz is fixed at about 65 mW EIRP (18 dBm), making the 2.4 GHz Performance models automatically compatible with older 2.4 GHz models.

DIP Switch 1	Transmit Power Level
OFF *	1 Watt (30 dBm, 900 MHz models only)
ON	250 mW (24 dBm, 900 MHz models only), DX80 compatibility mode

Modbus/UCT Configured or DIP Switch Configured

In Modbus/UCT Configured mode, the device parameters are changed using the User Configuration Tool (UCT) or a Modbus command. All DIP switch positions 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 SureCross DX80 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 sent 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		Output State During a Radio Link Loss
3	4	
OFF *	OFF *	Off (discrete) or 0 mA (analog)
ON	OFF	Hold last stable state
OFF	ON	On (discrete) or 20 mA (analog)
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.

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 for 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.
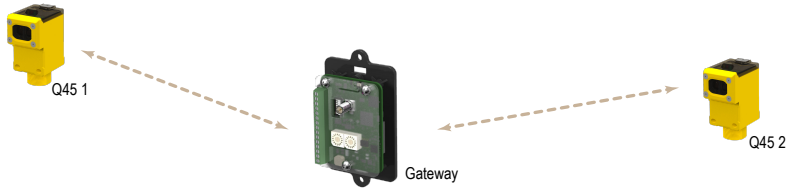
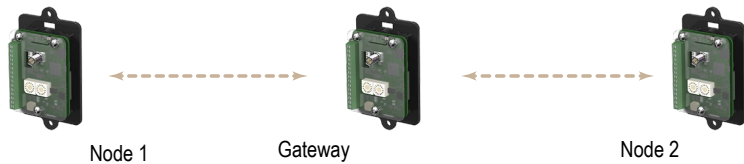| DIP Switches			I/O Mapping
6	7	8	
OFF *	OFF *	OFF *	Q45 01, input 1 → Gateway Discrete OUT 1 Q45 02, input 1 → Gateway Discrete OUT 2
OFF	ON	OFF	Q45 01, input 1 → Gateway Discrete OUT 1 Q45 01 link loss alarm → Gateway Discrete OUT 2
ON	OFF	OFF	Q45 01, input 1 → Gateway Discrete OUT 1 Q45 01, input 2 → Gateway Discrete OUT 2 Gateway Discrete IN 1 → Q45 01, output 1 Gateway Discrete IN 2 → Q45 01, output 2

* 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.

I/O Mapping for one DX80N2X6S-PB2 Node and a DX80G2M6S-B2Q Gateway
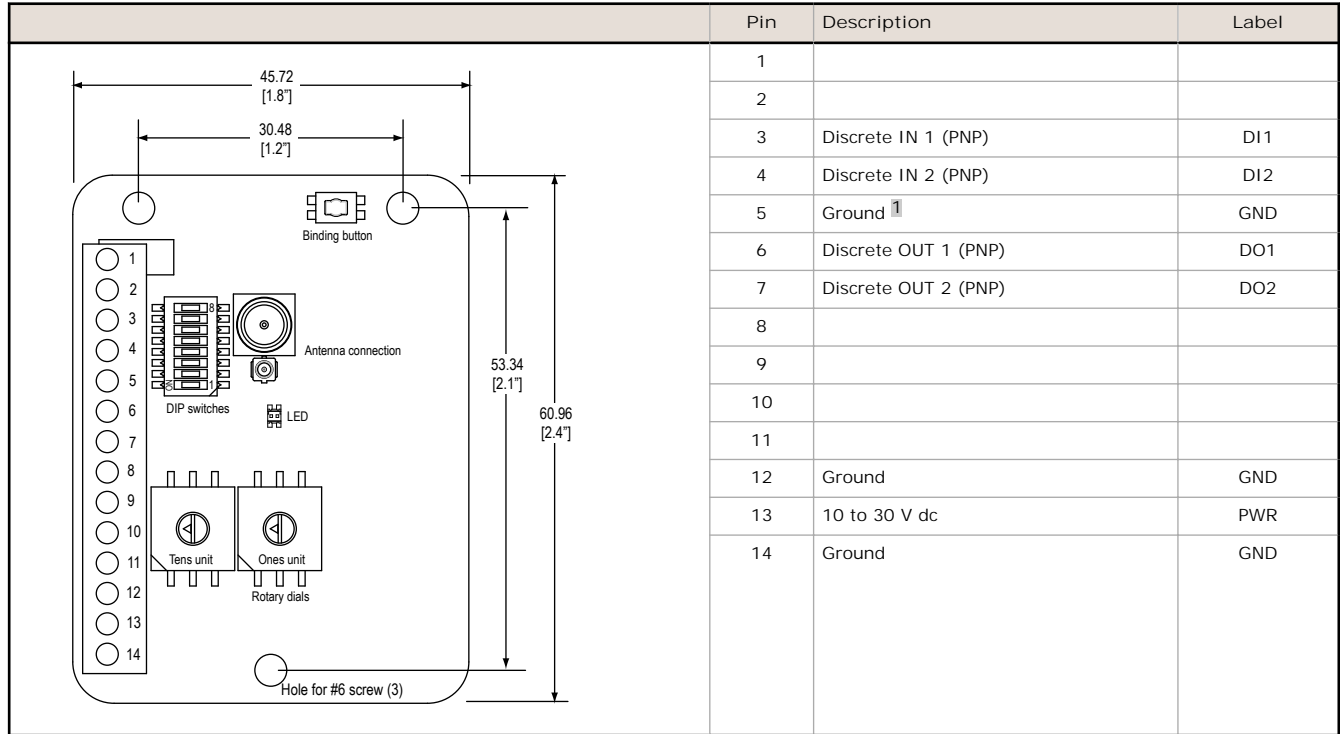

DIP Switches			
6	7	8	I/O Mapping Between a DX80N2X6S-PB2 and a DX80G2M6S-B2Q Gateway
ON	OFF	ON	Node 01 Discrete IN 1 → Gateway Discrete OUT 1 Node 01 Discrete IN 2 → Gateway Discrete OUT 2 Gateway Discrete IN 1 → Node 01 Discrete OUT 1 Gateway Discrete IN 2 → Node 01 Discrete OUT 2

I/O Mapping for two DX80N2X6S-PB2 Nodes and a DX80G2M6S-B2Q Gateway

DIP Switches			
6	7	8	I/O Mapping Between a DX80N2X6S-PB2 and a DX80G2M6S-B2Q Gateway
ON	ON	OFF	Node 01 Discrete IN 1 → Gateway Discrete OUT 1 Node 02 Discrete IN 1 → Gateway Discrete OUT 2 Gateway Discrete IN 1 → Node 01 Discrete OUT 1 Gateway Discrete IN 2 → Node 02 Discrete OUT 1

Wire the Gateway's I/O and Apply Power

Pin	Description	Label
1		
2		
3	Discrete IN 1 (PNP)	DI1
4	Discrete IN 2 (PNP)	DI2
5	Ground [1]	GND
6	Discrete OUT 1 (PNP)	DO1
7	Discrete OUT 2 (PNP)	DO2
8		
9		
10		
11		
12	Ground	GND
13	10 to 30 V dc	PWR
14	Ground	GND

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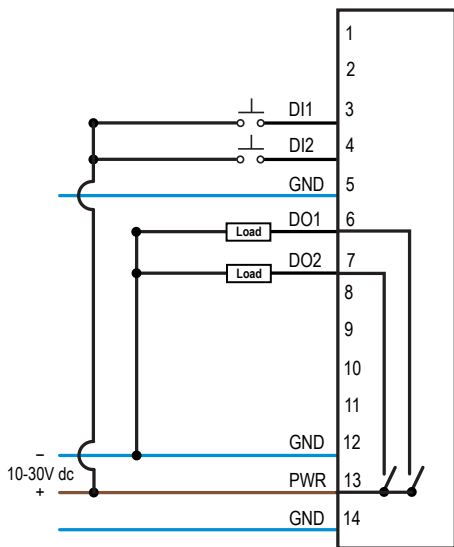

Figure 1. Input and Output Wiring

Bind the Q45s to the Gateway and Assign the Node Address

Before beginning the binding procedure, apply power to all the devices.

1. Enter binding mode on the Gateway.
   - For single-button models, triple-click the button.
   - For two-button models, triple-click button 2.

   On the board modules, the green and red LED flashes. On the housed Gateway models, both LEDs flash red.

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[1] The three ground connections are tied together internally.

2. Assign the Q45 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 Q45 to Node 01, set the left dial to 0 and the right dial to 1.

   Valid Node addresses are 01 through 47.

3. Loosen the clamp plate on the top of the Wireless Q45 Sensor and lift the cover.

4. Enter binding mode on the Wireless Q45 Sensor by triple-clicking the button. For the opposed mode sensor, the button is on the receiver.
   The red and green LEDs flash alternately and the sensor searches for a Gateway in binding mode. After the Q45 is bound, the LEDs stay solid momentarily, then they flash together four times. The Q45 exits binding mode.

5. Label the sensor with the Q45's Node address number and place the sticker on the Wireless Q45 Sensor.

6. Repeat steps 2 through 5 for as many Wireless Q45 Sensors as are needed for your network.

7. After binding all Wireless Q45 Sensors, exit binding mode on the Gateway.

   • For single-button models, double-click the button.
   • For two-button models, double-click button 2.

For Gateways with LCDs, after binding your Wireless Q45 Sensors 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 Q45s if your Gateway is ever replaced.

LED Behavior for the Gateways

Verify all devices are communicating properly. The radios and antennas must be a minimum distance apart to function properly. Recommended minimum distances are:

   900 MHz 150 mW radios: 6 feet
   900 MHz 1 Watt radios: 15 feet
   2.4 GHz 65 mW radios: 1 foot

LED (Bi-color)	Gateway Status
Solid green	Power ON
Green and red flashing alternately	Binding mode
Flashing red	Device Error
Green and red flashing together, looks amber	Modbus Communication Active
Flashing red	Modbus Communication Error
Solid red	Gateway is trying to conduct a Site Survey with a Node that doesn't exist
Green and red solid together, looks amber)	No radio communication detected

For Gateway and Ethernet Bridge systems, active Modbus communication refers to the communication between the Gateway and the Ethernet Bridge. For Gateway-only systems, the Modbus communication LEDs refer to the communication between the Gateway and its host system (if applicable).

Conduct a Site Survey from a Gateway Board Model

Conducting a Site Survey, also known as an RSSI (Radio Signal Strength Indication), 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. Only the Gateway can initiate a Site Survey, and the Site Survey analyzes the radio communications link with one Node at a time. Follow these steps to conduct a Site Survey from the board module Gateway.

1. To start the Site Survey, set the Gateway's rotary dials to the Node address you'd like to conduct a Site Survey with. For example, to analyze the signal strength between this Gateway and Node 02, rotate the left rotary dial to 0 and the right rotary dial to 2.
   The Site Survey automatically begins running. If there is a device at address 02, the LED flashes amber. If there is no device at address 02, the LED is solid red. The amber LED flashes at varying rates to indicate the signal strength.

2. To exit the Site Survey, set the Gateway's rotary dials to 00. Otherwise, after 15 minutes the Gateway automatically exits Site Survey mode.
   The LED flashes green to indicate the Gateway is in standard operating mode.

The amber LED flashes at specific rates to indicate the Site Survey results. Each signal strength represents the majority of the data packets being received at that signal strength. For example, a strong signal strength indicates the majority of the data packets were received at a strong signal, but a few many have been received at a good or weak signal strength.

   • Eight flashes per second: Very strong signal strength
   • Four flashes per second: Strong signal strength

- Two flashes per second: Good signal strength
- One flash per second: Weak signal strength
- Solid amber LED: No radio communication detected

Modbus Register Table

I/O #	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation	
	Gateway	Any Node		Min.	Max.	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Discrete IN 1	0	1	0	1
2	2	2 + (Node# × 16)	Discrete IN 2	0	1	0	1
		…					
7	7	7 + (Node# × 16)	Reserved				
8	8	8 + (Node# × 16)	Device Message				
9	9	9 + (Node# × 16)	Discrete OUT 1	0	1	0	1
10	10	10 + (Node# × 16)	Discrete OUT 2	0	1	0	1
		…					
15	15	15 + (Node# × 16)	Control Message				
16	16	16 + (Node# × 16)	Reserved				

Specifications

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

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

2.4 GHz Compliance
FCC ID UE300DX80-2400 - This device complies with FCC Part 15, Subpart C, 15.247
ETSI EN 300 328 V1.8.1 (2012-06)
IC: 7044A-DX8024

Discrete Input
Two, sourcing
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 Output
Two, sourcing
Update Rate: 1 second
ON Condition (PNP): Supply minus 2 V
OFF Condition (PNP): Less than 2 V
Output State Following Timeout: De-energized (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

Supply Voltage
10 to 30 V dc (Outside the USA: 12 to 24 V dc, ±10%). [3]

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)

Interface
Indicators: One bi-color LED
Buttons: One

Wiring Access
Terminal block

Radiated Immunity
10 V/m (EN 61000-4-3)

Operating Conditions [4]
−40 °C to +85 °C (−40 °F to +185 °F)
95% maximum relative humidity (non-condensing)

Certifications

CSA: Class I Division 2 Groups ABCD, Class I Zone 2 AEx/Ex nA II T4 — Certificate: 1921239

ATEX: II 3 G Ex nA IIC T4 Gc (Group IIC Zone 2) — Certificate LCIE 10 ATEX 1012 X

Refer to the Class I Division 2/Zone 2 control drawings (p/n *143086*) for wiring specifications or limitations. All battery-powered devices must only use the lithium battery manufactured by Xeno, model XL-205F.

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[2] 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.
[3] For European applications, power this device from a Limited Power Source as defined in EN 60950-1.
[4] Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.

Accessories for the Board Models

BWA-HW-034 • DIN rail clip, black plastic	BWA-HW-030 • u.FL to RP-SMA adapter cable

MultiHop M-HBx and Performance PBx Models Mounted on the Base

94 mm [3.70"]

4.5mm dia [0.18"]

26.8 mm [1.06"]
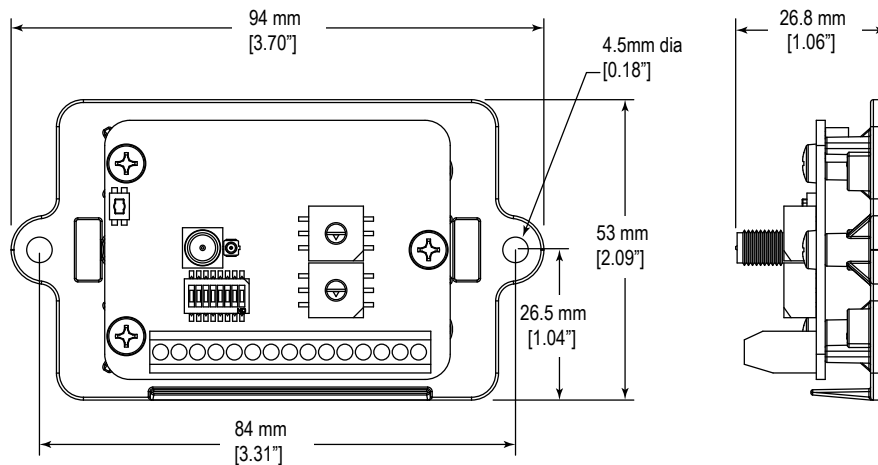
53 mm [2.09"]

26.5 mm [1.04"]

84 mm [3.31"]

Figure 2. Most MultiHop M-HBx and Performance PBx models ship from the factory mounted on a plastic base.

Warnings

Install and properly ground a qualified surge suppressor when installing a remote antenna system. Remote antenna configurations installed without surge suppressors invalidate the manufacturer's warranty. Keep the ground wire as short as possible and make all ground connections to a single-point ground system to ensure no ground loops are created. No surge suppressor can absorb all lightning strikes; do not touch the Sure Cross® device or any equipment connected to the Sure Cross device during a thunderstorm.

Exporting Sure Cross® Radios. It is our intent to fully comply with all national and regional regulations regarding radio frequency emissions. Customers who want to re-export this product to a country other than that to which it was sold must ensure the device is approved in the destination country. A list of approved countries appears in the *Radio Certifications* section of the product manual. The Sure Cross wireless products were certified for use in these countries using the antenna that ships with the product. When using other antennas, verify you are not exceeding the transmit power levels allowed by local governing agencies. Consult with Banner Engineering Corp. if the destination country is not on this list.

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