SureCross Performance Radio Module with I/O

Configurable FlexPower Node with discrete inputs, discrete outputs, and analog inputs

more sensors, more solutions

SureCross® Performance embeddable board 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. SureCross Performance embeddable board modules communicate with all SureCross Performance radios.

- Wireless industrial I/O device with two sinking discrete inputs, two NMOS discrete outputs, two 0 to 20 mA analog inputs, and two switch power 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.
- DIP switches for user configuration
- 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

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	Inputs and Outputs
DX80N9X2S-PB1	900 MHz ISM Band	**Inputs**: Two sinking discrete. two 0-20 mA analog **Outputs**: Two NMOS/sinking discrete **Switch Power**: Two
DX80N2X2S-PB1	2.4 GHz ISM Band	

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 handing 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.

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.

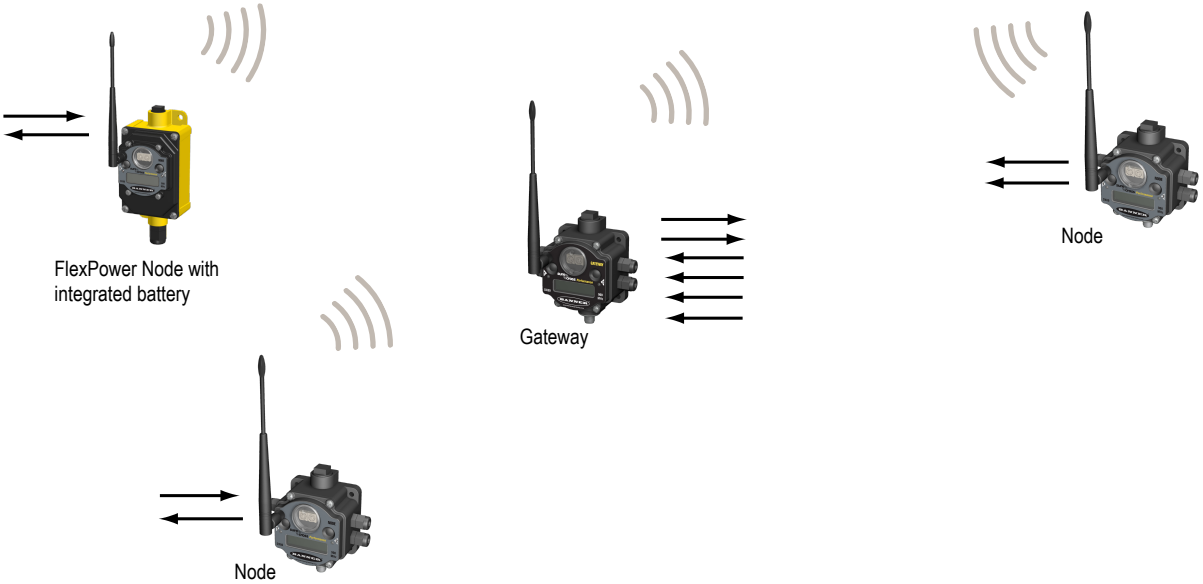
The SureCross® Performance Wireless Network

The SureCross® Performance wireless I/O network provides reliable monitoring without the burden of wiring or conduit installation. The SureCross wireless network can operate independently or in conjunction with a host system, PLC, and/or PC software.

P/N 163210 Rev. B 11/14/2012

0 163210 7

Each wireless network system consists of one Gateway and one or more Nodes. Devices ship with factory defined inputs and outputs that may be all discrete, all analog, or a mix of discrete and analog I/O.



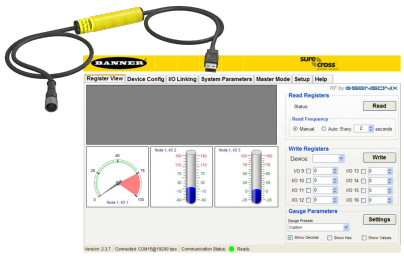
The SureCross® Performance network is a deterministic system—the network identifies when the radio signal is lost and drives relevant outputs to user-defined conditions. Once the radio signal is reacquired, the network returns to normal operation.

SureCross® Performance Gateways and Nodes

A **Gateway** is the master device within each radio network. Every wireless network must have one Gateway that schedules communication traffic and controls the I/O configuration for the network. A radio network contains only one Gateway, but can contain many 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 and 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. Each Node device can be connected to sensors or output devices and reports I/O status to the Gateway.

SureCross User Configuration Tool



The User Configuration Tool (UCT) offers an easy way to link I/O points in your wireless network, view I/O register values graphically, and set system communication parameters when a host system is not part of the wireless network.

The UCT requires a special USB to RS-485 (model number BWA-UCT-900 for 1 Watt radios, BWA-HW-006 can be used for all other radios) converter cable to pass information between your computer and the Gateway. Download the most recent revisions of the UCT software from Banner Engineering's website: *http://www.bannerengineering.com/wireless*.

Mixing Performance and Non-Performance Radios in the Same Network

To comply with federal regulations, the 150 mW radios and 1 Watt radios communicate differently. To mix Performance radios with non-Performance radios:

- Performance radios must operate in 250 mW mode, **not** 1 Watt mode (DIP switch 1 ON)
- Non-Performance radios must be set to use Extended Address Mode (DIP switch 1 ON)

For more detailed instructions about setting up your wireless network, refer to the Quick Start Guide, Banner document number 128185. For more information about using Performance and non-Performance radios within the same network, refer the technical note titled *Mixing Performance Radios and 150 mW Radios in the Same Network*listed on the FAQ/Knowledgebase section of Banner's Wireless Sensor Networks website.

Setting Up Your Wireless Network

To set up and install your wireless network, follow these steps:

1. Configure the DIP switches of all devices.
2. Connect the sensors to the SureCross devices.
3. Apply power to all devices.
4. Form the wireless network by binding the Nodes to the Gateway. If the binding instructions are not included in the datasheet, refer to the product manual for binding instructions.
5. Observe the LED behavior to verify the devices are communicating with each other.
6. Conduct a site survey between the Gateway and Nodes. If the site survey instructions are not included in this datasheet, refer to the product manual for detailed site survey instructions.
7. Install your wireless sensor network components. If installation instructions are not included in this datasheet, refer to the product manual for detailed installation instructions.

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.

- SureCross Quick Start Guide: Banner part number *128185*
- SureCross Wireless I/O Network Manual: *132607*
- Web Configurator Manual (used with "Pro" and DX83 models): *134421*
- Host Configuration Manual *132114*

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.

DIP Switch Settings

	Switches							
Device Settings	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Transmit power level (900 MHz only): 1 Watt (30 dBm)	OFF*							
Transmit power level (900 MHz only): 250 mW (24 dBm), DX80 compatibility mode	ON							
Host configured (overrides switches 3-8)		OFF*						
Use switch settings		ON						
Link loss output: OFF or 0 mA				OFF*	OFF*			
Link loss output: ON or 20 mA				OFF	ON			
Link loss output: hold last state				ON	OFF			
Reserved				ON	ON			
0–20 mA scale **						OFF*		
4–20 mA scale **						ON		

* Default configuration

** This DIP switch is only used for 0–20 mA analog I/O models, not for 0–10V analog I/O models.

Analog Input and Output Scale

Use the DIP switch to select which current scale to use for all the device's analog inputs and outputs: 0 to 20 mA or 4 to 20 mA. When using a 4-20 mA sensor with a 0-20 mA input, the sensor uses the 4-20 mA section of the total range. Using a 4-20 mA with a 0-20 mA

input allows you to determine when you have an error condition with the sensor. A normal input reading between 4 and 20 mA indicates a functioning sensor whereas a value below 4 mA indicates an error condition, such as a broken wire or loose connection. This DIP switch is used only on the 0 to 20 mA models, not the 0 to 10V models.

Host Configured

Selecting “Host Configured (override switches)” uses the factory’s default configuration for this device or allows a host system to set parameters. If the host configured option is not selected, use the DIP switches to configure the device parameters.

Link Loss Outputs

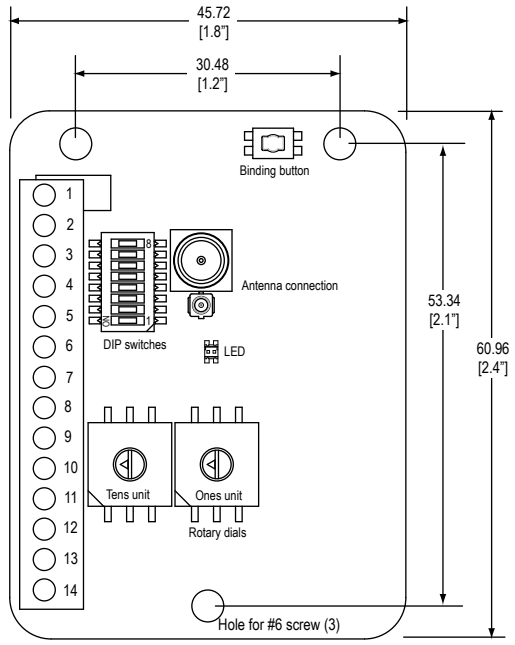
The SureCross DX80 wireless devices use a deterministic radio link time-out method to address RF link interruption or failure. When a radio link fails, all pertinent wired outputs are sent to defined states until the link is recovered, ensuring that disruptions in the communications link result in predictable system behavior.

Following a radio link time-out, all outputs linked to the Node in question are set to de-energize (discrete outputs to zero, analog outputs to 0 mA or 4 mA), energize (discrete outputs to one, analog outputs to 20 mA), or to hold the last stable state/value. Use the DIP switches to select the link loss output state.

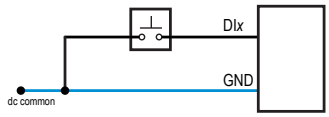
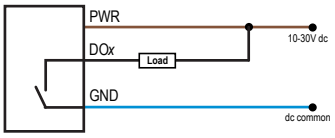
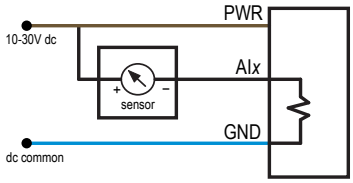
Transmit Power Levels

The 900 MHz radios can be operated at 1 watt (30 dBm) or 250 mW (24 dBm). While the radios operate in 1 Watt mode, they cannot communicate with 150 mW DX80 radio devices. To communicate with the 150 mW radio models, operate this radio in 250 mW mode. For 2.4 GHz radios, this DIP switch is disabled. The transmit power for 2.4 GHz is fixed at about 100 mW EIRP (18 dBm), making the 2.4 GHz Performance models automatically compatible with the DX80 2.4 GHz models.

Wiring Diagrams



Pin	Description	Diagram Label
1	Analog IN 1 (0 to 20 mA)	AI1
2	Analog IN 2 (0 to 20 mA)	AI2
3	Discrete IN 3 (NPN)	DI3
4	Discrete IN 4 (NPN)	DI4
5	Ground	GND
6	Switch Power 1 (see Switch Power output register definition)	SP1
7	Switch Power 2 (see Switch Power output register definition)	SP2
8	Discrete OUT 3	DO3
9	Discrete OUT 4	DO4
10	RS-485 + Host communication connection	Not used
11	RS-485 – Host communication connection	Not used
12	Ground	GND
13	10 to 30V dc	PWR
14	3.3V to 5.5V dc low power connection	

Discrete Input Wiring for NPN Sensors	Discrete Output Wiring (NPN or NMOS)	Analog Input Wiring
		

Binding Radios to Form Networks

Binding Nodes to a Gateway ensures the Nodes only exchange data with the Gateway they are bound to.

Apply power to the Gateway and the Node you are binding.

Binding Nodes to a Gateway ensures the Nodes only exchange data with the Gateway they are bound to. After a Gateway enters binding mode, the Gateway automatically generates and transmits a unique extended addressing (XADR), or binding, code to all Nodes within range that are also in binding mode. The extended addressing (binding) code defines the network, and all radios within a network must use the same code. After binding your Nodes to the Gateway, make note of the binding code displayed under the *DVCFG menu, XADR submenu on the LCD. Knowing the binding code prevents having to re-bind all Nodes if your Gateway is ever replaced.

1. Put the Gateway in binding mode.

Option	Description
Two-button Gateways	Triple-click button 2
One-button Gateways	Triple-click the button
Gateways without buttons	Remove the rotary dial access cover and set both the right and left rotary dials to 0, then set both the right and left rotary dials to F. Note that both rotary dials must be changed to F after applying power, not before applying power.

   The red LEDs flash alternately when the Gateway is in binding mode. Any Node entering binding mode will bind to this Gateway.

2. Put the Node in binding mode.

Option	Description
Two-button Nodes	Triple-click button 2
One-button Nodes	Triple-click the button
Nodes without buttons	Remove the top cover and set both the left and right rotary dials to F to enter binding mode.

   The Node enters binding mode and locates the Gateway in binding mode. With two LED models, the red LEDs flash alternately. With one LED models, the red and green LED flashes alternately while the Node searches for the Gateway; after binding is complete, the LED is red and green for four seconds (looks orange), then the red and green flash simultaneously (looks orange) four times. The Node automatically exits binding mode. After the Node is bound, the LEDs are both solid red for a few seconds. The Node cycles its power, then enters RUN mode.

3. Use both of the Node's rotary dials to assign a valid decimal Node Address (between 01 and 47). The left rotary dial represents the tens digit (0 through 4) and the right dial represents the ones digit (0 through 9) of the Node Address.
4. Repeat steps 2 and 3 for all Nodes that need to communicate to this Gateway.
5. Exit binding mode on the Gateway.

Option	Description
Two-button Gateways	Single click either button 1 or button 2
One-button Gateways	Single-click the button
Gateways with no buttons	Change the Gateway’s rotary dials to a valid Network ID.

Notes on Network IDs: Valid Network IDs are 01 through 32, in decimal, established using both rotary dials. The left dial may be set to 0, 1, 2, or 3. The right dial may be set from 0 to 9 when the left dial is at 0, 1, or 2; or set to 0 through 2 when the left dial is at 3. (Positions A through F are invalid network ID numbers.)

When installing special kits with pre-mapped I/O, indicated by device model numbers beginning in DX80K, return the rotary dials to their original positions after binding. If the rotary dials are not returned to their original positions, the I/O mapping will not work.

LED Behavior for the Nodes

After powering up and binding the Gateway and its Nodes, verify all devices are communicating properly. A Node will not sample its inputs until it is communicating with the Gateway to which it is bound. When testing communication between the Gateway and Node, verify all radios and antennas are at least two meters apart or the communications may fail. This table lists the LED behavior for the Node models with one LED.

LED (Bi-color)	Gateway Status
(green flashing)	Radio link okay
(green and red flashing alternately)	Binding mode
(red flashing, once every three seconds)	Radio link error
(red flashing, once every second)	Device error

Installing the Board Modules

SureCross board modules must be mounted inside a panel or OEM enclosure.

Modbus Register Table

I/O	Modbus Holding Register		I/O Type	Units	I/O Range		Holding Register Representation	
	Gateway	Any Node			Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Discrete IN 3	-	0	1	0	1
2	2	2 + (Node# × 16)	Discrete IN 4	-	0	1	0	1
3	3	3 + (Node# × 16)	Analog IN 1	mA	0.0	20.0	0	65535
4	4	4 + (Node# × 16)	Analog IN 2	mA	0.0	20.0	0	65535
		...						
7	7	7 + (Node# × 16)	Reserved					
8	8	8 + (Node# × 16)	Device Message					
9	9	9 + (Node# × 16)	Discrete OUT 3	-	0	1	0	1
10	10	10 + (Node# × 16)	Discrete OUT 4	-	0	1	0	1
		...						
15	15	15 + (Node# × 16)	Control Message					
16	16	16 + (Node# × 16)	Reserved					

Specifications

Radio

Radio Range

900 MHz (1 Watt): Up to 9.6 kilometers (6 miles) *

2.4 GHz: Up to 3.2 kilometers (2 miles) *

Radio Transmit Power

900 MHz (1 Watt): 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)

Link Timeout

Gateway: Configurable

Node: Defined by Gateway

* 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. To determine the range of your wireless network, perform a Site Survey.

General

Power*

Requirements: +10 to 30V dc or 3.6 to 5.5V dc low power option (For European applications: +10 to 24V dc, ± 10% or 3.6 to 5.5V dc low power option)

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

* For European applications, power the DX80 from a Limited Power Source as defined in EN 60950-1.

Inputs

Discrete Input

Rating: 3 mA max current at 30V dc

Sample Rate: 62.5 milliseconds

Report Rate: On change of state

ON Condition (NPN): Less than 0.7V

OFF Condition (NPN): Greater than 2V or open

Analog Inputs

Rating: 24 mA

Impedance: 100 Ohms

Sample Rate: 1 second

Report Rate: 16 seconds or On Change of State (1% change in value)

Accuracy: 0.1% of full scale +0.01% per °C

Resolution: 12-bit

To verify the analog input's impedance, use an Ohm meter to measure the resistance between the analog input terminal (AI*x*) and the ground (GND) terminal.

Outputs

Discrete Output Rating (NMOS)

Less than 10 mA max current at 30V dc

ON-State Saturation: Less than 0.7V at 20 mA

Discrete Output

Update Rate: 1 second

ON Condition: Less than 0.7V

OFF Condition: Open

Output State Following Timeout

De-energized (OFF)

Switch Power Outputs

Two

Environmental

Environmental

Operating Temperature: −40 to +85° C

Operating Humidity: 95% max. relative (non-condensing)

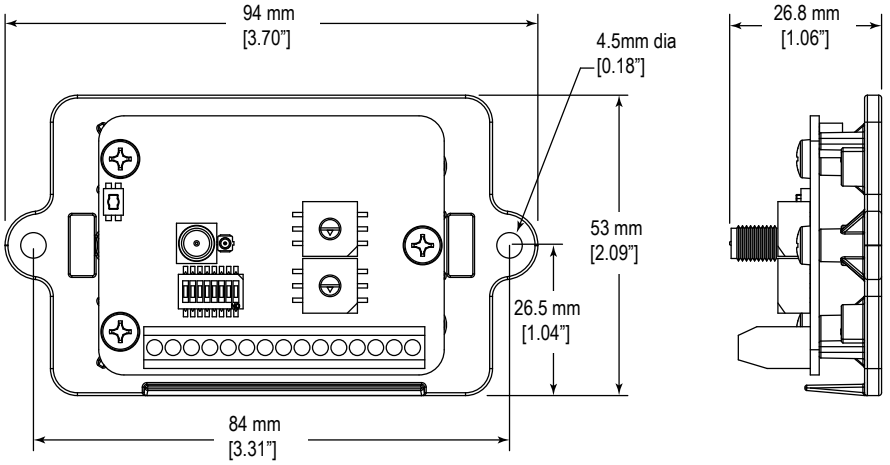
Radiated Immunity

10 V/m, 80-2700 MHz (EN61000-6-2)

Refer to the SureCross® DX80 Wireless I/O Network product manual, Banner 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.

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

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



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.

All specifications published in this document are subject to change. Banner reserves the right to modify the specifications of products without notice. Banner Engineering reserves the right to update or change documentation at any time. For the most recent version of any documentation, refer to our website: *www.bannerengineering.com*.

Banner Engineering Corp Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp.