

# SureCross Temperature Probe with DX80 Node



Configurable temperature Node with thermocouple inputs and a battery integrated into the housing, mounted on a probe

## Features



The SureCross™ wireless system is a radio frequency network with integrated I/O that can operate in most environments while eliminating the need for wiring runs. Systems are built around a Gateway, which acts as the wireless network master device, and one or more Nodes.

This temperature probe is designed for measuring the temperature at three different depths of a compost pile. A DX80 Node with a battery integrated into the housing transmits the temperature readings to a Gateway.

- Wireless industrial I/O device with three thermocouple inputs
- FlexPower™ technology driven by one lithium primary battery integrated into the housing
- DIP switches for user configuration
- Frequency Hopping Spread Spectrum (FHSS) technology and Time Division Multiple Access (TDMA) control architecture combine to 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
- Internal antenna

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](http://www.bannerengineering.com/surecross).

## Models

Model	Description	Frequency	I/O
BWA-TPROBE-001	Wireless DX80 Node and temperature probe	900 MHz ISM Band	<b>Inputs:</b> Three thermocouple
BWA-TPROBE-002		2.4 GHz ISM Band	
DX80N9C-16999	DX80 Node (no probe assembly)	900 MHz ISM Band	
DX80N2C-16997		2.4 GHz ISM Band	

**These Nodes are powered by an internal battery. All batteries must be ordered separately.**



### WARNING: Not To Be Used for Personnel Protection

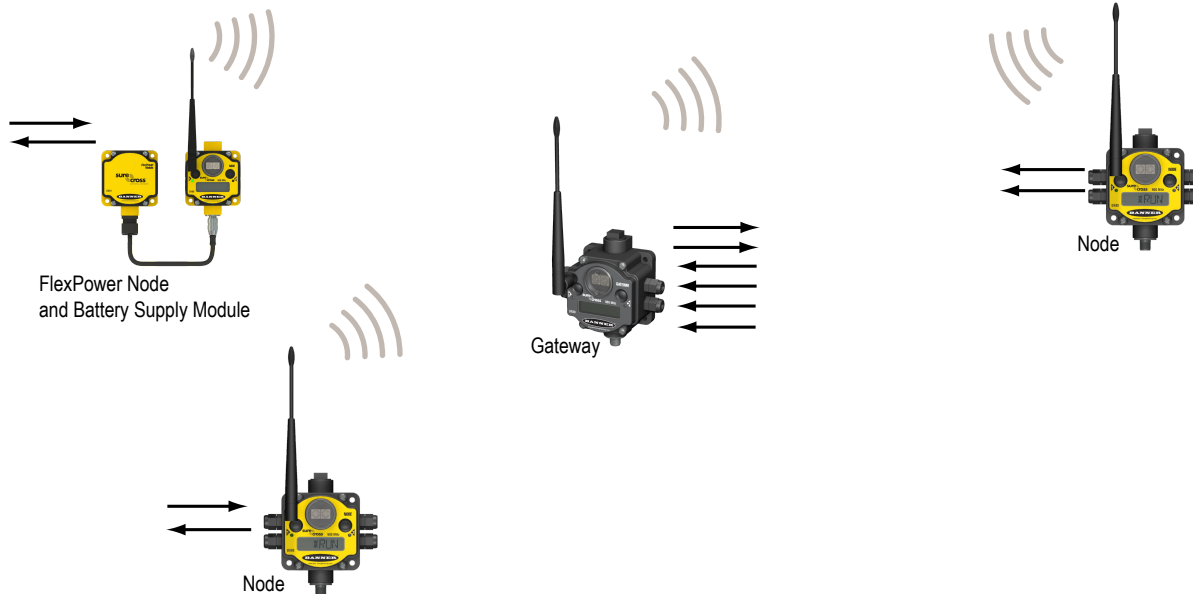
Never use this product as a sensing device for personnel protection. Doing so could lead to serious injury or death. This product does NOT include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.



## The SureCross DX80 Wireless Network

The SureCross DX80 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.

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 DX80 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 DX80 Gateways and Nodes

A **Gateway** acts as the master device within each radio network, initiates communication and reporting with the Nodes, and controls the timing for the entire network.

The Gateway also holds the configuration for the 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 central control process.

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.

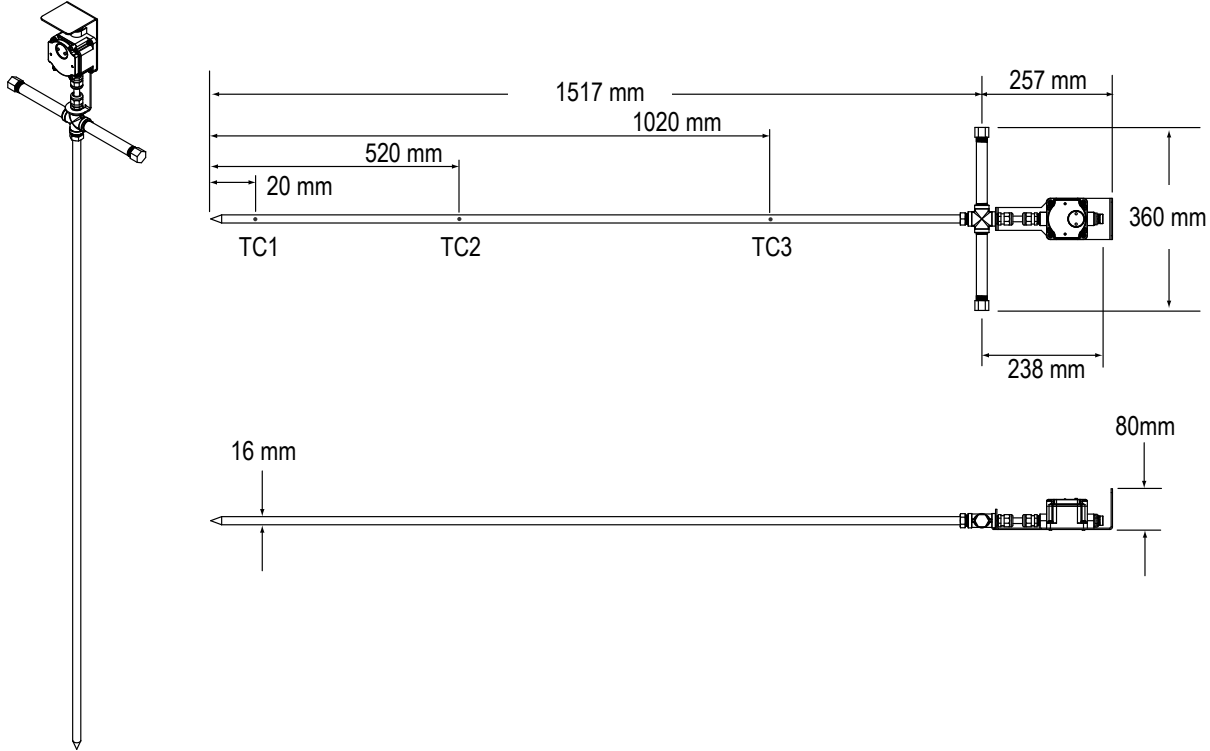
### Host Systems

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.

## Dimensions

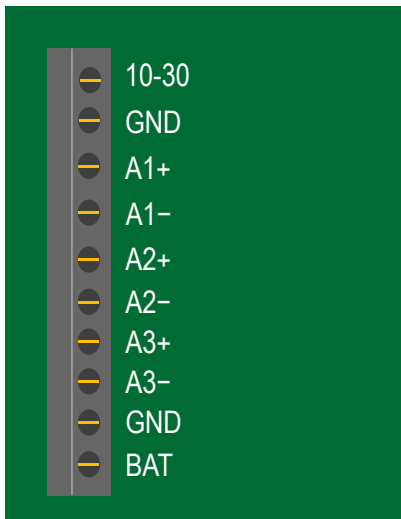


## Assembly

The probe is assembled except for the two handles and handle caps, which ship in a separate bag (model ACC-BWA-TPROBE-HANDLES). To attain the proper seal and protect the probe and sensors from the environment, wrap each pipe thread connection three or four times with the PTFE tape before tightening the handles to the probe bracket assembly.

## Wiring Diagrams

### Terminal Block (Mini Board)



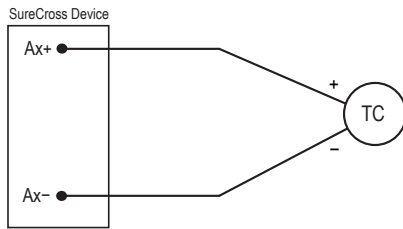
10-30. Power, 10 to 30V dc power connection. (For internal battery models, do not use this connection.)

Ax+ and Ax-. Analog IN x. Analog inputs for devices requiring more than one connection, such as thermocouples or RTDs. When there is no Ax-, use Ax+ as an analog input.

BAT. Internal battery connection.

GND. Ground/dc common connection.

## Wiring Diagram for Thermocouple Inputs



Thermocouple: When wiring the thermocouple, x is the same number. For example, a thermocouple is wired to A1+ and A1-.

## Additional Information

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](#)

## Modbus Register Table

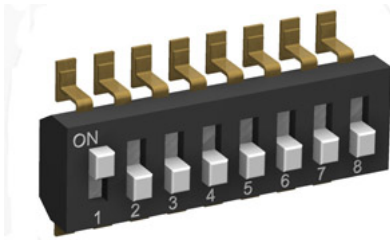
I/O	Modbus Holding Register		I/O Type	Units	I/O Range		Holding Register Value		Terminal Block Labels
	Gateway	Any Node			Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)	
1	1	1 + (Node# × 16)							
2	2	2 + (Node# × 16)							
3	3	3 + (Node# × 16)	Thermocouple IN 1	°F/°C	-1638.3	+1638.4	0	65535	A1+/A1-
4	4	4 + (Node# × 16)	Thermocouple IN 2	°F/°C	-1638.3	+1638.4	0	65535	A2+/A2-
5	5	5 + (Node# × 16)	Thermocouple IN 3	°F/°C	-1638.3	+1638.4	0	65535	A3+/A3-
6	6	6 + (Node# × 16)	Thermistor IN	°F/°C	-1638.3	+1638.4	0	65535	On board
7	7	7 + (Node# × 16)	Reserved						
8	8	8 + (Node# × 16)	Device Message						
9	9	9 + (Node# × 16)							
10	10	10 + (Node# × 16)							
11	11	11 + (Node# × 16)							
12	12	12 + (Node# × 16)							
13	13	13 + (Node# × 16)							
14	14	14 + (Node# × 16)							
15	15	15 + (Node# × 16)	Control Message						
16	16	16 + (Node# × 16)	Reserved						

The temperature = (Modbus register value) ÷ 20.

Temperature values are stored as signed values in the Modbus register. A 0 in the register is interpreted as 0°; and 65535 in the register (0xFFFF) is interpreted as -1 ÷ 20 = -0.05°.

## Device Configuration

### DIP Switch Changes



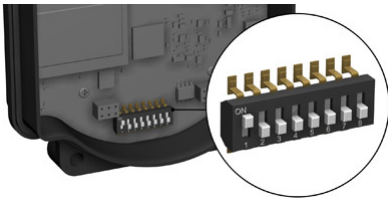
Before making any changes to the DIP switch positions, disconnect the power. For devices with batteries integrated into the housing, remove the battery for at least one minute.

DIP switch changes will not be recognized if power isn't cycled to the device.

### Accessing the DIP Switches

To access the DIP switches, follow these steps:

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. For Class I, Division 2 certified devices, skip this step (the ribbon cable is glued).
4. Remove the black cover plate from the bottom of the device's cover.



The DIP switches are located behind the rotary dials. After making the necessary changes to the DIP switches, place the black cover plate back into position and gently push into place. Plug the ribbon cable in after verifying that the blocked hole lines up with the missing pin. Mount the cover back onto the housing.

### DIP Switch Settings

All unused switches must remain in the OFF position.

Device Settings	Switches							
	1	2	3	4	5	6	7	8
Rotary switch address mode	OFF*							
Extended address mode	ON							
Temp °Fahrenheit		OFF*						
Temp °Celsius		ON						
Thermocouple, J-Type					OFF	OFF	OFF	OFF
Thermocouple, B-Type					OFF	OFF	OFF	ON
Thermocouple, C-Type					OFF	OFF	ON	OFF
Thermocouple, D-Type					OFF	OFF	ON	ON
Thermocouple, E-Type					OFF	ON	OFF	OFF
Thermocouple, G-Type					OFF	ON	OFF	ON
Thermocouple, K-Type					OFF	ON	ON	OFF

Switches								
Device Settings	1	2	3	4	5	6	7	8
Thermocouple, L-Type					OFF	ON	ON	ON
Thermocouple, M-Type					ON	OFF	OFF	OFF
Thermocouple, N-Type					ON	OFF	OFF	ON
Thermocouple, P-Type					ON	OFF	ON	OFF
Thermocouple, R-Type					ON	OFF	ON	ON
Thermocouple, S-Type					ON	ON	OFF	OFF
Thermocouple, T-Type					ON	ON	OFF	ON
Thermocouple, U-Type					ON	ON	ON	OFF

\* Default configuration.

### Address Mode

The SureCross wireless devices may use one of two types of addressing modes: rotary dial addressing or extended addressing. In **rotary dial** address mode, the left rotary dial establishes the network ID and the right rotary dial sets the device ID. The wireless network is restricted to a maximum of 16 devices.

**Extended** address mode uses a security code to "bind" Nodes to a specific Gateway. Bound Nodes can only send and receive information from the Gateway to which they are bound. In extended address mode, wireless networks may contain up to 48 radio devices. For more information on extended address mode, refer to the SureCross™ Wireless I/O Network product manual.

The device ships in rotary dial address mode by default, with the DIP switch in the OFF position. To use extended address mode, change the DIP switch to the ON position.

### Thermocouple Type

Use DIP switches 5, 6, 7, and 8 to select the thermocouple type. The default position is the OFF position for all switches, setting the thermocouple to a J-type thermocouple.

### Temperature Units

Use the DIP switch to specify if the temperature is stored in degrees Fahrenheit or Celsius. The default position is OFF, setting the temperature to Fahrenheit. For Celsius measurements, set this switch to the ON position.

### Supported Thermocouple Types

The Thermocouple Node supports up to three thermocouple inputs and defaults to the J-type thermocouple. The following thermocouples are available by configuring the Node.







Thermocouple	Range °F	Range °C
Type B	212 to 3,272 °F	100 to 1,800 °C
Type C	32 to 4,208 °F	0 to 2,320 °C
Type E	-58 to 1,832 °F	-50 to 1,000 °C
Type J	-292 to 1,382 °F	-180 to 750 °C
Type K	-292 to 2,282 °F	-180 to 1,250 °C
Type L	-328 to 1,652 °F	-200 to 900 °C
Type N	32 to 2,192 °F	0 to 1,200 °C
Type R	32 to 2,912 °F	0 to 1,600 °C
Type S	32 to 2,642 °F	0 to 1,450 °C

Thermocouple	Range °F	Range °C
Type T	-238 to 752 °F	-150 to 400 °C
Type U	-148 to 1,112 °F	-100 to 600 °C

## Verify Communications

After powering up and binding the Gateway and its Nodes, verify all devices are communicating properly. Verify LED 1 is green. Until communication is established with the Gateway, the Node's LED 2 flashes red. When communication is established, the Node's LED 1 flashes green.

A Node will not sample its inputs until it is communicating with the Gateway to which it is bound.

LED 1	LED 2	Gateway Status	Node Status
 (green on)		Power ON	
 (green flashing)			RF Link OK
 (red flashing)	 (red flashing)	Device Error	Device Error
	 (yellow flashing)	Modbus Communication Active	
	 (red flashing)	Modbus Communication Error	No radio link (when flashing once every three seconds)

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

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

## DX80 Integrated Battery Replacement

To replace the lithium "D" cell battery in any integrated housing model, follow these steps.



1. Remove the four screws mounting the face plate to the housing and remove the face plate.
2. Remove the discharged battery and replace with a new battery. Only use a 3.6V lithium battery from Xeno, model number XL-205F.
3. Verify the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case. The negative end is toward the spring. Caution: There is a risk of explosion if the battery is replaced incorrectly.
4. After replacing the battery, allow up to 60 seconds for the device to power up.

When removing the battery, press the battery towards the negative terminal to compress the spring. Pry up on the battery's positive end to remove from the battery holder. Properly dispose of your used battery according to local regulations by taking it to a hazardous waste collection site, an e-waste disposal center, or other facility qualified to accept lithium batteries.

As with all batteries, these are a fire, explosion, and severe burn hazard. Do not burn or expose them to high temperatures. Do not recharge, crush, disassemble, or expose the contents to water.

Replacement battery model number: BWA-BATT-001. For pricing and availability, contact Banner Engineering.

## Specifications

### Radio

#### Range

- 900 MHz: Up to 4.8 kilometers (3 miles) \*
- 2.4 GHz: Up to 3.2 kilometers (2 miles) \*

#### Transmit Power

- 900 MHz: 21 dBm conducted
- 2.4 GHz: 18 dBm conducted, less than or equal to 20 dBm EIRP

#### 900 MHz Compliance (150 mW Radios)

- FCC ID TGUDX80 - This device complies with FCC Part 15, Subpart C, 15.247
- IC: 7044A-DX8009

#### 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 standard 2 dB antenna. 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: 3.6V dc low power option from an internal battery
- Consumption: Less than 1.4 W (60 mA) at 24V dc

#### Housing

- Polycarbonate
- Weight: 0.30 kg (0.65 lbs)
- Mounting: #10 or M5 (M5 hardware included)
- Max. Tightening Torque: 0.56 N·m (5 in·lbf)

#### Interface

Indicators: Two bi-color LEDs

#### Wiring Access

Two 1/2" NPT ports

### Inputs

#### Thermocouple Inputs

- Sample Rate: 1 second
- Report Rate: 16 seconds
- Accuracy: 0.1% of full scale reading + 0.8° C
- Resolution: 0.1° C, 24-bit A/D converter

#### Thermistor (used for CJC)

- Model: BWA-THERMISTOR-001
- Accuracy: 0.4° C (10 to 50° C); Up to 0.8° C (-40 to +85° C)
- Resolution: 0.1° C, 24-bit A/D converter

### Environmental

#### Environmental

- Rating: IEC IP67; NEMA 6; (See UL section below for any applicable UL specifications)
- Operating Temperature: -40 to +85° C (Electronics); -20 to +80° C (LCD)
- Operating Humidity: 95% max. relative (non-condensing)
- Radiated Immunity: 10 V/m, 80-2700 MHz (EN61000-6-2)

#### Shock and Vibration

- IEC 68-2-6 and IEC 68-2-7
- Shock: 30g, 11 millisecond half sine wave, 18 shocks
- Vibration: 0.5 mm p-p, 10 to 60 Hz



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.

## Certifications



## 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](http://www.bannerengineering.com). © 2006-2010 Banner Engineering Corp. All rights reserved.

## Exporting SureCross 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 *Agency Certifications* section of the product manual. The SureCross 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 if the destination country is not on this list.

## 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.

## Contact Us

For more information: Contact your local Banner representative or Banner Corporate Offices around the world.

**Banner Corporate Headquarters**  
**Banner Engineering Corp.**  
9714 Tenth Ave. North  
Mpls., MN 55441  
Tel: 763-544-3164  
[www.bannerengineering.com](http://www.bannerengineering.com)  
[sensors@bannerengineering.com](mailto:sensors@bannerengineering.com)

**Asia — China**  
**Banner Engineering China**  
Shanghai Rep Office  
Rm. G/H/I, 28th Flr.  
Cross Region Plaza  
No. 899, Lingling Road  
Shanghai 200030 CHINA  
Tel: 86-21-54894500, Fax:  
86-21-54894511  
[www.bannerengineering.com.cn](http://www.bannerengineering.com.cn)  
[sensors@bannerengineering.com.cn](mailto:sensors@bannerengineering.com.cn)

**Europe**  
**Banner Engineering Europe**  
Park Lane  
Culliganlaan 2F  
Diegem B-1831  
BELGIUM  
Tel: 32-2 456 07 80, Fax:  
32-2 456 07 89  
[www.bannereurope.com](http://www.bannereurope.com)  
[mail@bannereurope.com](mailto:mail@bannereurope.com)

**Asia — Taiwan**  
**Banner Engineering Taiwan**  
8F-2, No. 308  
Section 1, Neihu Road  
Taipei 114  
Tel: 886-2-8751-9966, Fax:  
886-2-8751-2966  
[www.bannerengineering.com.tw](http://www.bannerengineering.com.tw)  
[info@bannerengineering.com.tw](mailto:info@bannerengineering.com.tw)

**Latin America**  
Contact Banner Engineering  
Corp. (US) or e-mail:  
**Mexico:** [mexico@bannerengineering.com](mailto:mexico@bannerengineering.com)  
**Brazil:** [brasil@bannerengineering.com](mailto:brasil@bannerengineering.com)

**Asia — Japan**  
**Banner Engineering Japan**  
Cent-Urban Building 305  
3-23-15, Nishi-Nakajima  
Yodogawa-Ku, Osaka  
532-0011 JAPAN  
Tel: 81-6-6309-0411, Fax:  
81-6-6309-0416  
[www.bannerengineering.co.jp](http://www.bannerengineering.co.jp)  
[mail@bannerengineering.co.jp](mailto:mail@bannerengineering.co.jp)

**Asia — India**  
**Banner Engineering India**  
Pune Head Quarters  
Office No. 1001  
Sai Capital Opp. ICC  
Senapati Bapat Road  
Pune 411016 INDIA  
Tel: 91-20-66405624, Fax:  
91-20-66405623  
[www.bannerengineering.co.in](http://www.bannerengineering.co.in)  
[india@bannerengineering.com](mailto:india@bannerengineering.com)