

Datasheet

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



The Sure Cross® wireless system is a radio frequency network with integrated I/O that operates in most environments to eliminate the need for wiring runs.

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 ensures reliable data delivery
- Transceivers provide bidirectional communication between the Gateway and Node, including fully acknowledged data transmission
- Internal antenna

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

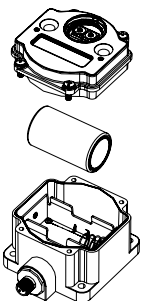
Models	Description	Frequency	I/O
BWA-TPROBE-001	Wireless DX80 Node and temperature probe	900 MHz ISM Band	Inputs: Three thermocouple
BWA-TPROBE-002		2.4 GHz ISM Band	
DX80N9C-16999	DX80 Node (no probe assembly)	900 MHz ISM Band	
DX80N2C-16997		2.4 GHz ISM Band	

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

Install or Replace the Battery for a DX80 Integrated Battery Model

To install or replace the 3.6 V lithium "D" cell battery in any model with a battery integrated into the housing, 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.
3. Install the new battery, verifying the battery's positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case.
4. After installing the battery, allow up to 60 seconds for the device to power up.
5. Properly dispose of used batteries 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.



CAUTION: There is a risk of explosion if the battery is replaced incorrectly.

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.

For non-hazardous locations, the replacement battery is model **BWA-BATT-011**. For non-hazardous or hazardous locations, the replacement battery is Xeno model XL-205F, Banner model **BWA-BATT-001**. For pricing and availability, contact Banner Engineering.



Setting Up Your Wireless Network

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

Disconnect the power from your Sure Cross devices.

1. Configure the DIP switches of all devices.
2. If your device has I/O, connect the sensors to the Sure Cross devices. If your device does not have I/O, skip this step.
3. Refer to the wiring diagrams to apply power to all devices.
 - For housed models, the Gateway's LED 1 is solid green and the Node's LED 2 flashes red to indicate there is no radio link to the Gateway.
 - For board-level models, the Gateway's LED is solid green and the Node's LED flashes red to indicate there is no radio link to the Gateway.
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.
 - For housed models, the Gateway's LED 1 is solid green and the Node's LED 1 flashes green to indicate it is communicating with the Gateway.
 - For board-level models, the Gateway's LED is solid green and the Node's LED flashes green to indicate it is communicating with the Gateway.
6. Configure any I/O points to use the sensors connected to the Sure Cross devices.
7. 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.
8. 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.

- Sure Cross® Quick Start Guide (p/n [128185](#))
- Sure Cross® Wireless I/O Network Instruction Manual (p/n [132607](#))

Configure the DIP Switches

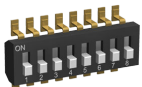
Before changing DIP switch positions, disconnect the power. Any changes made to the DIP switches are not recognized until after power is cycled to the device.

For devices with batteries integrated into the housing, triple-click button 2, then double-click button 2 to reset the device without removing the battery.

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

All unused switches must remain in the OFF position.

Switches								
Device Settings	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
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 is configured, by default, to use J-type thermocouples. 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

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

Wire Your Sure Cross® Device

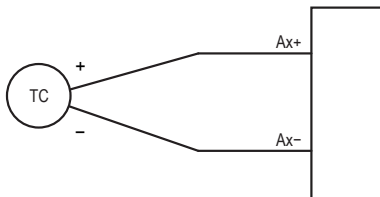
Use the following wiring diagrams to first wire the sensors and then apply power to the Sure Cross devices.

Terminal Block (Mini Board)

- 10-30
- GND
- A1+
- A1-
- A2+
- A2-
- A3+
- A3-
- GND
- BAT

10-30. 10 to 30 V DC power connection (do not use this connection for internal battery models)
 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-.

LED Behavior for the Nodes

Nodes do not sample inputs until they are communicating with the Gateway. The radios and antennas must be a minimum distance apart to function properly. Recommended minimum distances are:

900 MHz 150 mW and 250 mW radios: 6 feet

900 MHz 1 Watt radios: 15 feet

2.4 GHz 65 mW radios: 1 foot

LED 1	LED 2	Node Status
Flashing green		Radio Link Ok
Flashing red	Flashing red	Device Error
	Flashing red, 1 per 3 sec	No Radio Link

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)							

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.)	
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						
		...							
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 -32767 (65535 unsigned) in the register (0xFFFF) is interpreted as -1 ÷ 20 = -0.05°.

Specifications

DX80 Radio with Internal Antenna Specifications

Radio Range

900 MHz, 150 mW (internal antenna): Up to 2000 m (1.24 miles) with line of sight
 2.4 GHz, 65 mW (Internal antenna): Up to 1000 m (3280 ft) with line of sight

Antenna Minimum Separation Distance

900 MHz, 150 mW and 250 mW: 2 m (6 ft)
 2.4 GHz, 65 mW: 0.3 m (1 ft)

Radio Transmit Power

900 MHz, 150 mW: 21 dBm (150 mW) conducted
 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)

900 MHz Compliance

FCC ID TGUDX80: FCC Part 15, Subpart C, 15.247
 IC: 7044A-DX8009

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

Link Timeout

Gateway: Configurable via User Configuration Software
 Node: Defined by Gateway

Temperature Probe Specifications

Supply Voltage

3.6 V DC low power option from an internal battery
 Consumption: Less than 1.4 W (60 mA) at 24 V DC

Housing

Polycarbonate housing and rotary dial cover; polyester labels; EDPM rubber cover gasket; nitrile rubber, non-sulphur cured button covers
 Weight: 0.30 kg (0.65 lbs)
 Mounting: #10 or M5 (SS M5 hardware included)
 Max. Tightening Torque: 0.56 N·m (5 lbf·in)

Interface

Two bi-color LED indicators

Wiring Access

Two 1/2-inch NPT ports

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 Input (used for CJC)

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

Certifications



(CE approval only applies to 2.4 GHz models)

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

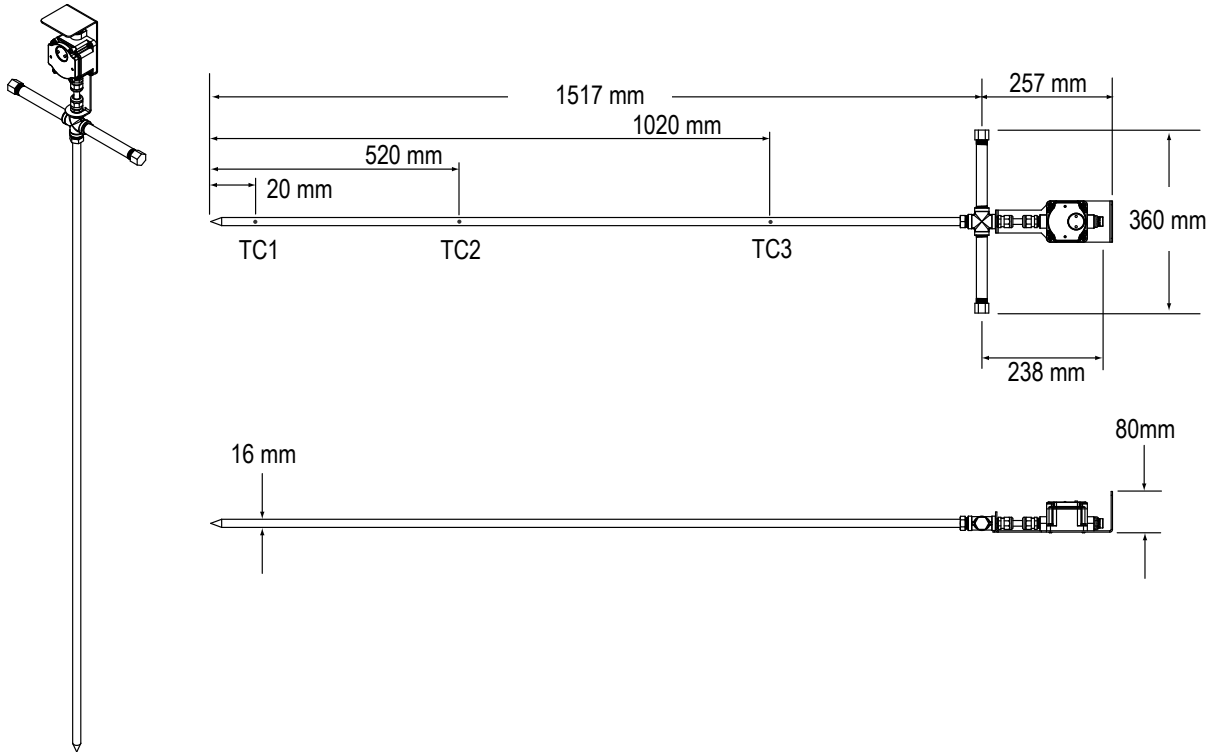
All models meet IEC 60068-2-6 and IEC 60068-2-27 testing criteria
 Shock: 30G 11 ms duration, half sine wave per IEC 60068-2-27
 Vibration: 10 Hz to 55 Hz, 0.5 mm peak-to-peak amplitude per IEC 60068-2-6

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.

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.

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.** 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. This device has been designed to operate with the antennas listed on Banner Engineering's website and having a maximum gain of 9 dBm. Antennas not included in this list or having a gain greater than 9 dBm are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen such that the equivalent isotropically radiated power (EIRP) is not more than that permitted for successful communication. Consult with Banner Engineering Corp. if the destination country is not on this list.



Important: Please download the complete DX80 Gateway or Node technical documentation, available in multiple languages, from www.bannerengineering.com for details on the proper use, applications, Warnings, and installation instructions of this device.



Important: Por favor descargue desde www.bannerengineering.com toda la documentación técnica de los DX80 Gateway or Node, disponibles en múltiples idiomas, para detalles del uso adecuado, aplicaciones, advertencias, y las instrucciones de instalación de estos dispositivos.



Important: Veuillez télécharger la documentation technique complète des DX80 Gateway or Node sur notre site www.bannerengineering.com pour les détails sur leur utilisation correcte, les applications, les notes de sécurité et les instructions de montage.



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.



Important:

- **Electrostatic discharge (ESD) sensitive device**
- ESD can damage the device. Damage from inappropriate handling is not covered by warranty.
- Use proper handling procedures to prevent ESD damage. Proper handling procedures include leaving devices in their anti-static packaging until ready for use; wearing anti-static wrist straps; and assembling units on a grounded, static-dissipative surface.

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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.

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