SureCross Temperature Probe with DX80 Node

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

The SureCross® wireless system is a radio frequency network with integrated I/O that can operate in most environments and eliminate the need for wiring runs. Wireless networks are formed 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
- *Flex*Power® 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 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*.

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	

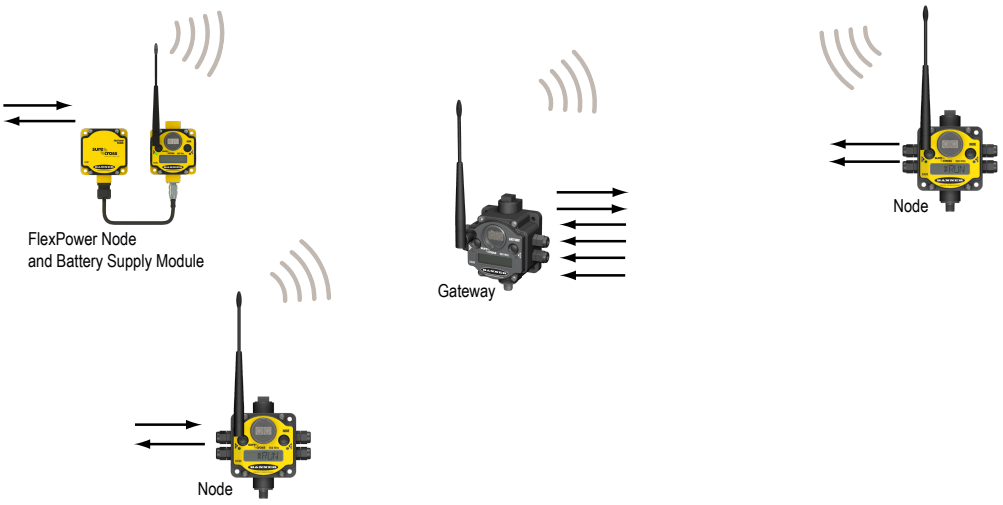
These Nodes are powered by an internal battery. All batteries must be ordered separately.

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.

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** 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.

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.

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

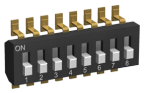
Before making any changes to the DIP switch positions, disconnect the power. For devices with batteries integrated into the housing, remove the battery for at least one minute. DIP switch changes will not be recognized if power isn't cycled to the device.

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.

Accessing the Internal DIP Switches

To access the internal 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 integrated battery models (no ribbon cable) and Class I, Division 2 certified devices (ribbon cable is glued down), skip this step.
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.

	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

	Switches							
Device Settings	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
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.

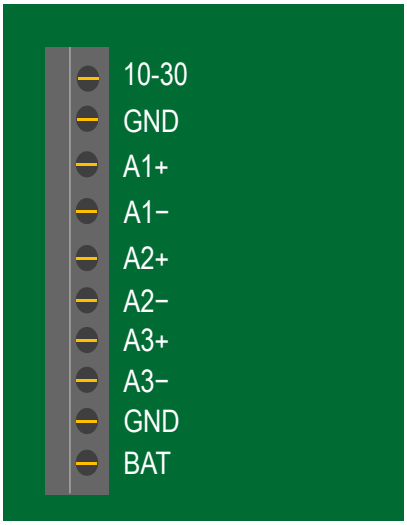
Supported Thermocouple Types
The thermocouple Node is configured, by default, to use J-type thermocouples. The following thermocouples are available by configuring the Node.

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
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

Wiring Your SureCross® Device

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

Terminal Block (Mini Board)



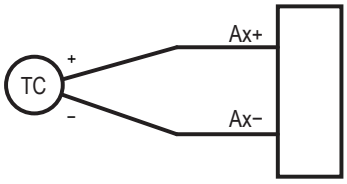
10-30. Power, 10 to 30V dc power connection. (For internal battery models, do not use this connection.)

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

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, all radios and antennas should be at least two meters apart or the communications may fail. This table lists the LED behavior for the Node models with two LEDs.

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)							
2	2	2 + (Node# × 16)							
3	3	3 + (Node# × 16)	Thermocouple IN 1	°F/°C	-1638.3	+1638.4	0	65535	A1+/A1-

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.)	
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°.

Replacing the Integrated Battery (DX80 Models)

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)

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 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)

Radio

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 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

Mounting: #10 or M5 (SS M5 hardware included)
Max. Tightening Torque: 0.56 N·m (5 lbf·in)

Interface

Indicators: Two bi-color LEDs

Wiring Access

Two 1/2" 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 (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

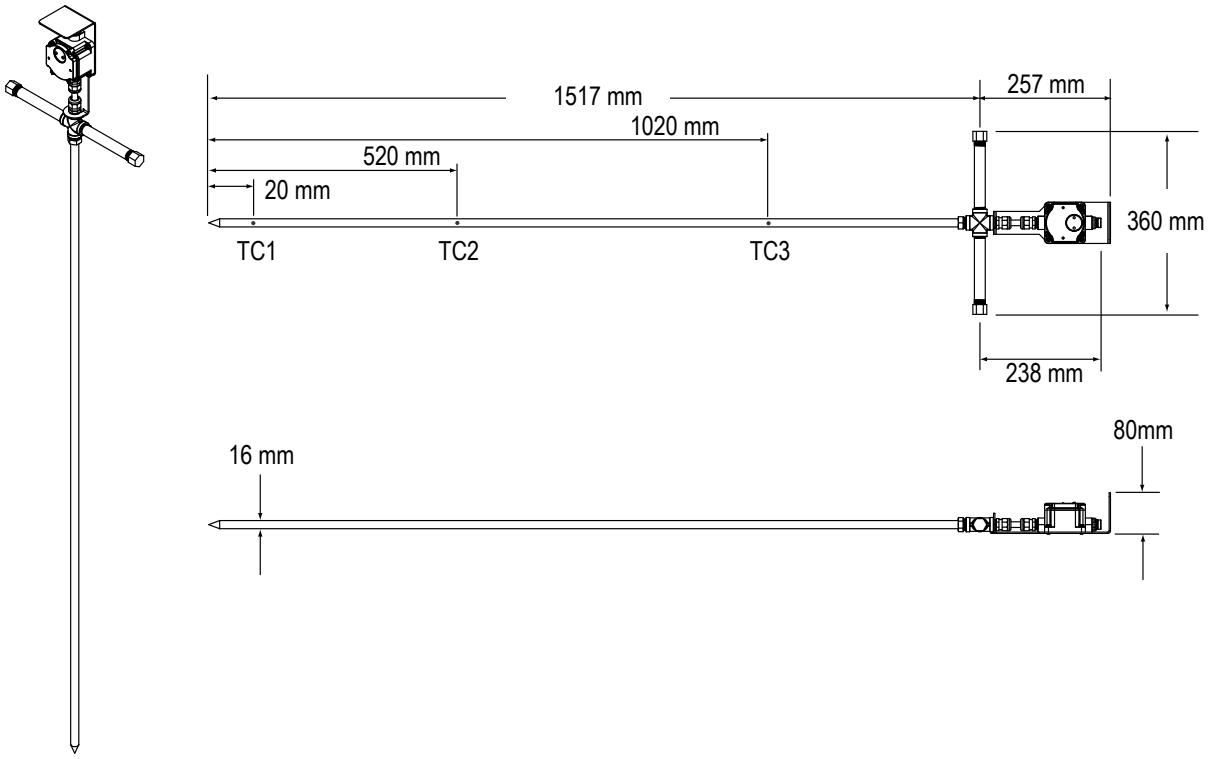
IEC 68-2-6 and IEC 68-2-7
Shock: 30g, 11 millisecond half sine wave, 18 shocks
Vibration: 0.5 mm p-p, 10 to 60 Hz

Certifications

CE

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.

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

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. **All specifications published in this document are subject to change.** Banner reserves the right to modify product specifications or to update documentation at any time. For the most recent version of any documentation, refer to: *www.bannerengineering.com*.

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