A MEMBER OF THE ABB GROUP

Installation & Operation Manual

# WT8000 Wireless Device

## Communication Between A Gateway And Up To 55 Nodes


For the latest version of this manual, visit ktekcorp.com or kteksolidslevel.com.

# Table of Contents

# WT8000 Wireless Device

**Communication Between A Gateway And Up To 55 Nodes**

## Introduction

The SureCross™ WT8000 wireless I/O network provides reliable monitoring without the burden of wiring or conduit installation and can operate independently or in conjunction with a PLC and/or PC software.


### The SureCross Network

The SureCross WT8000 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.

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

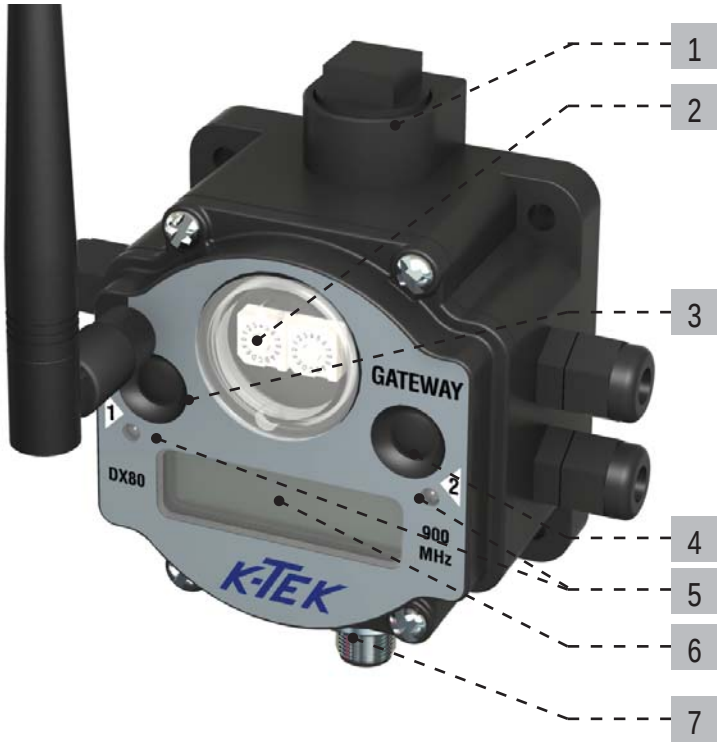
### Gateways and Nodes

A Gateway device acts as the master device within each radio network and initiates communication and reporting with the Nodes. A radio network contains only one Gateway, but can contain many Nodes. Each Node device can be connected to sensors or output devices and reports I/O status to the Gateway. Devices may be all discrete I/O, mixed discrete and analog I/O, or *Flex*Power™.

### Host Systems

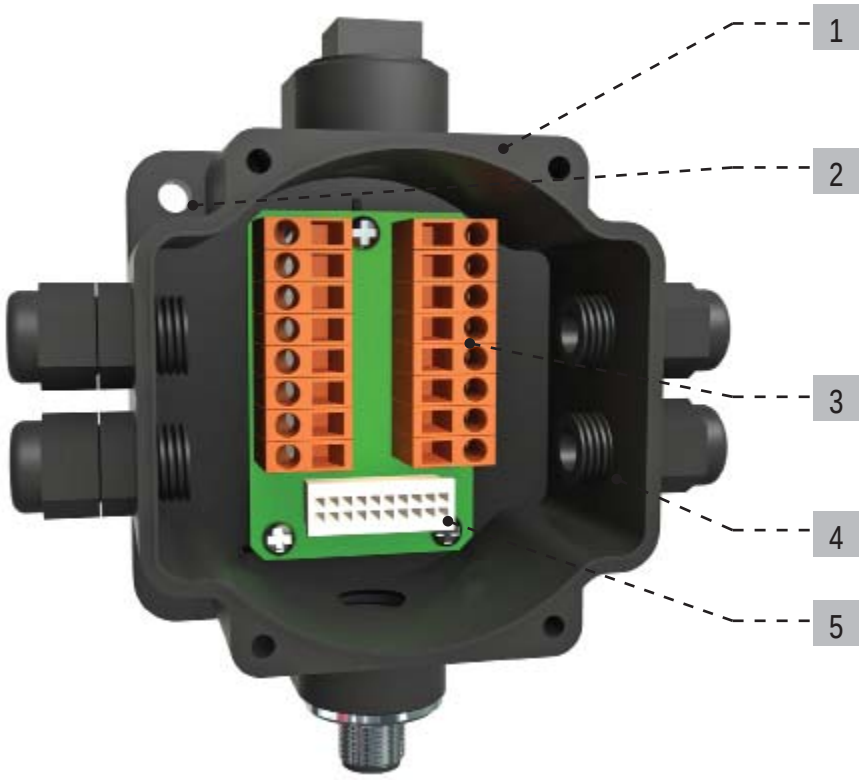
Host-connected systems can contain up to 15 Nodes (Rotary Switch addressing) or 56 Nodes (extended addressing mode) within a single network and may be all discrete, all analog, or a mix of discrete and analog I/O. Host-connected systems allow for logic and calculations to be applied to the I/O. Inputs 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.

## WT8000 Gateway and Node




| | | |
|---|---|---|
| 1. | Port, NPT Gland, or Plug | If unused, install the provided plug into the 1/2 NPT threaded port. Refer to the *Installation* section if an IP67 seal is required. |
| 2. | Rotary Switch 1 (left) | Sets the Network ID (NID) to a hexidecimal value from 0 to F, for a total of 16 Network IDs. A Gateway and its corresponding Nodes must be assigned the same Network ID. |
| | Rotary Switch 2 (right) | Gateway: Sets the Gateway's LCD viewing device address. The Gateway is predefined as Device Address 0. Node: Sets the Node's Device Address (hexidecimal 1 to F). Each Node within a network must have a unique Node Device Address. |
| 3. | Push Button 1 | Single-click to advance across all top-level WT8000 menus.<br>Single-click to move down interactive menus, once a top-level menu is chosen. |
| 4. | Push Button 2 | Double-click to select a menu and to enter manual scrolling mode.<br>Double-click to move up one level at a time. |
| 5. | LED 1 and 2 | Provide real-time feedback to the user regarding RF link status, serial communications activity, and the error state. |
| 6. | LCD Display | Six-character display provides run mode user information and shows enabled I/O point status. This display allows the user to conduct a Site Survey (RSSI) and modify other WT8000 configuration parameters without the use of a PC or other external software interfaces. On the Node, after 15 minutes of inactivity, the LCD goes blank. Press any button to refresh the display. |
| 7. | 5-Pin M12 Euro-style quick-disconnect serial port | |

## WT8000 Gateway and Node Wiring Chamber




| | | |
|---|---|---|
| 1. | Housing | The rugged, industrial WT8000 housing meets IEC IP67 standards. |
| 2. | Mounting Hole, #10/M5 Clearance | Mounting Holes accept metric M5 or UNC/UNF #10 hardware -- DIN rail mount adapter bracket available. |
| 3. | Wiring Terminal Strip | The 16 spring-clip type wiring terminals accept wire sizes: AWG 12-28 or 2.5 $mm^2$ |
| 4. | Port, PG-7 Gland or Blank | The PG-7 threaded ports can accept provided cable glands or blanks. |

## Pinouts


### 5-pin Euro-style Hookup (RS-485)

| | Wire Color | Gateway, GatewayPro, DX85* | *Flex*Power Gateway and Data Radio** | 10–30V dc Node | *Flex*Power Node** |
|---|---|---|---|---|---|
| 1 | Brown | +10 to 30V dc Input | +10 to 30V dc Input | +10 to 30V dc Input | |
| 2 | White | RS485 / D1 / B / + | RS485 / D1 / B / + | | |
| 3 | Blue | dc common (GND) | dc common (GND) | dc common (GND) | dc common (GND) |
| 4 | Black | RS485 / D0 / A / − | RS485 / D0 / A / − | | |
| 5 | Gray | Comms grnd | 3.6 to 5.5V dc | | 3.6 to 5.5V dc |

* Connecting dc power to the communication pins will cause permanent damage.

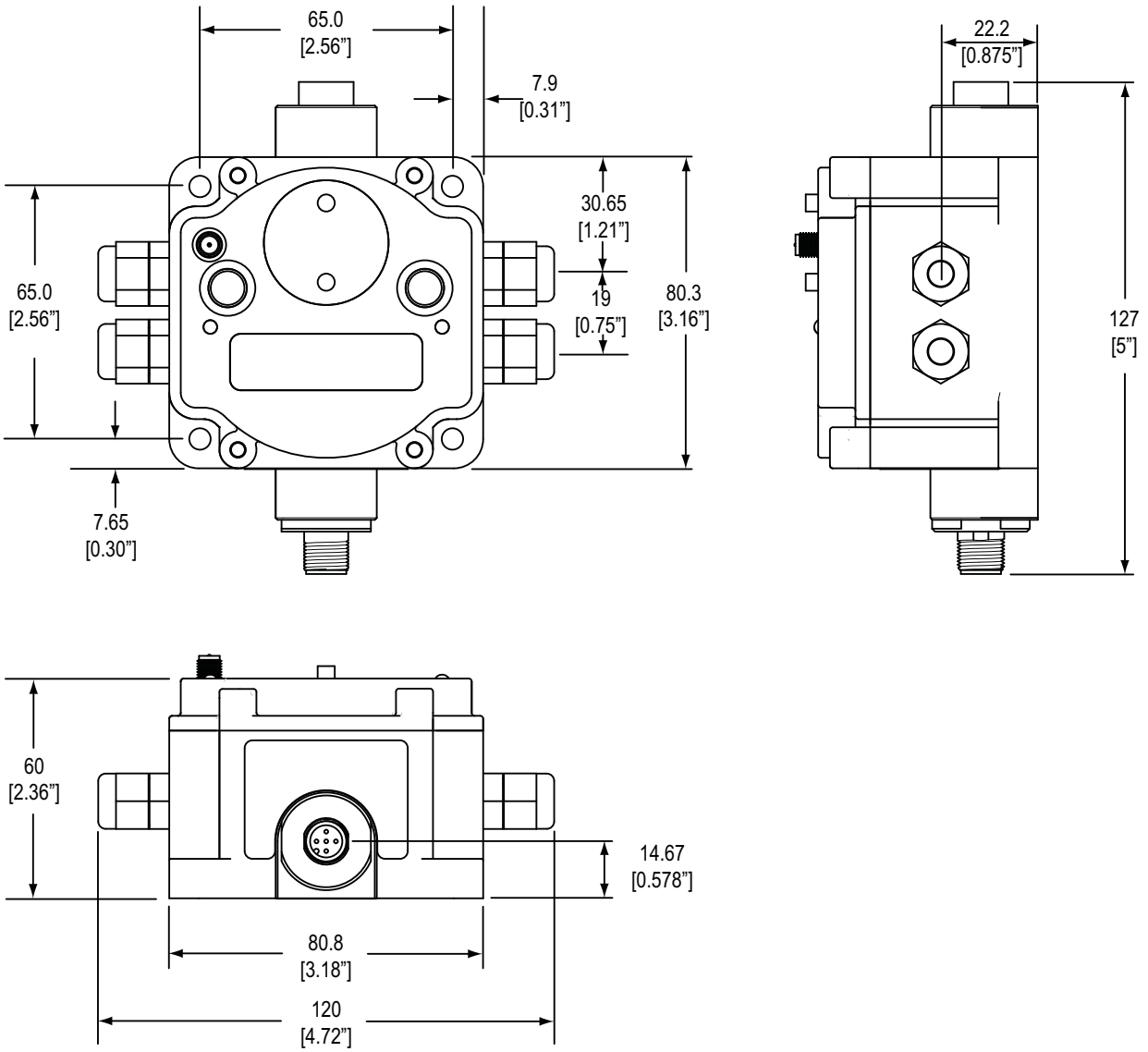
### 5-pin Euro-style Hookup (RS-232 Serial)

| | Wire Color | GatewayPro, Ethernet Bridge* | Data Radio** |
|---|---|---|---|
| 1 | Brown | +10 to 30V dc Input | +10 to 30V dc Input |
| 2 | White | RS232 Tx | RS232 Tx |
| 3 | Blue | dc common (GND) | dc common (GND) |
| 4 | Black | RS232 Rx | RS232 Rx |
| 5 | Gray | Comms grnd | 3.6 to 5.5V dc |

* Connecting dc power to the communication pins will cause permanent damage.

** For *Flex*Power devices, do not apply more than 5.5V dc to the gray wire.

## Dimensions


65.0
[2.56"]
7.9
[0.31"]
30.65
[1.21"]
19
[0.75"]
80.3
[3.16"]
65.0
[2.56"]
7.65
[0.30"]
22.2
[0.875"]
127
[5"]
60
[2.36"]
14.67
[0.578"]
80.8
[3.18"]
120
[4.72"]

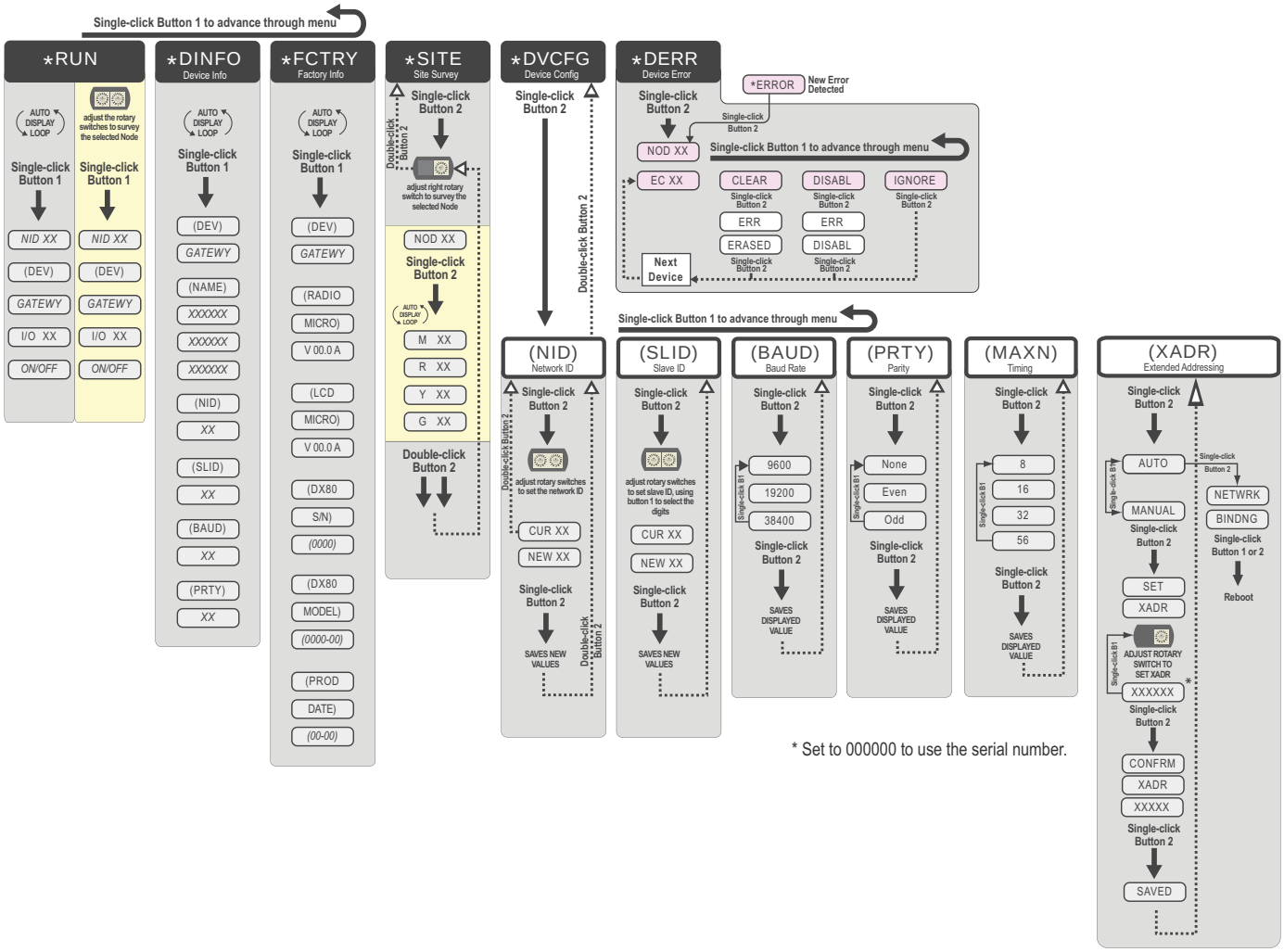
# Menu Structure

## WT8000 Gateway Setup Menu

When power is applied, the WT8000 begins running. The display screen auto loops through the RUN menu and communication begins between the Gateway and Node(s). Auto looping through the RUN menu is the normal operating mode for all devices on the wireless network.

From the RUN Menu (or any menu), single-click button 1 to advance through the top-level menus. The device auto display loops through the menu options if either of the RUN, DINFO, or FCTRY menus are selected. If the device is paused on the SITE, DVCFG, or DERR menu options, the display does not auto loop.

To enter manual scrolling mode, double-click button 2 at the top level menu. Use the instructions shown in the chart below to navigate the menu system. To return to the top level menus and auto display loop mode, double-click button 2 twice.




* Set to 000000 to use the serial number.

The MAXN and XADR menus are only available in extended addressing mode. To access extended addressing mode, move DIP switch 1 to the ON position. To manually select the serial number, use button 1 to move across the digits and use the right rotary switch to select the value used as the device serial number.

Navigating the menu:
* indicates a top level menu option
( ) indicates a sub-menu item
No characters indicate the value of the previous item

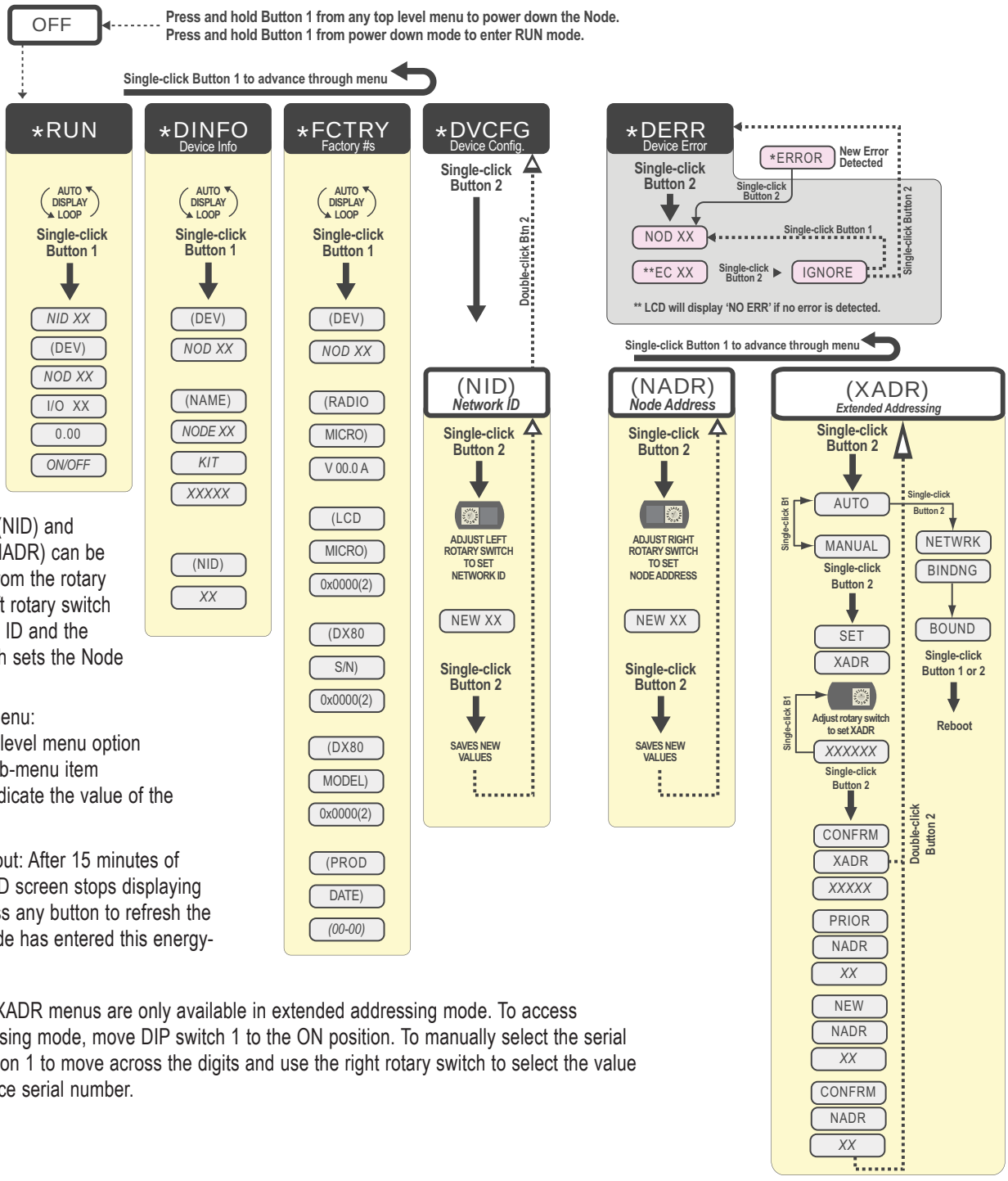
The Network ID (NID) can be set at any time using the rotary switches. Once changed, allow five seconds for the devices to update to the new NID.

## WT8000 Node Setup Menu

When power is applied, the WT8000 begins running. The display screen auto loops through the RUN menu and communication begins between the Gateway and Node(s). Auto looping through the RUN menu is the normal operating mode for all devices on the wireless network.

From the RUN Menu (or any menu), single-click button 1 to advance through the top-level menus. The device auto display loops through the menu options if either of the RUN, DINFO, or FCTRY menus are selected. If the device is paused on the DVCFG or DERR menu options, the display does not auto display loop.

To enter manual scrolling mode, double-click button 2 at the top level menu. Use the instructions shown in the chart below to navigate the menu system. To return to the top level menus and auto display loop mode, double-click button 2 twice.




The Network ID (NID) and Node Address (NADR) can be set at any time from the rotary switches. The left rotary switch sets the Network ID and the right rotary switch sets the Node Address.

Navigating the menu:
* indicates a top level menu option
( ) indicates a sub-menu item
No characters indicate the value of the previous item

Node LCD Timeout: After 15 minutes of inactivity, the LCD screen stops displaying information. Press any button to refresh the display if the Node has entered this energy-saving mode.

The MAXN and XADR menus are only available in extended addressing mode. To access extended addressing mode, move DIP switch 1 to the ON position. To manually select the serial number, use button 1 to move across the digits and use the right rotary switch to select the value used as the device serial number.

## RUN

The RUN menu displays the Network ID, device name, and the I/O values of the device. On a Gateway, the I/O displayed may be the I/O of the Gateway or of a selected Node, which is determined by the position of the rotary switches.

## DINFO (Device Information)

The Device Info menu displays the device-specific information, such as the device name, the Network ID, Slave ID, baud rate, and parity. When in extended address mode, the DINFO menu also displays the maximum Node setting and the extended addressing binding code used to form the network.

## FCTRY (Factory)

The FCTRY menu displays the version numbers of various components within the device, including the radio micro number, the LCD number, the device's serial number, the device's model number, and the production date.

## SITE (Site Survey)

Access the SITE menu to see the results of a Site Survey conducted with this Gateway. The SITE menu displays the device number of the Node the Site Survey was conducted with as well as the missed, green, yellow, and red received packet count. For more information on determining what these values represent, refer to the *Site Survey* chapter of this manual.

The SITE menu is only available on the Gateways.

## DVCFG (Device Configuration)

On Gateways, the DVCFG menu allows users to set various device-specific parameters, including the Network ID, Slave ID, baud rate, and parity. When in extended address mode, use this menu to set the maximum number of Nodes within the network and the extended address binding code.

On Nodes, use the DVCFG to set the network ID, Node address (also referred to as a device address), and extended address binding code.

## DERR (Device Error)

### *On the Gateway*

Use the DERR menu to clear, disable, or ignore error messages generated by devices within the network. The Node number that generated the error and the error code (EC) display onscreen. Single-click button 1 to advance through the menu of CLEAR (clear this particular instance of the error from the system), DISABL (disable this particular error from appearing from this specific Node), and IGNORE (ignore this error but do not remove it from the system).

After the error messages for a Node are cleared, disabled, or ignored, errors for any additional Nodes display on the Gateway's LCD.

### *On the Node*

Use the DERR menu to view and ignore error messages for that Node.

# Setting Up Your Wireless Network

## Step 1: Apply Power

1. Apply power to the Gateway by connecting the 10-30V dc cable as shown in the wiring diagram.
   The Gateway begins in *RUN mode, displays the current network ID (NID), then identifies itself as a Gateway.
2. Apply power to the Node by connecting the 10-30V dc cable or the DX81 Battery Supply Module as shown.
   The Node starts in *RUN mode, displays the current network ID, then identifies itself as a Node and lists the device ID. Once running, the Node begins displays its I/O points.


## 5-pin Euro-style Hookup (RS-485)

| | Wire Color | Gateway | 10–30V dc Node |
|---|---|---|---|
| 1 | Brown | +10 to 30V dc Input | +10 to 30V dc Input |
| 2 | White | RS485 / D1 / B / + | |
| 3 | Blue | dc common (GND) | dc common (GND) |
| 4 | Black | RS485 / D0 / A / − | |
| 5 | Gray | Comms grnd | |

* Connecting dc power to the communication pins will cause permanent damage.

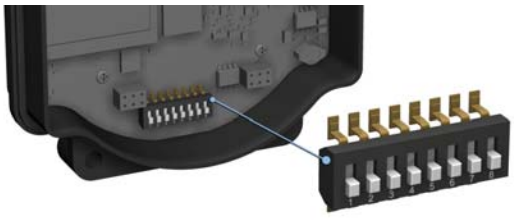
** For *Flex*Power devices, do not apply more than 5.5V dc to the gray wire.

## Step 2: Forming Networks and Assinging Node Address

Extended address mode adds the ability to isolate each network by assigning a unique code, the extended address code, to all devices in a particular network. Only devices sharing the extended address code can communicate. The extended addressing mode also allows up to 56 Nodes to connect to a single Gateway. Without extended addressing, only 15 Nodes can connect to a single Gateway.

Binding WT8000 devices locks Nodes to a specific Gateway by teaching the Nodes the Gateway's extended address code. After the devices are bound, the Nodes only accept data from the Gateway to which they are bound.

To select extended address mode, turn the device off. Set DIP switch 1 to the 'ON' position, then turn the device on. Do not set the DIP switch while the power is on to the device.



To automatically bind the Gateway and its Node(s), follow these steps:

## On the Gateway

1. Remove the Gateway's top cover.
2. Move DIP switch 1 to the ON position to activate Extended Addressing Mode.
3. Apply power to the Gateway.
   The LCD shows POWER, then *RUN.
4. Triple click button 2 to enter binding mode.
   The red LEDs flash alternately when the Gateway is in binding mode. Any Node entering binding mode will bind to this Gateway. The LCD shows NETWRK BINDNG.

# Setting Up Your Wireless Network

## On the Node

1. Remove the Node's top cover.
2. Mode DIP switch 1 to the ON position to activate Extended Addressing Mode.
3. Apply power to the NODE.
   The LCD shows POWER, then *RUN.
4. Use both of the Node's rotary dials to assign a decimal Node address (device ID) between 01 and 56.*
   The left rotary dial represents the tens digit (0-5) and the right dial represents the ones digit (0-9) of the Node address (device ID).
5. Triple click button 2 to enter binding mode.
   The Node enters binding mode and locates the Gateway that is also in binding mode. While the Node in binding, the LCD shows NETWRK BINDNG. When the Node is bound, the LEDs are both solid red for a few seconds. The Node cycles its power, then entering RUN mode. The LCD shows BOUND, then *RUN.
6. Repeat steps 5 through 9 for each additional Node that needs to communicate to that Gateway.

## On the Gateway

7. Single click either button 1 or button 2 on the Gateway to exiting binding mode and reboot the Gateway.
   The Gateway exists binding mode and reboots. The LCD reads POWER, then *RUN.

* IMPORTANT: For special kits, indicated by device model numbers beginning in WT8000K, do not change the position of the right rotary dial. Set the left rotary dial to zero.

## Step 3: Verify Communications

### On the Gateway

Verify LED 1 is on and green.

| Gateway Status | LED 1 | LED 2 |
|---|---|---|
| Power ON | Green ON | — |
| Modbus Communication Active | — | Yellow Flash |
| Modbus Communication Error | — | Red Flash |
| System Error | Red Flash | Red Flash |


### On the Node

Verify LED 1 is flashing green and LED 2 is off. 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 in sync with a Gateway.

| Node Status | LED 1 | LED 2 |
|---|---|---|
| RF Link Ok | Green Flash (1 per sec) | — |
| RF Link Error | — | Red Flash (1 every 3 sec) |
| System Error | Red Flash | Red Flash (1 per sec) |


When testing the Gateway and Node before installation, verify the Gateway and Node are at

Next Steps: Conducting a Site Survey and Installing your devices.

# Installation

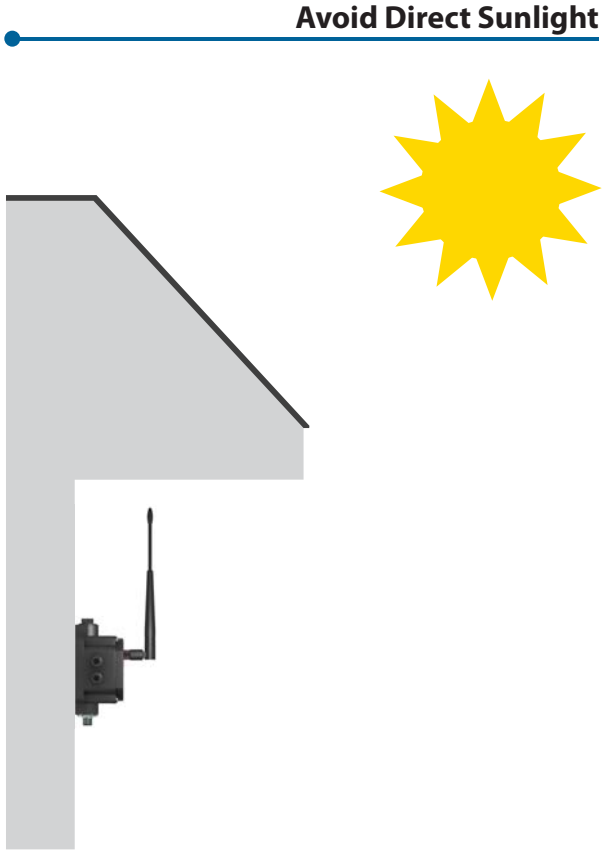
## Ideal Mounting Conditions

### Avoid Direct Sunlight

To minimize the damaging effects of ultra-violet radiation, avoid mounting any SureCross™ device facing intense direct sunlight.

- Mount within a protective enclosure,
- Mount under an overhang or other source of shade,
- Install indoors, or
- Face the devices north when installing outside.

For harsh outdoor applications, consider installing your SureCross radio inside a secondary enclosure. For a list of available enclosures, refer to the *Accessories* chapter.




### Avoid Collecting Rain

When possible, mount the devices where rain or snow will drain away from the device.

- Mount vertically so that precipitation, dust, and dirt do not accumulate on permeable surfaces.
- Avoid mounting the devices on flat or concave surfaces, especially if the display will be pointing up.

### Reduce Chemical Exposure

Before installing any SureCross™ devices in a chemically harsh environment, contact Banner for more information regarding the life-expectancy. Solvents, oxidizing agents, and other chemicals will damage the devices.

### Minimize Mechanical Stress

While the SureCross devices are very durable, they are sophisticated electronic devices that are sensitive to shock and excessive loading.

- Avoid mounting the devices to an object that may be shifting or vibrating excessively. High levels of static force or acceleration may damage the housing or electronic components.
- Do not subject the devices to external loads. Do not step on them or use them as handgrips.
- Do not allow long lengths of cable to hang from the WT8000 glands on the Gateway or Node. Cabling heavier than 100 grams should be supported instead of allowed to hang from the WT8000 housing.

It is the user's responsibility to install the WT8000 devices so they will not be subject to overvoltage transients. Always ground the devices in accordance with local, state, or national regulations.

## Weather-Proofing Glands and Plugs

Watertight Glands and Plugs

If the Gateway or Node is mounted outdoors or will be exposed to moisture, dirt, or dust, follow these steps to weatherproof the units.

### Watertight Glands

To make the glands watertight:

1. Wrap four to eight passes of polytetrafluoroethylene (PTFE) tape around the threads as close as possible to the hexagonal body of the gland.
2. Manually thread the gland into the housing hole. Never apply more than 5 in-lbf of torque to the gland or its cable clamp nut.*

Note, these instructions apply both to the PG-7 glands and the 1/2" NPT gland.

### Rotary Switch Access Cover

Check the rotary switch access cover o-ring every time the access cover is removed. Replace the o-ring when it is damaged, discolored, or showing signs of wear. The o-ring should be:

- Seated firmly against the threads without stretching to fit or without bulging loosely, and
- Pushed against the flanged cover.

When removing or closing the rotary switch access cover, manually twist the cover into position. Do not allow cross-threading between the cover and the WT8000 face.

Once the cover is in place and manually tightened, use a small screwdriver (no longer than five inches total length) as a lever to apply enough torque to bring the rotary switch access cover even with the WT8000 cover surface.

### Watertight 1/2" NPT Plug

Seal the 1/2" NPT port if it is not used. To install a watertight NPT plug:

1. Wrap 12 to 16 passes of PTFE tape evenly across the length of the threads.
2. Manually thread the plug into the housing port until reaching some resistance.
3. Using a 9/16" crescent wrench, turn the plug until all the plug's threads are engaged by the housing port or until the resistance doubles. Do not overtighten as this will damage the SureCross unit. These threads are tapered and will create a waterproof seal without overtightening.

### Watertight PG-7 Plug

Seal any unused PG-7 access holes with one of the supplied black plastic plugs. To install a watertight PG-7 plug:

1. Wrap four to eight passes of PTFE tape around the plug's threads, as close as possible to the flanged surface.
2. Carefully thread the plastic plug into the vacant hole in the WT8000 housing and tighten using a slotting screwdriver. Never apply more than 10 in-lbf torque to the plastic plug.

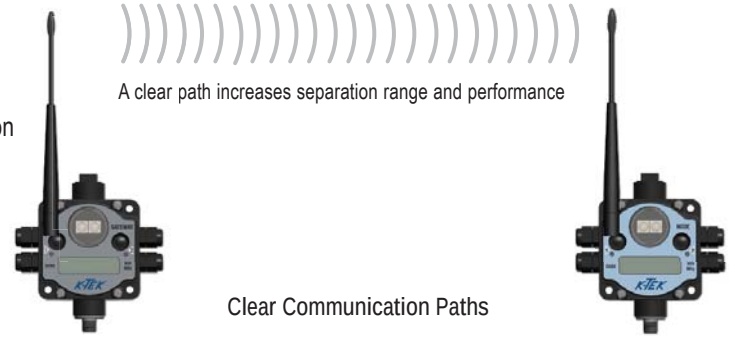
* This is not a lot of torque and is equivalent to the torque generated without using tools. If a wrench is used, apply only very light pressure. Torquing these fittings excessively damages the device.

## Quick Tips

### Create a Clear Communication Path

Wireless communication is hindered by radio interference and obstructions in the path between the transmitter and receiver. To achieve the best radio performance, carefully consider the installation locations for the Gateways and Nodes and select locations without obstructions in the path.

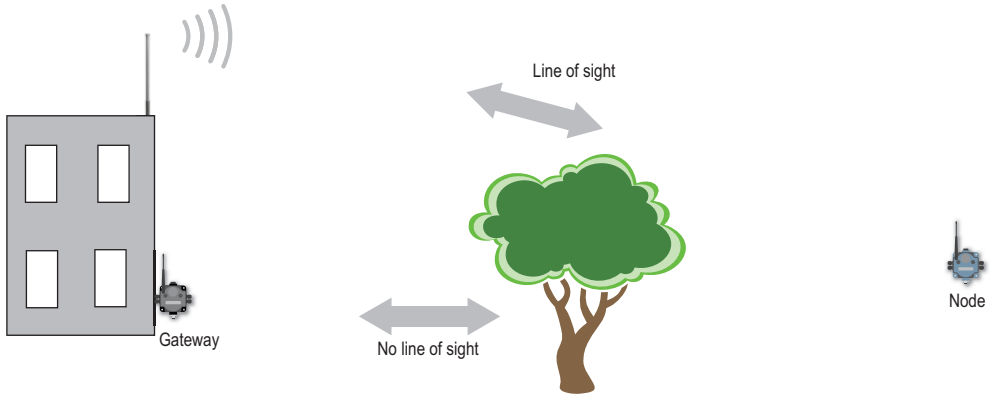
For more information about antennas, please refer to DOCUMENT NAME.




Clear Communication Paths

### Increase the Height of the WT8000 Units

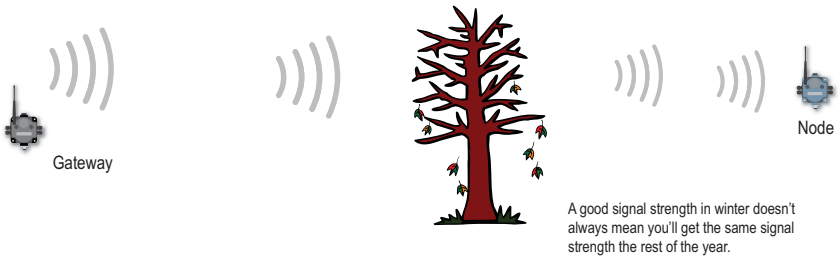
Position the external antenna vertically for optimal RF communication. If necessary, consider changing the height of the SureCross radio, or its antenna, to improve reception. For outdoor applications, mounting the antenna on top of a building or pole may help achieve a line-of-sight radio link with the other radios in the network.




Increase the height of the WT8000 units or antenna

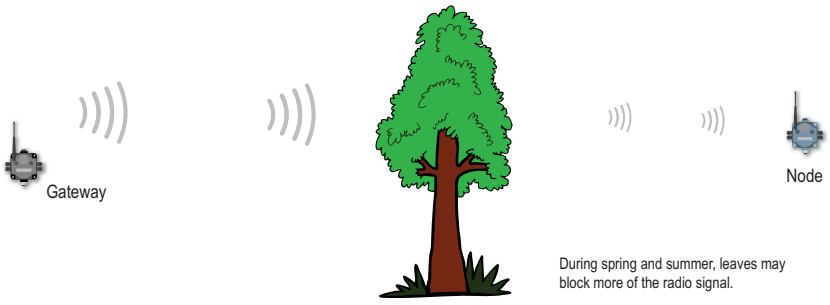
### Collocation Issues

When the radio network's master device is located too close to another radio device, communications between all devices is interrupted. For this reason, do not install a SureCross Gateway device within two meters of another SureCross WT8000 Gateway or Node.




### Be Aware of Seasonal Changes

When conducting the initial Site Survey, the fewest possible missed packets for a given link is better. However, seasonal changes may affect the signal strength and the total signal quality. Radios installed outside with 50% missed packets in the winter months may have 80% or more missed packets in the summer



# Advanced Setup

## Manual Binding

Manually choosing the extended address code is particularly useful when replacing components of an existing wireless network. To determine the existing extended address code, access the DINFO (Device Information) menu of either the existing Gateway or another Node in the network. Follow the submenu structure to the XADR display for that device.

## To Manually Bind a Gateway

1. Remove the Gateway's top cover.
2. Move DIP switch 1 to the ON position to activate Extended Addressing Mode.
3. Apply power to the Gateway.
   The Gateway's LCD shows POWER, then RUN.
4. On the Gateway, single click button 1 to advance across the menus, stopping at the DVCFG menu.
   The Gateway's LCD shows (DVCFG).
5. Single click button 2 to select DVCFG. Single click button 1 to select from the available menu options, stopping at XADR.
6. Single click button 2 to enter the XADR menu.
   AUTO is automatic binding mode and uses the Gateway's serial number as the extended address code.
7. Single click button 1 to select manual mode.
8. Single click button 2 to enter manual mode.
   MANUAL allows the user to manually enter an extended address code.
9. Single click button 2 to advance to the extended address code entry step.
   Once in manual mode, use the right rotary dial to select the digits of the extended address code. The LCD shows SET XADR 000000.
10. Use the right rotary switch to begin setting the extended address code. Digit selection begins with the left most digit. After selecting the first digit, single click button 1 to advance right to the next digit. All six digits must be filled, even if it is with leading zeros. For example, to use 2245 as the code, enter 002245 into the device.
    To use the Gateway's serial number, enter 000000 as the extended addressing code.
11. Continue entering the code using a single click of button 1 to advance from left to right.
    Upon reaching the sixth digit, the curser returns to the first digit.
12. Single click button 2 when code entry is complete.
    The Gateway LCD displays the entered value for confirmation by showing CONFRM XADR, then repeating back your value.
13. Single click button 2 to save the code and exit the XADR menu.

When entering the extended address code, the digits auto fill with whatever position the rotary switch is currently in. For example, after entering the 00 part of the extended address code 002245, the third digit auto fills with a 0 until the rotary dial is rotated to 2.

After manually changing the extended address code on a Gateway in an existing network, change the extended address code for all Nodes in that network by either manually setting the code on all Node(s) or by beginning the automatic binding sequence on the Gateway and auto-binding all the Node(s).

## To Manually Bind a Node

1. Remove the Node's top cover.
2. Move DIP switch 1 to the ON position to activate extended address mode.
3. Apply power to the Node.*
   The LCD displays POWER, then RUN.
4. On the Node, single click button 1 to advance across the menus, stopping at the DVCFG menu.
5. Single click button 2 to select DVCFG. Single click button one to select from the available menu options, stopping at XADR.
6. Single click button 2 to enter the XADR menu.
   AUTO is automatic binding mode and uses the Gateway's serial number as the extended address code.
7. Single click button 1, stopping at manual mode.
   MANUAL allows the user to manually enter an extended address code.
8. Single click button 2 to enter manual mode.
9. Single click button 2 to enter the extended address code entry step.
   The LCD shows SET XADR 000000.
10. Use the right rotary switch to begin setting the extended address code. Digit selection begins with the left most digit. After selecting the first digit, single click button 1 to advance right to the next digit. All six digits must be filled, even if it is with leading zeros. For example, to use 2245 as the code, enter 002245 into the device.
11. Continue entering the code using a single click of button 1 to advance from left to right.
    Upon reaching the sixth digit, the curser returns to the first digit.
12. Single click button 2 when code entry is complete. The Node LCD displays the entered value for confirmation.
    The LCD shows CONFRM XADR XXXXXX.
13. If the rotary dial hasn't been returned to the previous Node address (device address or ID), the LCD displays the prior setting as a reminder. Return the rotary dial to its previous Node address.
14. The new Node address setting displays (NEW NADR XX).
15. The Node confirms the new Node address by displaying CONFRM NADR XX.
16. Double click button 2 to exit the XADR menu and to return to RUN mode.

When entering the extended address code, the digits auto fill with whatever position the rotary switch is currently in. For example, after entering the 00 part of the extended address code 002245, the third digit auto fills with a 0 until the rotary dial is rotated to 2.

* For devices with batteries integrated into the housing, remove the battery for one minute to cycle power to the device.

## Automatic Binding (Menu Navigation)

The easiest way to bind the Gateway to its Nodes is by triple clicking button 2 to enter automatic binding mode. For these instructions, refer to the installation and setup instructions in the *Installation* chapter.

If you would prefer to begin automatic binding mode using the menu structure instead of the buttons, follow these steps:

### On the Gateway

1. Remove the Gateway's top cover.
2. Move DIP switch 1 to the ON position to activate extended addressing mode.
3. Apply power to the Gateway.
   The LCD should show POWER, then *RUN.
4. On the Gateway, single click button 1 to advance across the menus, stopping at the DVCFG menu.
5. Single click button 2 to select DVCFG. Single click button 1 to select from the available menu options, stopping at XADR.
6. Single click button 2 to enter XADR mode. When the display reads (AUTO), single click button 2 again to begin the automatic binding mode.
   The LCD shows NETWRK BINDNG and the LEDs flash alternately when the Gateway is in binding mode. Any Node entering binding mode will bind to this Gateway.

### On the Node

7. Remove the Node's top cover.
8. Move DIP switch 1 to the ON position to activate extended addressing mode.
9. Apply power to the Node.*
   The LCD should show POWER, then *RUN.
10. On the Node, single click button 1 to advance across the menus, stopping at the DVCFG menu.
11. Single click button 2 to enter the DVCFG menu.
12. Single click button 1 to select from the available submenu options, stopping at XADR.
13. Single click button 2 to enter the XADR submenu.
14. When the display reads (AUTO), single click button 2 to begin the automatic binding mode.
    The LCD shows NETWRK BINDNG to indicate the Node has entered binding mode.

    When the Node is bound, the LEDs are both solid red for a few seconds and the LCD shows BOUND. The Node cycles its power, then enters RUN mode.
15. Use both of the Node's rotary dials to assign a decimal Device Address between 01 and 56.
    The left rotary dial represents the tens digit (0–5) and the right dial represents the ones digit (0–9) of the Device Address.
16. Repeat steps 7 through 16 for each additional Node that needs to communicate to that Gateway.

### On the Gateway

17. Single click button 1 or button 2.
    When button 1 or 2 is pressed, the Gateway exits binding mode and reboots. When the LCD shows POWER, then *RUN, the Gateway has entered RUN mode.

* For devices with batteries integrated into the housing, remove the battery for one minute to cycle power to the device. After making any changes to DIP switch settings, you must cycle power to the device or the DIP switch changes will not be recognized.

## Collacated Networks - Setting the Network ID

Remember, the extended addressing code is independent from the system network ID (NID). Consequently, multiple networks can share a NID and will not exchange data; the networks are completely isolated from one another. Users of the WT8000 product do not need to be aware of other nearby networks to ensure their network does not unintentionally exchange data with other networks.

Assigning different NIDs to different networks improves collocation performance in dense installations; this is true whether the network is in standard addressing mode or extended addressing mode.

To set the network ID follow these steps on the Gateway device:

1. From the top level menus, single click button 1 to advance through the menus, stopping at DVCFG (Device Configuration).
2. Single click button 2 to enter the DVCFG menu options and stop at (NID).
3. Single click button 2 to enter the (NID) menu option.
4. Using both rotary dials on the front of the Gateway, select a Network ID number. The left rotary dial acts as the left digit and the right rotary dial acts as the right digit of the Network ID. In extended addressing mode, the Network ID can only be set from the rotary dials while in the (NID) menu.
   Any Nodes bound to this Gateway 'follow' the Gateway to the new Network ID automatically. The current Network ID and the new Network ID display on the LCD panel.
5. Single click button 2 to save the new values.
6. Double click button 2 to exit this submenu.
7. Double click button 2 to exit to the main menu system and return to RUN mode.

## Setting the Maximum Node Count

Use the MAXN submenu, located under the *DVCFG (Device Configuration) menu to set the maximum number of Nodes for this system. For example, if you are running four Nodes in this network, set the system's maximum Node count to 8. This allows up to 8 Nodes in the wireless network. Selecting 8 also results in the highest throughput, 62.5 milliseconds, for each Node. The choices are 8, 16, 32, and 56 Nodes.

# System Layouts

## Gateways

A SureCross Gateway is the wireless network master device used to control network 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.

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.

## Nodes

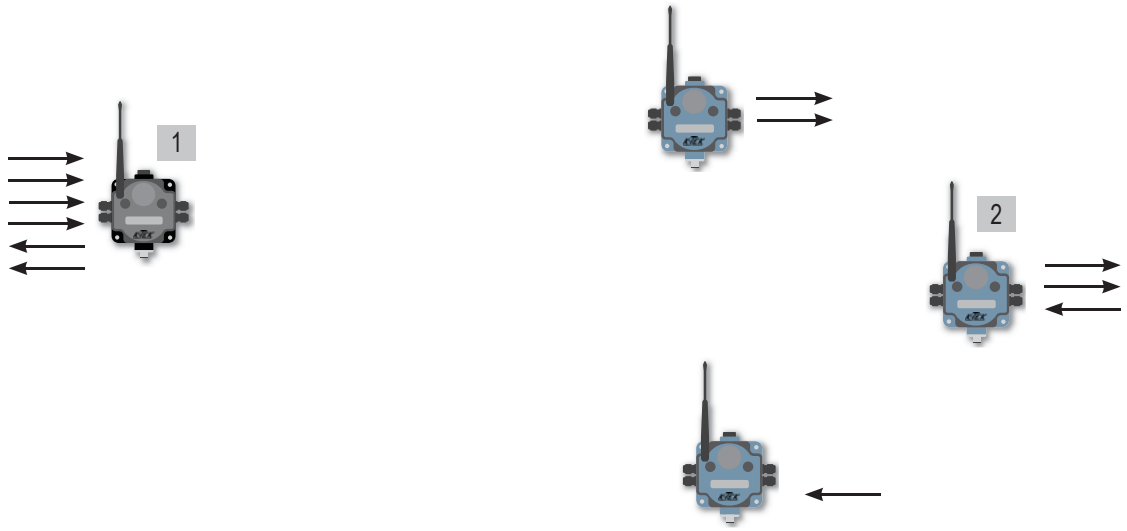
Generally, a node is any point within a network. A SureCross Node is a wireless network slave device used to provide sensing capability in a remote area or factory. The Node collects sensor data from sensors and communicates the data back to the SureCross Gateway.

SureCross Nodes are available in a wide variety of power or input/output options. Each wireless network includes one Gateway and up to 56 Nodes.

# Stand-Alone Systems

## Gateway with Multiple Nodes (WT8000)

In this configuration, the Gateway is the master of the wireless network. This network may be configured using the User Configuration Tool (UCT) and RS-485 to USB adapter cable. The UCT is used to map inputs and outputs between Nodes and Gateways.

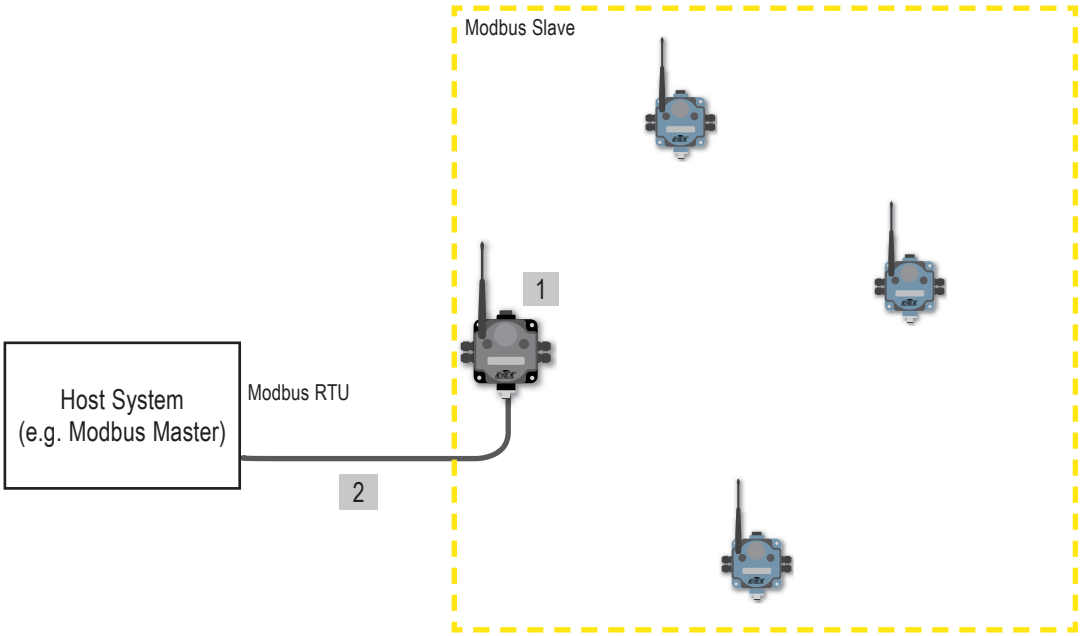



| Item | Model No. | Description |
|---|---|---|
| 1 | WT8000G | WT8000 Gateway |
| 2 | WT8000N | WT8000 Node |
| 3 | BWA-HW-006 | RS-485 to USB adapter cable (not shown) |

# MODBUS RTU

## Modbus RTU Host Controlled Operation

A simple host-connected system uses an RS485 serial cable to connect the WT8000 Gateway device to a host system. The host system may be a PC or a PLC unit. Because the serial cable is used to connect to a host system, the communications protocol used is Modbus RTU. The wireless network is a Modbus slave.




Purpose: The wireless network collects I/O data and sends it back to a Modbus host system.

| Item | Model No. | Description |
|---|---|---|
| 1 | WT8000G | Gateway |
| 2 | CSRB-M1250M125.47M125.73 | Cable, RS-485, quick disconnect, 5-pin Euro, male trunk, female branches, black* |
| | MQDC1-5*** | Cable, quick disconnect, 5-pin Euro, female, straight, lengths vary |

# Modbus/TCP and RTU Register Map

Modbus/TCP and Modbus RTU provide device control and monitoring using holding registers in the 40000 register block. Each wireless device in the system is allocated 16 holding registers.

The Gateway uses the first 16 registers followed by each Node in the network, based on the Node address. For Node 5, the starting Modbus registers are 1 + (Node# × 16) = 1 + (5 × 16) = 81, the ending register is 97.

| I/O Point | Gateway Modbus Holding Register | Node Modbus Register |
|---|---|---|
| 1 | 1 | 1 + (Node# × 16) |
| 2 | 2 | 2 + (Node# × 16) |
| 3 | 3 | 3 + (Node# × 16) |
| 4 | 4 | 4 + (Node# × 16) |
| 5 | 5 | 5 + (Node# × 16) |
| 6 | 6 | 6 + (Node# × 16) |
| 7 | 7 | 7 + (Node# × 16) |
| 8 | 8 | 8 + (Node# × 16) |
| 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) |
| 16 | 16 | 16 + (Node# × 16) |

| Registers | Device and Input Connections |
|---|---|
| 1 | Gateway I/O 1 |
| 2 | Gateway I/O 2 |
| 3 | Gateway I/O 3 |
| 4 | Gateway I/O 4 |
| 5 | Gateway I/O 5 |
| 6 | Gateway I/O 6 |
| 7 | Gateway I/O 7 |
| 8 | Gateway I/O 8 |
| 9 | Gateway I/O 9 |
| 10 | Gateway I/O 10 |
| 11 | Gateway I/O 11 |
| 12 | Gateway I/O 12 |
| 13 | Gateway I/O 13 |
| 14 | Gateway I/O 14 |
| 15 | Gateway I/O 15 |
| 16 | Gateway I/O 16 |
| 17 | Node #1 I/O 1 |
| 18 | Node #1 I/O 2 |
| 19 | Node #1 I/O 3 |
| 20 | Node #1 I/O 4 |
| 21 | Node #1 I/O 5 |
| 22 | Node #1 I/O 6 |
| 23 | Node #1 I/O 7 |
| 24 | Node #1 I/O 8 |
| 25 | Node #1 I/O 9 |
| 26 | Node #1 I/O 10 |
| 27 | Node #1 I/O 11 |
| • | • |
| • | • |
| • | • |
| 905 | Node #56 I/O 9 |
| 906 | Node #56 I/O 10 |
| 907 | Node #56 I/O 11 |
| 908 | Node #56 I/O 12 |
| 909 | Node #56 I/O 13 |
| 910 | Node #56 I/O 14 |
| 911 | Node #56 I/O 15 |
| 912 | Node #56 I/O 16 |

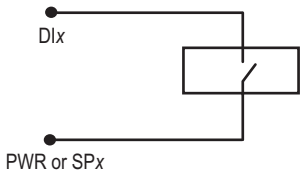
# Sensor Connections

## Digital Sensors, Sourcing (PNP) Inputs

Neither the inputs nor the outputs on the WT8000 devices are isolated. Under certain operating conditions, externally powered sensors may need to have ground in common with the WT8000 device to which they are connected. The power sources do not have to be the same.

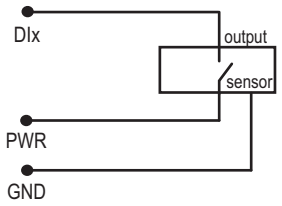
### Powered by WT8000

#### Two-Wire



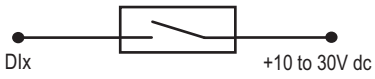

Wiring diagram for a sourcing (PNP), two-wire sensor powered using the WT8000 device terminal block.

#### Three-Wire

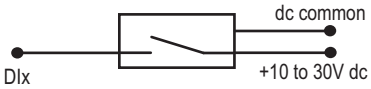



Wiring diagram for a sourcing (PNP), three-wire sensor powered using the WT8000 device terminal block.

### Powered Externally




Wiring diagram for a sourcing (PNP) two-wire sensor powered externally. Under certain conditions, the dc commons between the sensor and the WT8000 might need to be connected.



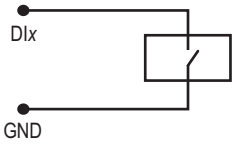

Wiring diagram for a sourcing (PNP) three-wire sensor powered externally. Under certain conditions, the dc commons between the sensor and the WT8000 might need to be connected.

## Digital Sensors, Sinking (NPN) Inputs

Neither the inputs nor the outputs on the WT8000 devices are isolated. Under certain operating conditions, externally powered sensors may need to have ground in common with the WT8000 device to which they are connected. The power sources do not have to be the same.

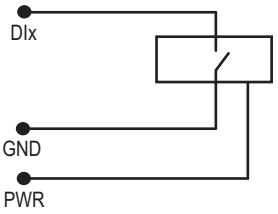
### Powered by WT8000

#### Two-Wire



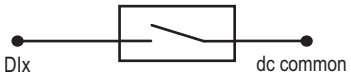

Wiring diagram for a sinking (NPN) two-wire sensor powered using the WT8000 device terminal block.

#### Three-Wire

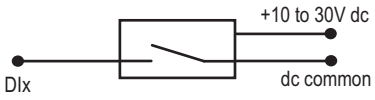



Wiring diagram for a sinking (NPN) three-wire sensor powered using the WT8000 device terminal block.

### Powered Externally




Wiring diagram for a sinking (NPN) two-wire sensor grounded outside the WT8000 device. Under certain conditions, the dc commons between the sensor and the WT8000 might need to be connected.



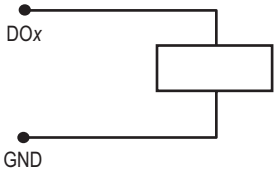

Wiring diagram for a sinking (NPN) three-wire sensor grounded outside the WT8000 device. Under certain conditions, the dc commons between the sensor and the WT8000 might need to be connected.

## Digital Sensors, Sourcing (PNP) Outputs

Neither the inputs nor the outputs on the WT8000 devices are isolated. Under certain operating conditions, externally powered sensors may need to have ground in common with the WT8000 device to which they are connected. The power sources do not have to be the same.

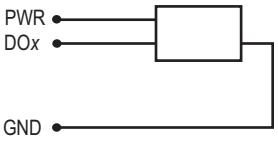
### Powered by WT8000

#### Two-Wire



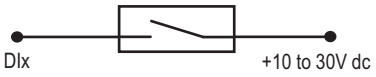

Wiring diagram for a sourcing (PNP) two-wire output load powered using the WT8000 device terminal block.

#### Three-Wire

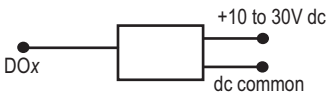



Wiring diagram for a sourcing (PNP) three-wire output load powered using the WT8000 device terminal block.

### Powered Externally




Wiring diagram for a sourcing (PNP) two-wire output load powered from outside the WT8000 device. Under certain conditions, the dc commons between the sensor and the WT8000 might need to be connected.



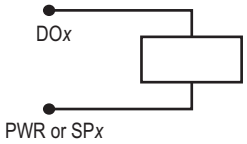

Wiring diagram for a sourcing (PNP) three-wire output load powered from outside the WT8000 device. Under certain conditions, the dc commons between the sensor and the WT8000 might need to be connected.

## Digital Sensors, Sinking (NPN) Outputs

Neither the inputs nor the outputs on the WT8000 devices are isolated. Under certain operating conditions, externally powered sensors may need to have ground in common with the WT8000 device to which they are connected. The power sources do not have to be the same.

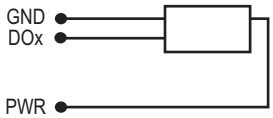
### Powered by WT8000

#### Two-Wire



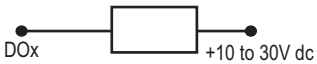

Wiring diagram for a sinking (NPN) two-wire output.

#### Three-Wire

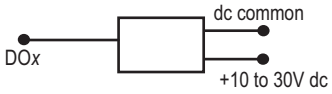



Wiring diagram for a sinking (NPN) three-wire output.

### Powered Externally




Wiring diagram for a sinking (NPN) two-wire output. Under certain conditions, the dc commons between the sensor and the WT8000 might need to be connected.



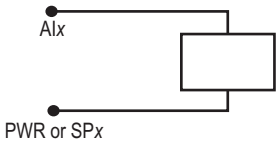

Wiring diagram for a sinking (NPN) three-wire output. Under certain conditions, the dc commons between the sensor and the WT8000 might need to be connected.

## Analog Inputs

For analog sensors, the ground/dc common of the sensor should be connected to the ground of the WT8000 device. For best results, Banner recommends that the power source for the sensor and WT8000 device is the same.

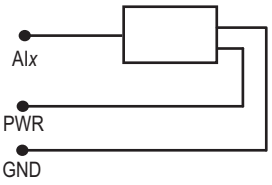
### Powered by WT8000

#### Two-Wire



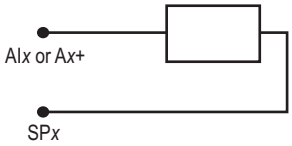

Two-wire analog sensor powered from a 10 to 30V dc power WT8000 device using the PWR terminal.

#### Three-Wire

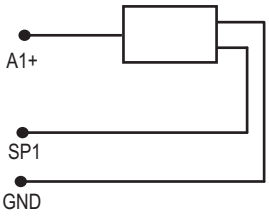



Three-wire analog sensor powered from 10 to 30V dc power WT8000 device using the PWR terminal.

### Switch Powered

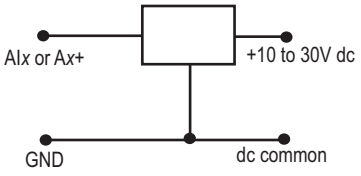



Two-wire analog sensor using a *Flex*Power™ Node and powered using the Node's switch power.




Three-wire analog sensor using a *Flex*Power™ Node and powered using the Node's switch power.

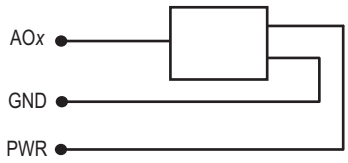
### Powered Externally



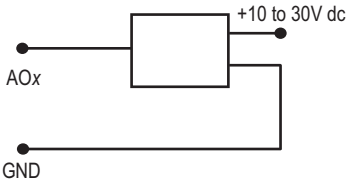

Three-wire analog sensor using a *Flex*Power Node but the sensor is powered externally (not from the WT8000 device).

## Analog Outputs

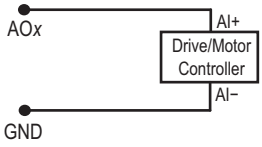
For analog sensors, the ground/dc common of the sensor should be connected to the ground of the WT8000 device. For best results, Banner recommends that the power source for the sensor and WT8000 device is the same.



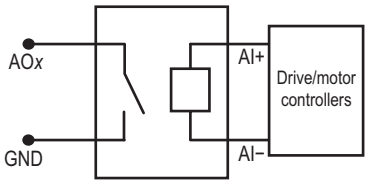

Three-wire analog output device powered off the WT8000 device.




Three-wire analog output device powered externally (not from the WT8000 device).




When the AI- can be referenced to ground, use this wiring diagram for drive/motor controllers.




When the AI- cannot be referenced to ground, use this wiring diagram for drive/motor controllers.

# Agency Certifications

## FCC Certification 900 MHz

The WT8000 Module complies with Part 15 of the FCC rules and regulations.

FCC ID: TGUWT8000 This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### *FCC Notices*

IMPORTANT: The WT8000 Modules have been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

IMPORTANT: The WT8000 Modules have been certified for fixed base station and mobile applications. If modules will be used for portable applications, the device must undergo SAR testing.

IMPORTANT: If integrated into another product, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door, or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: Contains FCC ID: TGUWT8000.

### *Note*

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna,
- Increase the separation between the equipment and receiving module,
- Connect the equipment into an outlet on a circuit different from that to which the receiving module is connected, and/or
- Consult the dealer or an experienced radio/TV technician for help.

Antenna Warning WARNING: This device has been tested with Reverse Polarity SMA connectors with the antennas listed in Table 1 Appendix A. When integrated into OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas not listed in the tables must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

### *FCC-Approved Antennas*

WARNING: This equipment is approved only for mobile and base station transmitting devices. Antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

WT8000 Module may be used only with Approved Antennas that have been tested with this module.

| Part Number | Antenna Type | Maximum Gain |
|---|---|---|
| — | Integral antenna | Unity gain |
| BWA-9O1-x | Omni, 1/4 wave dipole | ≤2 dBi |
| BWA-9O2-C | Omni, 1/2 wave dipole, Swivel | ≤2 dBi |
| BWA-9O6-A | Omni Wideband, Fiberglass Radome | ≤8.2 dBi |
| BWA-9O5-B | Omni Base Whip | ≤7.2 dBi |
| BWA-9Y10-A | Yagi | ≤10 dBi |

Table 1. Type certified Antenna

## FCC Certification, 2.4 GHz

The WT8000 Module complies with Part 15 of the FCC rules and regulations.

FCC ID: UE300WT8000-2400 This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### *FCC Notices*

IMPORTANT: The WT8000 Modules have been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

IMPORTANT: The WT8000 Modules have been certified for fixed base station and mobile applications. If modules will be used for portable applications, the device must undergo SAR testing.

IMPORTANT: If integrated into another product, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door, or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: Contains FCC ID: UE300WT8000-2400.

### *Note*

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna,
- Increase the separation between the equipment and receiving module,
- Connect the equipment into an outlet on a circuit different from that to which the receiving module is connected, and/or
- Consult the dealer or an experienced radio/TV technician for help.

Antenna Warning WARNING: This device has been tested with Reverse Polarity SMA connectors with the antennas listed in Table 1 Appendix A. When integrated into OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas not listed in the tables must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

### *FCC-Approved Antennas*

WARNING: This equipment is approved only for mobile and base station transmitting devices. Antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

WT8000 Module may be used only with Approved Antennas that have been tested with this module.

| Part Number | Antenna Type | Maximum Gain |
|---|---|---|
| — | Integral antenna | Unity gain |
| BWA-2O2-C | Omni, 1/2 wave dipole, Swivel | ≤2 dBi |
| BWA-2O5-C | Omni, Collinear, Swivel | ≤5 dBi |
| BWA-2O7-C | Omni, Coaxial Sleeve, Swivel | ≤7 dBi |

Table 1. Type certified Antenna

## Certified Counties List

| Country | Frequency | Models |
|---|---|---|
| | | WT8000 |
| Australia | 2.4 GHz | x |
| Austria | 2.4 GHz | x |
| Bahamas, The | 900 MHz | x |
| Bahamas, The | 2.4 GHz | x |
| Bahrain (Kingdom of) | 2.4 GHz | x |
| Belgium | 2.4 GHz | x |
| Brazil | 2.4 GHz | x |
| Bulgaria | 2.4 GHz | x |
| Canada | 900 MHz | x |
| Canada | 2.4 GHz | x |
| China (People's Republic of) | 2.4 GHz | x |
| Colombia | 900 MHz | x |
| Colombia | 2.4 GHz | x |
| Cyprus | 2.4 GHz | x |
| Czech Republic | 2.4 GHz | x |
| Denmark | 2.4 GHz | x |
| Estonia | 2.4 GHz | x |
| Finland | 2.4 GHz | x |
| France | 2.4 GHz | x |
| Germany | 2.4 GHz | x |
| Greece | 2.4 GHz | x |
| Hungary | 2.4 GHz | x |
| Iceland | 2.4 GHz | x |
| India | 2.4 GHz | x |
| Ireland | 2.4 GHz | x |
| Israel | 2.4 GHz | x* |
| Italy | 2.4 GHz | x |
| Latvia | 2.4 GHz | x |
| Liechtenstein | 2.4 GHz | x |
| Lithuania | 2.4 GHz | x |
| Luxembourg | 2.4 GHz | x |
| Malta | 2.4 GHz | x |
| Mexico | 900 MHz | x |
| Mexico | 2.4 GHz | |
| Netherlands | 2.4 GHz | x |
| New Zealand | 2.4 GHz | x |
| Norway | 2.4 GHz | x |
| Panama | 900 MHz | x |
| Panama | 2.4 GHz | x |
| Poland | 2.4 GHz | x |

| Country | Frequency | Models |
|---|---|---|
| | | WT8000 |
| Portugal | 2.4 GHz | x |
| Romania | 2.4 GHz | x |
| Saudi Arabia (Kingdom of) | 2.4 GHz | x |
| Slovakia | 2.4 GHz | x |
| Slovenia | 2.4 GHz | x |
| South Africa | 2.4 GHz | x |
| Spain | 2.4 GHz | x |
| Sweden | 2.4 GHz | x |
| Switzerland | 2.4 GHz | x |
| Taiwan | 2.4 GHz | x** |
| United Kingdom | 2.4 GHz | x |
| United States of America | 900 MHz | x |
| United States of America | 2.4 GHz | x |

* External antenna models

** Only specific models. Refer to certificate for the model list.

## Additional Messages

### *Bulgaria*
Authorization required for outdoor and public service use.

### *France*
In Guyane (French Guiana) and La Reunion (Reunion Island), outdoor use not allowed.

When ordering products for use in France, add -FR to the model number. For example, the model number for a six discrete I/O Gateway would be WT8000G2M6S6P6-FR.

### *Italy*
If used outside of own premises, general authorization is required. General authorization is required for public service.

### *Canada*
This Class A digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouiller du Canada. Le present appareil numérique n'emet pas de bruits radioélectriques dépassant les limites applicables aux appareils numeriques de le Classe A préscrites dans le Reglement sur le brouillage radioélectrique édits par le ministere des Communications du Canada.

### *Luxembourg*

#### *900 MHz*
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 that 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.

It is Banner Engineering's intent to fully comply with all national and regional regulations regarding radio frequency emissions. The SureCross wireless products were certified for use in these countries using the standard antenna that ships with the product. When using other antennas, verify you are not exceeding the transmit power levels allowed by local governing agencies. Customers who want to re-export this product to a country other than that to which it was sold must ensure that the device is approved in the destination country. Consult with Banner Engineering if the destination country is not on this list.

This page was intentionally left blank.

This page was intentionally left blank.

For the latest version of this manual, visit ktekcorp.com.

K-TEK
18321 Swamp Road
Prairieville, LA 70769 USA
Tel: (1) 225.673.6100
Fax: (1) 225.673.2525
Email: service@ktekcorp.com
Website: ktekcorp.com

K-TEK Solids Level
6100 West by Northwest #140
Houston, TX 77040 USA
Tel: (1) 713.462.7665
Fax: (1) 713.462.7684
Email: service@kteksolidslevel.com
Website: kteksolidslevel.com