# Banner Tank Level Monitoring Solution Kit

This kit provides visual status of up to 16 Banner K50U Performance Node sensors (assets) that are bound to the included DXM Wireless Controller. This provides a simple and effective way of monitoring the level of many tanks, totes, or barrels to avoid disruption, downtime, or damage to pumps.

To use any analog sensor input for monitoring tank levels, refer to the Measuring Larger Tanks with the Tank Level Solution Kit documentation (p/n b_4503670).

This kit uses a unique version of the Banner Tank Level Monitoring Solutions Guide software to program the DXM Wireless Controller. The Nodes take a data sample every 5 minutes and the software uses the raw data along with user tank settings to calculate the tank level percentage. Users can also enter in low or high warnings and/or alarms for visual indication of a potential problem.

Included with the Tank Level Monitoring Solutions Kit are:

- 10-inch Banner Touch Screen HMI with Ethernet connection
- DXM700-B1R1 Wireless Controller (900 MHz) or DXM700-B1R3 (2.4 GHz)
- 5-port Ethernet switch
- M12/Euro-style power input connector
- Polycarbonate enclosure, 14" × 12", with DIN rails and terminal blocks
- This kit also requires a 24 V DC Class 2 (UL) or a Limited Power Source (LPS) (CE) power supply that is sold separately (Banner recommends model PSW-24-1 (FCC/CE) or model PSD-24-4 (FCC/CE) if you are powering additional indicator lights)
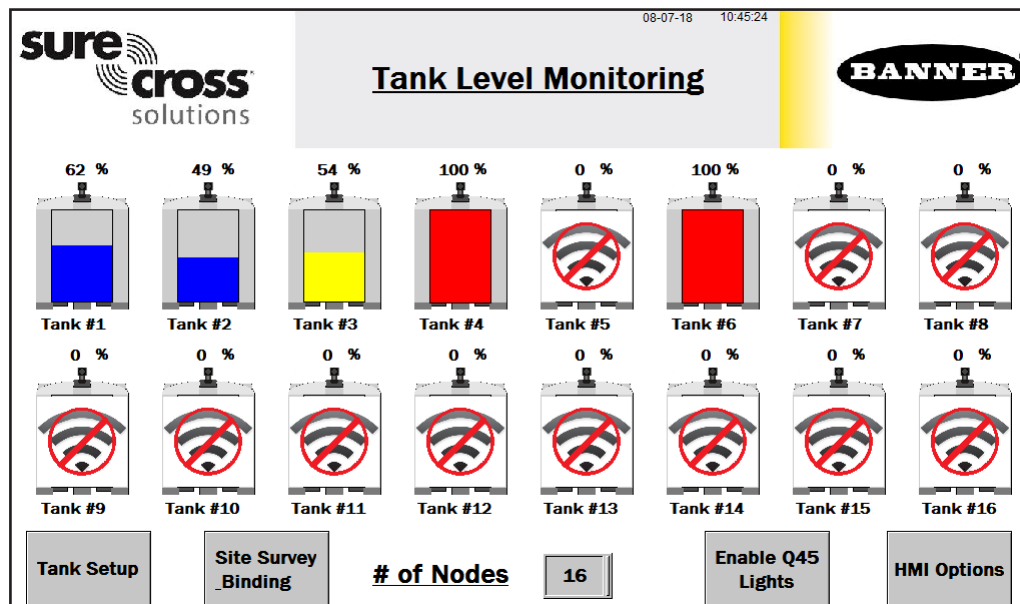
HMI Home Screen

- Each individual Nodes' icon is a color-coded indication of the status of tank level warnings or alarms and a touch button that will bring up that Nodes' screen to view detailed data. (See page 4)
- Use the Site Survey and Binding button to conduct a site survey or bind any Node.
- Use the Tank Setup screen to define tank depth, offset, warning levels, alarm level, and/or change units.
- Change the # of Nodes from 1 to 16 to display how many Nodes are used.
- The HMI Options button provides an icon legend, options for HMI panel configuration, and access to log files.
- The Enable/Disable Q45 Lights button enables the LEDs to begin flashing on any of the Q45s that are in a warning (yellow) or alarm (red) state. No light appears in a typical situation. Press once to enable; press again to disable and save battery life.
- Touch the Node label to re-label any asset icon. The label is used on all associated screens for that Node.

Tank Level Node (Asset) Site Survey and Binding Screen

Banner Wireless Q45 or P6 Nodes combined with Banner K50U ultrasonic sensors must be bound to the DXM Wireless Controller to begin communicating. After you complete these instructions, the Q45/P6 Nodes are assigned a Node address and begin communicating with the DXM.

Purchase the Nodes and sensors separately. After they are installed, they must be bound individually. Follow these instructions to add a new Node/sensor radio. Perform a site survey on each Q45/P6 Node after they are installed to ensure a proper radio connection between the Nodes and DXM.

Bind a Node to the DXM
1. On the HMI screen: Touch the Binding button to turn on binding for the Node.
2. On the Node:
   a. Connect the K50U ultrasonic sensor
   b. Enter binding mode by triple-clicking the binding button under the Q45 lid or by triple-clicking button 2 on a P6. For the P6 follow the Node's datasheet for setting the rotary dials before binding.
   c. After the Node is bound, the LEDs stay solid momentarily, then they flash together four times. The node automatically exits binding mode.
3. On the HMI screen, touch the same Binding switch again to toggle the switch to off.

Repeat these steps for as many Nodes as are needed for the network.

Conduct a Site Survey
1. On the HMI screen: Select Site Survey for the Node.
   If the selected Node is communicating with the DXM, the site survey results display at the bottom of the HMI screen.
2. Refer to the Conducting a Site Survey and Interpreting the Results technical note (p/n 133602) on www.bannerengineering.com to interpret the Site Survey results.
3. On the HMI screen: After the site survey is complete, toggle the Site Survey switch to turn Site Survey off.

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www.bannerengineering.com • Tel: 763.544.3164
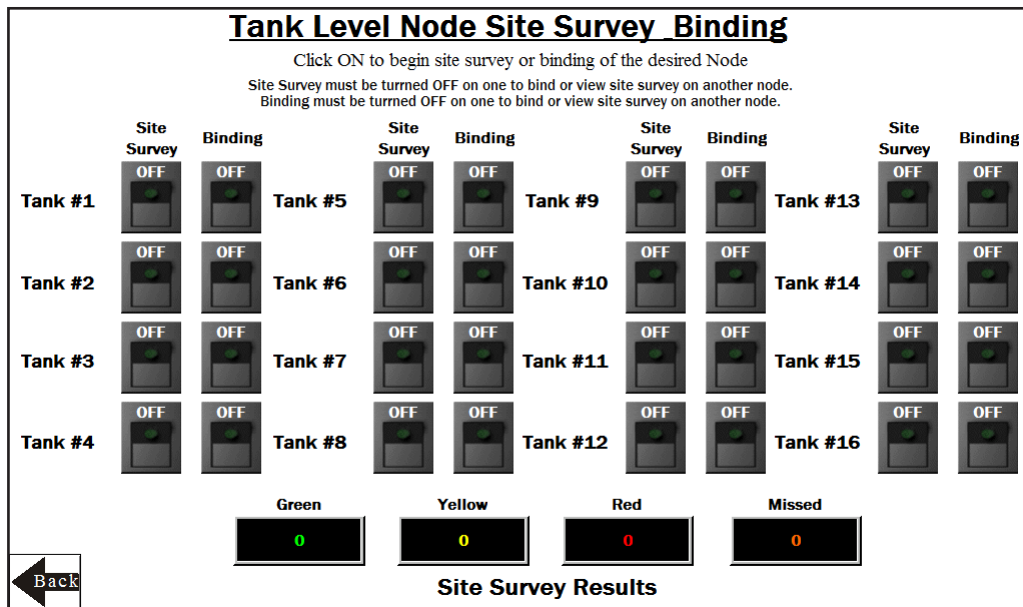
Tank Setup Screen

Each tank level Node reports back data to determine the percentage of the tank depth and if any offset height is required. The maximum tank depth is 120 inches or 3000 mm. If there is no offset, leave it set to zero. Push the Change Units button to toggle between inches and millimeters.

1. Enter in the tank depth and offset height (if applicable) for each tank level Node.
2. Set each tank level Node's low and high warning and/or alarm levels. Set those values between 0 and 100%. Leave the values at 0 for Low and 110 for High if you are not using that warning or alarm.

Tank Monitoring Depth, Offset and Alarm Settings

REQUIRED : Click on the numeric entry box to set the tank depth and offset (if applicable) in inches(0-120) or mm(0-3000).
OPTIONAL : Click on the numeric entry box to set the warning and alarm thresholds in % full (0-100%).

	Tank Depth (inches)	Offset (inches)	Low Warning %	Low Low Alarm %	High Warning %	High High Alarm %
Tank #1	72.00	6.00	30	10	70	90
Tank #2	120.00	0.00	0	0	110	110
Tank #3	120.00	0.00	0	0	110	110
Tank #4	120.00	0.00	0	0	110	110
Tank #5	120.00	0.00	0	0	110	110
Tank #6	120.00	0.00	0	0	110	110
Tank #7	120.00	0.00	0	0	110	110
Tank #8	120.00	0.00	0	0	110	110

Change Units:
Metric (mm)

◀ Back

Nodes #9–16 Settings ➡

3. Use the arrow button next to Nodes #9–16 settings to set up the additional Nodes. Use the return arrow on that screen when complete and the Back button to return to the Tank Level Monitoring Home screen.

HMI Options Menu Screen

This screen provides some added HMI functionality along with an icon and graph legend.

HMI System Setup—Enters the HMI Panel Setup; clears any logged data from the graphs but will not clear any data saved to files.

Restart HMI Application—Restarts the HMI application, which clears all graphed data but retains saved logs.

Stop Operation Safely—Stops HMI operation safely without data corruption, then turns off the HMI.

The HMI provides data logging of all tank levels, tank settings, and warnings and/or alarms. This data is saved to a file every 30 minutes and a new file is generated every day and stored in monthly folders. The HMI stores about 75 days of log files. Below are some options for managing and retrieving those files.

Copy Log Files to USB Drive—Plug a USB drive into the back of the HMI and click here to select the log files or folders to copy.

Manually Delete Files Older than X Days—Delete files older than a specified number of days immediately. Use this option if the HMI is warning about an inability to save data or a lack of storage space. Shortening the auto delete days may be necessary.

Auto Delete Files Older than X Days—The HMI auto deletes files older than the selected number of days.

HMI System Setup

Copy Log Files to USB Drive

Restart HMI Application

Manually Delete Files Older than 'X' days

Stop Operation Safely

Auto delete files older than 'X' days   30

Icon Legend

No Alerts   Warning   Alarm   Node Out of Sync
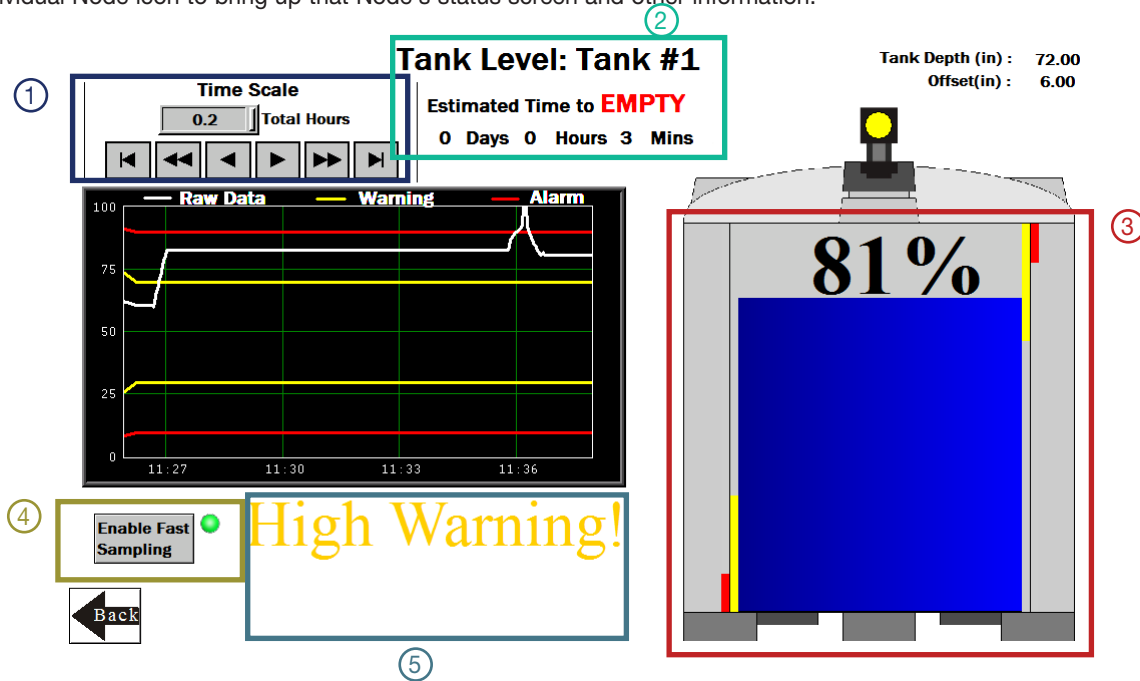
Graph Legend

Raw Data   Warning   Alarm

◀ Back

Tank Level Monitoring Solutions Kit V1.0

Individual Tank Level Node (Asset) Status Screen

Select an individual Node icon to bring up that Node's status screen and other information.

1. **Time Scale**—Selects the time scale of the graph from 1 to 168 total hours. Use the arrow keys to scroll to view different periods of the collected data. Maximum viewable data on the HMI: 168 hours or 7 days.

2. Indicates whether the tank is filling or emptying and the estimated time to full or empty based on the change in depth during the last two samples.

3. **Tank Level Display**—The image of the tank shows the current tank depth with the warning and alarm levels. The simulated Q45 light on top of tank changes color to match any warning (yellow) or alarm (red) state.

4. **Enable Fast Sampling**—Enables fast sampling of the Node associated with the current screen and enables the graph to start logging every two seconds. The green light indicates when the fast sampling for the graph is enabled and automatically turns off after 15 minutes. Each Node's fast sampling is independently set. NOTE: If this button had already been pressed on another tank screen, the green light might already be lit even if the Node isn't fast sampling because the Node doesn't report its fast sampling status. If you are unsure of the Node's state, pressing the button again resends the fast sample command to that particular Node and restarts the 15 minute timer. This should only be used to quickly monitor a filling or emptying situation; frequent use reduces the battery life of the Node(s) being fast sampled.

5. Indication of any current warnings or alarm display near the bottom of the screen, below the graphs.

Advanced Options

Installing a Warning/Alarm Light Indicator

A tower light or indicator light (such as a K70, TL50, TL70, etc.) may be added to the solution box for added local indications of all clear, warnings, or alarms. The DXM Wireless Controller uses PNP outputs with a maximum of 100 mA per output so an interposing relay may need to be added to accommodate higher amperage lights. To install:

1. Cut a hole in the box and mount the light accordingly.
2. Wire DC ground to the light or an interposing relay from the bottom row of the gray 2-row terminal blocks inside the kit on the DIN rail adjacent to the DXM Controller.
3. Wire the input of the light or interposing relay to the DXM as follows:
    a. O1 – Pin 5 – indicates any node/asset in Alarm condition
    b. O2 – Pin 6 – indicates any node/asset in Warning condition
    c. O3 – Pin 7 – indicates any node/asset in either Warning or Alarm condition
    d. O4 – Pin 8 – indicates no Warning or Alarms conditions exist

Connecting the DXM and HMI to a wide area network (WAN)

By default, the HMI and DXM Wireless Controller are configured to communicate via static IP addresses.

To connect to a WAN, the two devices need to be adjusted to either have new static IP address on the new network or to acquire their own IP address via DHCP. Connecting to a WAN allows the devices to be accessed for configuration by any computer on the network and allows the DXM to be set up to push data to a cloud webserver for remote monitoring on the web. Follow the instructions in Push Information to the Cloud to connect the DXM to the Banner Cloud Data Services website.

1. Open the solution box and connect an Ethernet cable from the WAN to the Ethernet switch inside the solution box.
2. [DXM]: With power applied to the DXM, use the arrow keys to select **System Config** and press **Enter**.
3. [DXM]: Use the arrow keys to select **Ethernet**.
4. [DXM]: If you are using a static IP address
    a. Select the IP address shown and click **Enter**.
    b. Use the arrow and **Enter** keys to set the new static IP address.
    c. Reboot the DXM after making these changes.

    [DXM]: If you are using DHCP

    a. Click **Enter** on DHCP.
    b. Use the arrow keys to select **DHCP ON** and press **Enter**.
    c. Reboot the DXM after making these changes.
    d. Navigate to the **System Info > Ethernet** and write down the IP address for entering into the HMI. The subnet mask can be adjusted here as well if needed.
    e. [HMI]: From the main screen go to the **HMI Options** screen and then choose **HMI System Setup**.
    f. [HMI]: In the **Panel Setup** screen select, **General**.
    g. [HMI]: On the pop-up screen that appears, either adjust the IP address and network information for a static IP address by touching the boxes for the appropriate fields or in the box next to Get an IP address automatically push on the box to change **False** to **True** then press **OK**.
5. [HMI]: Press **Link 1** and select the IP address field.
6. [HMI]: Enter the IP address of the DXM from earlier and click **OK**.
7. [HMI]: To finish press **Run**.

Push Information to the Cloud

The DXM Wireless Controller can connect to the Web via Ethernet or an internal cell module. The controller pushes data from the DXM to the cloud to be stored and displayed on a website. To enable this capability, modify the DXM's XML configuration file.

The Banner website for storing and monitoring the system's data is https://bannercds.com/. The Banner Cloud Data Services website automatically generates dashboard icons and graphs for the Solutions Kit that can be placed in the Dashboard tab. Email alerts can be set up on the Alarms tab as well.
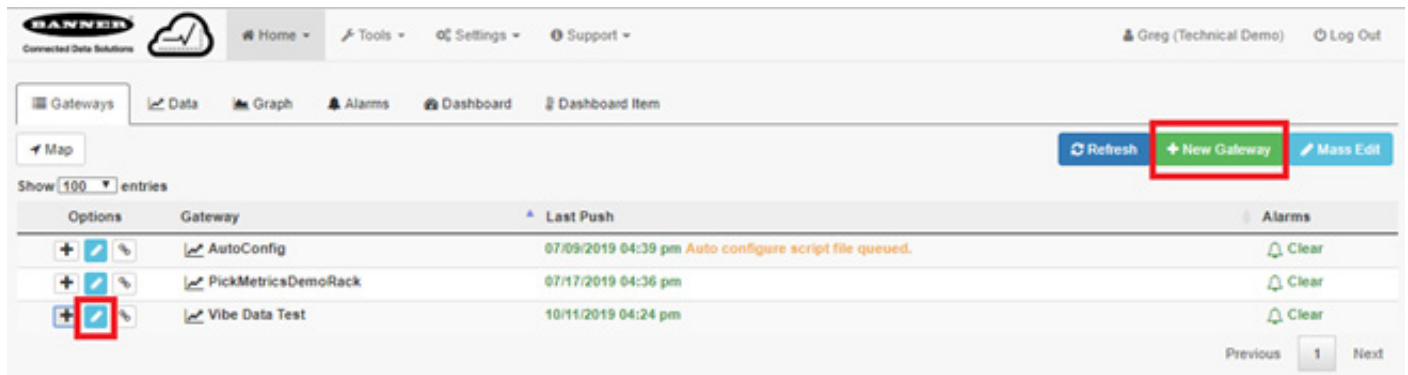
1. On the Website: Visit the Banner Cloud Data Services website (https://bannercds.com/) and log into an existing account or register a new account. Click + New Gateway. Name the Gateway then click Create.
2. After the Gateway appears, click the + symbol on the far left and highlight and copy the Gateway ID.
3. On the computer: Open the DXM Configuration Software v4.
4. On the DXM: Apply power to the DXM.
5. Connect the DXM Controller to the computer with a USB cable or skip if the DXM is connected to the same network as the computer.
6. Select DXM Model as DXM700 and connect the DXM to the tool by clicking Device-> Connection Settings in the menu bar.
7. If you are using the USB cable, select Serial, then select the COM port that the USB cable is plugged into. Click Connect. If you are unsure which COM port and multiple appear, attempt to connect to each one of them until successful. If connected to the same network as the DXM, select TCP/IP and enter the DXM IP address and click Connect.
8. After the DXM is connected to the software, get the current XML file by clicking Device->Get XML configuration from DXM. Name and save the file to the computer.
9. Within the tool, click the Settings tab on the left and then the Cloud Services tab on the top.
10. Make sure the Server name/IP is set to push.bannercds.com.
11. Select the appropriate Push interface to either Cellular or Ethernet. (To set up Ethernet, use the Network Tab under settings. To set up cellular, refer to the Activating a Cellular Modem tech note)
12. Leave the Cloud push interval and Sample count set as they were. The DXM script controls this to push every 5 minutes.
13. Registers are not preselected to push to the cloud. Some registers can be removed if you are not using all 16 Nodes. Additional registers can be added by going to the Local Registers tab on the left. The recommended READ registers are 1+10*(N-1) (N=node number) for the tank level data, 160-236 for individual warnings and alarms (0/1), and 251-266 for sensor connection status.
14. Under Web Server heading, keep the Site ID is drop-down selection as GUID and paste the copied ID from the webpage into the Site ID field.
15. Save the XML file (File > Save).
16. Upload the file to the DXM (Device > Send XML Configuration to the DXM).
17. On the Website: Click the blue pencil icon under the Options column on the row of the newly created Gateway. Click the "Choose File" next to Update XML and select the XML file that was just uploaded to the DXM.
18. Click Save to complete the connection to the website.
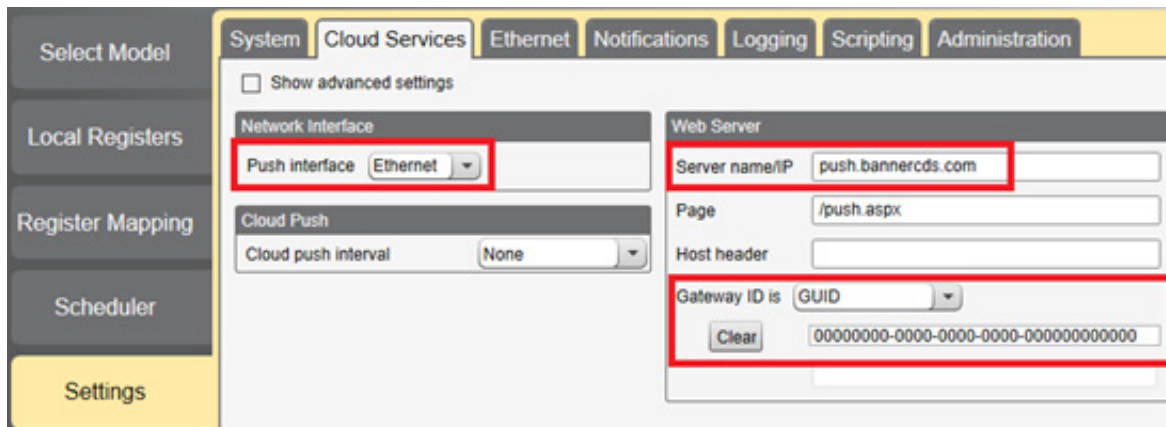
Specifications

Supply Voltage

24 V DC (±10%) (use only with a Class 2 (UL) power supply or a Limited Power Source (LPS) (CE) power supply)

Power Consumption

9 W average; 30 W maximum

Operating Conditions

–20 °C to +60 °C (–4 °F to +140 °F)

95% maximum relative humidity (non-condensing)

900 MHz Compliance (1 Watt)

ContainsFCC ID UE3RM1809: This device complies with FCC Part 15, Subpart C, 15.247

Contains IC: 7044A-RM1809

2.4 GHz Compliance (DX80-2400 Radio Module)

Radio module is indicated by the product label marking

Contains FCC ID: UE300DX80-2400: FCC Part 15, Subpart C, 15.247

Radio Equipment Directive (RED) 2014/53/EU

Contains IC: 7044A-DX8024

ANATEL: 15966-21-04042 Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para maiores informações, consulte o site da ANATEL www.gov.br/anatel/pt-br/

2.4 GHz Compliance (SX243 Radio Module)

Radio module is indicated by the product label marking

Contains FCC ID UE3SX243: FCC Part 15, Subpart C, 15.247

Radio Equipment Directive (RED) 2014/53/EU

Contains IC: 7044A-SX243

Radio Range

900 MHz, 1 Watt: Up to 9.6 km (6 miles)

2.4 GHz, 65 mW: Up to 3.2 km (2 miles)

Antenna Minimum Separation Distance

900 MHz, 150 mW and 250 mW: 2 m (6 ft) 900 MHz, 1 Watt: 4.57 m (15 ft)

2.4 GHz, 65 mW: 0.3 m (1 ft)

Radio Transmit Power

900 MHz, 1 Watt: 30 dBm (1 W) conducted (up to 36 dBm EIRP)

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)

Mounting

A mounting system that provides for various mounting options has been provided with this enclosure.

To connect the mounting brackets, turn the enclosure such that the backside is visible. Place the mounting brackets over the octagon bosses either horizontally, diagonally, or vertically, and fasten them with the ¼"-20 x 0.25" SS, countersunk Philips drive screws provided (torque limit = 30 in. lbs.). The enclosure can be mounted vertically (ie. on a wall) or horizontally (ie. table top).

Certifications

CE

(CE applies only to the 2.4 GHz models)

UKCA

(UKCA applies only to the 2.4 GHz models)

NOM NYCE

(NOM applies only to the 900 MHz models)

Important

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

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

Veuillez télécharger la documentation technique complète sur notre site www.bannerengineering.com pour les détails sur leur utilisation correcte, les applications, les notes de sécurité et les instructions de montage.

FCC Part 15 Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Industry Canada

IC: 7044A-RM1809 or 7044A-SX7023EXT—This device contains licence-exempt ransmitters(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). 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 contient des émetteurs/récepteurs exemptés de licence conformes à la norme Innovation, Sciences, et Développement économique Canada. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage.
2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Banner Engineering Corp. Limited Warranty

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

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For patent information, see www.bannerengineering.com/patents.

Notas Adicionales

Información México: La operación de este equipo está sujeta a las siguientes dos condiciones: 1) es posible que este equipo o dispositivo no cause interferencia perjudicial y 2) este equipo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

Banner es una marca registrada de Banner Engineering Corp. y podrán ser utilizadas de manera indistinta para referirse al fabricante. "Este equipo ha sido diseñado para operar con las antenas tipo Omnidireccional para una ganancia máxima de antena de 6 dBd y Yagi para una ganancia máxima de antena 10 dBd que en seguida se enlistan. También se incluyen aquellas con aprobación ATEX tipo Omnidireccional siempre que no excedan una ganancia máxima de antena de 6dBd. El uso con este equipo de antenas no incluidas en esta lista o que tengan una ganancia mayor que 6 dBd en tipo omnidireccional y 10 dBd en tipo Yagi, quedan prohibidas. La impedancia requerida de la antena es de 50 ohms."

Antenas SMA	Modelo
Antena, Omni 902-928 MHz, 2 dBd, junta de caucho, RP-SMA Macho	BWA-9O2-C
Antena, Omni 902-928 MHz, 5 dBd, junta de caucho, RP-SMA Macho	BWA-9O5-C

Antenas Tipo-N	Modelo
Antena, Omni 902-928 MHz, 6 dBd, fibra de vidrio, 1800mm, N Hembra	BWA-9O6-A
Antena, Yagi, 900 MHz, 10 dBd, N Hembra	BWA-9Y10-A

Mexican Importer

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San Pedro Garza Garcia Nuevo Leòn, C. P. 66269
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more sensors, more solutions