# DXM Enclosure Kit (DEK) Series Quick Start Guide

Original Instructions
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# Chapter 1 DEK Series Kit Contents

The contents of the **DXM Enclosure Kit** include everything needed to create the primary element of a standalone sensing network.

*DXM DEK kit enclosure assembly*



The DXM100-A1 or DXM100-A2 Controllers have a highly optimized charging circuit to manage the solar energy and battery that keeps the system operating with sufficient power for demanding applications.

The enclosure is rated for harsh environments with a hinged cover and security tab. Two three-cable cord grips are included with the kit along with a vent for heat exhaustion and a cord grip for the solar cable. The enclosure comes prefabricated with the appropriate cutouts for the cable glands, a DIN rail with end clamps, an aluminum mounting plate with pole clamps, and antennas for wireless communication.

A lithium-iron phosphate battery provides the principal source of power for a self-sustained monitoring system. This battery is purposefully suited for solar-supplemented systems, as the kit is delivered with a robust autonomous power circuit for those applications typically isolated from traditional infrastructure.

A five-watt solar panel delivers a nominal 12 V DC standard output built with a heavy-duty anodized frame and rugged design for withstanding high winds, hail, and snow loads.

The included mounting hardware can be used to anchor the panel to a wall or a pole for easy installation and a three-meter cable connects to the charging circuit of the DXM Controller.

The DEK Series is a Direct-to-Cloud solution using an embedded cellular module to access a wide area network from remote locations that are generally beyond an enterprise connection.

A cellular subscription plan can be readily activated and managed through the Banner Cell Data management portal. Access to a prepaid 90-day trial of the Banner Cloud Data Services web-based software is provided with an authorization code delivered with each kit. This software allows users to access, store, protect, and export critical data collected by the controller.

*Solar panel*



Users can make better, data-driven decisions as they track and analyze performance trends over time using visualization tools, trending graphs, and alert notifications.

*Banner CDS screens*





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# Chapter 2 Controller Enclosure

The DEK100 Series kit includes an enclosure assembly with the following parts already installed.

- DXM Controller with USB programming cable
- Lithium-Iron Phosphate ($LiFePO_4$) battery with flying leads
- LTE tape antenna threaded to the second SMA connector for the cellular module (on all models)
- Multi-band tape antenna threaded to the ANT SMA connector for the ISM radio (only on A2 model)
- DIN rail with four end clamps to securely position the DXM Controller and battery

To complete the assembly:

1. Install a set of cord grips to secure the solar cable and other wired inputs or outputs.
2. Wire the inputs to the Controller.
3. Install the vent to exhaust excessive heat.
4. Wire the battery to the appropriate terminals to supply power to the Controller.

## Install the Cord Grips

*Cord grip placement*




1. Open the accessory bag of cord grips and install them in the pre-drilled holes in the bottom of the enclosure. Tighten the cord grips carefully to avoid stripping the nut across the threads.
2. Place the vent below the battery to ensure proper ventilation (1).
3. Insert the three-cable cord grips into locations (3) and (4).
4. Install the smallest cable gland (PG7) for the solar cable at location (2).

## Wire the Battery

The battery and DXM ship from the factory pre-mounted to the DIN rail.

1. Remove the DXM from the DIN rail to provide better access to the wiring terminals. To remove the DXM:
    a. Insert a small flat-blade screwdriver in the tab shown and pry the spring-loaded DIN rail catch outwards. The catch releases the bottom part of the DXM.
    b. Rock the bottom of the DXM up, then slide the DXM up and off the top part of the DIN rail.
    c. Verify the antenna connection(s) remain fastened to the DXM. Note that the antenna connected to the ANT terminal will only be available in the DEK100-A2 model.
2. On the battery's black (0 V DC) wire, cut approximately one inch off (just behind the tape cap on the end) and then strip the wire sheathing back 0.25 inches.


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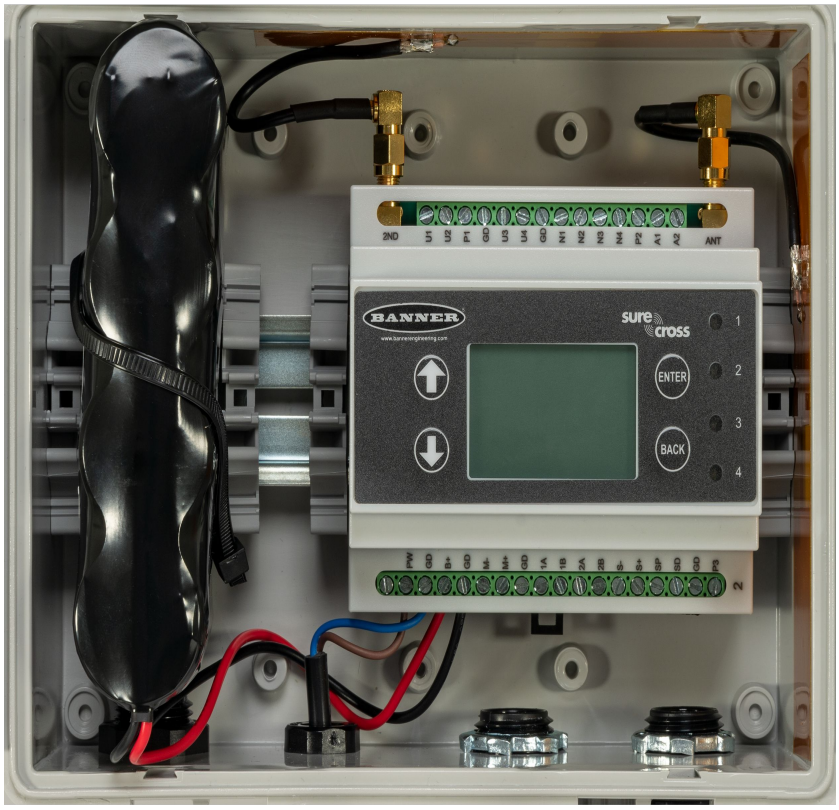
3. Connect the black lead to the GD terminal on the bottom of the DXM.
4. Verify the antenna(s) are still fastened to the DXM. Supplying power without a connected antenna may damage the wireless module.
5. Repeat the strip-back procedure with the red lead and connect it to the **B+** terminal.

   The controller will power up at this time.

Note that some models may not include a battery and/or solar panel. Please consult the Solar Components section of this manual for recommendations on selecting the appropriate battery and solar panel for this system.

*DEK100 internal layout*




# Install and Wire the Solar Panel

1. Install the solar panel's bracket.

*Solar panel bracket installation*



   a. Open the packaging for the five-watt solar panel and assemble the aluminum mounting cleat with the arc facing out. (Convex orientation)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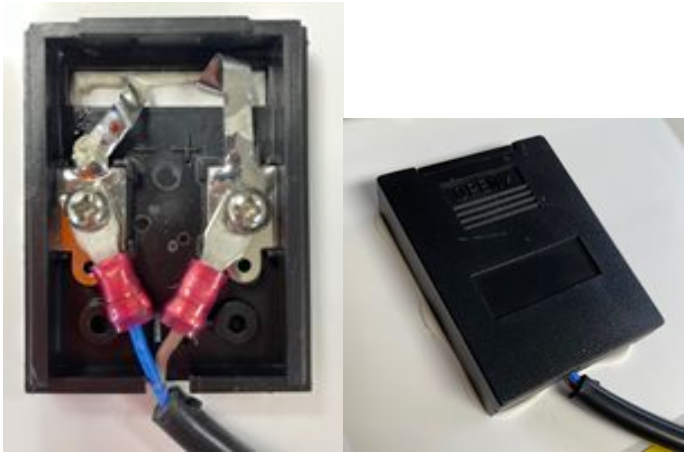
b. Leave the hardware a little loose so that the bracket can slide onto the panel frame between the mating surfaces.
c. Move the cleat to the center of the panel and tighten the hardware to secure it. See the included manufacturer documentation for further instruction.

2. Connect the solar cable to the panel.

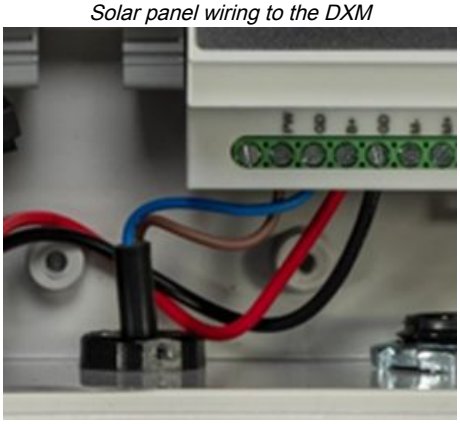
*Solar panel wiring*



a. Place the solar panel **face down** to prevent unplanned power applied to the kit.
b. Remove the black sliding cover to expose the terminals.
c. Wire the two-wire cable lead to the back of the panel. First, wire the blue lead to the negative terminal as marked on the plastic wiring chamber, then connect the brown lead to the positive terminal.
d. Tighten both screws and press down on the terminals to ensure they lay flat against the wiring chamber base.
e. Replace the cover by sliding it from the bottom back up to the top until it clicks closed.

3. Wire the solar panel to the DXM.

*Solar panel wiring to the DXM*



a. Feed the cable from the solar panel to the DXM through the small cable gland.
b. Connect the brown lead to the **PW** terminal on the bottom of the controller.
c. Connect the blue wire to the **GD** terminal next to the **PW** terminal.
d. Set the slack on the solar panel wire to prevent excess tension on the wire. Slide it in or out to leave some strain relief for the wire.
e. Tighten the cable gland by twisting the nut in a clockwise rotation.
f. Pull gently on the cable to verify it is engaged by the clamp. Adjust if necessary.

The DXM is now ready for its inputs to be configured.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# Chapter 3 DXM100-Ax Controller Overview

The DXM controller is optimized for solar/battery power. A full-featured application configuration on the controller will operate over 20 days of autonomy with a 5.5 AHr LiFePO4 battery.

Use the DXM Configuration Software, DXM Instruction Manuals, technical notes, and videos at www.bannerengineering.com to configure/program the DXM for your application. Banner's DXM Logic Controller integrates cellular connectivity and local I/O to provide a platform for the Industrial Internet of Things (IIoT).

**Inputs and Outputs**

On-board universal and programmable I/O ports connect to local sensors, indicators, and control equipment

Universal inputs, discrete outputs, courtesy power and switched power outputs, DC latching outputs, and analog outputs

SDI-12 interface, battery backup, solar controller

**Connectivity**--The DXM100's wired and wireless connectivity options make it easy to share data between local and remote equipment. The cellular modem option eliminates the need for IT infrastructures to connect remote equipment for sensing and control. The integrated Sure Cross® wireless radio enables Modbus connectivity to remote sensors, indicators, and control equipment.

**Wired Connectivity**

Field Bus Modbus and RS-485 Client/Server

**Wireless Connectivity**

Sure Cross® Wireless Radio: DX80 900 MHz; DX80 2.4 GHz;

Cellular modem: LTE-M (United States) or LTE-M/NB-IoT (outside the United States)

**Logic Controller**—Program the DXM's logic controller using action rules and/or ScriptBasic language, which can execute concurrently. The control functions allow freedom when creating custom sensing and control sequences. The logic controller supports the Modbus protocol standards for data management, ensuring seamless integration with existing automation systems. File and LCD password protection is an option.

**Register Mapping**

Cyclical read rules from wireless devices or local wired Modbus devices that include optional scaling, error conditions, and the ability to activate a read rule.

Cyclical or change of state write rules to wireless devices or local wired Modbus devices with scaling.

**Action Rules**

Thresholds (IF/THEN/ELSE) with timers, minimum on/off time, and logging options

Math/Logic Rules (arithmetic and bitwise operators)

Control Logic (logical operators and SR/T/D/JK flip flops)

Trending (multiple averaging filters) Tracking (counts, on/off times) Push data on conditions

**Optional Text Programming Language**

ScriptBasic to create variables, arrays, functions, loops, IF/THEN/ELSE, logical and arithmetic operators, API commands, register access, string functions and operators, time commands

**Scheduler**

Time/calendar-based events

Holiday skips and one-time events

Dynamic scheduler updating Astronomical clock

**Data Logging**

Cyclic Data/Event logging

**Data Sampling**

Adjust cloud push intervals and sampling intervals between pushes

**User Programmable LCD**—A simple user interface consists of an LCD screen and four LED indicators. Use the LCD to access the system's status and configuration, view user-selectable events and data, and configure inputs and outputs.

**User programmable LCD**

Binding Sure Cross radios

Conducting a Site Survey

Viewing sensor information

Viewing the system's status

**User-Defined LED Indicators**

Four multicolored LEDs: green, amber, red Programmable behavior


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# DXM100-Ax Features



The **DXM100-A1** and **DXM100-A2** Controllers are programmable logic controllers with multiple I/O connectivity options or a local ISM radio network and are optimized to be powered by a solar/battery system. Collected data is sent to the cloud through the cellular modem.

- Optimized for use in a solar-powered system with a battery backup
- Cellular modem Internet connectivity
- 900 MHz or 2.4 GHz ISM radio module (A2 model only)
- Logic controller with action rules and ScriptBasic programming
- Interactive programmable user interface with LCD and LED indicators
- Universal, on-board I/O with analog and discrete I/O
- Industry-standard RS-485 and USB communication ports
- Data logging with a removable SD card
- Secure email and text messaging for alarms when you use the Banner Cloud Data Services software platform

# DXM100-Ax Models

| Models | Cellular Carrier | ISM Radio | Inputs and Outputs |
|---|---|---|---|
| **DXM100-A1-V** | Verizon | None | Four universal inputs: Sinking/sourcing discrete, 4–20mA analog, 0–10 V analog, counter, and/or temperature with a 10 kOhm thermistor<br>Four NMOS outputs, two 0–10 V analog outputs, and two DC Latching outputs<br><br>Two adjustable 5 V to 24 V switched power outputs, one SDI switched power outputs, and one 5 V courtesy power output |
| **DXM100-A1-W** | Multi-Carrier* | | |
| **DXM100-A1-A** | AT&T | | |
| **DXM100-A2R1-V** | Verizon | 900 MHz Performance Gateway | |
| **DXM100-A2R1-A** | AT&T | | |
| **DXM100-A2R3-W** | Multi-Carrier* | 2.4 GHz Performance Gateway | |

A cellular modem is installed in the **DXM100-A1** or **DXM100-A2** Controller.

* Not all regions or carriers are available. Please contact Banner Engineering or visit the Cellular Connectivity Products and Services page for more detail.


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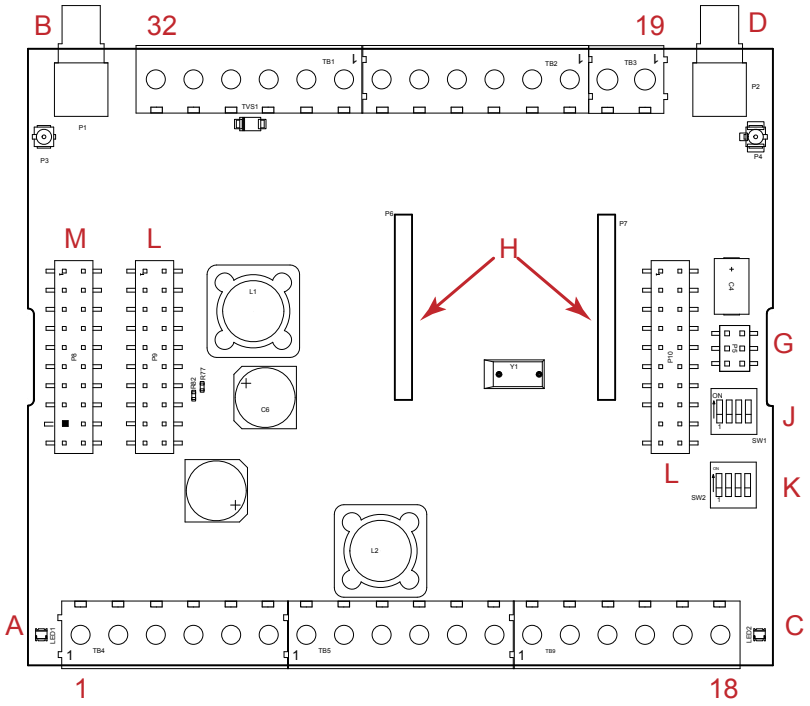
# IO Base Board for the DXM100-Ax

*I/O base board for the DXM100-A1 and -A2 models*




| Pin | Name | Description |
|---|---|---|
| 1 | No Connection | Not used |
| 2 | **PW**. 12-30 V DC or solar power in (+) | Main power in for DXM Controller, can be 12-30 V DC or solar power (20 W panel max) |
| 3 | **GD**. Ground | DXM ground |
| 4 | **B+**. Battery in (< 15 V DC) | 12 V battery connection, positive |
| 5 | **GD**. Ground | DXM ground |
| 6 | **M-**. Primary RS-485 - | Modbus client port (+) controlled by the DXM Controller. DXM can read/write Modbus server devices connected to this port. |
| 7 | **M+**. Primary RS-485 + | Modbus client port (-) |
| 8 | **GD**. Ground | DXM ground |
| 9 | **1A**. DLatch 1A | Input A (+) connection for first external DC latching solenoid. Use I/O board Modbus register 507 to control. |
| 10 | **1B**. DLatch 1B | Input B (-) connection for first external DC latching solenoid |
| 11 | **2A**. DLatch 2A | Input A (+) connection for second external DC latching solenoid. Use I/O board Modbus register 508 to control. |
| 12 | **2B**. DLatch 2B | Input B (-) connection for second external DC latching solenoid |
| 13 | **S-**. Secondary RS-485 - | Modbus server RS-485 (+) connection for host system as a Modbus client communicating to the DXM controller as a Modbus server device. |
| 14 | **S+**. Secondary RS-485 + | Modbus server RS-485 (-) connection. |
| 15 | **SP**. SDI-12 Courtesy Power | Power connection for external SDI-12 sensors |
| 16 | **SD**. SDI-12 Data | Communications line for external SDI-12 sensors |
| 17 | **GD**. Ground | Ground connection for SDI-12 sensor (DXM common ground) |
| 18 | **P3**. Courtesy Power 5 V | Courtesy Power output 5 V, limited to 500 mA |

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| Pin | Name | Description |
|---|---|---|
| 19 | **A2**. Analog OUT 2 (0–10 V) | Analog output 2, (0-10 V) controlled by I/O board Modbus register 508. (values range from 0-10000) |
| 20 | **A1**. Analog OUT 1 (0–10 V) | Analog output 1, (0-10 V) controlled by I/O board Modbus register 507. (values range from 0-10000) |
| 21 | **P2**. Adjustable Courtesy Power | Adjustable Power Output 2: 5 V DC to 24 V DC. Use the DXM Configuration Software to set the voltage output and the associated power output to input pins. |
| 22 | **N4**. NMOS OUT 4 | NMOS switch to ground controlled by I/O Modbus registers 504; 1 A maximum at 30 V DC. |
| 23 | **N3**. NMOS OUT 3 | NMOS switch to ground controlled by I/O Modbus registers 503; 1 A maximum at 30 V DC. |
| 24 | **N2**. NMOS OUT 2 | NMOS switch to ground controlled by I/O Modbus registers 502; 1 A maximum at 30 V DC. |
| 25 | **N1**. NMOS OUT 1 | NMOS switch to ground controlled by I/O Modbus registers 501; 1 A maximum @ 30 V DC. |
| 26 | **GD**. Ground | DXM ground |
| 27 | **U4**. Universal Input 4 | Universal input #4, NPN, PNP, 0–20 mA, 0–10 V, 10k Thermistor. Use DXM Configuration Software or Modbus registers to set input type. I/O Modbus register 4 |
| 28 | **U3**. Universal Input 3 | Universal input #3, NPN, PNP, 0–20 mA, 0–10 V, 10k Thermistor. Use DXM Configuration Software or Modbus registers to set input type. I/O Modbus register 3 |
| 29 | **GD**. Ground | DXM ground |
| 30 | **P1**. Adjustable Courtesy Power | Adjustable Power Output 1: 5 V DC to 24 V DC. Use the DXM Configuration Software to set the voltage output and the associated power output to input pins. |
| 31 | **U2**. Universal Input 2 | Universal input #2, NPN, PNP, 0–20 mA, 0–10 V, 10k Thermistor. Use the DXM Configuration Software or Modbus registers to set the input type. I/O Modbus register 2 |
| 32 | **U1**. Universal Input 1 | Universal input #1, NPN, PNP, 0–20 mA, 0–10 V, 10k Thermistor. Use the DXM Configuration Software or Modbus registers to set the input type. I/O Modbus register 1 |

| | | | | | |
|---|---|---|---|---|---|
| A | Base board LED | | | J | Modbus server ID DIP Switches |
| B | A1. Cellular or secondary antenna | | | K | Modbus server ID DIP Switches |
| C | Radio LED | G | Programming header | L | Processor Board Connection |
| D | A2. ISM Antenna | H | ISM Radio Board Connection (A2 model only) | M | Display Connection |


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# Chapter 4 Configuration Instructions

## DXM100-Ax Configuration

Use the DXM Configuration Software to customize the configuration of the controller. Select the DXM100-A model when using the configuration software.

To configure the DXM-100Ax, connect the DXM's USB to a computer. When the USB cable is plugged into the DXM Controller, the device is powered by the USB power. When the USB cable is unplugged, the device resets itself and is powered by the connected battery.

The software allows the user to define parameters for the DXM, then saves the configuration in an XML file on the PC. After the configuration file is saved, upload the XML configuration file to the DXM for operation. There are several example configuration files available in our Configuration Library at http://bannerengineering.com/dekconfig. This quick start guide outlines the basic operations to set up a DXM using the configuration software. For a more comprehensive explanation of features, refer to the software Instruction Manual (p/n 209933).

For a complete list of all associated product documentation, refer to your model's instruction manual.

The DXM100-A kit has operating limitations based on the storage capacity of the 12 V lithium iron phosphate battery (5.5 Ah), the 5 W solar panel (0.29 A maximum) and the days of autonomy desired. The main power consumption contributors are:

- Cellular push interval, which should be set to 10 minutes or longer (use the Sample Count parameter for greater granularity)
- RS485 communications of external Modbus devices using switched power
- Poor cellular signal strength and/or radio signal strength, creating multiple retry attempts.

Efficient operations include:

- DC Latch operations
- SDI-12 operations
- I/O operations
- ISM radio network operations

Some example configurations that operate on less than 5 mA (on average), and operate using the 12 V battery (5.5 Ah) without sun for over 20 days include:

- SDI-12 reading in 15-minute intervals
- Two DC latching outputs toggling every 5 minutes
- One temperature/humidity probe powered from 16 V switched power reading every 5 minutes
- ScriptBasic program controlling temperature/humidity power and reading, DC latching control
- Read rules operating every 5 to 15 minutes for solar charging parameters and SDI-12 data
- Cellular push every 15 minutes, sampling every 5 minutes, for 16 Local Registers
- ISM radio devices operating at 0.25 W transmit power mode (default radio transmit power is 1 W)

Verify the battery consumption. When creating custom configurations, measure the current draw on the battery. Load the DXM100-A device configuration and measure the average current draw over two or three cellular pushes. A meter in series with the battery may cause the device to brown out if the battery is not fully charged.

## Introduction to Traditional Setup Mode

This section will walk you through the traditional method of setting up the DXM Configuration Software and communicating with a connected DXM device. Version 4 of the configuration software supports multiple DXM device models, each of which incorporates different features.

As soon as a DXM model is connected to your computer, the software automatically detects the correct model and loads the appropriate screens. You may also manually select which model of DXM you are configuring if you intend to create a


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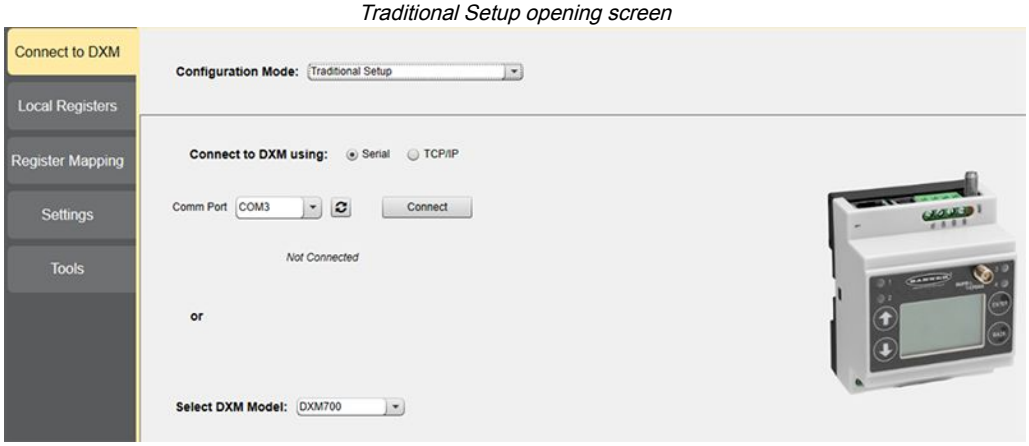
configuration file without connecting a device. This ensures that the interface and the configuration file use the correct features.

Not all screens are available for all models. To change to another model of DXM, go to the **Connect to DXM** screen and use the drop-down list to select another model. If the active configuration is incompatible with the selected model, you will be prompted to either proceed and wipe out the active configuration or cancel the model change and preserve the configuration.

*Traditional Setup opening screen*




Banner recommends disconnecting the COMM port through the **Device** menu before turning off power or disconnecting the USB cable. Use **Device › Reboot** to restart the DXM if needed; the tool automatically disconnects the COMM port, then reconnect it again.

> **TIP:** If connection attempts are failing (Application Status Icon in the footer of the tool is Red), close the configuration software and disconnect the USB cable from the computer. Reconnect the cable, launch the software, and attempt connecting again.

> **IMPORTANT:** Any model of DXM may connect to the configuration software regardless of which device model is selected in the tool. Compatibility is checked before configuration files are uploaded to the device.

## Configuration Example: Reading Registers on a Modbus Server Device

The local registers are the main global pool of registers that are defined by the user to store data within the DXM. The local registers are listed on the **Local Registers › Local Registers in Use** screen.

The bottom status bar displays the communications status, application status, and the DXM Configuration Software version.

In this short example, we will configure the DXM to read six registers on an external Modbus server device and save the data into the local registers.

The software only loads a file to the DXM. Internal parameter settings that are changed in the tool but not saved to the file will not be sent to the device.

### Modify Multiple Registers

Modify a range of registers from the **Local Registers › Local Registers in Use › Modify Multiple Registers** screen.

Select which parameter fields to modify. Most parameters have three selections.

- Unchanged—no changes
- Default—change to default settings
- Set—modify the parameter. Other selections will appear based on the parameter.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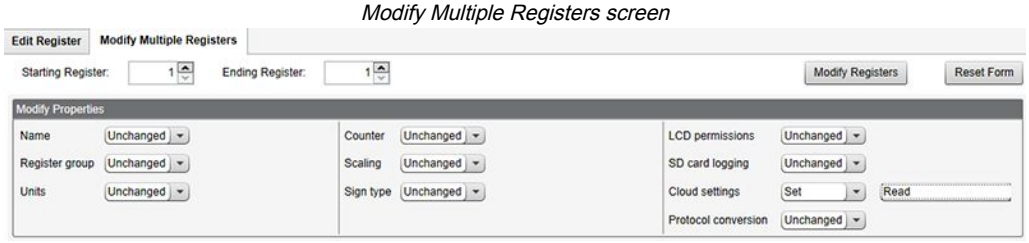
*Modify Multiple Registers screen*



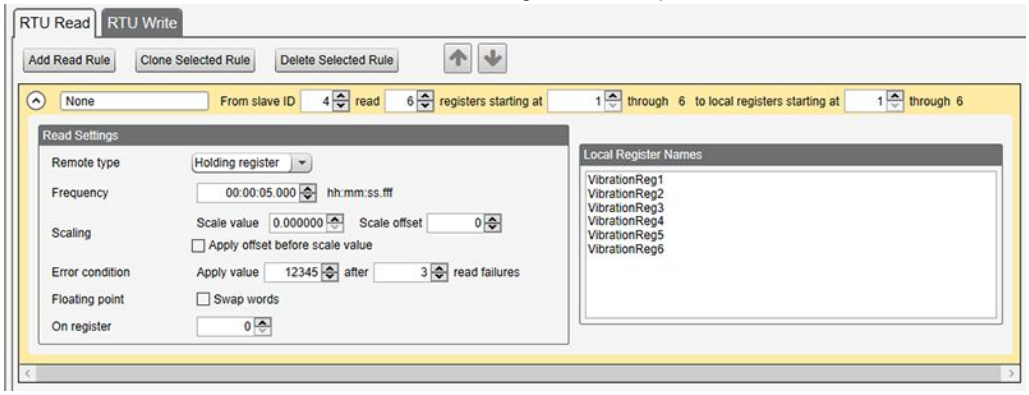

1. Enter the **Starting register** and **Ending register**.
2. Select the value to change using the drop-down list next to each value.
3. Enter the new value in the field provided.
4. To push register values to the web server, set **Cloud Settings** to **Read**.
   If the **Cloud Settings** are set to **Read**, the web server only views data from the device and cannot write data to the device. If the permissions are set to Write, the web server only writes to the device and cannot read the data. If the permissions are set to Read/Write, the web server can read the data from the device and write to the device from the web.
5. Click **Modify Registers** to save and apply the changes.

## Create an RTU Read Rule

Follow these steps to create a new read rule.

This example screen shows a read rule created to read six registers (address 1 through 6), from Modbus ID 4. The results are stored in the Local Registers 1 through 6.

*Read Rules - Configuration Example*




1. From the **Register Mapping › RTU › RTU Read** screen, click **Add Read Rule**.
2. Click the arrow next to the name to display the parameters.
3. Name your rule.
4. Select the device ID.
5. Select how many registers to read, and the beginning register.
6. Define the register type, how often to read the register, and any other appropriate parameters.
7. If necessary, select the error condition. For this example, if the read function fails after three attempts, the read rule writes 12345 to the DXM local registers. Notice the list of local register names this read rule is using.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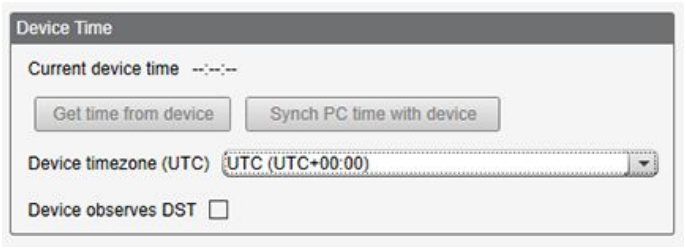
### Set the Time

Use the **Settings › System** screen to define the time zone and daylight saving option. The time zone and DST options are saved into the configuration file.

*Settings > System > Device Time*




1. Go to the **Settings › System** screen.
2. If you connect the DXM to a computer, click **Sync PC Time with Device** to set the time on the DXM to match the time of the computer.
3. Set your time zone and select whether or not your device observes daylight saving time (DST).

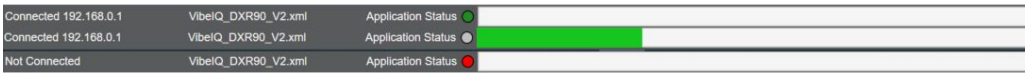
## Save and Upload the Configuration File

After making any changes to the configuration, you must save the configuration files to your computer, then upload it to the device.

Changes to the XML file are not automatically saved. Save your configuration file before exiting the tool and before sending the XML file to the device to avoid losing data. If you select **DXM › Send XML Configuration to DXM** before saving the configuration file, the software will prompt you to choose between saving the file or continuing without saving the file.

1. Save the XML configuration file to your hard drive by going to the **File › Save As** menu.
2. Go to the **DXM › Send XML Configuration to DXM** menu.

*Status indicator bar*




   - If the Application Status indicator is red, close and restart the DXM Configuration Tool, unplug and re-plug in the cable and reconnect the DXM to the software.
   - If the Application Status indicator is green, the file upload is complete.
   - If the Application Status indicator is gray and the green status bar is in motion, the file transfer is in progress.

   After the file transfer is complete, the device reboots and begins running the new configuration.

# DXM100-A2 Models Only

## Binding and Conducting a Site Survey with the ISM Radio

Before the ISM radio can communicate, the ISM radio within the DXM must be bound to the other radios in the wireless network.

Use the DXM LCD menu to bind external radios to the internal ISM radio.

If you are having difficulty running binding or site surveys, it may be because of the speed of the XML configuration file or script running on the DXM. To resolve this issue, try one of the following options:

- Disable the XML and script by setting DIP switch 4 on the processor board to ON and cycling the power to the DXM. After binding the devices, turn DIP switch 4 back OFF and cycle power again to return to normal operation of the XML and script.
- Adjust the XML or script to slow down the RTU read or write rules.
- Upload a blank XML, bind all devices, then upload the configured XML file.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## Bind a DX80 Node to a DXM and Assign the Node Address

Binding Nodes to a Gateway ensures the Nodes only exchange data with the Gateway they are bound to. After a Gateway enters binding mode, the Gateway automatically generates and transmits a unique extended addressing (XADR), or binding, code to all Nodes within range that are also in binding mode. The extended addressing (binding) code defines the network, and all radios within a network must use the same code.

1. Apply power to all the devices.

   Separate radios by two meters when running the binding procedure. Put only one DXM Gateway into binding mode at a time to prevent binding to the wrong Gateway.
2. Enter binding mode on the DXM radio:
   a. Use the arrow keys to select the **ISM Radio** menu on the LCD and press **ENTER**.
   b. Highlight the **Binding** menu and press **ENTER**.
3. Assign the Node address to the Node.
   - For Nodes without rotary dials: Use the DXM arrow keys to select the Node address to assign to the DX80 Node about to enter binding mode. The DXM assigns this Node address to the next Node that enters binding mode. Only bind one Node at a time.
   - For Nodes with rotary dials: Use the Node's rotary dials to assign a valid decimal Node Address (between 01 and 47). The left rotary dial represents the tens digit (0 through 4) and the right dial represents the ones digit (0 through 9) of the Node Address. You can leave the DXM "Bind to" address set to 1 because the Node's rotary dials will override that setting.
4. Start binding mode on the DXM radio by pressing **ENTER** on the DXM radio.
5. Enter binding mode on the DX80 Node.
   - For housed radios, triple-click button 2.
   - For board-level radios, triple-click the button.
   - For Nodes without buttons, refer to the Node's datasheet for instructions on entering binding mode.

   The left and right LEDs flash alternately and the Node searches for a Gateway in binding mode. After the Node binds, the LEDs stay solid momentarily, then they flash together four times. The Node automatically exits binding mode and reboots.
6. Label the Node with the assigned address number for future reference.
7. Press **BACK** on the DXM to exit binding mode for that specific Node address.

   The Node LEDs continue to flash red until the DXM exits binding mode with that Node address.
8. Repeat these steps for as many DX80 Nodes as are needed for your network.
9. When you are finished binding, press **BACK** on the DXM until you return to the main menu.

## Conduct a Site Survey from the DXM

Conduct a Site Survey to verify the wireless communication between the radios within your wireless network.

Conduct the site survey when the Nodes and DXM Controller are at the proposed installation sites to determine each radio's signal strength with the DXM.

For a DX80 network, the Gateway controls the site survey and the results display on the LCD. Running a site survey on a DX80 network does not affect the throughput of the DX80 network. The DX80 Gateway-Node system can run a site survey analysis while the network is operational. For a MulitHop network, the client device passes the site survey request to the intended Modbus server device. The Site Survey runs and the results display on the LCD. Running a site survey on a MultiHop network stops all network traffic to that device.

1. On the DXM: Use the arrow buttons to select the **ISM Radio** menu and press **ENTER**.
2. Select the **Site Survey** menu and press **ENTER**.
3. Use the Up or Down arrows to select the device ID number and press **ENTER** to run the site survey with that radio.

   The site survey results display as green, yellow, red, and missed packets. Green indicates the highest signal strength, then yellow, and red. Missed packets were not received.
4. When you are finished running the Site Survey, press **Back** twice to return to the main menu and exit site survey mode.


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If the Site Survey fails (100 missed packets), verify the radios are at least 10 feet from the DXM and/or rerun the binding procedure. If you find poor signal quality, common solutions include moving the DXM to a more central location relative to the Nodes or using higher-gain antennas on the DXM. Contact your local Banner Engineering representative for assistance.


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# Chapter 5 Activating Services

## Banner Cellular Data Services

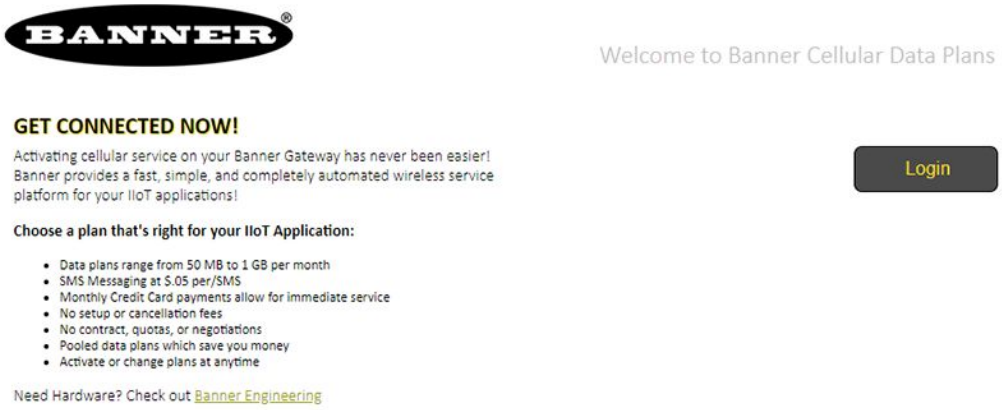
### Activate Cell Services

Follow these instructions to activate the cellular data plan for your DEK Series Kit.

The DEK Series kit uses a cellular network specifically designed for IoT devices that use low power, have minimal data consumption, and are low cost. Banner has created several tiers of service plans for IoT deployment. Select the appropriate plan size for the kit to avoid any data overage fees applied to your account.

1. Visit the cellular data calculator at our support site to determine a suitable plan for your needs.
2. Using a web browser, navigate to celldata.bannercds.com.

*Banner cellular data opening screen*




3. Select the region the system is operating in.
   - If the system is within the contiguous United States, select **United States** from the region drop-down list.
   - If the system will be used in Alaska, Hawaii, Canada, or Mexico, select **North America**.
   - If the system will be deployed within the European region, select **Europe**.
4. From the drop-down list of cellular data plans, select the plan identified by the cellular data calculator.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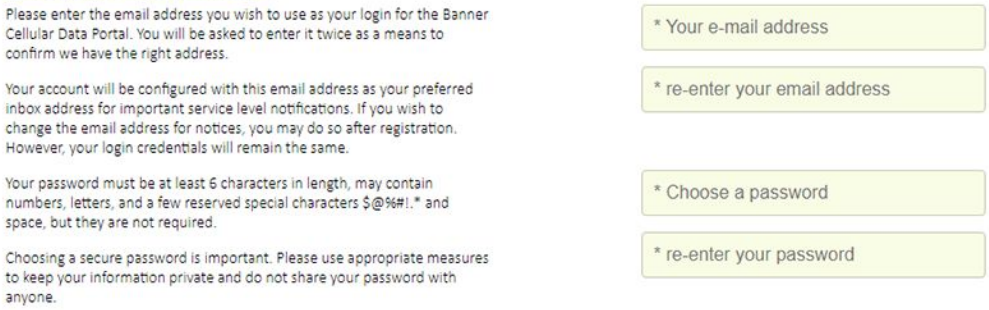
## Create an Account

*Banner cell data username and password screen*




1. Enter an email address (username) and password.
2. Enter the requested payment information for your account.
3. Enter your mailing address and contact information.
4. Review and accept the terms and conditions.

## Add a Device to the Cellular Network

1. Navigate to the **My Services and Equipment** section.
   The purchased type of service displays.
2. Click on the drop-down arrow next to the cellular carrier to expose the **ICCID** and **IMEI** entry fields.
3. Select the appropriate cellular carrier for your kit.
   - For a kit model number ending in **-V**, select **Verizon 4G**.
   - For a kit model number ending in **-A**, select **AT&T 4G**.
   - For a kit model number ending in **-W**, select **Europe Data**.
4. Enter the **ICCID** and **IMEI** numbers.
   The ICCID and IMEI numbers are on the DXM housing.
5. Refresh the page as prompted.
   The device appears under the carrier line of service with a **Status** of **Active**.

It can take up to five minutes for the cellular module to be recognized by the network. Please wait until **Status** has changed to **Active** before proceeding. You will also receive a confirmation email that your device has been activated.

The DXM is now connected to the cellular network.

# Banner Cloud Data Services (BannerCDS)

## Activate the Banner Cloud Data Services

Follow these instructions to activate your Banner CDS™ account.

1. Go to the bannercds.com website.
2. Register your account by going to the **Sign Up** menu.
3. Enter the requested information. The authorization code is on the Authorization Card included with your kit.
4. Read and accept the Services Access and Use Agreement.

## Create a New Gateway

After you log into the Banner Cloud Data Services website, the **Overview** screen displays. Follow these steps to create a new monitoring site.

1. Click on **New Gateway** (top right corner of the **Overview** screen).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Create a new Gateway for each DXM Controller that sends data to the web server.

A **New Gateway** prompt appears.

2. Verify **Traditional** is selected for the **Gateway Type**.
3. Enter a **Gateway Name**.
4. Select the **Company** from the drop-down list.
5. Copy the **Gateway ID** number located within the prompt window to your computer's clipboard.
   The **Gateway ID** number created by the web server is a required parameter in the configuration of the DXM. The **Gateway ID** is the address the webserver uses to store the data pushed from the DXM.
6. Click **Submit** to close the prompt window.

## Modifying the XML Configuration File

Use the DXM Configuration Software to configure the operation of the DXM.

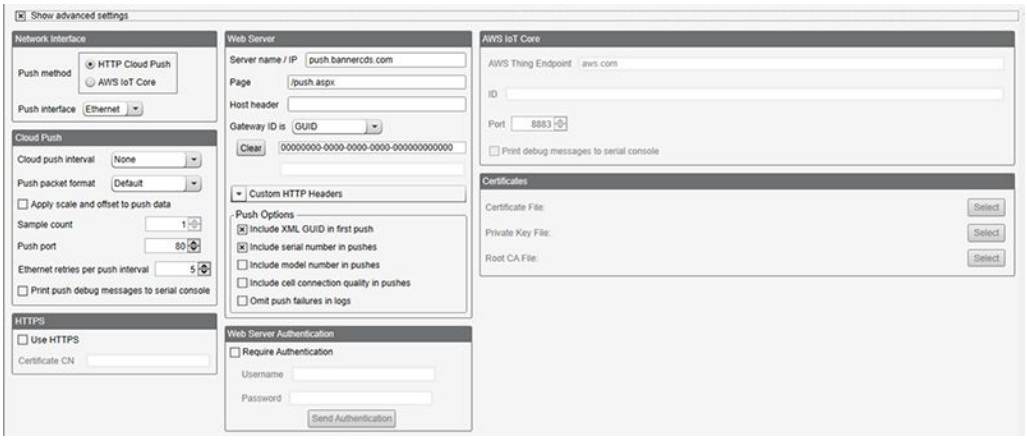
Launch the software. You can use one of these three screens to modify registers:

- **Local Registers**—Edits individual registers
- **Modify Multiple Registers**—Edits multiple registers at the same time
- **Local Registers in Use**—Edits individual registers

Refer to the DXM Configuration Software Instruction Manual (p/n 209933) for more details.

## Configure the Cloud Data Services Settings

1. To configure the connection to the web server, go to the **Settings › Cloud Services** screen.




2. Copy and paste the **Gateway ID**.
   The **Gateway ID** is that long string of numbers and letters from the Banner Cloud Data Services website.
3. Verify the **Server Name/IP** is set to `push.bannercds.com` and the **Page** is set to `/push.aspx` for sending to the website.
4. Set the **Cloud Push Interval** to a value appropriate for your application.
   The **Cloud Push Interval** determines how often the device pushes the data to the web. The faster the push interval, the more data is sent to the site. Cellular plans can only push at an interval of 10 minutes or longer. The **Sample Count** specifies how many times the data is gathered within the **Cloud Push Interval**.
   For example, if the **Cloud Push Interval** is 15 minutes and the **Sample Count** is set to 3, then during each data push (every 15 minutes), 3 samples are sent to the web. This is one sample every 5 minutes.
5. Set the **Push Method** to **HTTP Cloud Push** and the **Push Interface** to **Cell**.
6. On the **Cellular** screen, select the appropriate **Cell Module**.
   - Select **SXI-CATM1VZW-001** for kit model numbers ending in **-V**
   - Select **SXI-CATM1ATT-001** for kit model numbers ending in **-A**
   - Select **SXI-CATM1WW-001** for kit model numbers ending in **-W**

   The **APN** will automatically change accordingly.
7. Save the configuration file by going to **File › Save**.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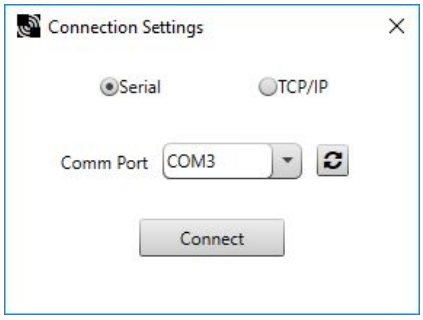
File names must be no more than 30 characters long, and should not contain any spaces or special characters.

8. With a USB cable connected to the device, go to the **Device › Connection Settings** menu.
9. Select the appropriate **Comm Port** and click **Connect**.




If multiple comm ports are visible, try each one until the software is able to connect to the device.

10. Go to **Device › Send Configuration to the Device** to upload the new XML file.

## Upload the XML Configuration File to the Website

To upload an XML configuration file to the website, follow these instructions.

1. On the BannerCDS website, select **Gateways** on the **Overview** screen.
2. On the row displaying your **Gateway**, click the **Details** under **View**.
3. Select **Edit Gateway**.

   The **Edit Gateway** prompt appears.
4. Click **Select File** under **Update XML**.
5. Select the file that was just updated to the DXM and click **Open**.

   After the XML file is loaded into the webserver, the webserver uses the register names and configurations defined in the configuration file. The same XML configuration file is now loaded on both the DXM and the Website. After some time, the data should be seen on the website.
6. To view the data from the Gateway's screen, click on the **Details** link for each **Gateway**.

   The Gateway **Details** screen lists the **Sensor** objects and default **Alarms** for that gateway. You may view the individual register information by selecting **Registers**.

Completing these steps creates continuity between the **Gateway** created on the website with the DXM used in the field. The DXM pushes data to the website, which can be viewed at any time.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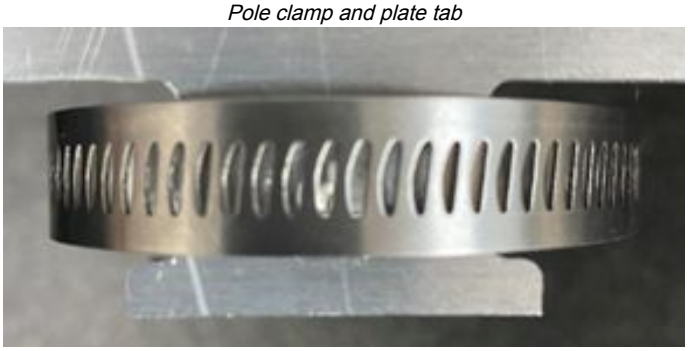
# Chapter 6 Installation Instructions

## Install the Enclosure's Mounting Plate

The DEK100 kit includes a custom mounting plate designed to be fastened to a pole with the included clamps or bolted to a wall or flat surface.

1. Close the enclosure's lid and fasten the latches.
2. Turn the enclosure over and place on a flat surface with the lid facing down.
3. Remove the mounting plate from the packaging along with the self-tapping screws and pole clamps.
4. Align the four holes of the mounting plate with the embossed holes of the enclosure.
5. Verify the plate is oriented such that the countersunk hole faces outward from the enclosure.
6. Use the included screws to fasten the plate to the enclosure. Do not over-torque.
7. Use the 2 13/16" to 3 3/4" pole clamps and the geometry of the plate tabs to fasten the enclosure to an appropriately sized pole.

*Pole clamp and plate tab*



## Mount the Solar Panel

Mount the solar panel at an angle appropriate to your geographic region and avoid any light obstructions to the panel for best performance.

The typical angle for solar panel orientation is no less than 20 degrees from parallel to avoid rain accumulation on the surface. There are many online resources to determine the best angle for each geographical region.

## Solar Components

The components of a solar system include the battery and the solar panel.

### Battery

The DXM solar controller is designed to use a 12 V sealed lead acid (SLA) battery. The characteristics of a solar system require the battery to be of a certain type. There are two types of lead acid batteries:

- SLI batteries (Starting Lights Ignition) are designed for quick bursts of energy, like starting engines
- Deep Cycle batteries - greater long-term energy delivery. This is the best choice for a solar battery.

Since a solar system charges and discharges daily, a deep-cycle battery is the best choice. There are different versions of a lead acid battery: wet cell (flooded), gel cell, and an absorbed glass mat (AGM).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Wet cell batteries are the original type of rechargeable battery and come in two styles, serviceable and maintenance-free. Wet cell batteries typically require special attention to ventilation as well as periodic maintenance but are the lowest cost. The gel cell and AGM battery are sealed batteries that cost more but store very well and do not tend to sulfate or degrade as easily as a wet cell. Gel or AGM batteries are the safest lead acid batteries you can use.

**Battery capacity** is a function of the ambient temperature and the rate of discharge. Depending upon the specific battery, a battery operating at –30 °C can have as much as 40 percent less capacity than a battery operating at 20 °C. Choose enough battery capacity based on your geographical location.

*Average voltage readings relative to battery charge*

| State of Battery Charge (%) | Open Circuit Voltage |
|---|---|
| 100 | 13.0 or higher |
| 75 | 12.6 |
| 50 | 12.1 |
| 25 | 11.66 |
| 0 | 11.4 or less |

A larger capacity battery typically lasts longer for a given solar application because lead-acid batteries do not like deep cycling (discharging a large percentage of its capacity). Depending upon the battery, a battery discharging only 30 percent of its capacity before recharging will have approximately 1100 charge/discharge cycles. The same battery discharging 50 percent of its capacity will have approximately 500 charge/discharge cycles. Discharging 100 percent leaves the battery with only 200 charge/discharge cycles.

Use this information as a guide to the approximate state of charge and in determining when to apply conservation measures. Batteries degrade over time based on discharge/charge cycles and environmental conditions. Always monitor the battery system to obtain the best performance of the solar-powered system.

### Solar Panel

Banner solar panels come in two common sizes for the DXM: 5-watt and 20-watt. Both panels are designed to work with the DXM but provide different charging characteristics. Use the 5-watt panel for light-duty operation and use the 20-watt panel when you require greater charging capabilities.

| Solar Panel | Voltage | Current | Typical DXM Configurations |
|---|---|---|---|
| 5 Watt | 17 V | 0.29 A | DXM Controller configured as a server, ISM radio, I/O base board |
| 20 Watt | 21 V | 1 A | DXM Controller with ISM radio and Cellular modem |

Photovoltaic panels are very sensitive to shading. Unlike solar thermal panels, PV solar panels cannot tolerate shading from a branch of a leafless tree or small amounts of snow in the corners of the panel. Because all cells are connected in a series string, the weakest cell will bring down the other cells' power level.

Good quality solar panels will not degrade much from year to year, typically less than 1 percent.

To capture the maximum amount of solar radiation throughout the year, mount a fixed solar panel to optimize the sun's energy. For the northern hemisphere, face the panel true south. For the southern hemisphere, face the panel true north. If you are using a compass to orientate the panels, compensate for the difference between true north and magnetic north. Magnetic declination varies across the globe.

A solar panel's average tilt from horizontal is at an angle equal to the latitude of the site location. For optimum performance, adjust the tilt by plus 15 degrees in the winter or minus 15 degrees in the summer. For a fixed panel with a consistent power requirement throughout the year, adjust the tilt angle to optimize for the winter months: latitude plus 15 degrees. Although in the summer months, this angle may not be the most efficient, there are more hours of solar energy available.

For sites with snow in the winter months, the increased angle helps to shed snow. A solar panel covered in snow produces little or no power.


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# Chapter 7 Product Support and Maintenance

## Final Support Information

Congratulations! You have successfully configured and installed your kit. Please visit www.bannerengineering.com for detailed information regarding the DXM Controller; wired analog, discrete, and Modbus sensors; wireless Sensor Nodes; and Banner Cloud Data Services.

Please visit our Configuration Library (http://bannerengineering.com/dekconfig) for configuration and script files to help deploy the DEK kit for your application.

Banner Engineering is available to assist with all your predictive maintenance and condition monitoring applications. Please contact our applications team to assist in continuing software services after the trial period has concluded. Contact Banner Engineering's support team at 1-888-373-6767 or fill out the **Contact an Engineer** form at www.bannerengineering.com.

## DXM100-Ax Documentation

For more information about the DXM100 family of products, please see additional documentation and videos on the Banner website: www.bannerengineering.com.

- DXM100-A1 and A2 Datasheet, p/n 212027
- DXM100-Bx Wireless Controller Instruction Manual, p/n 190037
- DXM ScriptBasic Instruction Manual, p/n 191745
- DXM Controller API Protocol, p/n 186221
- DXM Controller Configuration Quick Start, p/n 191247
- DXM Enclosure Kit Setup Guide (Solar Kits), p/n 223953
- DXM Configuration Software v4 (p/n b_4496867)
- DXM Configuration Software v4 Instruction Manual, p/n 209933
- Banner CDS Web Service Quick Start Guide, p/n 201126
- Banner CDS Web Service Instruction Manual, p/n 178337
- Additional technical notes and videos

Technical notes, configuration examples, and ScriptBasic program examples are available at www.bannerengineering.com.

## Warnings

**WARNING:**
- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

**IMPORTANT:** Please download the complete DXM Enclosure Kit (DEK) Series technical documentation, available in multiple languages, from www.bannerengineering.com for details on the proper use, applications, Warnings, and installation instructions of this device.

**IMPORTANT:** Por favor descargue desde www.bannerengineering.com toda la documentación técnica de los DXM Enclosure Kit (DEK) Series, disponibles en múltiples idiomas, para detalles del uso adecuado, aplicaciones, advertencias, y las instrucciones de instalación de estos dispositivos.


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**IMPORTANT:** Veuillez télécharger la documentation technique complète des DXM Enclosure Kit (DEK) Series sur notre site www.bannerengineering.com pour les détails sur leur utilisation correcte, les applications, les notes de sécurité et les instructions de montage.

**Install and properly ground a qualified surge suppressor when installing a remote antenna system.** Remote antenna configurations installed without surge suppressors invalidate the manufacturer's warranty. Keep the ground wire as short as possible and make all ground connections to a single-point ground system to ensure no ground loops are created. No surge suppressor can absorb all lightning strikes; do not touch the Sure Cross® device or any equipment connected to the Sure Cross® device during a thunderstorm.

**Exporting Sure Cross® Radios.** It is our intent to fully comply with all national and regional regulations regarding radio frequency emissions. **Customers who want to re-export this product to a country other than that to which it was sold must ensure the device is approved in the destination country.** The Sure Cross wireless products were certified for use in these countries using the antenna that ships with the product. When using other antennas, verify you are not exceeding the transmit power levels allowed by local governing agencies. This device has been designed to operate with the antennas listed on Banner Engineering's website and having a maximum gain of 9 dBm. Antennas not included in this list or having a gain greater than 9 dBm are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen such that the equivalent isotropically radiated power (EIRP) is not more than that permitted for successful communication. Consult with Banner Engineering Corp. if the destination country is not on this list.

**IMPORTANT:**

- **Never operate a radio without connecting an antenna**
- Operating radios without an antenna connected will damage the radio circuitry.
- To avoid damaging the radio circuitry, never apply power to a Sure Cross® Performance or Sure Cross® MultiHop radio without an antenna connected.

**IMPORTANT:**

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

# Banner Engineering Corp Limited Warranty

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

**THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.**

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp. Any misuse, abuse, or improper application or installation of this product or use of the product for personal protection applications when the product is identified as not intended for such purposes will void the product warranty. Any modifications to this product without prior express approval by Banner Engineering Corp will void the product warranties. All specifications published in this document are subject to change; Banner reserves the right to modify product specifications or update documentation at any time. Specifications and product information in English supersede that which is provided in any other language. For the most recent version of any documentation, refer to: www.bannerengineering.com.

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

# Document Information

Document title: DXM Enclosure Kit (DEK) Quick Start Guide
Part number: 223953
Revision: B
Original Instructions
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