Temperature and Humidity Monitoring Application Guide

Guide Features and Benefits

TEMPERATURE & HUMIDITY MONITORING	Monitor up to 16 wireless temperature and humidity nodes.
WARNINGS AND ALARMS	User configurable settings for up to 8 alerts per device with low and high levels for warnings and alarms on both temperature and humidity.
LOCAL INDICATION LIGHTS	Local alert indication available by enabling lights on the Q45s: yellow = warning, red = alarm
REMOTE MASTER LIGHT	Use one of the 16 Nodes to be a master light to indicate any warning or alarm is present
SMS TEXT/EMAIL ALERTS	Generate SMS text and/or email alerts based on specific events
TIME-STAMPED LOGGING	Cyclical time-stamped logging available to monitoring temperature, humidity and alerts over time.
CLOUD MONITORING	Push data to Cloud Webserver or PLC (via LAN or Cellular connection) for remote viewing, alerting, and logging.

Using the temperature and humidity sensor connected to a Wireless Q45 Node paired to a DXM100, we can develop a wireless monitoring system for multiple environmental measurements that is easy to set up, interpret the results, and monitor locally and through a cloud-based system. Information can be sent to the cloud using either the internal cellular module or by connecting to the local area network (LAN) with an Ethernet cable directly to the DXM. Warnings and alarms are generated based on user configurable levels and can be used to alert users of issues in the system via SMS text messaging, email, or a remote master light.

Equipment





Model	Description
DX80N9Q45U or DX80N9Q45TH (900 MHz) OR DX80N2Q45U or DX80N2Q45TH(2.4 GHz)	Sure Cross® Wireless Q45 Sensor Node - Universal 1-Wire Serial OR Sure Cross® Wireless Q45 Sensor Node – Temperature and Humidity Node
M12FTH4Q	Temperature and Humidity Sensor – 1-Wire Serial Interface
DEE2R-51D (available in various lengths)	1-Wire Serial Interface adaptor cable – ONLY REQUIRED WITH Q45U node
DXM100-B1C1R1 (900 MHz) or DXM100-B1C1R3 (2.4 GHz)	DXM100 Wireless Controller with Cell; C1 only necessary if Cell Module is desired

A PDF version of this Application Guide is available at https://goo.gl/YJ8VER

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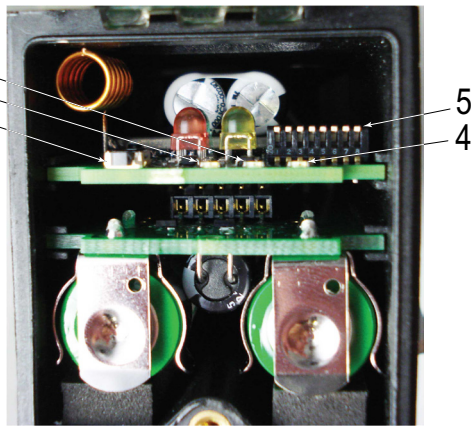
The following guide demonstrates how to bind the wireless Q45 nodes to the DXM and load a preconfigured XML file and script for 16 Nodes. The XML file only requires some minor modifications to be customized for any site.

Step 1: Bind the System and Assign Addresses

Binding the Q45 Nodes to the DXM100 establishes a secure connection between them and assigns a specific network address to each radio in the wireless network.

1. For each M12FTH4Q and Q45 pair, connect the M12FTH4Q to the Q45's integral 5-pin connector either directly for the Q45TH or with the adaptor cable if using the Q45U.
2. Apply power to the DXM.
3. On the DXM: Use the arrow buttons to select the **ISM Radio** menu. Push **Enter**.
4. Select the **Binding** submenu. Push **Enter**.
5. On the Q45U: Starting with the Q45U for sensor #1, triple-click the button to begin the binding procedure.

   The green and red LEDs flash four times after the Node is bound. This Node is now bound to the Gateway in the DXM as Node ID 1. The amber light may turn on after binding, indicating the Q45 has entered into a faster sampling mode, and stops on its own after 15 minutes.
6. Label the device for future reference using the included label.
7. On the DXM: If you are done binding the devices, press **Back** to return to the main menu. If not, continue to the next step.
8. If you are binding another Q45U to the Gateway, change the DXM menu to **Bind to > 2** and press **Enter**.
9. Triple-click the Q45U button to begin binding. The Node binds to the Gateway in the DXM as Node ID 2.
10. Continue repeat steps 7 and 8 for as many Q45s that you have.
11. When you are finished binding, press **Back** on the DXM until the DXM returns to the main menu.



1 - Button
2 - Red LED
3 - Green LED
4 - Not Used
5 - DIP Switches

Step 2: Conduct a Site Survey

Conduct a Site Survey to verify the wireless connection between your Q45s and the DXM.

1. On the DXM: Use the arrow buttons to select the **ISM Radio** menu. Push **Enter**.
2. Select the **Site Survey** submenu, and press **Enter**.
3. Select each Node ID within the system to verify the wireless connection between the Node and the DXM.
4. When you are finished running the site survey, press **Back** twice to return to the main menu.

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Step 3: Configure the System

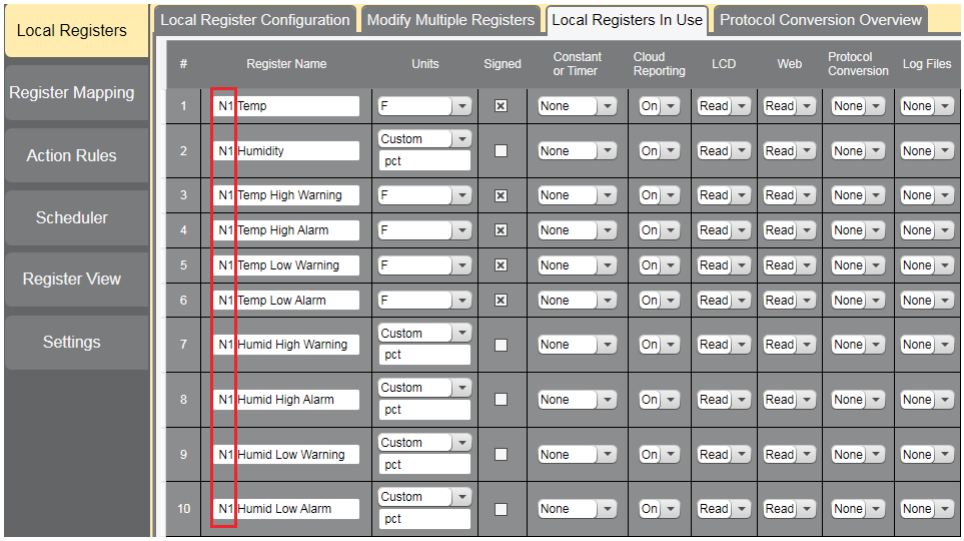
To customize the system to an application, make some basic modification to the template files. There are two files uploaded to the DXM: the XML file sets the DXM's initial configuration and the ScriptBasic file reads the raw temperature and humidity and scales the values for °F or °C, sets warnings and alarms, and organizes the information in easy-to-find registers in the DXM. There are two versions of each file: one for Fahrenheit and one for Celsius. The XML and ScriptBasic files MUST both be the Fahrenheit version or both the Celsius version.

To load and adjust these files, use Banner's DXM Configuration Tool software and the "Temp Humidity Monitoring" files available via in the links below.

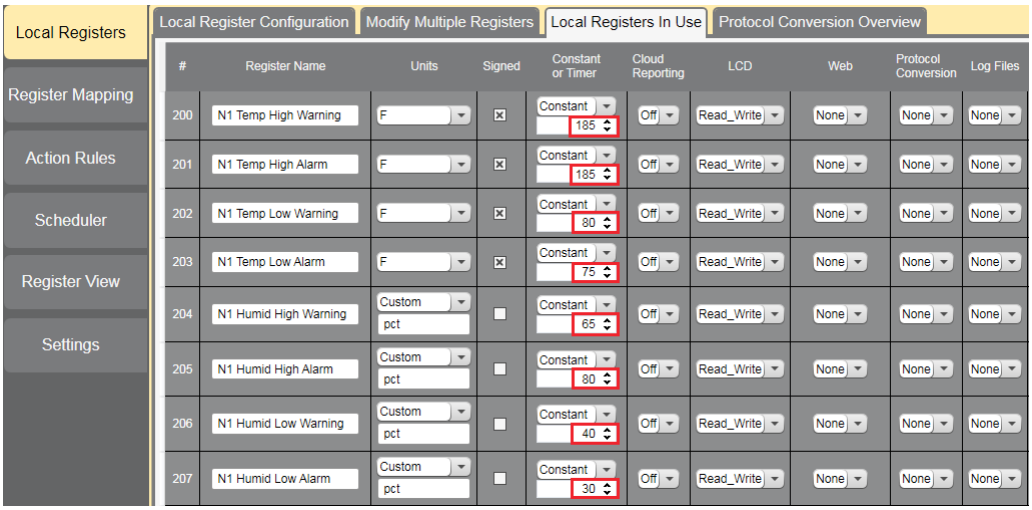
1. Download the preconfigured files. (https://goo.gl/4IBQUZ)
2. Extract the ZIP files into a folder on your computer. Note the location where the files were saved.
3. Connect the DXM, via the USB cable supplied with the DXM, to a computer containing the DXM Configuration Tool software or download the software and install it on a computer.
4. Launch the software.
5. Load the Temp Humidity Monitoring XML file by going to the **File > Load** menu and choosing the configuration files.
6. Connect the software to the DXM by going to the **Device > Connection Settings** menu. Select **Serial** and then select the COM port the USB cable is plugged into. Click **Connect**. If you are unsure which COM port to use and multiple appear, attempt to connect to each one of them until you are successful.
7. Upload the Temp Humidity Monitoring script file by going to the **Settings > Scripting** screen. Click **Upload Script** and select the file.
8. Select the uploaded file in the window to the right of the **Upload Script** button. Click **Add Selected to Startup**; the DXM will run this script every time the device restarts.
9. **Save** the XML file using the **File > Save** menu. Save the XML file any time the XML has been changed because the tool does not autosave.

Optional Steps: Customize the XML file

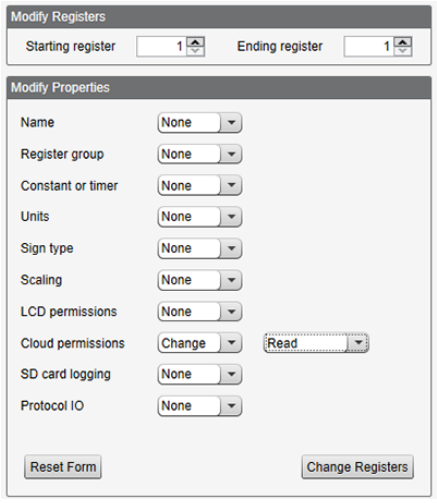
1. Within the DXM Tool, go to the **Local Registers** > **Local Registers in Use** screen.
2. Rename the Nodes using the text boxes within the **Register Name** column. Because there are 10 registers per Node, copy and paste names for efficiency.
3. To display the temperatures, humidity, warnings, and alarms on the website you must change the **Cloud Permissions** column drop-down lists to **Read** for each Nodes' information piece (temp, humidity, warning, alarm, etc.) that you would like to appear on the website.



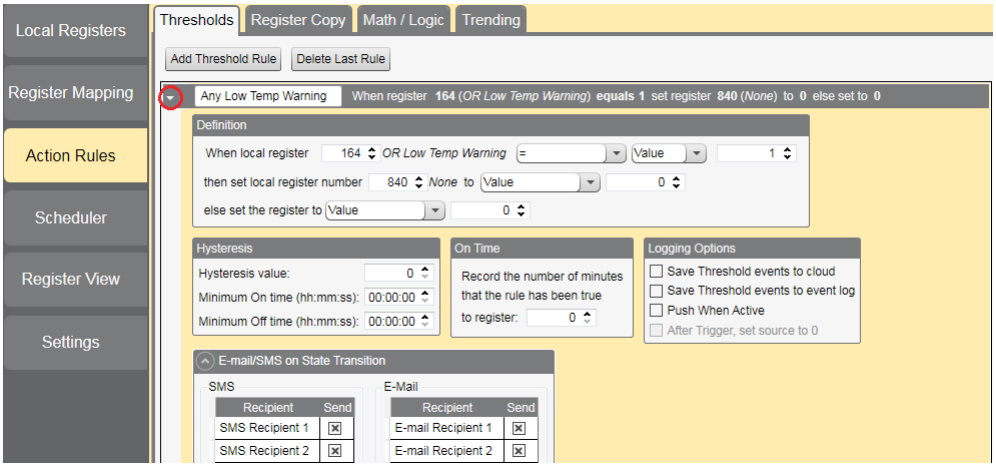
4. Each Node has four warnings and four alarms based on the scaled temperature and humidity values. Users must set the levels of those alarms in Local Registers 200-327. For example, in the Local Registers In Use tab, find register 200, labeled “NX Temp High Warning” and change the number underneath the Constant dropdown box to the desired temperature. When the Node’s temperature rises above that warning threshold, the 3rd local register associated with that node will be set to a value of 1. Users can set both the warning and alarm thresholds for each Node in the system. The default values are the maximum and minimum readings for these sensors and will not create a warning or alarm if not modified.



5. To display the temperature, humidity, warnings and alarms for each Node on the website, change the cloud permissions.
   a) On the **Modify Multiple Registers** screen, select **Change** in the drop-down list next to **Cloud Permissions**.
   b) In the drop-down list to the right, select **Read** for **Cloud Permissions**.
   c) Set the **Starting Register** to 1 and the **Ending Register** to the value equal to 10 × Number of Nodes in the system (for example, set the ending register 160 for 16 Nodes).
   d) Click **Change Registers** on the bottom right of the section.
6. Configure to receive email or text alerts based on an action rule.
   a) Click on the **Action Rules** tab and expand any rule using the arrow next to the rule OR create a new action rule using the **Add Threshold Rule** button on the top.
   b) Click on the arrow next to **Email/SMS on State Transition**.
   c) Select the recipient of the SMS and/or email upon the action rule becoming true.
   In the example shown, both SMS Recipient 1 and 2 and Email Recipient 1 and 2 will receive a message when the action rule meets its criteria.



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Set up the Ethernet or Cellular Connection

By default, the XML file configures the DXM100 with an Ethernet Push interface with the ability to send emails and push the data registers to a webserver. The device can also be configured to use a cellular push if the DXM Controller contains a cellular module and data plan. This section is only necessary if the user wants to receive or display information beyond just the DXM Controller's LCD.

1. If the DXM will text, email, or push to the cloud webserver, set up the push interface.
   a) On the DXM Configuration Tool, go to the **Settings > Cloud Services** screen.
   b) Select the appropriate **Push Interface** (**Ethernet** or **Cell**) from the drop-down list.
   Selecting **Cell** requires a cellular module be installed in the DXM Controller and a wireless plan be set up for sending data.
2. The **Cloud Push Interval** determines how often the DXM pushes the current status data to the webserver. By default, this interval is set to zero and should not be changed. If data is being pushed to the cloud, set the **Cloud Push Interval** to 00:15:00 (15 minutes).
3. Set up the email and text messages. SMS works only if the DXM has a cellular module. Expand the **Email Recipients** and **SMS Recipients** to enter up to 10 email addresses and 10 phone numbers, along with a custom message.
   a) Go to the **Settings** > **Mail and Messaging** screen.
   b) All SMTP fields should remain set to their default values, except the **Password** field. Enter “sxiemail1” into the password field.
   c) Click **Send SMTP Password**.
   d) Click **Yes** when asked to reboot the device.

Step 5: Save and Load the XML File

When changes are made to the XML file, save the changes. To apply the changes, load the XML file to the DXM.

1. **Save** the file by going to the **File > Save** menu.
2. **Load** the file onto the DXM by going to the **Device > Send Configuration to Device** menu.

   Because of the size of the XML file, the file may take up to three minutes to load. Verifying the file is loading by looking at the Application Status indicator in the status bar.

   If the Application Status indicator is red, close and restart the DXM Configuration Tool, unplug and re-plug in the USB 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 yellow, the file transfer is in progress.

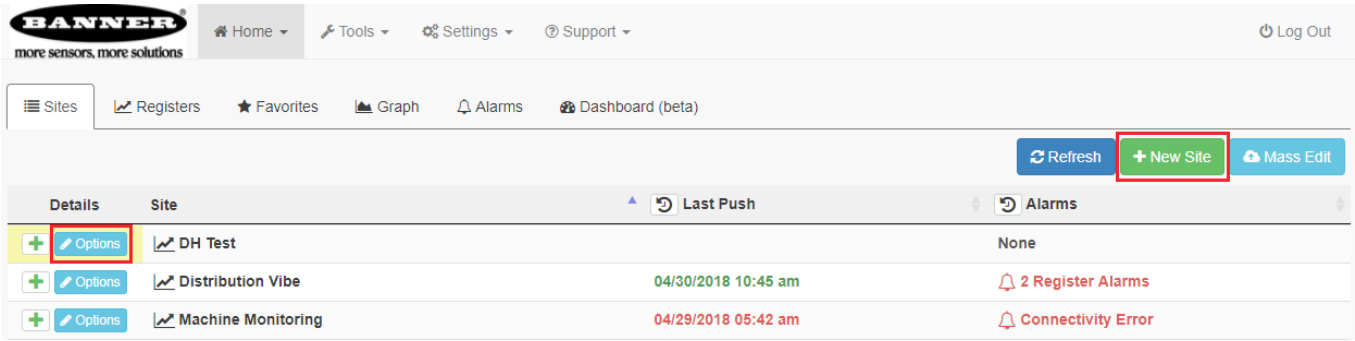


Step 6: Push Information to the Cloud

The DXM100 can connect to the web via Ethernet or an internal cell module to push data from the site to the cloud and displayed on a website. To enable this capability for remote monitoring and alarms settings, modify the XML file.

The Banner Cloud Data Services (BannerCDS) website for storing and monitoring the system's data is https://bannercds.com.

1. Connect the DXM to a computer with the DXM Configuration Software.
2. Launch the software and connect to the DXM.
3. Load the saved XML file.
4. Go to the **Settings > Cloud Services** screen.
5. Visit the BannerCDS website and log into an existing account or register a new account.
6. Click **+ New Site** and name your site.
7. Highlight and copy the Site ID.
8. On the DXM Configuration Software: Return to the **Settings > Cloud Services** screen and paste the copied ID into the Site ID field.



9. Save the XML file (**File > Save**).
10. Upload the file to the DXM (**Device > Send Configuration to the Device**).
11. On the website: Click **Options** on the row of the newly created site. Click the checkbox next to **XML Config** and select the XML file that was just saved/uploaded to the DXM.
12. Click **Save** to complete the connection to the website.

This creates continuity between the site 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. Refer to the Banner Cloud Data Services Instruction Manual to review all the features available for monitoring, comparing data, and establishing warnings/alarms on the website.

To access a demo version of the website please contact your local Banner distributor and follow the instructions in the technical note: Connecting to the Banner Cloud Data Services Demo Site for modified instructions on how to send data to the demo site.

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Additional Features

Enabling Q45 Lights

Warnings and alarms can be indicated by the Q45s by using the Enable Lights registers on the DXM to illuminate yellow for warnings and red for alarms when the device is reporting those values within those user configured positions.

Enable from the DXM LCD

1. Use the arrows on the DXM to highlight **Registers** and click **Enter.**
2. Find the **Enable Lights** registers using the arrows and click **Enter**.
3. Change the value from a zero to a one and click **Enter** three times.
4. To return to zero, click **Enter** and change the value back to zero with the arrows. Click **Enter** three times.

Enable from the Website

1. Sign into the website and click **Options**.
2. Select **Type** to be **Register** and the **Register Name** to be **Enable Lights.**
3. Change the value to 1 and click **Queue**.
4. To change back, follow the same procedure and set the value to zero. This changes the **Enable Lights** register the next time the DXM pushes data to the website.

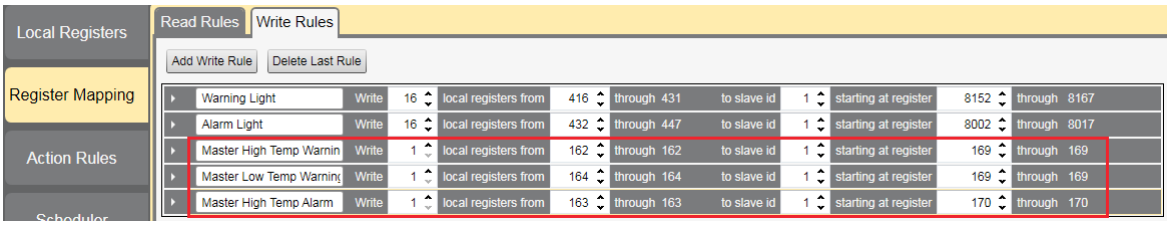
We do NOT RECOMMEND leaving the lights enabled at all times as this reduces battery life. If uploading the data to the cloud, create a master light.

Create a Master Light

Local Registers 162–169 are used to OR each warning and alarm independently for all the Q45 Nodes (for example, 162 is 1 when ANY High Temperature Warning in the system is ON). A master light can be used as one of the 16 Nodes in the system to reflect these OR'd warnings and alarms.

1. On the DXM Configuration Tool software: Go to **Register Mapping > Write Rules**.
2. For each warning or alarm type, select **Add Write Rule** and map one registers starting at the correct register (162–169 being mapped to the light) to slave ID 1 at the output register for the Master Light.

   The register number for the master light outputs is N × 16 + 9 for the first light module or N x 16 + 10 for the second light module and so on, where N is the Node ID of the master light. The example shows the setup for the OR High Temperature warning and the Master Light on Node ID 10 (10 × 16 + 9 = 169). Multiple OR'd warnings or alarms can be written to the same module on the light if desired.



Configure Time Stamped Logging

To setup time-stamped logging, follow these steps.

1. Go to the **Local Registers > Modify Multiple Registers** screen.
2. Click **Reset Form**.
3. From the SD Card Logging drop-down list, select **Change**.
4. Select Log 1 in the drop-down list that appears to the right.
5. Set the **Starting Register** to 1 and the **Ending Register** to the value equal to 10 × Number of Nodes in the system (for example, the Ending Register 16 Nodes is 160).
6. Click **Change Registers**.

Retrieve a Log File

1. Connect the DXM to the computer via USB or Ethernet.
2. Connect the DXM Configuration Tool software to the DXM using the **Device > Connection Settings** menu.
3. Go to the **Settings > Logging** screen.
4. Click **Refresh List**.
5. In the **Log File Management** window, select the file to save.
6. Click **Save Selected** to save the file to your computer.

Local Registers

	Local Register #	Description
Temperature & Humidity Monitoring Information	1 + 10 × (N–1)	Current Temperature
	2 + 10 × (N–1)	Current Humdity
	3 + 10 × (N–1)	Temp High Warning
	4 + 10 × (N–1)	Temp High Alarm
	5 + 10 × (N–1)	Temp Low Warning
	6 + 10 × (N–1)	Temp Low Alarm
	7 + 10 × (N–1)	Humidity High Warning
	8 + 10 × (N–1)	Humidity High Alarm
	9 + 10 × (N–1)	Humidity Low Warning
	10 + 10 × (N–1)	Humidity Low Alarm
Enable Q45 Lights	161	Enable Q45 Lights
OR'd Warnings/Alarms	162–169	OR'd warnings and alarms
Warning/Alarm Thresholds	200–327	User configurable warnings and alarm settings
Node Connection Status	400–415	Node Connection Status
Write registers for Q45 lights	416–431	Warning Lights for Q45 output
	432–447	Alarm Lights for Q45 output

Where N represents the Q45 Node ID Number.

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