

## Guide Features and Benefits

<b>VEHICLE DETECTION</b>	Monitor up to 24 M-GAGE sensors, U-GAGE sensors, or a combination of both to detect vehicle presence
<b>INDICATION</b>	Indicate vehicle presence on up to four wireless TL70s with each location turning on one of six light modules on each wireless TL70
<b>EVENT COUNTERS</b>	Count the number of times each location detected vehicle presence
<b>TOTAL AND AVERAGE TIME</b>	Track total time at each location and calculate average time at each location using the count
<b>EXTENDED TIME INDICATION</b>	User configurable setting to indicate an extended vehicle presence by changing the solid light on the wireless TL70 to a flashing light
<b>SMS TEXT/EMAIL ALERTS</b>	Generate SMS text and/or email alerts based on specific events
<b>CLOUD MONITORING</b>	Push data to Cloud Webserver or PLC (via LAN or Cellular connection) for remote viewing, alerting, and logging.

This guide provides the ability to monitor and track a combination of up to 24 M-GAGES or U-GAGES through the DXM100 while providing indication through up to four wireless TL70 tower lights with six light segments on each.

Each time a presence is detected, a corresponding tower light segment illuminates and after an optional user-configurable number of minutes changes from a solid light to a flashing light. The DXM tracks the total time of all vehicle presence, a count the vehicles detected, the average time of vehicle presence, and a current time of vehicle presence that resets to zero upon the vehicle leaving. The local light indication can save time and money when action is required upon a vehicles arrival. It can also provide overall metrics to track and improve performance of the actions being taken. Application examples include loading docks and mobile pick-up areas.



## Equipment

Model	Description
TL70DXN9XXXQ or TL70DXN2XXXQ (XXX is any combination of light colors)	EZ-LIGHT TL70 Wireless Modular Tower Light; select either 900 MHz or 2.4 GHz ISM radio to match the DXM100
DXM100-B1C1R1 or DXM100-B1C1R3	DXM100 Wireless Controller with Cell; select either 900 MHz or 2.4 GHz ISM radio to match the M-GAGES or U-GAGES; C1 only necessary if Cell Module is desired
DX80N2X1W0P0ZT or DX80N9X1W0P0ZT	Wireless M-GAGE; select either 900 MHz or 2.4 GHz ISM radio to match the DXM100; Optional "D" on part name for D Cell Battery
DX80N2X1W0P0U or DX80N9X1W0P0U	Wireless Ultrasonic U-GAGE; select either 900 MHz or 2.4 GHz ISM radio to match the DXM100
BWA-MGFOB-001	Optical Commissioning LED Tool for M-GAGES and U-GAGES

A PDF of this Application Guide is available at <https://goo.gl/WMOZHR>

## Loading Dock and Mobile Pick-Up Application Guide

The following guide demonstrates how to bind the wireless M-GAGEs, U-GAGEs, and TL70s to the DXM and load a preconfigured XML file and script for up to 24 vehicle detection spots with indication on up to four wireless TL70s. The XML file only requires some minor modifications to be customized for any site.

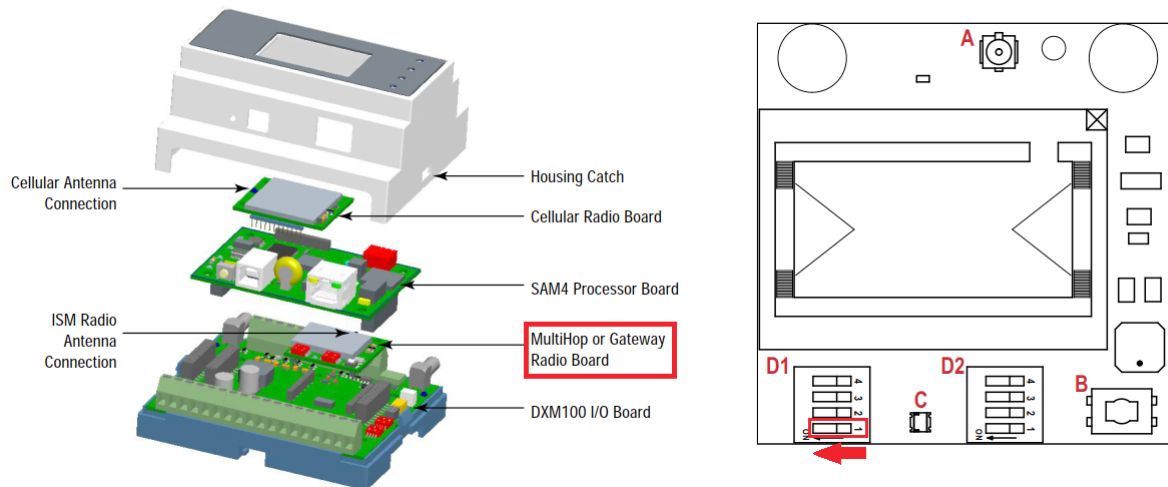
### Step 1: Bind the System and Assign Addresses

Bind the M-GAGEs and/or U-GAGEs and TL70 to the DXM100 to establish a secure connection and assign the Nodes a network address. The first 24 Nodes in the system are reserved for binding the M-GAGEs and/or U-GAGEs. The remaining four lights must be bound to addresses 25–28. Each light segment on the TL70 will be associated with specific Node IDs. The first six Node IDs correlate to the first six light segments on the first TL70. Label the M-GAGEs and/or U-GAGEs with their Node IDs for proper installation with their associated TL70.

When operating at 900 MHz, these devices must transmit at 250 mW to communicate with the M-GAGEs and/or U-GAGEs. To transmit at 250 mW, change DIP switch 1 on the TL70s and the DXM ISM Radio to the ON position.

To change the DXM ISM Radio to 250 mW, remove the top cover, remove the processor board, and on the ISM radio move DIP switch D1-1 ON. Refer to the DXM datasheet for detailed instructions.

To change the Wireless TL70 to 250 mW, remove the TL70 base from any light segments and move DIP switch 1 to ON. Leave the base detached for binding. Refer to the TL70 Wireless Tower Light datasheet for detailed instructions.



### Bind the M-GAGE and/or U-GAGE Radios

To bind the M-GAGE and/or U-GAGE radios to the DXM master radio:

1. Apply power to the DXM.
2. On the DXM: Use the arrow button to select the **ISM Radio** menu on the DXM's LCD. Press **Enter**.
3. Select **Binding** and press **Enter**.
4. Select **Bind to > 1** (the first Node) and press **Enter**.
5. Wake up the M-GAGE or U-GAGE using the Optical LED tool. Click and hold the light on above the optical sensor on the Node until a red LED flashes indicating it is awake. Refer to the Node's datasheet for more information.
6. On the M-GAGEs or U-GAGEs: Triple-click the Optical LED tool above the optical sensor on the device. The LED on the device flashes green and red. When the LED combines colors and flashes four times, the unit is bound to the DXM as Node ID 1. Label the Node for future reference.
7. On the DXM: Press **Back** to return to the main menu.
8. To bind additional M-GAGEs or U-GAGEs, select **Bind to > X** (where X is the next device in the network) and press **Enter**.
9. On the second M-GAGE or U-GAGE: Triple-click the LED tool above the optical sensor.

If more M-GAGEs or U-GAGEs are being used in the system, continue binding until all GAGEs are bound to the DXM with unique Node IDs.

### Bind the TL70 Wireless Modular Tower Lights

Bind the wireless TL70 as Nodes 25–28 with ID 25 covering Nodes 1–6 and 28 covering Nodes 19–24.

1. Apply power the TL70s.
2. Apply power to the DXM.
3. On the DXM: Use the arrow button to select the **ISM Radio** menu on the DXM's LCD. Press **Enter**.
4. Select **Binding** and press **Enter**.
5. Select **Bind to > 25** (the first Node) and press **Enter**.
6. On the first TL70: With the base section removed, triple-click the binding button.  
The LED flashes four times after it binds to the DXM. This Node is now bound as Node ID 25. Label the TL70 for reference.
7. Reconnect the TL70's base to its light modules.
8. On the DXM: Press **Back** to return to the main menu.
9. To bind additional TL70s, select **Bind to > 26** and press **Enter**.
10. On second TL70: Repeat steps 6 through 8. Continue binding TL70s lights until complete.
11. When you are finished binding, press **Back** on the DXM until the DXM returns to the main menu.

To complete the configuration of the TL70 light modules, each module has a DIP switch on the bottom of the light. The DIP switch in the ON position indicates which Node input with which it is associated (1–6). Typically, the modules are placed in order of 1 through 6 with 1 being the bottom light segment and 6 being the top segment. If you have fewer than six light segments on a TL70 your module may vary.

## Step 2: Configure the System

To customize the system to an actual 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 looks for vehicle presence, tracks the times and counts of the vehicle presence, outputs vehicle presence to the TL70 light, creates a teach function via the DXM display, creates a reset function via the DXM display for timer and count resets, and organizes the information in registers in the DXM.

Loading these files and making adjustments requires using Banner's DXM Configuration Tool software and the "Vehicle Detection..." files available using the links below.

1. **Download** the [preconfigured files](https://goo.gl/kvliQj). (<https://goo.gl/kvliQj>)
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 "Vehicle Detection..." 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 that the USB cable is plugged into. Click **Connect**. If you are unsure which COM port to select, and multiple appear, attempt to connect to each one of them until you are successful.
7. Upload the "Vehicle Detection..." 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 it 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 vehicle locations using the text boxes within the **Register Name** column. Because there are five registers per vehicle location, copy and paste names for efficiency.

To display the vehicle location status, count, or timer on the website, change the **Cloud Permissions** column drop-down lists to **Read** for each vehicle locations' information piece (presence, timer, count, etc.) that you would like to appear on the website.

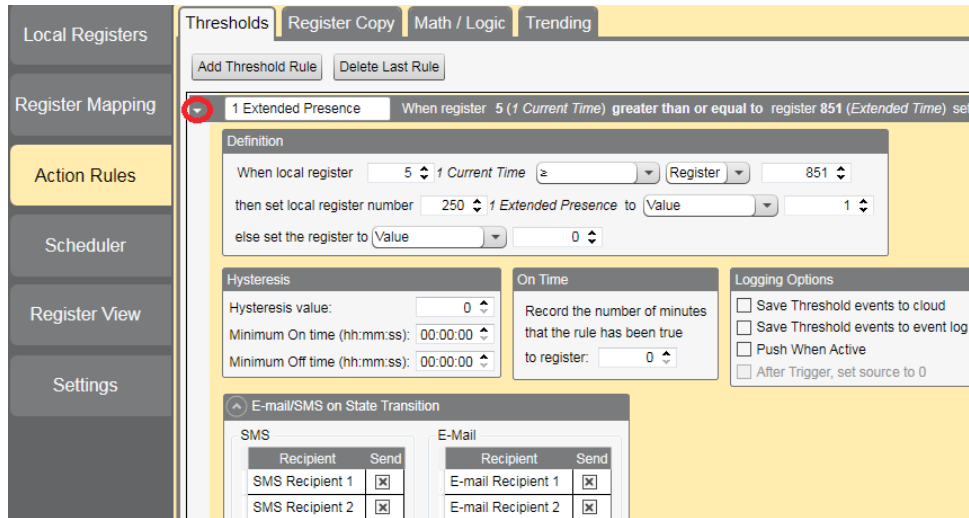
Local Register Configuration										
#	Register Name	Units	Signed	Constant or Timer	Cloud Reporting	LCD	Web	Protocol Conversion	Log Files	
1	1 Vehicle Present	None	<input type="checkbox"/>	None	Off	None	None	None	None	
2	1 Total Time	None	<input type="checkbox"/>	None	Off	None	None	None	None	
3	1 Count	None	<input type="checkbox"/>	None	Off	None	None	None	None	
4	1 Avg Time	None	<input type="checkbox"/>	None	Off	None	None	None	None	
5	1 Current Time	None	<input type="checkbox"/>	None	Off	None	None	None	None	
6	2 Vehicle Present	None	<input type="checkbox"/>	None	Off	None	None	None	None	
7	2 Total Time	None	<input type="checkbox"/>	None	Off	None	None	None	None	

3. The file has a nightly scheduled time (3:00 AM) to re-teach/baseline the M-GAGE and/or U-GAGE Nodes. To adjust this time:
  - a. go to the **Scheduler > Weekly Events** screen.
  - b. Click the arrow to expand the weekly event.
  - c. Adjust the times accordingly with the start and end times being one minute apart.
  - d. De-select any days you do not want the event to occur.
  - e. Leave the register set as 301. The event can be deleted if no scheduled teaching/baselining is desired.

4. To display the statuses for each vehicle location 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 5 × Number of vehicle locations in the system (for example, set the ending register 90 for 18 vehicle locations).
  - d. Click **Change Registers** on the bottom right of the section.

5. Configure to **Receive Email** or **Text Alerts** based on an **Action Rule**.
  - a. Go to the **Action Rules > Thresholds** screen.
  - b. 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.
  - c. Click on the arrow next to **Email/SMS on State Transition**.
  - d. 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.



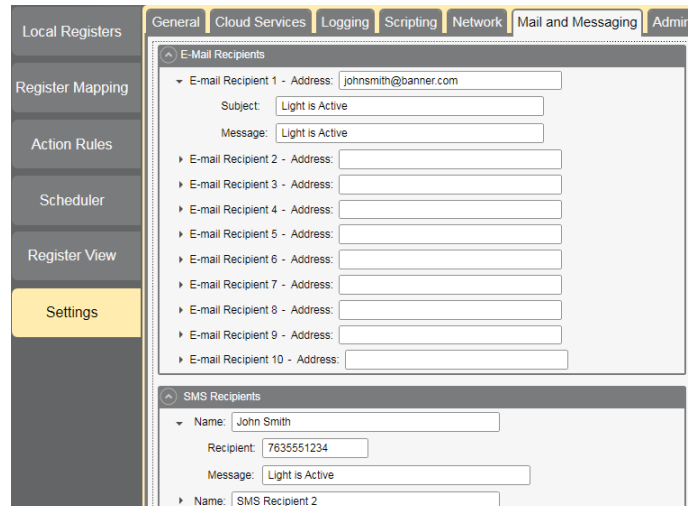
## Set up the Ethernet or Cellular Connection

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 3: 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 4: Run a Site Survey

Verify the wireless connection between your M-Gages and/or U-Gages, TL70s and the DXM by running a site survey on the DXM100.

1. On the DXM: Use the arrow buttons to select the **ISM Radio** menu and press **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.

### Step 5: Teaching the U-GAGE/Baselining the M-GAGE

All U-GAGEs must be taught where the floor is after the Nodes are installed. Each M-GAGE must be baselined for local magnetic fields after they are installed. Each vehicle location Node in the network has a Teach register that is available on the face of the DXM's LCD and via the website. Setting this register to 1 baselines/teaches the unit of that particular Node as described on the datasheet.

#### Teaching from the DXM

1. On the DXM: Use the arrows to select **Registers**. The registers are labeled **X Teach** (where X is the Vehicle location ID you want to reset). There is a **Teach All**, which resets all statistics for each vehicle location.
2. Select the appropriate register to reset.
3. Click the **Enter** button.
4. Change the value to 1 then click **Enter** three times. The reset register automatically returns to zero after the register(s) reset.

#### Teaching from the Website

1. Go to the **Dashboard > Sites** screen.
2. Click **Options** for the site where the particular vehicle location exists.
3. Click on the **Update** tab in the pop-up window that appears.
4. From the **Type** drop-down list, select **Register**.
5. From the **Register Name** drop-down list, select the vehicle location ID you want to reset.
6. Enter 1 into the **Value** field and click **Queue**.
7. Repeat steps 5 and 6 for each vehicle location that needs to be reset or use the **Teach All** register and follow steps 5 and 6.

When the next data push occurs, the chosen units reset. The reset registers automatically return to zero after the registers reset.

## Step 6: Push Information to the Cloud

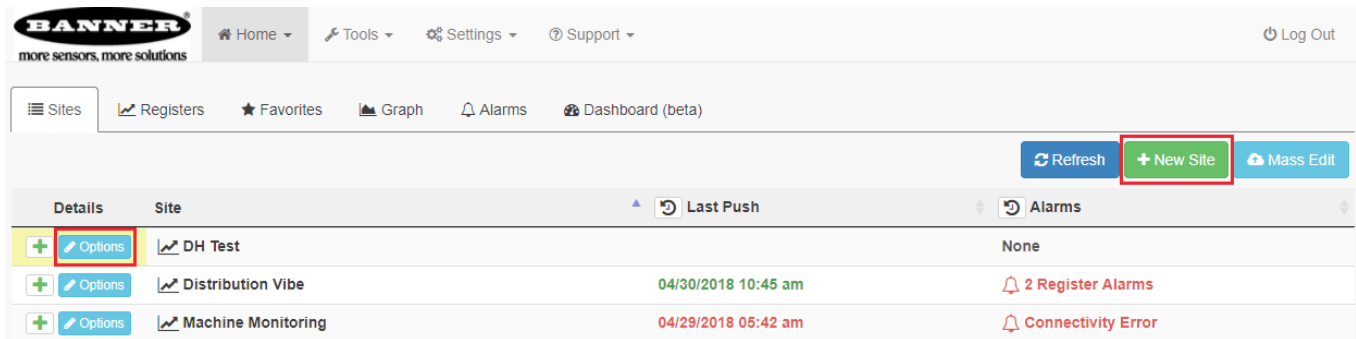
The DXM100 can connect to the web via Ethernet or an internal cell module to push data from the site to the cloud and display the data on a website. To enable this capability for remote monitoring and alarms settings, modify the XML file.

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 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 Tool: 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.



# Additional Features

## Setting Extended Vehicle Presence Time

The user may configure a threshold time, in minutes, that when exceeded changes the vehicle presence indication of the TL70 from a solid light to a flashing light for module associated with that vehicle location.

To configure the extended vehicle presence threshold:

1. On the DXM: Use the arrows to select **Registers**. Scroll with the arrows to the **Extended Time** register.
2. Click the **Enter** button.
3. Set the threshold time, in minutes, then click **Enter** three times. This value is stored in non-volatile memory and remains after any power cycling.
4. Cycle power to the DXM.

To return to the system default **Extended Time** setting

1. Use the arrows to select **Registers**. Scroll down with the arrows to **Initialize** and click **Enter**.
2. Change this value to 0 and click **Enter** three times.
3. Restart the DXM by cycling power to the device or from the main DXM menu, select **System > Restart** and click **Enter**.

## Resetting the Timer and Counts

Each vehicle location in the system has a reset register that is available on the face of the DXM's LCD and via the website. Setting this register to 1 resets all the counts and timers on that particular vehicle location.

### Resetting from the DXM

1. On the DXM: Use the arrows to select **Registers**. The registers are labeled **X Reset** (where X is the Vehicle location ID you want to reset). There is a **Reset All** that resets all statistics for each vehicle location.
2. Select the appropriate register to reset.
3. Click the **Enter** button.
4. Change the value to 1 then click **Enter** three times. The reset register automatically returns to zero after the register(s) reset.

### Resetting from the Website

1. Go to the **Dashboard > Sites** screen.
2. Click **Options** for the site where the particular vehicle location exists.
3. Click the **Update** tab in the pop-up window that appears.
4. From the **Type** drop-down list, select **Register**.
5. From the **Register Name** drop-down list, select the vehicle location ID you want to reset.
6. Enter 1 into the **Value** field and click **Queue**.
7. Repeat steps 5 and 6 for each vehicle location that needs to be reset or use the **Reset All** register following steps 5 and 6.  
When the next data push occurs, the chosen units will reset. The reset registers automatically return to zero after the register(s) reset.

## Configuring 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 5 × Number of vehicle locations in the system (ex. **Ending Register** 90 for 18 vehicle locations).
6. Click **Change Registers**.



## Retrieving a Log File

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

## Local Registers

	Local Register #	Description
Vehicle Detection Information	$1 + 5 \times (N - 1)$	Vehicle Presence (0=OFF/1=ON)
	$2 + 5 \times (N - 1)$	Total Vehicle Presence Time (mins)
	$3 + 5 \times (N - 1)$	Total Vehicle Presence Count
	$4 + 5 \times (N - 1)$	Average Vehicle Presence Time (mins)
	$5 + 5 \times N - 1$	Current Vehicle Presence Time (mins)
M-GAGE/U-GAGE Node Read	121–144	Raw Input from M-GAGE or U-GAGE
Node Connection Status	145–172	GAGE and Light Connection Status
Extended Presence	250–273	Extended Vehicle Presence
Teach All	301	Teach/Baseline All GAGE Nodes
Teach 1–24	302–325	Teach/Baseline GAGE Nodes 1–24
Reset All	326	Reset All Vehicle Detect Registers
Reset 1–24	302–325	Reset Vehicle Detect Registers 1–24
Extended Time Setting	851	User Configurable Extended Time Setting
Initialize	852	Initialize DXM with Extended Time Setting



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