Call for Parts, Call for Service, Andon Application Guide

Call for Parts, Call for Service, Andon Introduction

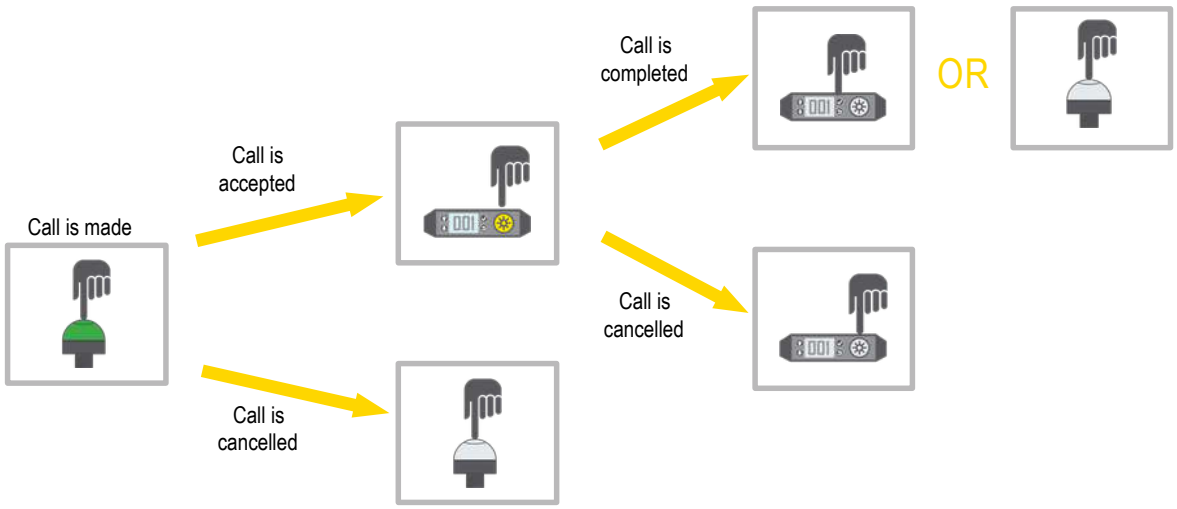
Increase production efficiency by developing a wireless call-for-parts/call-for-service/andon system that allows for 35 workstations to call out to 12 forklifts/mobile responders using the EZ-LIGHT K70 Touch and Direct Select Operator Interfaces.

This application enables quicker responses from forklift drivers and/or supervisors to indicate a request has been accepted. When creating a call system using wireless indicators, workstations can maintain a steady workflow and resolve critical issues quickly.

This application guide demonstrates how to bind the wireless Direct Select Operator Interfaces and K70 Wireless Touch Buttons to the DXM Controller and how to load pre-configured XML and ScriptBasic files. With the default settings, operators can quickly be up and running with a standalone call-for-parts solution. The system can be further customized for specific application requirements.

time of requests, number of requests, and total time to acknowledge requests are tracked, allowing analysis of average delivery and acknowledgment times for each station. Stations each have a single call light (K70 Touch) with a lighted response that is initially off. When pressed, the call light turns green momentarily to indicate that it was pressed, then changes to red to show the call was received by the controller. The light turns yellow after it is acknowledged by the supervisor or forklift driver with the Direct Select Operator Interface.

On the Direct Select Operator Interface, the display backlight turns on and displays the station number that requested service. Operators accept the call by pressing the capacitive touch button on the Direct Select Operator Interface. The display backlight turns off and shows the station number until either the operator or station confirms that the request has been completed by pressing the K70 touch again, or by pressing the check icon on the Direct Select Operator Interface Node. This system provides the information necessary to react quickly to workstation requests and drive efficiency improvements based on data that was previously unavailable.



Call for Parts Guide Features and Benefits

Call for Parts, Call for Service, or Andon	35 call stations fitted with K70 Touch Button Nodes can have a single call for parts, call for service, andon, call for pallet pickup, etc. The system can be expanded to allow additional call stations as long as the total call station and mobile responder count does not exceed 47.
Call Response	12 Direct Select Operator Interfaces can be used on mobile responders to accept calls as soon as they are available. The system can be expanded to allow additional mobile response devices as long as the total call station and mobile responder count does not exceed 47.
Event Counters	Automatically tracks the total number of calls made, calls completed, calls cancelled, and more.
Email Alerts	Uses Banner Cloud Data Services (CDS) to generate email alerts if wait times are long or if there are too many stations in the queue.
Efficiency Metrics	Provides efficiency metrics, such as average call times, average wait times, and average times to acknowledge calls.
Remote Monitoring	Pushes data to Banner CDS, customer-specific cloud servers, or PLC for remote viewing, generating alerts, and logging data.

Equipment

Users can order a Call For Parts Kit that includes the base hardware for the solution and can expand it by adding additional Direct Select and K70 Nodes. Additionally, they can build their own kit and manually configure the solution.

The pre-configured call for parts kit comes with a single DXM, one K70 Wireless Touch Button Node for a single call station, and one Direct Select Operator Interface Node for a single mobile responder. Users can purchase additional K70 and Direct Select Operator Interface Nodes to expand their system for their requirements.

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Pre-Configured Call-for-Parts Kit Models and Components

Model	Frequency	Kit Components
CallForPartsKit9	900 MHz ISM Band	**DXM700-B1R1-811388** DXM700 Wireless Controller **DX80N9DSTS** Direct Select Operator Interface Node **K70DXN9T2GRYQ** K70 Wireless Touch Button Node **PSW-24-1** Power Supply (qty 2), **MQDMC-401** Cordset, **LMB30LP** bracket, and a 90-day trial for Banner CDS
CallForPartsKit2	2.4 GHz ISM Band	**DXM700-B1R3-811389** DXM700 Wireless Controller **DX80N2DSTS-NB** Direct Select Operator Interface Node **K70DXN2T2GRYQ** K70 Wireless Touch Button Node **PSW-24-1** Power Supply (qty 2), **MQDMC-401** Cordset, **LMB30LP** Bracket, and a 90-day trial for Banner CDS

Build your own Kit— Users can build their own Call for Parts Kit and customize individual component choices.

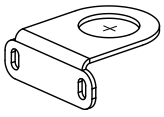
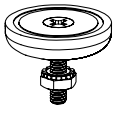
1. Select what radio frequency can be used:
   900 MHz
   2.4 GHz
2. Select a DXM Controller/gateway/Edge device:
   DXM700
   DXM1000
   DXM1200
3. Select how many call stations are required (K70 Nodes)
4. Select how many mobile responders are required (Direct Select Operator Interface Nodes)
5. Add optional accessories as needed

Refer to "Optional Accessories" on page 2 for suggested brackets, power supplies, and cables.

Solution Components

Model		Description
900 MHz	2.4 GHz	
DXM700-B1R1	**DXM700-B1R3**	DXM Series Wireless Controller, system compatible with DXM700, DXM1000, or DXM1200 Wireless Controllers
DX80N9DSTS	**DX80N2DSTS-NB**	Wireless Direct Select Operator Interface Node
K70DXN9T2GRYQ	**K70DXN2T2GRYQ**	K70 Wireless Touch Button Node

Optional Accessories

	Model	Description
	**TL70DXN9GYRQ**	TL70 Wireless Tower Light for remote status indication, 900 MHz
	TL70DXN2GYRQ	TL70 Wireless Tower Light for remote status indication, 2.4 GHz
	**LMB30LP**	Low profile mounting bracket for K70 Touch/Indicator or TL70 Tower Light
	**BWA-BK-020**	Magnetic mounts for Direct Select Operator Interface Node, compatible with most other mounting brackets

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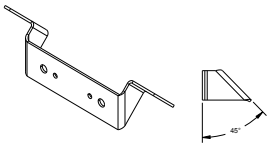
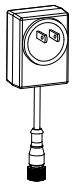
	Model	Description
	**LMBPTL110A45**	Angled mounting bracket for Direct Select Operator Interface Node
	**PSW-24-1**	DC power supply with multi-blade wall plug, 100–240 V AC 50/60 Hz input, 24 V DC 1 A output, UL Listed Class 2, 4-pin female M12 connector (comes with kit; power supply for the DXM Controller)
	**MQDMC-401**	Cordset, 4-Pin Threaded Male M12/Euro-Style, Single Ended, 0.23 m (0.75 ft) (comes with kit; connects the power supply to the DXM Controller)

Configuration Instructions

Set the DIP Switches

The K70 Wireless Touch Button and Direct Select Operator Interface Node require specific DIP switch settings to operate correctly with the Call for Parts Solution.

Set all DIP switches to the following:

- K70 DIP Switch Settings: OFF, OFF, OFF, OFF (default)
- Direct Select Operator Interface DIP Switch Settings: OFF, OFF, OFF, ON

For detailed instructions about how to access the DIP switches, refer to the K70 Wireless Touch Button datasheet (p/n 189843) and the Direct Select Operator Interface Node datasheet (p/n 214276).

After making changes to the DIP switches, cycle power to the K70 and Direct Select Operator Interface. To cycle power to battery-powered radios, enter binding mode and then exit binding mode (with or without binding). For instructions on how to enter/exit binding mode, see "Bind the K70 Touch Buttons and Direct Select Nodes" on page 3.

Bind the K70 Touch Buttons and Direct Select Nodes

The binding process establishes a secure radio connection between the Nodes and the DXM Controller. Follow these steps to bind Direct Select Nodes and K70 radios to your DXM Controller.

Before beginning the binding procedure, apply power to all the devices.

Each Node (K70 or Direct Select Operator Interface) is assigned a unique Node ID. The K70 and Direct Select Operator Interface require specific Node IDs to work with the pre-configured solution. The Node ID table shows the Node IDs required for the system to function correctly with the default settings. If more stations or more forklifts are required, see Step 3 below.

Default K70 and Direct Select Node IDs

Node ID	Model Number	Station/Forklift #
1	K70XN*T2GRYQ	Station 1
2	K70XN*T2GRYQ	Station 2
3	K70XN*T2GRYQ	Station 3
.	K70XN*T2GRYQ	Station .
.	K70XN*T2GRYQ	Station .
.	K70XN*T2GRYQ	Station .
35	K70XN*T2GRYQ	Station 35
36	DX80N*DSTS	Forklift 1
37	DX80N*DSTS	Forklift 2
38	DX80N*DSTS	Forklift 3
.	DX80N*DSTS	Forklift .
.	DX80N*DSTS	Forklift .

Continued on page 4

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Continued from page 3

Node ID	Model Number	Station/Forklift #
.	DX80N*DSTS	Forklift .
47	DX80N*DSTS	Forklift 12

1. On the DXM: Enter binding mode by going to the Main menu and selecting **ISM Radio › Binding**.
2. Select the Node ID you would like to assign to the Direct Select Node.
   Node IDs 1 through 47 are the valid selections. By default, Node IDs 1–35 are reserved for the K70 Touch Buttons, and Node IDs 36–47 are reserved for the Direct Select Operator Interfaces.
3. Press **Enter** to start the binding procedure.
4. Enter binding mode on a Direct Select Operator Interface or K70 Touch Button.
   - On the Direct Select Operator Interface: Hold down the back button and press the check button button three times.
   - On the K70 Touch Button: Access the binding button by holding the light module and twisting the base clockwise. Press the binding button three times.

   The red and green LEDs flash alternately and the radio searches for a DXM in binding mode. After the device is bound, the LEDs stay solid momentarily (appears orange), then flash four times. The radio exits binding mode.
5. Label the Node's ID number with the supplied Device ID sticker.
6. On the DXM: Press **Back** to return to the **Bind to #** screen.
   If the Node is bound and synchronized with the DXM, the green status LED flashes.
7. Repeat these steps for as many Nodes as are needed for your network.
8. After binding all Nodes, exit binding mode on the DXM by pressing **Back** 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.

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.

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.

Upload the Configuration Files

There are two files loaded onto the DXM: the XML configuration file that defines the DXM's Local Register configuration and the ScriptBasic file that runs the main program. **Skip these instructions and to go "Configure the Application Settings" on page 5 if your DXM700 is pre-loaded with the XML and ScriptBasic files.**

Verify you have run the binding instructions on all Nodes, assigned Node IDs to all radios, installed the radios, and conducted a Site Survey to test the signal strength.

1. Download and install Banner's DXM Configuration Software (v4 or newer) onto the computer you will be using to configure your files.
2. Download the Call-for-Parts configuration files (p/n b_4440714) from www.bannerengineering.com. The pre-configured files can also be found on the DXM Series Page or the Call for Parts application guide page.
3. Extract the ZIP files into a folder on your computer. Note the location where the files were saved.
4. Connect the DXM, using the USB Cable supplied or with an Ethernet cable, to a computer containing the DXM Configuration Software V4.
5. Launch the configuration software and connect to the DXM.
6. In the **Configuration Mode** drop-down list, select **Traditional**.
7. Select the connection mode.
   - **Serial**—Select the COM port the USB cable is plugged into. If you are unsure which COM port to select and multiple ports are listed, disconnect the USB cable to see which port disappears. Reconnect the USB cable and select the COM port that reappeared
   - **TCP/IP**—Enter the IP address of the DXM, which can be found in the DXM LCD under **System Info › Ethernet › IP**.
8. In the **Select DXM Model** drop-down list, select **DXM700**.
9. Click **Connect**.
10. To load the configuration file, go to **File › Open** and choose the XML file **221076.xml**.
11. To load the ScriptBasic file, go to **Settings › Scripting** and click **Upload File**. Select the ScriptBasic file **221075.sb**.

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12. On the menu bar, go to **DXM › Send Configuration to DXM**.
    The XML configuration file uploads to the DXM and runs the Call for Parts program after the DXM is rebooted.
13. Cycle power to the DXM Controller.

Configure the Application Settings

After uploading the configuration file to the DXM, users can modify application-specific settings directly from the DXM's menu system. Before making any changes, enable the Delay Mode via the DXM display.

1. On the DXM700, use the arrow keys to select the **Registers** menu and press **ENTER**.
2. Scroll down to **Delay Mode** and press **ENTER**.
3. Using the arrow keys, change the value to 1 and press **ENTER** three times.
   The **Delay Mode** setting should now display **ON**.
4. Use the arrow keys to modify any parameters based on the application/user requirements. See the Parameters table for parameters that are configured using the display.
5. After all the application settings changes are entered, disable **Delay Mode** by setting the **Delay Mode** value to **0**.
6. Cycle power to the DXM to apply your changes.

> **IMPORTANT:** Direct Select Operator Interface battery life is directly affected by the DSTS parameter settings. Having the Direct Select backlight and green LED on for long periods of time can significantly reduce battery life on the devices.

Local Registers for Parameters

DXM Register	Register Name	Description	Default Value	BannerCDS
821	Reset Station Stats	Resets station data registers. 1 = reset; register automatically changes back to 0.	0	Write Only
822	Reset FL Stats	Resets forklift data registers. 1 = reset; register automatically changes back to 0.	0	Write Only
851	Queue Alarm	Number of stations in queue that triggers a red flashing indicator on the Direct Select (Queue Alarm State)	7	x
852	FL Confirm Enable	Enables forklifts to confirm when a call has been completed by pressing the check button. 1 = enabled; 0 = disabled	1	
853	DSTS Backlight Timeout	Time (seconds) that the Direct Select backlight is ON when a command is sent to the Direct Select. Leaving the backlight on for long periods of time will significantly reduce battery life on the Direct Select.	2	
854	DSTS Green LED Timeout	Time (seconds) that the Direct Select green light is ON when a command is sent to the Direct Select.	2	
855	K70 Green ON	Enables the K70 green light to be always ON. 1 = enabled; 0 = disabled	0	
856	K70 Yellow Ack	Enables the K70 yellow light to be ON to acknowledge that a forklift has accepted the call. When disabled, the K70 green light will be ON to acknowledge. 1 = enabled; 0 = disabled	1	
857	Display Timeout	Time (minutes) that the display (numbers on DSTS) will stay ON	60	
858	Delay Mode	Enables a script delay that adds a four second wait time before starting another loop in the program. The system operates normally with this exception. This is helpful for troubleshooting the system and should be disabled during normal operation. 1 = enabled; 0 = disabled	0	
859	Warning Time	Time (minutes) that a station is in the queue before a yellow warning light turns ON	10	x
860	Alarm Time	Time (minutes) that a station is in the queue before a red alarm light turns ON	15	x
861	Number of Stations	Indicates the number of stations the solution will use. This value also determines the number of forklifts, where the number of forklifts = 47 – NumStations – NumTLs. The system cannot exceed 47 Nodes and the number of stations value must be below 47.	35	
862	Number of Alarm TL (Tower Lights)	Indicates the number of Tower Lights the solution will use. This value also determines the number of forklifts, where the number of forklifts = 47 – NumStations – NumTLs. The system cannot exceed 47 Nodes and the number of stations value must be below 47.	0	

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IMPORTANT: The total Node/radio count cannot exceed 47 devices. The Number of Stations and Number of Alarm Tower Lights registers cannot add up to more than 47 or the system will not function correctly. These register values also determine the number of Forklifts/Mobile Responders in the system, where 47 Devices = Number of Stations + Number of Alarm Tower Lights + Number of Forklifts/Mobile Responders.

Optional Configuration Steps

Change the Number of Stations

The Call for Parts application files are configured to manage up to 47 Nodes, which can include K70 Touch Button Nodes for Stations/ Operators, Direct Select Operator Interface Nodes for mobile responders and optional Alarm Tower Lights. The default configuration allows for 35 K70 Touch Buttons and 12 Direct Select Operator Interface Nodes.

Follow these steps to modify the program to allow for more K70 Touch Buttons or Direct Select Operator Interface Nodes. Note that the combination of Nodes (K70s, Direct Select Operator Interfaces, and Alarm Tower Lights) cannot exceed a total of 47 Nodes. Changing the **Number of Stations** parameter will affect the number of forklifts (Direct Select Operator Interfaces) the system allows.

1. On the DXM, go to **Registers › Number of Stations** and press **Enter**.
2. Enter the desired number of stations and press **SEND**.
   Valid station numbers are 1 through 46.
3. Cycle power to the DXM to apply the configuration changes.
4. Bind the new K70 Touch Buttons and Direct Select Nodes using the new Node IDs listed.
   The Node IDs for the K70 Touch Buttons and Direct Select Nodes changes based on the **Number of Stations**. K70 Node IDs start at 1 and go through the **Number of Stations**. Direct Select Node IDs begin at (**Number of Stations**+1) – (47 – **Number of Tower Lights**).

Example: A System with 40 Stations and 7 Forklifts/Mobile Responders

On the DXM: Set the **Number of Stations** register to 40. This will automatically configure the system to have seven mobile responders.

The Node IDs for the K70s at the stations are 1 through 40 (**Number of Stations**).

The Node IDs for the Direct Select Operator Interface Nodes for the forklifts are 41 (**Number of Stations** +1) through 47 (47 – **Number of Alarm Tower Lights**).

Use these generic Node IDs when you are setting up custom systems that may/may not include the optional Tower Light for remote indication and that modify the number of K70s for stations and Direct Selects for mobile responders.

Generic K70 and Direct Select Node IDs

Node ID	Model Number	Station/Forklift #
1	K70XN*T2GRYQ	Station 1
2	K70XN*T2GRYQ	Station 2
...	K70XN*T2GRYQ	Station ...
Number of Stations	K70XN*T2GRYQ	Station ID = Total Number of Stations
Number of Stations + 1	DX80N*DSTS	Forklift 1
Number of Stations + 2	DX80N*DSTS	Forklift 2
...	DX80N*DSTS	Forklift ...
47 – Number of Tower Lights	DX80N*DSTS	Forklift ID = (47 – Number of Stations – Number of Tower Lights)
48 – Number of Tower Lights	TL70DXN*GYRQ	Tower Light 1
48 – Number of Tower Lights + 1	TL70DXN*GYRQ	Tower Light 2
...	TL70DXN*GYRQ	Tower Light ...
47	TL70DXN*GYRQ	Tower Light ID = Number of Tower Lights

Add a Wireless Tower Light for Remote Alarm Indication

Enable a TL70 Wireless Alarm Tower Light to show the OR'd Station Ok, Warning, and Alarm Status. Follow these instructions to add TL70 Wireless Alarm Tower Lights to the system.

For a list of approved accessories, see "Optional Accessories" on page 2.

1. Apply power to DXM and TL70 Wireless Alarm Tower Light.
2. On the DXM, go to **Registers › Number of Tower Lights** and press **Enter**.
3. Enter the number of TL70 Wireless Alarm Tower Lights that are going to be added and press **Send**.
4. Cycle the power to the DXM.
5. Bind the TL70 Alarm Tower Light to the DXM.

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a. On the DXM, go to **ISM Radio › Binding**.
b. Enter the Node ID (Node ID = 48 – **Number of Alarm Tower Lights**) for the Alarm Tower Light and press **Enter**.
c. On the Alarm Tower Light, press the binding button three times to enter binding mode. The Alarm Tower Light enters binding mode when LEDs flash alternating red and green. Binding is confirmed when the LEDs stay solid ON (appears orange) and flash consecutively four times.
d. Repeat step 5 for additional TL70 Alarm Tower Lights and increment the Node ID by 1 for each additional light.

Example: A system with 30 Stations, 12 Mobile Responders, and 5 Alarm Tower Lights

On the DXM: Set the **Number of Stations** register to 30. Set the **Number of Alarm Tower Lights** to 5. The Number of Mobile Responders = 47 – **Number of Stations** – **Number of Alarm Tower Lights** = 12.

Using the **Number of Stations** value (30) and the **Number of Alarm Tower Lights** value (5), the number of forklifts/mobile responders is 12. The Node IDs are consecutively ordered by stations (1–30), forklifts/mobile responders (31–42) and alarm tower lights (43–47).

The Node IDs for K70s at the stations are 1 through 30 (**Number of Stations**).

The Node IDs for the Direct Select Operator Interface Nodes for the forklifts/mobile responders are 31 (**Number of Stations** + 1) through 42 (47 – **Number of Alarm Tower Lights**).

The Node IDs for the TL70 Alarm Tower Lights are 43 (48 – **Number of Tower Lights**) through 47.

Reset the Station and Forklift Data Registers from the DXM

The station and forklift data registers in the system have a reset register that can be accessed using the DXM's display, Modbus registers, or Banner CDS. Set these registers to 1 to reset the data registers for the stations and forklifts. Register 821 resets the stations and register 822 resets the forklifts.

1. On the DXM: Use the arrows to select **Registers**.
   The registers are labeled **Reset Station Stats** and **Reset FL Stats**.
2. Select the appropriate register to reset.
3. Press **Enter**.
4. Change the value to 1 then press **Enter** three times.
   The reset register automatically returns to zero after the devices reset the data.

Reset the Station and Forklift Statistics from Banner CDS

1. Go to the **Dashboard › Sites** screen.
2. Select the **Dashboard** name where the Call for Parts Kit exists.
3. Toggle the **Reset FL Stats** or **Reset Station Stats** button based on what parameters need to be reset.
4. A pop-up window asks if you would like to trigger an update. Click **Yes**.
   An update to reset the statistics is sent to the DXM the next time the DXM pushes data to Banner CDS.

Configure the Kit for a Cellular Modem

By default, the DXM in the Call for Pars kit is configured for an Ethernet push interface to push information to Banner CDS or other web servers. To configure the system for a cellular push interface, configure the default XML file (221076.xml) for cell capabilities.

1. In the DXM Configuration Software: Load the Call for Parts configuration XML file (221076.xml).
2. Go to the **Settings › Cloud Services** screen and select **Cell** in the **Push Interface** drop-down list. If you are changing the configuring from **Cell** to **Ethernet**, select Ethernet and go to step 4.
3. In the **Settings › Cellular** screen, select the appropriate Cell Module that is connected to your DXM from the drop-down list.
4. Go to **File › Save** to save the changes to your configuration file.
5. Go to **DXM › Send Configuration to DXM** to upload the new configuration file to the DXM.

Push Information to BannerCDS

The DXM Wireless Controller can connect to the Web via Ethernet or an internal cell module. The controller pushes data from the DXM to be stored and displayed on a website.

The Banner platform for storing and monitoring the system's data is https://bannercds.com. The Banner Cloud Data Services website automatically generates dashboard content for the application that is populated onto the Dashboard. Email alerts can be configured using the Alarms screen.

To push data to the cloud, change register 844 to one (1).

For more information on creating accounts on and using the Banner Cloud Data Services (CDS) system, please refer to the Banner CDS Quick Start Guide (p/n 201126).

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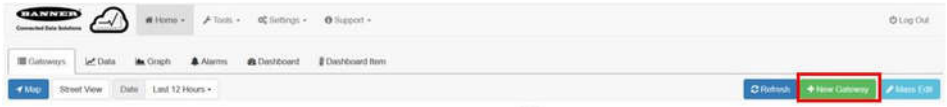
Create a New Gateway

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

1. Click on **+New Gateway**.
   Create a new Gateway/site for each device that will be sending data to the web server.

Create a New Gateway/Site



   A **Create New Gateway** prompt appears.
2. Verify **Traditional** is selected for the **Configuration**.
3. Enter a site name.
4. Under **XML Config**, select **Choose File** and upload the call for parts configuration XML file: **221076.xml**.
5. When prompted to generate a unique gateway ID, click **Yes** and then click **Get XML** when prompted to download the file. This generates a unique ID that needs to be loaded back into the DXM. Save this file for the next step.
6. Click **Create**.
   The Gateway/Site appears in the listing of devices on the **Gateways** screen and lists a status of **Waiting for device to connect**. After the DXM begins pushing data, the status changes to a green timestamp after a successful push.

Update the DXM with the Banner CDS Configuration

The DXM is automatically configured to push data to Banner CDS at five-minute intervals. No additional configuration changes are required after downloading the modified XML that was created for this application.

1. Within the DXM Configuration Software, connect to the DXM and go to the **File › Open** menu. Open the XML configuration file downloaded from Banner CDS for this application.
2. Send the updated XML to the DXM Controller using the **DXM › Send XML Configuration to DXM** menu.

Completing these steps 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.

Main dashboard screen



Refer to the BannerCDS website 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.

Add a Wired Indicator for Alarm Indication

An indicator light (tower or dome light) can be wired to the DXM700 to provide local status indication of the overall system performance.

The DXM700 has four PNP outputs. Three of these PNP outputs are used to show the OR'd Station ok, Warning, and Alarm Statuses. A compatible Indicator Light (PNP Input) is required for this task. The following example uses Banner's three-color Tower Light model **TL50GYR** (datasheet p/n 142406).

1. Wire the Tower Light's ground wire to the DXM's GD pin.
2. Wire the green segment wire (black/bk) to O1.
3. Wire the yellow segment wire (brown/bn) to O2.
4. Wire the red segment wire (white/wh) to O3.

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Interpreting the Status Registers

The station and forklift/mobile responder Nodes contain virtual status registers. These registers can be used to determine what state each station/forklift is in, as well as for calculating advanced metrics.

Registers 5001 through 5050 contain the status registers for the K70s at the stations. Registers 5501 through 5550 contain the status registers for the forklifts. The register's value determines what state the station/forklift is in.

Users can map this information to a PLC, HMI, or SCADA system for advanced analytics such as monitoring Individual station waiting times, station idle time, or forklift delivery times.

Local Registers for Status Register Values

DXM Registers	Register Value	Status	Station Description	Forklift Description
5001–5050 and 5501–5550	100	Idle	On status	On status
	200	Waiting	In queue and waiting to be the active caller	n/a
	300	Calling	Actively calling to stations	Receiving a call from a station
	400	Acknowledged	Has had call accepted	Accepted a call
	500	Served	Call was completed	Call was completed
	600	Dropped	Call was dropped by the forklift	n/a
	700	Reset	Unlatches the button	n/a
	900	Cancelled	Station cancelled call	Forklift cancelled the call

Visualizing Queue Position Data

The queue registers (6001 through 6300) contain the active queue data that can be sent to a PLC/HMI/SCADA for live monitoring of each station and forklift calling or being serviced. The following example shows how to visualize and interpret the queue data registers.

Queue Position	Stations		Call Time		Ack Calling Time		Forklift		Priority Level		Status	
	Register	Value	Register	Value	Register	Value	Register	Value	Register	Value	Register	Value
1	6001	13	6051	15	6101	5	6151	2	6201	2	6251	400
2	6002	7	6052	14	6102	4	6152	1	6202	1	6252	400
3	6003	5	6053	12	6103	3	6153	6	6203	0	6253	400
4	6004	9	6054	11	6104	1	6154	10	6204	1	6254	400
5	6005	25	6055	8	6105	2	6155	9999	6205	1	6255	300
6	6006	16	6056	4	6106	0	6156	9999	6206	1	6256	200
...	60xx	x	60xx	x	61xx	0	61xx	9999	62xx	0	62xx	200
46	6046	4	6096	7	6146	0	6196	9999	6246	0	6296	200

Local Registers

Local Registers for Supervisory Data

DXM Register	Register Name	Description	BannerCDS
801	Total Station Calls Made	Sum of all station calls made	x
802	Total Station Calls Cancelled	Sum of all station calls cancelled	x
803	Stations Avg Wait Time	Average of all station wait times (minutes), time from call made through call completed	x
804	Total Stations Waiting	Number of stations currently waiting for a call to be acknowledged	x
805	Total Stations In delivery	Number of stations that are currently acknowledged and in delivery	x
806	Total Forklift Calls Completed	Sum of all forklift calls completed	x
807	Total Forklift Calls Cancelled	Sum of all forklift calls cancelled	x
808	Forklifts Avg time to ACK	Average of all forklift time (minutes) to ack, time from call made through forklift ack	x
809	Forklifts Avg time to Serve	Average of all forklift time (minutes) to serve, time from call made through call completed	x
810	Stations OK	No stations in warning or alarm state	x

Continued on page 10

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Continued from page 9

DXM Register	Register Name	Description	BannerCDS
811	Stations Warning	A station is waiting longer than the warning time; OR'd value of all stations	x
812	Stations Alarm	A station is waiting longer than the alarm time; OR'd value of all stations	x
813	Queue Alarm State	Number of stations in the queue has exceeded the Queue Alarm Value. 1 = active; 0 = inactive	x

Local Registers for Parameters

DXM Register	Register Name	Description	Default Value	BannerCDS
821	Reset Station Stats	Resets station data registers. 1 = reset; register automatically changes back to 0.	0	Write Only
822	Reset FL Stats	Resets forklift data registers. 1 = reset; register automatically changes back to 0.	0	Write Only
851	Queue Alarm	Number of stations in queue that triggers a red flashing indicator on the Direct Select (Queue Alarm State)	7	x
852	FL Confirm Enable	Enables forklifts to confirm when a call has been completed by pressing the check button. 1 = enabled; 0 = disabled	1	
853	DSTS Backlight Timeout	Time (seconds) that the Direct Select backlight is ON when a command is sent to the Direct Select. Leaving the backlight on for long periods of time will significantly reduce battery life on the Direct Select.	2	
854	DSTS Green LED Timeout	Time (seconds) that the Direct Select green light is ON when a command is sent to the Direct Select.	2	
855	K70 Green ON	Enables the K70 green light to be always ON. 1 = enabled; 0 = disabled	0	
856	K70 Yellow Ack	Enables the K70 yellow light to be ON to acknowledge that a forklift has accepted the call. When disabled, the K70 green light will be ON to acknowledge. 1 = enabled; 0 = disabled	1	
857	Display Timeout	Time (minutes) that the display (numbers on DSTS) will stay ON	60	
858	Delay Mode	Enables a script delay that adds a four second wait time before starting another loop in the program. The system operates normally with this exception. This is helpful for troubleshooting the system and should be disabled during normal operation. 1 = enabled; 0 = disabled	0	
859	Warning Time	Time (minutes) that a station is in the queue before a yellow warning light turns ON	10	x
860	Alarm Time	Time (minutes) that a station is in the queue before a red alarm light turns ON	15	x
861	Number of Stations	Indicates the number of stations the solution will use. This value also determines the number of forklifts, where the number of forklifts = 47 – NumStations – NumTLs. The system cannot exceed 47 Nodes and the number of stations value must be below 47.	35	
862	Number of Alarm TL (Tower Lights)	Indicates the number of Tower Lights the solution will use. This value also determines the number of forklifts, where the number of forklifts = 47 – NumStations – NumTLs. The system cannot exceed 47 Nodes and the number of stations value must be below 47.	0	

Local Registers for Station Data

DXM Register	Register Name	Description	BannerCDS
5001–5050	Station # Status	Current status of the station, see "Local Registers for Status Register Values" on page 11	
5051–5100	Station # ON Time	Total time (minutes) station is ON from moment it is pressed until call is completed, see "Local Registers for Status Register Values" on page 11	
5101–5150	Station # OFF Time	Total time (minutes) station is OFF (idle)	
5151–5200	Station # Avg Serve Time	Average time (minutes) it takes for a call to be completed (start to finish)	
5201–5250	Station # Avg Wait Time	Average time (minutes) it takes for a call to be accepted by a forklift	
5251–5300	Station # Calls Cancelled	Number of times the station makes a call but cancels it before it is confirmed	
5301–5350	Station # Calls Made	Number of times the station button is pressed and a call is successfully completed	
5351–5400	Station # Alarm Status	Alarm state for each station, value of 0 = no alarm, 1 = warning, 2 = alarm	

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Local Registers for Status Register Values

DXM Registers	Register Value	Status	Station Description	Forklift Description
5001–5050 and 5501–5550	100	Idle	On status	On status
	200	Waiting	In queue and waiting to be the active caller	n/a
	300	Calling	Actively calling to stations	Receiving a call from a station
	400	Acknowledged	Has had call accepted	Accepted a call
	500	Served	Call was completed	Call was completed
	600	Dropped	Call was dropped by the forklift	n/a
	700	Reset	Unlatches the button	n/a
	900	Cancelled	Station cancelled call	Forklift cancelled the call

Local Registers for Forklift (FL) Data

DXM Registers	Register Name	Description	BannerCDS
5501–5550	FL # Status	Current status of the forklift (FL); see "Local Registers for Status Register Values" on page 11	x
5551–5600	FL # ON Time	Total time (minutes) the FL is ON (if the FL is getting a call or is actively in a call, this will increment)	x
5601–5650	FL # OFF Time	Total time (minutes) the FL is OFF (idle)	x
5651–5700	FL # Avg Serve Time	Average time (minutes) it takes a FL to complete a call (will only be calculated after the ACK has been made and if a call was completed)	x
5701–5750	FL # Avg Time to Ack	Average time (minutes) it takes for a FL to ack a call (will only be calculated if an ACK was performed and call completed)	x
5751–5800	FL # Total Availability	Total time (minutes) the FL is in ON but has not taken a call, total available time but not working/in a call	x
5801–5850	FL # Calls Cancelled	Number of times the FL cancels a call that was previously accepted but not completed	x
5851–5900	FL # Calls Completed	Number of times the FL has accepted a call and successfully completed it	x

Local Registers for Queue Position (QP) Data

DXM Register	Register Name	Description	BannerCDS
6001–6050	Station - QP	Station number If the Alt Station Display Number is used, this register will show that value. Else the Node ID for the station displays	
6051–6100	Call Time - QP	Total time (minutes) in queue	
6101–6150	Ack-Calling Time - QP	Time (minutes) since last state change while in queue	
6151–6200	Forklift - QP	Forklift number (not Node ID) that accepted/acknowledged the call. Value of 9999 when call is in queue but has not been accepted by a forklift. See "Default K70 and Direct Select Node IDs" on page 3.	
6201–6250	Priority Level	Priority level for the station (0, 1, 2, or 3)	
6251–6300	Station Status	Current status of the station	

Local Registers for Additional Parameters

DXM Register	Register Name	Description	Default Value	BannerCDS
7001–7050	Station Priority Level	Priority level for the station (Value of 0, 1, 2, or 3), with 3 being the highest priority level for the station.	0	Write only
7051–7100	Alt Station Display Number	Alternative ID for the station (value of 0 to 999), this will display on the Direct Select Operator Interface Node for that specific station, will also display on the station QP register. A value of 0 displays the station's Node ID.	0	Write only

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