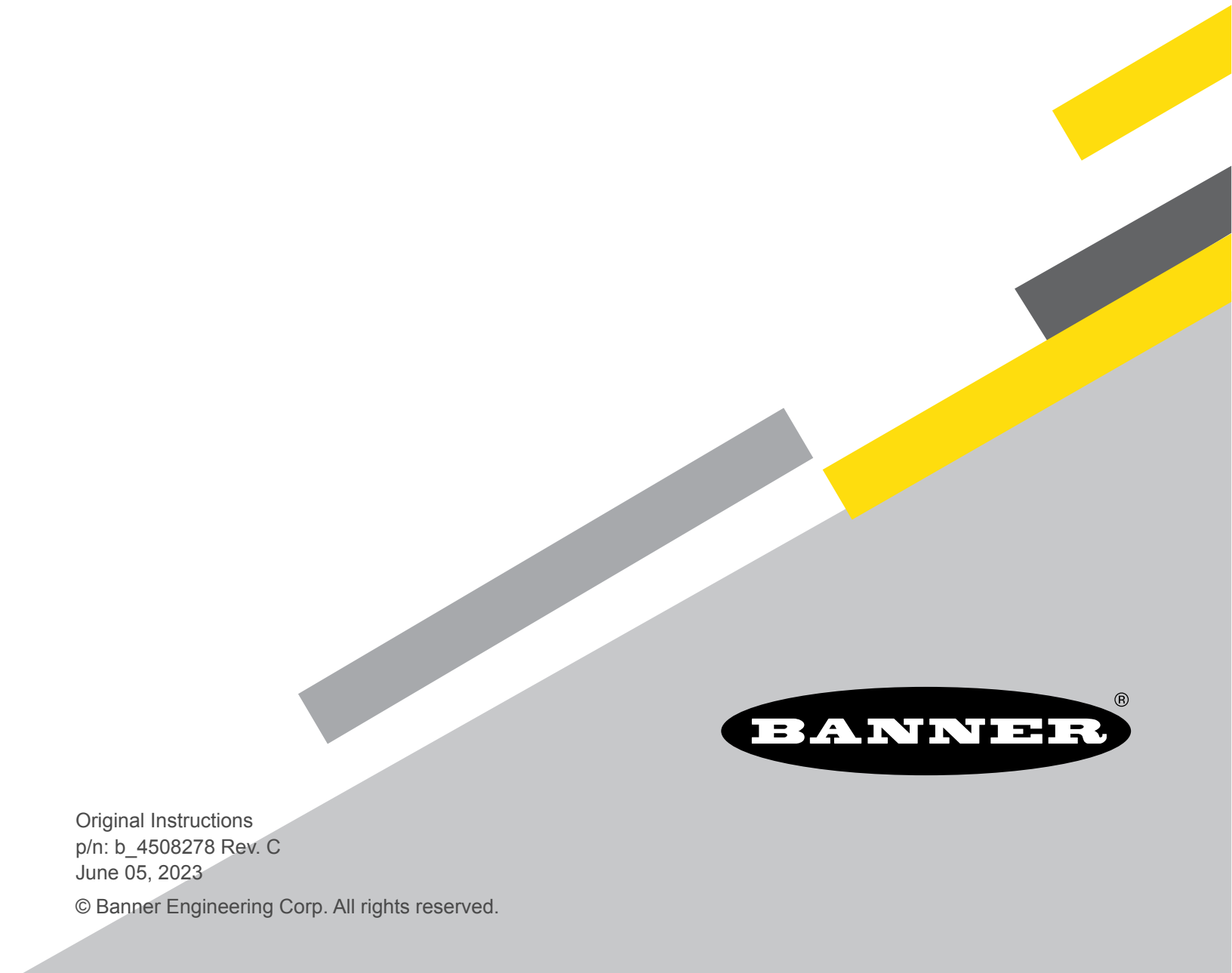
DXM Tips and Tricks



Original Instructions
p/n: b_4508278 Rev. C
June 05, 2023

Contents

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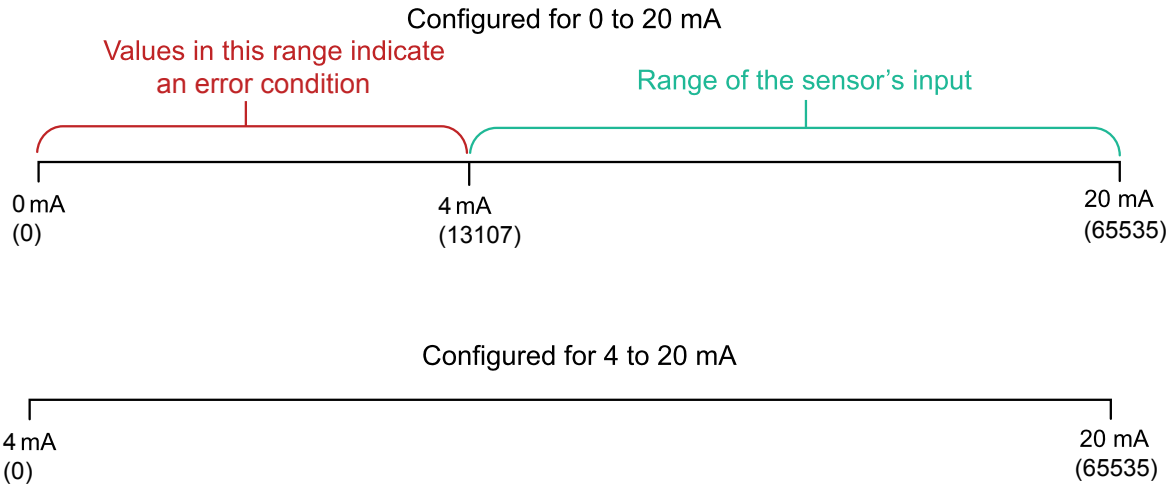
Chapter Contents

Chapter 1 Using 4–20 mA Sensors with 0–20 mA Inputs

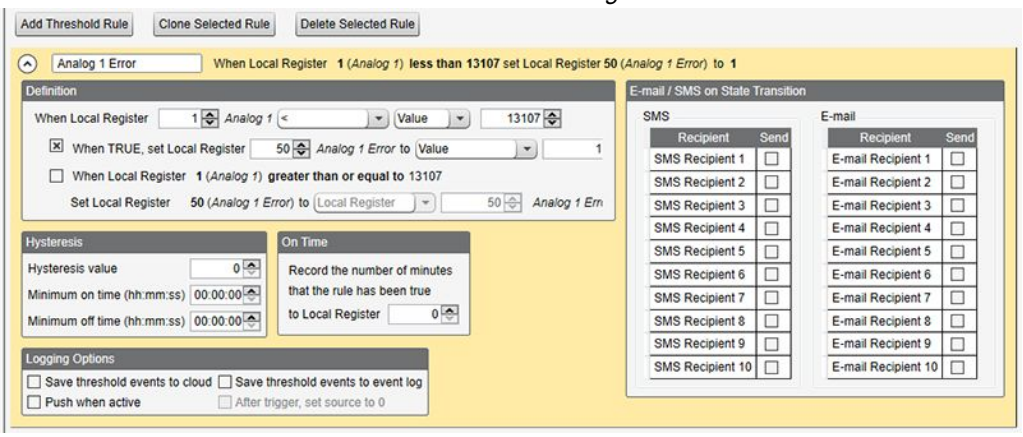
Sure Cross® devices allow analog inputs and outputs to use either 0–20 mA or 4–20 mA sensors. When using a 4–20 mA sensor with a 0–20 mA input, the sensor uses the 4–20 mA section of the total range.

Using a 4–20 mA with a 0–20 mA input allows you to determine when you have an error condition with the sensor. A normal input reading between 4 and 20 mA indicates a functioning sensor. A value below 4 mA indicates an error condition, such as a broken wire or loose connection. Banner recommends using 0–20 mA analog I/O with 4–20 mA sensors to retain the ability to detect errors.



Use **Threshold Rules** to define the error conditions. In this example, when the Analog 1 input value drops below 13107, an error register (Local Register 50 in this example) changes from 0 to 1 to indicate there is a problem with the analog sensor.

Threshold rules with the DXM Configuration Software



Using the 4 to 20 mA Range—If you want to only use the 4 to 20 mA range, use the DIP switches to configure the analog inputs/outputs. Using the full register range for only the 4–20 mA readings changes the 4 mA register value from 13107 to 0.

Converting the analog I/O to 4–20 mA removes the value range that could notify you of a physical problem with the sensor or wiring.

Document title: Using 4-20 mA Sensors with 0-20 mA Inputs
Part number: b_3087488
Revision: A

Chapter Contents

Chapter 2 Mixing Performance and Non-Performance (150 mW) Radios in the Same Network

To comply with federal regulations, the 150 mW radios and 1 Watt radios communicate differently. All Performance models offer the ability to select between 250 mW and 1 Watt operation using the DIP switches.

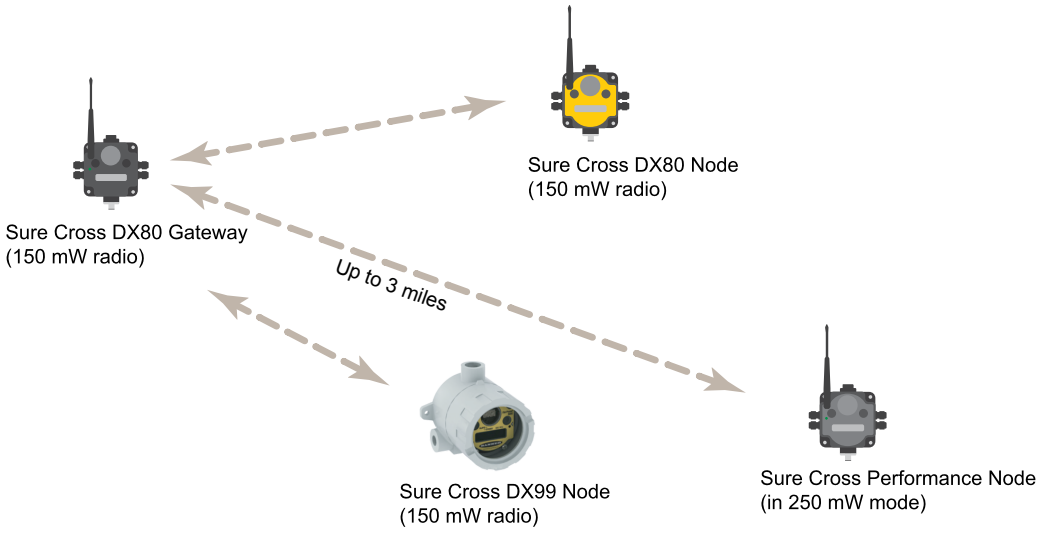
To mix Performance radios with non-Performance radios, refer to the product datasheet and:

- Operate Performance radios in 250 mW mode, not 1 Watt mode
- Set non-Performance (150 mW) radios to use Extended Address Mode

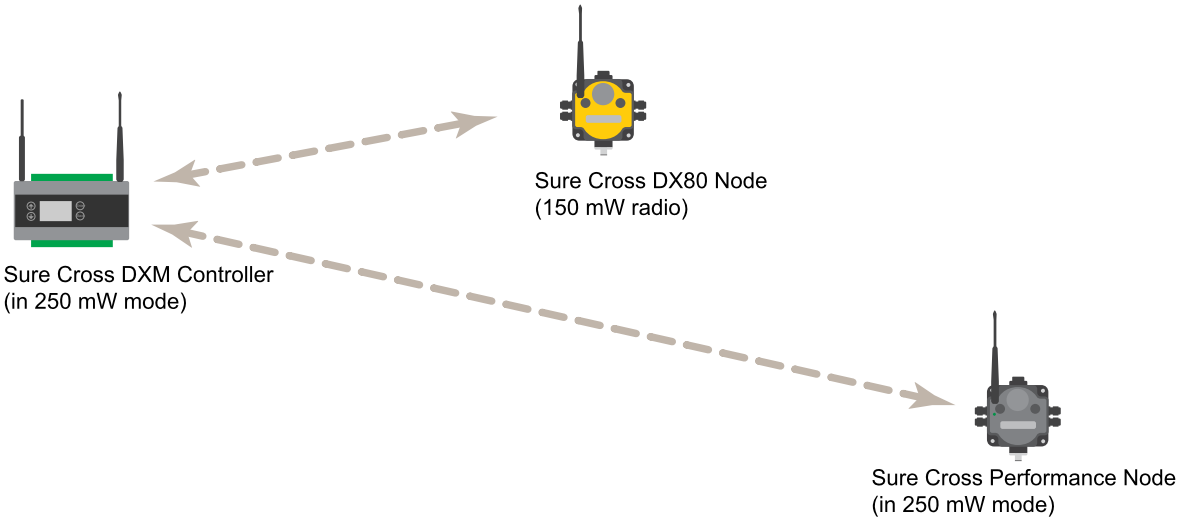
The 150 mW, 250 mW, and 1 Watt networks operate when collocated, but verify the antenna separation distance between a Gateway and Node or between two Gateways is at least 10 feet apart. For more detailed instructions about setting up your wireless network, refer to the following documents:

- DX80 Performance Quick Start Guide (p/n 128185)
- DX80 Performance Wireless I/O Network Instruction Manual (p/n 132607)
- DXM Quick Start Guide (p/n 191247)
- DXM Instruction Manuals (DXM100-Bx: 190037 and DXM150-Bx: 190038)

Performance radio network with Gateway and Nodes



Performance radio network with a DXM and Nodes



Document title: Mixing Performance and Non-Performance Radios in the Same Network
Part number: b_3089494
Revision: A

Chapter Contents

Chapter 3 How Do You Monitor System Health?

The Gateway monitors the radio link status in a DX80 system using one of two methods: polling or heartbeat. Each method has different properties and is useful in different system configurations. Some system configurations may require both methods to be used. Independent of the method, the status indication is stored in each device's Modbus register eight.

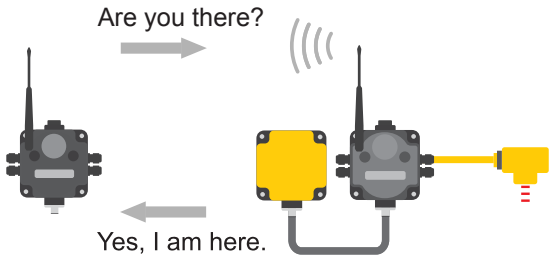
Polling

A polling message originates from the Gateway to Nodes. When a Node receives a polling message, it is expected to immediately respond to the Gateway, indicating the link is operational.

There are no retries on a polling message, just a single attempt of communication between the Gateway and Node. If the message fails, the Gateway increments a missed message counter. A successfully received message resets the missed message counter back to zero. When the maximum number of missed messages is reached, the link is considered bad.

The length of time to determine a radio link error is: **Health Polling Interval** × **Maximum Bad Count**.

A Gateway polling a Node



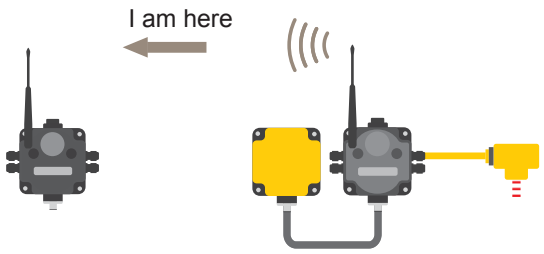
Heartbeat

Heartbeat mode is driven by the Node. The Node sends a heartbeat message to the Gateway based on a specific time interval.

The Node resends the message when the message is not acknowledged by the Gateway. Use the configuration software to define the heartbeat interval for each Node in the network using the Node's parameters.

The Gateway is programmed to expect a message from each Node within the Node Heartbeat RX interval. If the Gateway determines that a Node has not checked in within a specified interval and within the defined number of misses, the radio link is considered to be bad. The maximum time an error is detected will be between one and two heartbeat intervals.

A Gateway and Node exchanging heartbeat signals



Do I Use Heartbeat Mode or Polling?

By default, the DX80 wireless network uses Polling to determine network health in 10-30 V DC-powered devices and Heartbeat mode for battery-powered devices.

Polling is the most flexible method for a variety of 10–30 V DC-powered applications. Polling can be programmed to be fast or slow, but it will drain battery-powered devices quickly when the polling interval is not set to 16 seconds or longer.

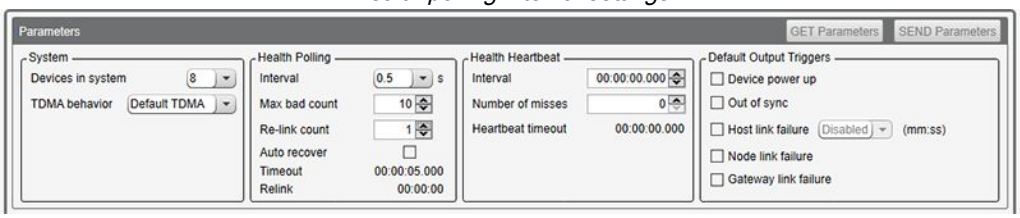
The Heartbeat method is engineered to be more efficient for battery devices. Although radio link failures may not be determined as quickly as with Polling, Heartbeat Mode is more efficient for most battery-powered networks.

For networks containing both battery-powered and 10–30 V DC powered devices, both Polling and Heartbeat modes are used to determine the radio link status. Using both methods results in a programmable error detection time for 10–30 V DC devices and a more efficient interaction (and increased battery life) for battery-powered devices.

Using the latest version of the configuration software:

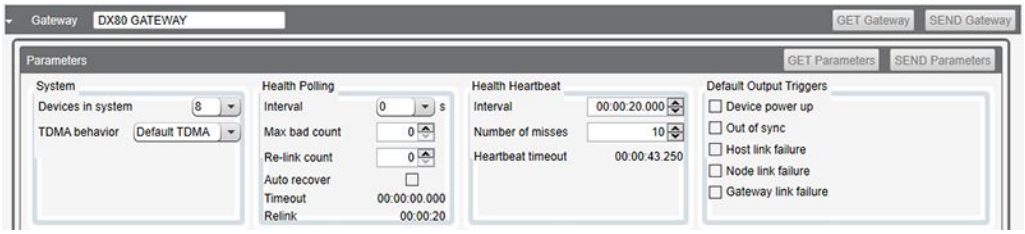
1. Go to the **Configuration › Device Configuration** screen.
2. Click the arrow next to the **Gateway** device to display the **Parameters**.
3. Set either the **Health Polling** or **Health Heartbeat** parameters.
    - **Polling**—For 10–30 V DC powered devices, set the **Health Polling interval** to 4 seconds with a **Max bad count** of 16. This allows the system to detect a bad radio link within 64 seconds.

Health polling interval settings



    - **Heartbeat**—Set the Health **Heartbeat Interval** to 2 minutes and 30 seconds and the **Number of misses** to 16 to get a **Heartbeat Timeout** of 5 minutes and 4 seconds. The **Heartbeat Timeout** interval is calculated using the **Heartbeat Interval**, the **Number of misses**, and the speed of the device. Using these settings, a bad radio link for battery-powered devices would be detected within 5 minutes and 4 seconds.

Health heartbeat settings



To set the ISM radio settings on a DXM Wireless Controller, you must use the DX80 Performance Configuration Software.

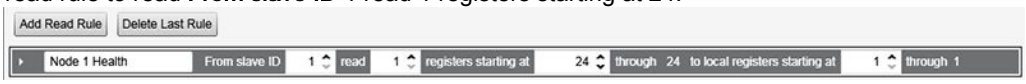
Map a Node's Lost Link Output to a DXM Controller

Mapping a Node's lost link output to its master radio allows you to trigger an alarm or light or to send email or text message notifications.

Because of heartbeat and polling, the link loss notification is not immediate. There is some time between when the radio loses communication and when it drops out of the wireless network. For more information on heartbeat and polling, please refer to Monitoring System Health.

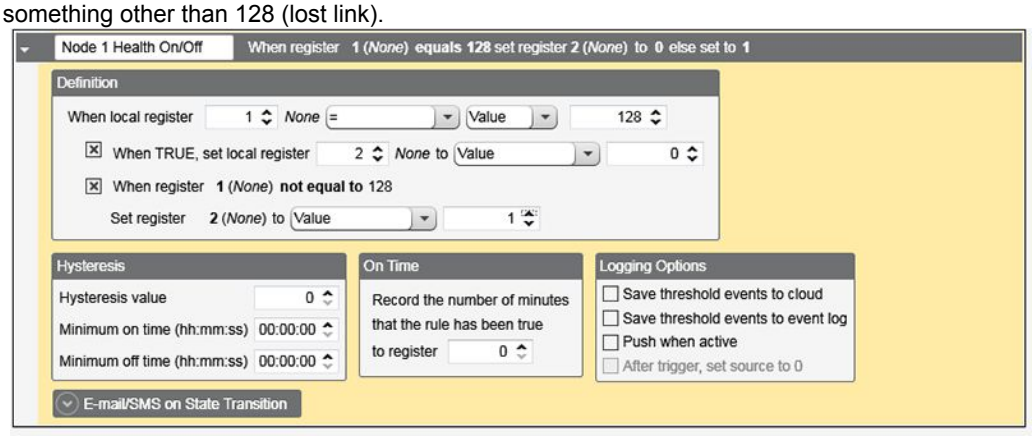
It is important to know that I/O 8 on every Node is reserved as the "health" register. If there is a 128 in this register, there is good communication between the Node and the DXM. Any other value indicates a communication issue.

1. Go to the **Register Mapping › RTU › RTU Read** screen.
2. Click **Add Read Rule**.
   A new read rule opens and is read to be defined.
3. Name your read rule.
   For this example, the rule is named Node 1 Health.
4. Define the read rule to read **From slave ID** 1 read 1 registers starting at 24.



   Node 1's I/O point 8 (the health register) is in register 24 for the wireless network. This rule stores the data from the health register of Node 1 into the DXM's local register 1.

5. Go to the **Local Registers › Action Rules › Thresholds** screen.
6. Click **Add Threshold Rule** and click the arrow next to the new rule to display the parameters.
7. Name and define a threshold rule for the DXM's local register 1 to determine when the value is 128 (good communication) or something other than 128 (lost link).



   This threshold rule sets local register 2 to 0 when Node 1 is in the network and sets local register 2 to 1 when Node 1 has dropped out of the network. Use local register 2 to turn on an LED when the Node has lost its radio link with its master radio.

8. To turn on a DXM LED, go to the **Register Mapping › RTU › RTU Write** screen.
9. Click **Add Write Rule**.
10. Define a Write Rule to write a local register from 2 (Node 1 Health On/Off), to slave ID 201 (Slave ID of the DXM display) starting at register 1103 (Output LED 2, red light on DXM display) through 1103.

   When Node 1 drops out of the wireless network, the red light (LED 2) on the DXM display turns on.

Initial Steps and Equipment Needed

Follow these steps to monitor a Modbus Banner Engineering sensor connection and/or operation status when the sensor is connected to a MultiHop radio or a DXM Controller with an embedded MultiHop module.

Required equipment includes:

- Wireless DXM Controller master with a MultiHop radio module
- Wireless DXM Controller slaves and/or MultiHop slave radios
- Modbus sensor such as the Temperature/Humidity Modbus Sensor model M12FTH3Q, or an SDI-12 sensor
- Windows-based PC running the DXM Configuration Tool v3 (downloaded from the Banner website)

To confirm an active radio communication between the sensor and radio, define **Read Rules** and **Action Rules**. Use two local registers to monitor each Modbus RTU sensor. Use an optional third register to monitor how long the sensor was not communicating with the radio.

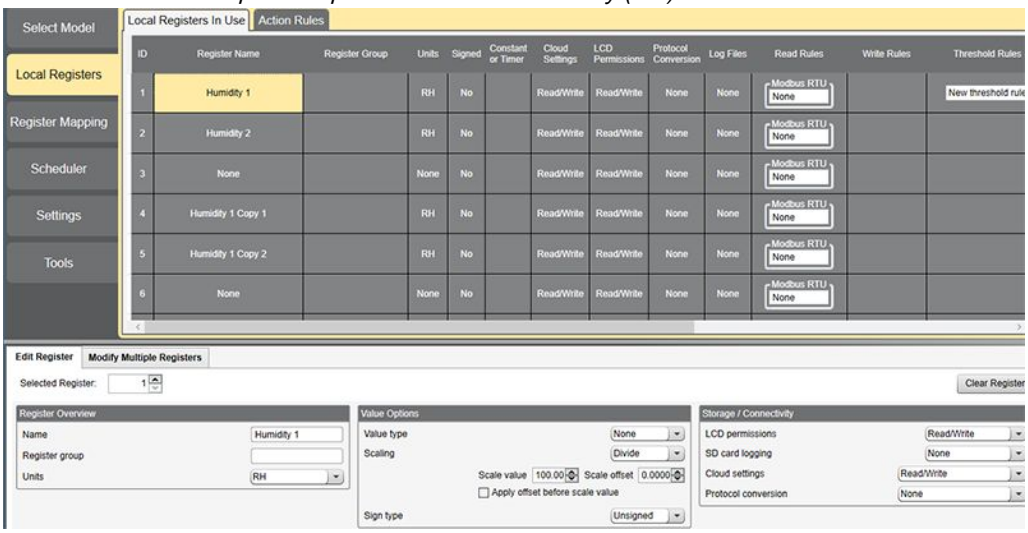
1. Connect to the DXM Controller master radio using serial or TCP/IP.
2. Define the **Local Registers**.
3. Define the **Read Rule**.
4. Define the **Threshold/Action Rule**.
5. Repeat these steps for each Modbus sensor and MultiHop slave radio you'd like to track.

Define the Local Registers

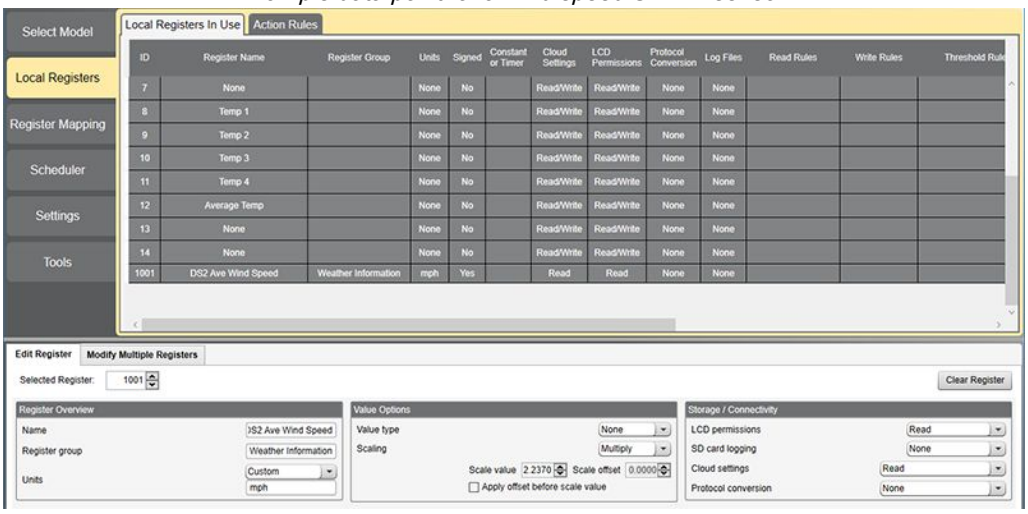
Define the local registers used to verify the connection between a Modbus sensor and a MultiHop radio.

1. Go to the **Local Registers › Local Registers in Use** screen.
2. Define a register to hold a data point.

Example data point for a relative humidity (RH) Modbus sensor.

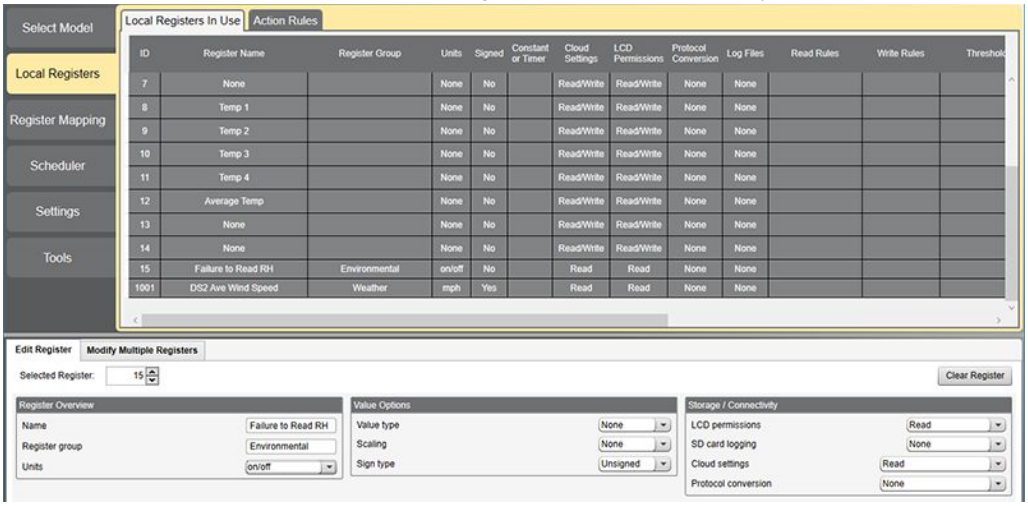


Example data point for a wind speed SDI-12 sensor.

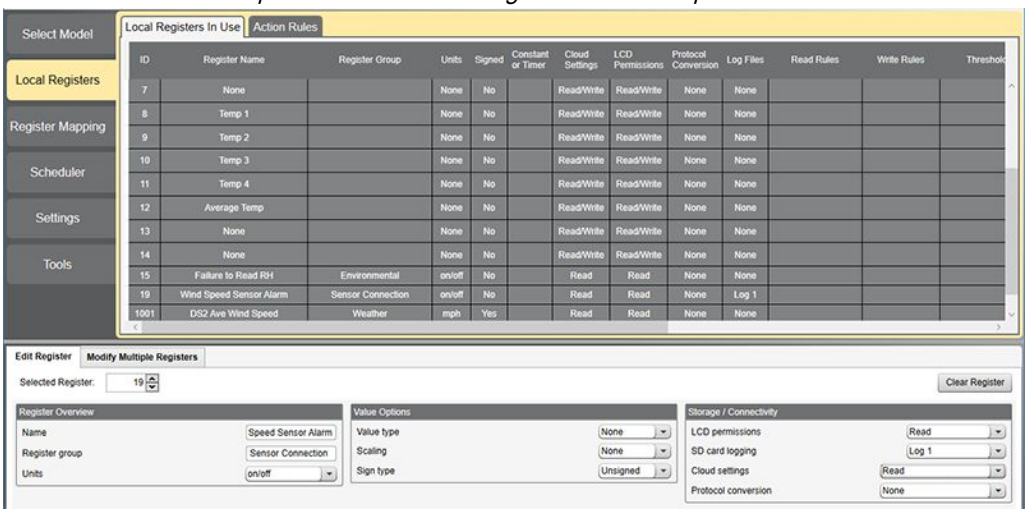


3. Define a register to be used as an alarm notification register when the MultiHop radio cannot communicate with the sensor.

Example alarm notification register for a relative humidity sensor.

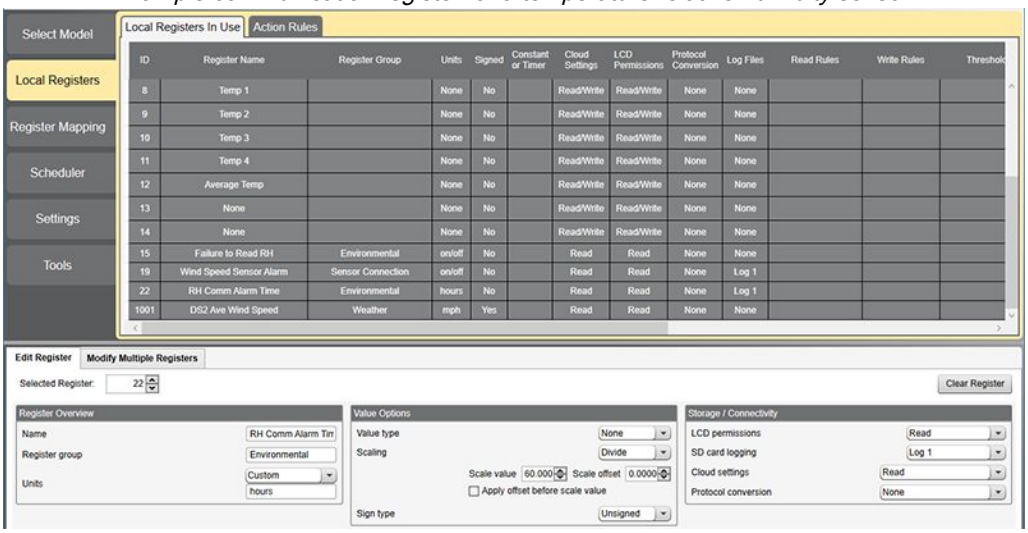


Example alarm notification register for a wind speed sensor.



4. Define a register to be used to track how long the Modbus sensor was not communicating with the master radio.

Example communication register for a temperature/relative humidity sensor.

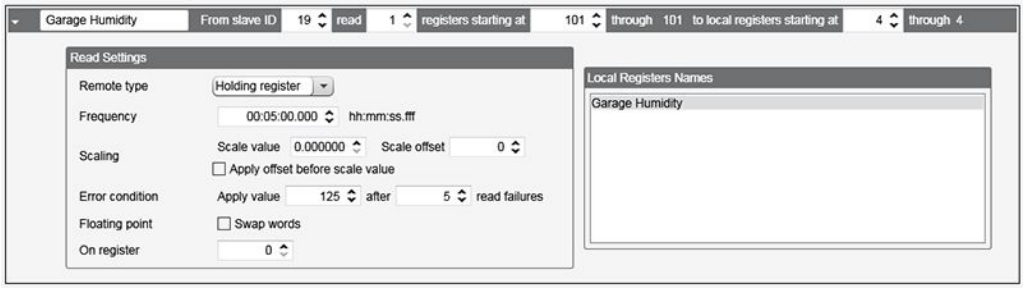


Create a Read Rule

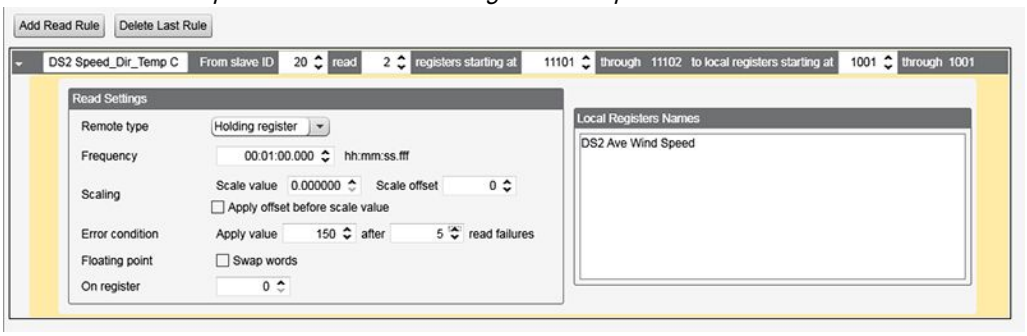
Create a Read Rule to define how often to read the sensor register and what to do if the communication attempt fails.

1. Go to the **Register Mapping › RTU › RTU Read** screen.
2. Click **Add Read Rule** to create a Read Rule.
3. Name the Read Rule and define from which slave ID this register is being read, how many registers are being read, and the starting register.
4. Define how often to read this register (**Frequency**).
5. Define what value should be written to the register (**Apply value**) after the number of failed read attempts (**read failures**).

Example read rule for monitoring the relative humidity sensor connection..



Example read rule for monitoring the wind speed sensor connection.



For the relative humidity example, local register 4 (Garage Humidity) will be populated with the value from Modbus ID 19, register 101. The DXM master radio attempts to communicate with the Modbus sensor (Slave ID 19) every 5 minutes. After five consecutive unsuccessful attempts, the value of 125 is placed in the local register 19 (Failure to Read Garage RH).

For the wind speed example, local register 1001 (DS2 Wind Speed) will be populated with the value from Modbus ID 20, registers 11101 and 11102. The DXM master radio attempts to communicate with the Modbus sensor (Slave ID 20) every 1 minute. After five consecutive unsuccessful attempts, the value of 150 is placed in the local register 19 (Failure to Read DS2 Wind Sensor).

> **NOTE:** You must place the SDI-12 sensor results in the 32-Bit Floating Point Register set in the DXM Controller. When using an SDI-12 sensor and an SDI-12 enabled MultiHop radio, when the DXM master or remote radios cannot communicate with the sensor, a value of 65535 is entered into the Results Register for that sensor in the Local Registers.

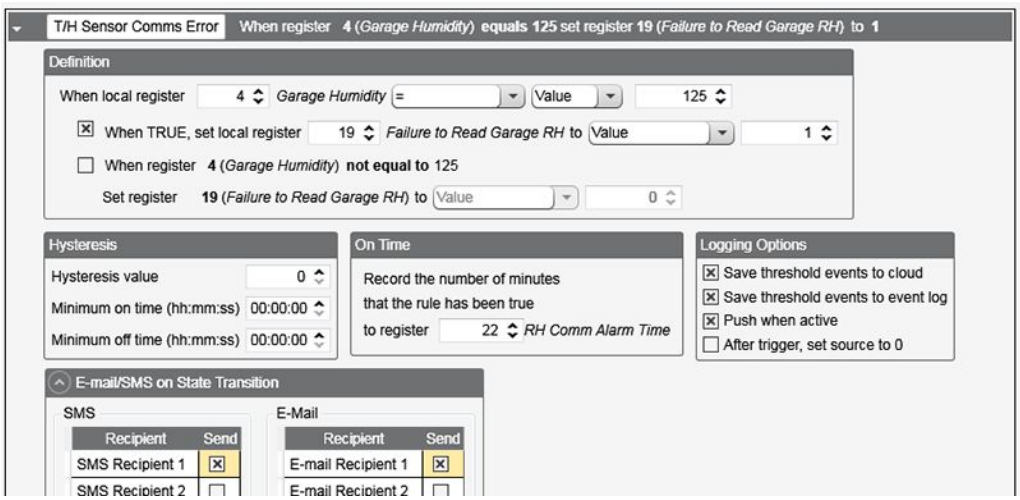
Select an alarm value that makes sense for the potential values of the application, but won't adversely affect graphing or charting the data point for analysis. For the RH example, the normal value for this local register is between 0 and 100. Therefore, 125 is not too excessive but is different enough to be a trigger value. For the wind speed example, 150 is a good choice.

Create a Threshold Rule

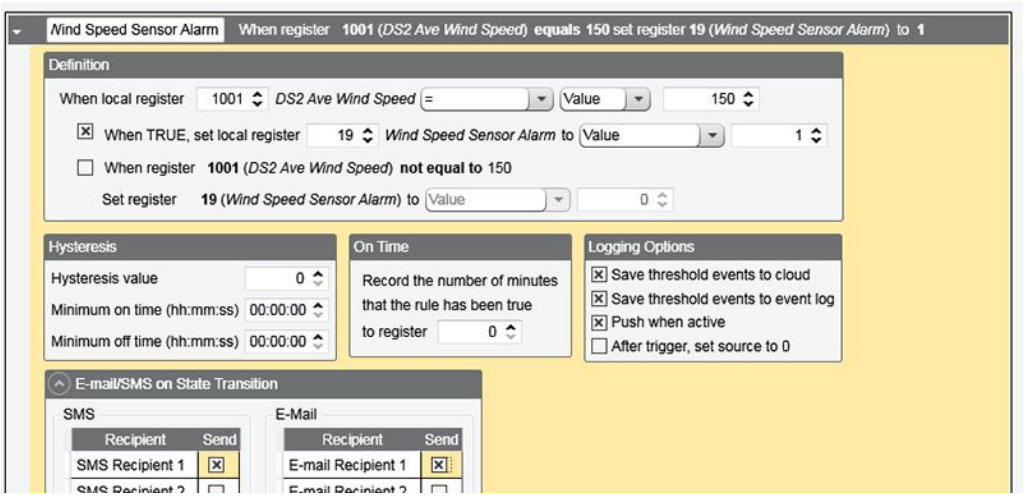
Create an action rule to define the behavior of the system when the communication fails.

1. Go to the **Local Registers › Action Rules › Thresholds** screen.
2. Click **Add Threshold Rule**.
3. Define a **Threshold Rule** so that when the local register Failure to Read value equals the error value (125 for relative humidity, 150 for wind speed), a value of 1 is entered into the Communication Alarm register.

Example threshold/action rule for a humidity sensor communication failure.



Example threshold/action rule for a wind speed sensor communication failure.



For the relative humidity example, when this register's value equals 1, local register 22 tracks how long this Modbus sensor was not able to be reached. The alarm is sent to the web server service, and the event is logged in the Events Log on the DXM. A message is sent to one SMS recipient and one email recipient, although you can configure it to send more messages if necessary.

Chapter Contents

Chapter 4 Modbus Communication Timeouts

A Modbus timeout is the amount of time a Modbus server is given to return an acknowledgment of a message sent by the Modbus client. If the Modbus client waits for the timeout period and no response is seen, the Modbus client considers it a lost message and continues on to the next operation.

The timeout parameter is simple to set for Modbus devices directly connected to the DXM Controller, if there are no MultiHop wireless devices. Special considerations need to be made to set the timeout parameter when a MultiHop network uses the DXM Controller as the client radio.

Configure controllers operating wireless networks to allow for enough time for hardware transmission retries. Set the **Communications Timeout** parameter to cover the expected time for messages to be sent throughout the wireless network. For the DXM Controller, the **Communications Timeout** parameter is the maximum amount of time the DXM Controller should wait after a request is sent until the response message is received from the Modbus server device. Use the DXM Configuration Software to set the timeout parameter on the **Settings › System** screen (select **Show advanced settings**).

The default setting for the timeout parameter is 5 seconds.

MultiHop Networks vs DX80 Star Networks

The DX80 star Gateway collects all the data from the Nodes, which allows the host system to directly read the data from the Gateway without sending messages across the wireless network. This allows for DX80 Gateway to be treated like any other wired Modbus device.

In a MultiHop network, the data resides at each device, forcing the controller to send messages across the wireless network to access the data. For this reason, carefully consider the value of the wireless timeout parameter.

Calculating the Communications Timeout for Battery-Powered MultiHop Radios

Battery-powered MultiHop radios are configured to run efficiently to maximize battery life. By optimizing battery life, the allowed communications window to receive messages is slow (once per 1.3 seconds) and sending message rates are standard (once per 0.04 seconds).

A MultiHop device is set from the factory with the retry parameter of 8. This means that under worst-case conditions, a message is sent from the DXM Controller to an end device a total of nine times (one initial message and eight retry messages). The end device sends the acknowledgment message back to the DXM Controller a maximum of nine times (one initial message and eight retries). A single Modbus transaction may send up to two messages + 16 retry messages before the transaction is complete. In addition, the radios randomly wait up to one time period before retransmitting a retry message. So to allow for the random wait time, add one extra time period for each in-between time of retries.

To calculate the communication timeout parameter for a client to a server radio (no repeaters):

Client to Server Send time = (9 × 1.3 sec) + (8 retry wait × 1.3 sec) = 22 seconds
Server to Client Send time = (9 × 0.04 sec) + (8 retry wait × 0.04 sec) = 1 second
Total Send/Receive time = 23 seconds
Minimum Timeout period = 23 seconds

If the link quality of the network is poor, the maximum transfer times may happen. Set the timeout parameter to accommodate the maximum number of retries that may happen in your application.

When MultiHop repeaters are added to the wireless network, each additional level of hierarchical network increases the required timeout period. Since MultiHop repeaters are running at the highest communications rate, the overall effect is not as great.

Client to Repeater Send time = (9 × 0.04 sec) + (8 retry wait × 0.04 sec) = 1 second
Repeater to Client Send time = (9 × 0.04 sec) + (8 retry wait × 0.04 sec) = 1 second
Additional Timeout period for a repeater = 2 seconds

Using the timeout calculation above of 23 seconds, if a repeater is added to the network the timeout should be set to 25 seconds. For each additional MultiHop repeater device creating another level of network hierarchy, add an additional two seconds to the timeout period.

Adjusting the Receive Slots and Retry Count Parameters

The number of receive slots governs how often a MultiHop device can communicate on the wireless network.

Battery-powered devices typically have DIP switches that allow the user to set the number of receive slots, which directly affects the battery life of the radio. Adjusting the receive slots changes how often a message can be received. By default, the receive slots are set to 4 (every 1.3 seconds). When the receive slots are set to 32, the radio listens for an incoming message every 0.16 seconds.

Users may also leave the retry mechanism to the application that is accessing the wireless network, in this case the DXM Controller. Adjust the number of retries in the MultiHop devices by writing the number of retries desired to Modbus register 6012. The factory default setting is 8.

Calculating the Communication Timeout for 10–30 VDC Multi-Hop Radios

Line-powered (10–30 V DC) MultiHop devices operate at the maximum communication rate, resulting in a much lower timeout parameter setting. For each repeater added to the network, increase the timeout parameter 2 seconds.

For a client radio to a 10–30 V DC powered server radio (no repeaters):

Client to Server Send time = (9 × 0.04 sec) + (8 retry wait × 0.04 sec) = 1 second
Server to Client Send time = (9 ×* 0.04 sec) + (8 retry wait × 0.04 sec) = 1 second
Total send/receive time = 2 seconds
Minimum timeout period = 2 seconds

Calculating the Communication Timeout for a DX80 Star Network

In the DX80 network, all Node data is automatically collected at the Gateway to be read. The DXM Controller does not use the wireless network to access the data, which allows for much faster messaging and much lower timeout values.

For a DXM Controller with an internal DX80 Gateway, set the timeout value 0.5 seconds. If other Modbus devices are connected to the RS-485 lines, the timeout parameter governs all communication transactions and must be set to accommodate all devices on the bus.

Document title: Calculating the Communication Timeout on a DXM Controller
Part number: b_4462766
Revision: A

Chapter Contents

Chapter 5 Interpreting Register Values in the Banner Wireless System

The units conversion table defines the type and range of values for each type of I/O.

The wireless devices have many different units of measure for inputs including: milliamp (mA), voltage (V), temperature (°C or °F), humidity (RH), or a raw 16-bit or 32-bit value. Outputs can be either current (4 to 20 mA, 0 to 20 mA) or voltage (0 to 10 V DC). All values stored in Modbus registers are unsigned numbers, except for temperature readings. The temperature readings are stored as signed numbers (two's complement).

The following table defines the range of values and descriptions for input units.

Register values

Input Type	I/O Range		Holding Register Representation		Data Conversion	Description
	Min.	Max.	Min.	Max.		
Discrete	0	1	0	1	-	-
0 to 20 mA	0.0 mA	20.0 mA	0	65535	(20 mA ÷ 65535) × Reg Value = mA	Linear mapping of unsigned register value to current
4 to 20 mA	4.0 mA	20.0 mA	0	65535	((16 mA ÷ 65535) × Reg Value) + 4 = mA	Linear mapping of unsigned register value to current
0 to 10 V dc	0.0 V DC	10.0 V DC	0	65535	(10 V ÷ 65535) × Reg Value = V	Linear mapping of unsigned register value to voltage
Temp C/F (high resolution)	–1638.3	+1638.4	0	65535	(Converted Reg Value) ÷ 20 = Temp	Signed Values
Counter	0	65535	0	65535	-	-
16-bit T30UF	0 mm	65535 mm	0	65535	None; stored as millimeter value	Unsigned
Humidity	0% RH	100% RH	0	10000	(Reg Value) ÷ 100 = Relative Humidity (RH)	Unsigned

Temperature Measurements:

- In high resolution mode, the temperature = (Modbus register value) ÷ 20. For high resolution temperature input, 0 in the register is interpreted as 0° and 65535 in the register (0xFFFF) is interpreted as −1 ÷ 20 = −0.05°.
- In low resolution mode, the temperature is (Modbus register value) ÷ 2. For low resolution temperature input, 0 in the register is interpreted as 0° and 65535 in the register (0xFFFF) is interpreted as −1 ÷ 2 = −0.5°. The I/O range values are –16383 through 16384.

When using a 4 to 20 mA sensor with a 0 to 20 mA input, the sensor uses the 4 to 20 mA section of the total range. Using a 4 to 20 mA with a 0 to 20 mA input allows you to determine when you have an error condition with the sensor. A normal input reading between 4 and 20 mA indicates a functioning sensor whereas a value below 4 mA indicates an error condition, such as a broken wire or loose connection. Some Sure Cross devices allow you to configure the analog inputs and outputs to use either 0 to 20 mA or 4 to 20 mA.

Signed Numbers

Temperature values are stored in Modbus registers as two's complement signed numbers. Using two's complement allows negative numbers to be stored in Modbus registers.

Although not technically a sign bit, the most significant bit (MSB) indicates a negative number when the value is set to one (1). When the most significant bit is zero (0), the value is greater than or equal to zero.

Modbus register values of 32768 through 65535 (decimal) represent negative temperatures. These numbers in binary form are: 1000 0000 0000 0000 through 1111 1111 1111 1111.

To convert to a negative temperature value from a Modbus register value, first convert the value from the two's complement number. To convert from a two's complement number in binary form, invert all the bits (0 changes to 1, 1 changes to a 0), then add 1. Convert this binary value to a decimal value and divide by either 20 (high-resolution mode) or 2 (low-resolution mode) to calculate the negative temperature.

Defining the signed numbers

Register Value (Two"s Complement)	Register Value (Decimal)	Converted Decimal	Calculated Temperature (Converted Decimal ÷ 20)
0000 0000 0000 0101	5	5	0.25
0000 0000 0000 0100	4	4	0.20
0000 0000 0000 0011	3	3	0.15
0000 0000 0000 0010	2	2	0.10
0000 0000 0000 0001	1	1	0.05
0000 0000 0000 0000	0	0	0
1111 1111 1111 1111	65535	-1	-0.05
1111 1111 1111 1110	65534	-2	-0.10
1111 1111 1111 1101	65533	-3	-0.15
1111 1111 1111 1100	65532	-4	-.20
1111 1111 1111 1011	65531	-5	-0.25
1111 1100 0001 1000	64536	-1000	-50

Document title: Interpreting Register Values in the Sure Cross® Wireless System
Part number: b_3100627
Revision: A

Chapter Contents

Chapter 6 Using Action Rules to Control External Sensors

Action rules allow for simple logic functions and simple manipulation of local register data. The processing of an action rule is autonomous from other local register functions.

- Threshold rules create event-driven conditions, such as events to the cloud, local logs, or an email address
- Register Copy rules copy the contents of one register to another
- Math/Logic rules deal with 32-bit register logic with results from 0 to 4,294,967,295
- Control Logic rules are binary rules, with the results being either 0 or 1
- Trending rules find average, minimum, and maximum values
- Tracker rules monitor a Local Register value and store the result of a function in another register

The DXM can control external sensors using the timer/counter feature and Action Rules. In this example, the DXM controls a sensor using a cyclical loop with a timer. To configure this application, you must

1. Define the Local Registers
2. Define the Read/Write Rules
3. Define the Action Rules

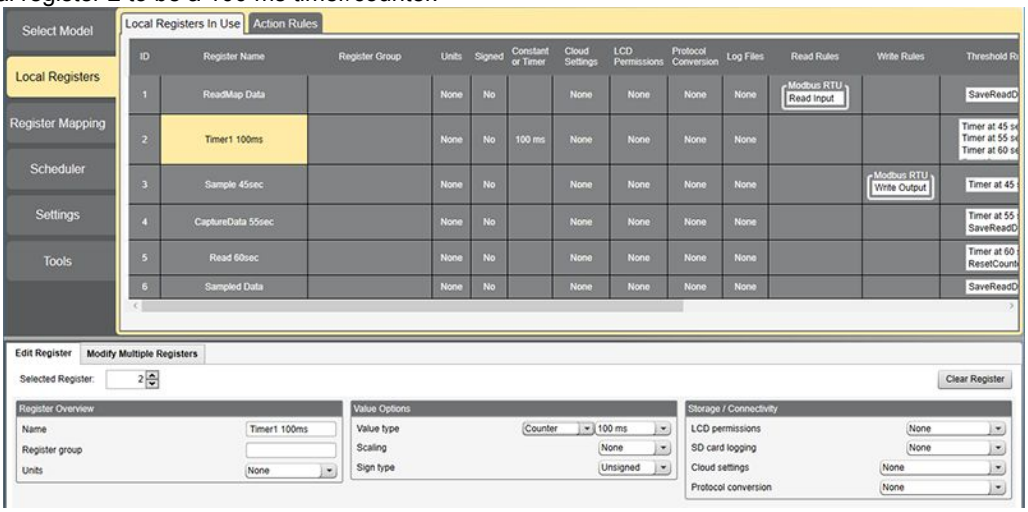
One of the local registers is defined as a timer, which starts counting at zero. When 45 seconds has passed, the output is turned on to supply power to the sensor. At 55 seconds, the data is captured from the I/O board and saved. At 65 seconds, the output is turned off and the counter reset.

Define the Local Registers

Use the DXM Configuration Software to define the local registers needed to control the external sensor.

This task assumes you have downloaded and installed the latest version of the DXM Configuration Software onto a Windows-based PC.

1. Go to the **Local Registers › Local Registers in Use** screen.
2. Name local register 1 to contain the read data from the DXM I/O board.
3. Define local register 2 to be a 100 ms timer/counter.



4. Name local register 3 to hold the result of Action Rule 1 (when the timer/counter reaches 45 seconds, this register value is 1).
5. Name local registers 4 and 5 to hold the results of Action Rules 2 and 3.
6. Name local register 6 as the saved sensor data.
7. Set the LCD permission to Read on all registers so that the register values display on the LCD.

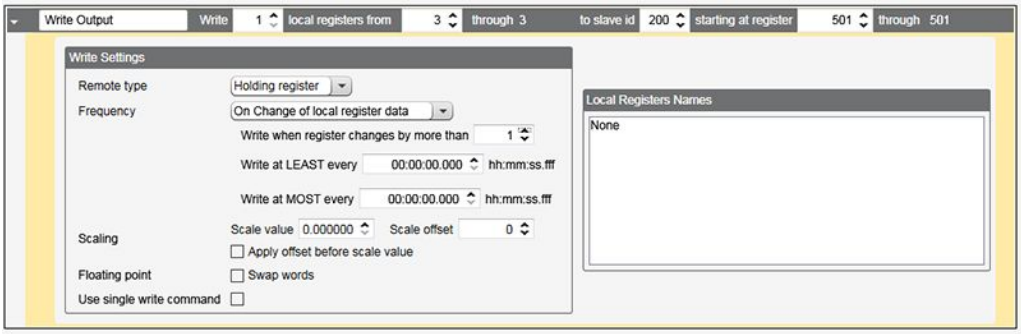
After this configuration file is saved and uploaded to the DXM, the register values display on the LCD under the **Register** menu.

Create the Read and Write Rules

Use Read/Write maps to write local register values to other Modbus devices or read Modbus registers from other Modbus devices.

For our example, the DXM I/O board is another Modbus device (slave ID 200) to read to or write from.

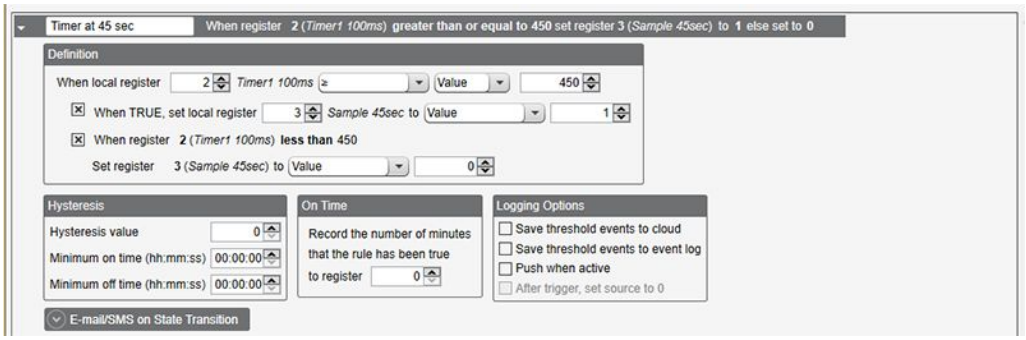
1. Go to the **Register Mapping › RTU › RTU Read** screen. Click **Add Read Rule**.
   A new read rule is created.
2. Click the arrow next to the new read rule to display the parameters.
3. Name your read rule.
4. Enter the **From slave ID** and the number of registers to read from.
   For this example, we want to read from slave ID 200, the DXM100 I/O board (the DXM700 I/O board is slave ID 203).
5. Enter the frequency you'd like to read from this register.
   For our example, we'd like to read the selected register every 1 second.
6. Go to the **RTU Write** screen and click **Add Write Rule**.
   A new write rule is created.
7. Click the arrow next to the new write rule to display the parameters.
8. Name your write rule.
9. Enter the parameters to write from the local register to the target register.
   For our example, we have to write from local register 3 to a holding register on slave ID 200, register 501. This writes a local register to an output on the DXM I/O board (slave ID 200) to control the power to the external sensor. We want to write at a **Frequency** of **On Change of local register data** so that the output register 501 only changes when the local register value changes from 0 to 1.



Create the Action Rules

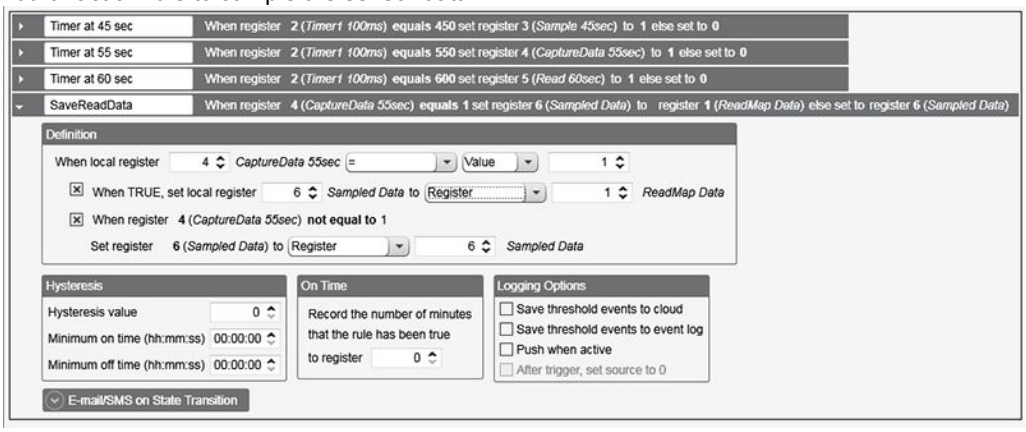
Five Action Rules define the logic statements required to complete the application. The first three action rules define when the timer is greater than 45 seconds, greater than 55 seconds, and greater than 60 seconds. The final two rules capture the read data and reset the timer back to zero to restart the process.

1. Go to the **Local Registers › Action Rules › Thresholds** screen and click **Add Threshold Rule**.
2. Name the first action rule (checks the timer to see if it has reached 45 seconds or greater) and enter the necessary parameters.



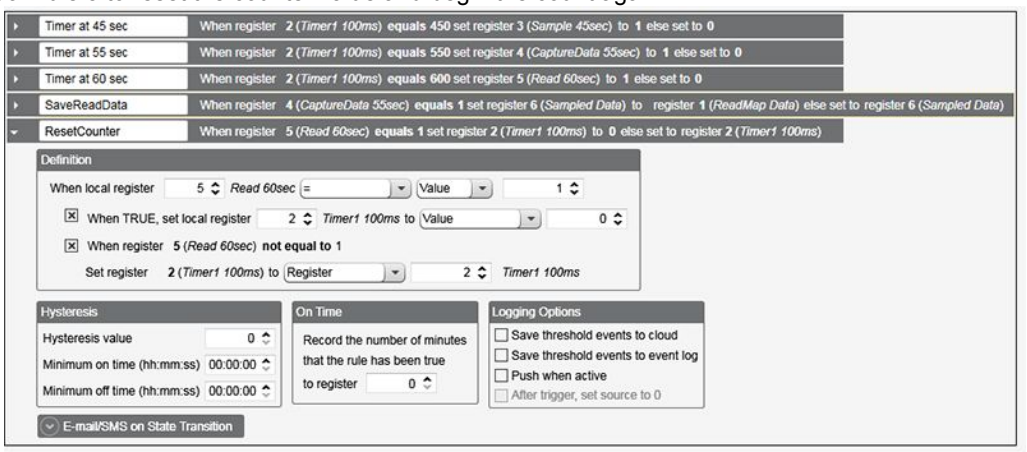
For this example, we want to check when local register 2 (the timer/counter) is greater than or equal to 45 seconds. When true, it sets local register 3 to 1, otherwise, set local register 3 to zero.

3. Create the second and third action rules, which also check the timer count (local register 2) and change the values of local register 4 (CaptureData 55sec) and local register 5 (Read 60sec), respectively.
4. Create the fourth action rule to sample the sensor data.



This action rules detects when local register 4 (timer at 55 seconds) is 1. The value of local register 6 is set to the value of local register 1 (ReadMap Data). When the value of local register 4 is not 1, local register 6 remains unchanged.

5. Create action rule 5 to reset the counter value and begin the count again.



When the timer/counter register has reached 60 seconds (local register 5 is 1), set the value of the timer register back to 0. Otherwise, do not change the value.

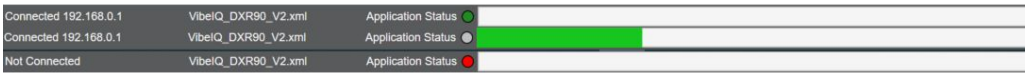
Save and Upload the Configuration File

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.

Chapter Contents

Chapter 7 Setting Multiple Thresholds

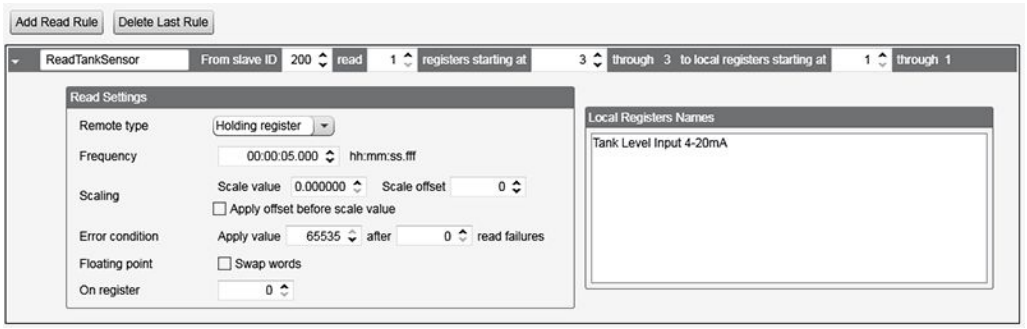
The DXM uses Action Rules and the DXM Configuration Software to do simple operations with local registers. ScriptBasic is a programming language that can handle the simple operations as well as the complex operations.

This example application creates multiple thresholds on a single analog input from an external 4-20 mA sensor to indicate tank levels. The first method uses Action Rules and the second method uses ScriptBasic.

Use Action Rules to Set Multiple Thresholds

This procedure assumes you have installed the DXM Configuration Software on a Windows-based computer.

1. Launch the configuration software.
2. Define the Local Register.
    a. Go to the **Local Registers › Local Registers in Use** screen.
    b. Click on the arrow next to input 1 to display its parameters. Name this input.
    c. Set the **Units** to mA and set **LCD Permissions** to Read. Setting the Units to mA isn't necessary, but does make the field easier to understand. Setting LCD Permissions to Read displays the register value on the DXM's LCD.
3. Define the Read Rule.



    a. Go to the **Register Mapping › RTU › RTU Read** screen and click **Add Read Rule** to define the read rule that reads an input into local register 1.
    b. Enter a name for the Read Rule. For our example, we have named the rule: ReadTankSensor.
    c. Set the parameters to read one register from Slave ID 200 (DXM100 I/O board; the DXM700 I/O board is slave ID 203), starting at register 3, and writing the value to local register 1 every 5 seconds.
4. Define the Local Registers and Action Rules that check the thresholds.
    a. Name and define Local Register 2 as the 8 mA Threshold. Set the Units to on/off and the LCD Permissions to Read.
    b. Name and define Local Register 3 as the 12 mA Threshold. Set the Units to on/off and the LCD Permissions to Read.
    c. Name and define Local Register 4 as the 16 mA Threshold. Set the Units to on/off and the LCD Permissions to Read.
    d. Define an Action Rule to set Local Register 2 to 1 when the tank level sensor reading is above 8 mA.
    e. Define an Action Rule to set Local Register 2 to 1 when the tank level sensor reading is above 12 mA.

f. Define an Action Rule to set Local Register 3 to 1 when the tank level sensor reading is above 16 mA.

To view the results of the Action Rules, go to the DXM Controller. On the menu system, select **Registers** and click **Enter**. Any registers configured with **LCD Permissions** set to **Read** displays on the screen.

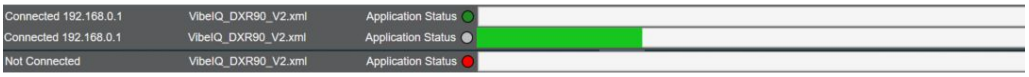
Save and Upload the Configuration File

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.

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Chapter 8 Sending a Text Message from an Input

The DXM Wireless Controller with a cellular modem can send text messages on defined conditions. This short example shows the configuration settings to send a text message when Node 1's input 1 is on.

The following example demonstrates sending a text message to call for maintenance or call for service. Follow these steps to configure Node 1's input 1 to send a text message:

1. Define the Local Registers.
2. Create a Read Rule to read the input.
3. Define the SMS recipients and network settings.
4. Set a threshold using Action Rules.

Before beginning the steps below, verify the Node was bound as Node 1 to the Gateway radio board in the DXM. Also verify the cellular module was provisioned and has an active data plan.

Define the Local Registers in the DXM Wireless Controller's processor.

1. Launch the DXM Configuration Software and select the **Local Registers › Local Registers in Use** screen.
2. In the **Edit Registers** section of the screen, use the drop-down list to select the register to be configured. For this example, we use register 1.
3. Name the register (for example, Need assistance).
4. Select a register to store the value of the output of the pushed button (typically a tower or indicator light). For this example, the output is not mapped to anything.
5. For both registers, select "Read" for **LCD Permissions** to enable the register values to be viewed on the DXM's LCD screen.

Create a Read Rule to read the input.

1. Select the **Register Mapping › RTU › RTU Read** screen.
2. Click **Add Read Rule**.
3. Click the arrow to open the detailed Read Rule parameters section.
4. Enter a descriptive name for the rule, for example, Read Input. The data is read from slave address 1, which in this case is the ISM radio in the DXM. A Node sends the input to the Gateway in the DXM.
5. The Modbus holding register for Node 1, I/O 1 is: 1 + (Node# × 16) = 1 + (1 × 16) = 17. This is the Gateway's register 17, which stores Node 1's data. Refer to the Node's datasheet for more information.
6. Select **slave address** 1, **starting at register** 17, through 17 to **local register** 1 through 1. Local Register 1 was defined as "Need assistance".
7. Select the **Frequency** with which you'd like updates (for example, 1 second).

Define the list of text or email recipients that will receive the notifications.

1. Go to the **Settings › Notifications** screen.
2. In the **SMS Recipients** section, click the arrow next to **Name**.
3. In the **Name** field, enter the name (for example, Supervisor) of the first recipient.
4. In the **Number** field, enter the phone number.
5. In the **Message** field, enter message to be sent.
6. Go to the **Settings › Cloud Services** screen.
7. In the **Network Interface** field, select **Cell** from the drop-down list.

Set a threshold using an Action Rule to define the behavior of the registers under specific conditions, for example, when the Node's input is on.

1. Go to the **Local Registers › Action Rules › Thresholds** screen.
2. Click **Add Threshold Rule**.
3. Click on the arrow to expand the threshold rule.
4. Under Definition, enter a 1 in the **When local register** field. Local Register 1 was defined as *Need assistance*.
5. To set the threshold, select =, then select Value in the next drop-down list. Enter a 1 in the next field.

6. Under **When true, set Local Register**, enter a 2. In the next drop-down list, select Value. Enter a 1 in the next field. This defines register 2's value as 1 (on) when the Node's input is on (1).
7. Under **When Local Register is not equal to 0**, select Value and enter a 0. This means that if the Node's input is off, the register value remains at 0 (off).
8. At the bottom of this screen, click the arrow under **E-mail/SMS on State Transition** to expand that section.
9. Select the recipient(s) to send the text to.

Save your XML file to your computer and upload the XML file to the DXM. You are now ready to receive a text message when Node 1's input 1 is turned on.

Chapter Contents

Chapter 9 What is a Scheduled Push?

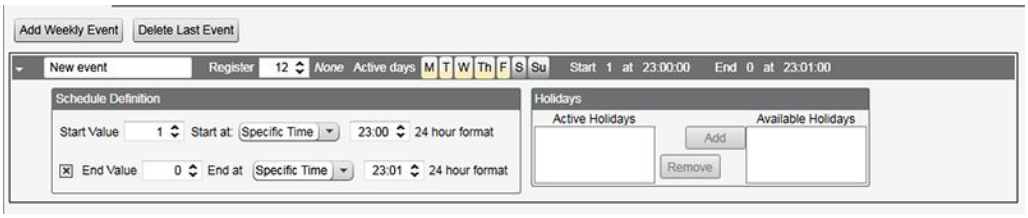
A scheduled push uses the DXM Controller's **Scheduler** function to force a data push at a specific time. Use the DXM Configuration Software software to create, save, and upload the configuration file to the DXM Controller.

Create a Scheduled Push

These instructions assume you have installed the latest version of the DXM Configuration Software and have launched it on your Windows-based PC.

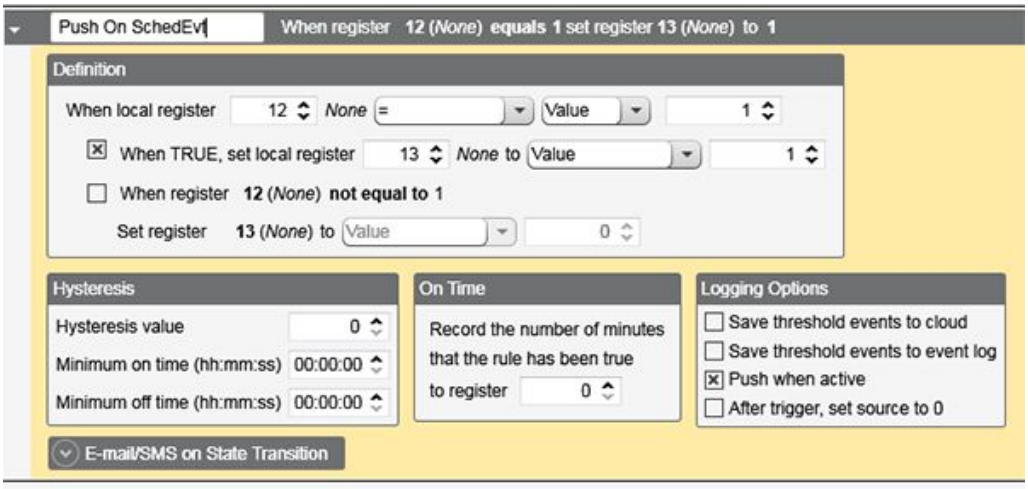
The following example creates an automatic data push that runs at 11pm, Monday through Friday.

1. Define all local registers to push to the webserver.
    a. Go to the **Local Registers › Local Registers in Use** screen.
    b. Click the register number to display that register's parameters.
    c. Set **Cloud settings** to Read.
    d. Set **LCD Permissions** to Read to display the local register to the DXM's LCD.
2. Define the scheduled event.
    a. Go to the **Scheduler › Weekly Events** screen.
    b. Click **Add Weekly Event**.
    c. Click the arrow next to the new event to view all parameters.
    d. Enter a name for the event.
    e. Select the local register. For this example, we are using local register 12.
    f. Click on the days of the week that this local register will be changed. For this example, we have selected Monday through Friday.
    g. Select the start value and the specific time you want this event to occur. For this example, we have selected the start value of 1, to occur at 23:00 hours (11 pm).
    h. Select the end value and specific time you want this event to occur. For this example, the register value returns to zero at 23:01 (11:01 pm), one minute later.



3. Create an Action rule to push data to the webserver.
    a. Go to the **Local Registers › Action Rules › Thresholds** screen.
    b. Click **Add Threshold Rule**.
    c. Click the arrow next to the new rule to view all parameters.
    d. Enter a name for the rule.
    e. Fill in the parameters. For our example, we are setting local register 13 to 1 when local register 12 is 1.

f. Select **Push when active**.



When the value of register 12 is 1, the DXM Controller pushes the defined data set to the webserver.

The Scheduler creates the timed event that occurs Monday through Friday. At the scheduled time and day, the value of local register 12 is set to 1 for one minute. The Action rule watches local register 12, and when the value is 1, the action rule creates a push event to the webserver.

Configure the DXM to Access the Webserver

Before the DXM can read or write data to the webserver, you must define or confirm several parameters.

1. Go to the **Settings › System** screen and set the **Device Time** and time zone.
   The device time can be verified on the DXM LCD.
2. Select whether or not the DXM should use daylight saving time (DST).
3. On the **Settings › Cloud Services** screen, set the **Cloud push interval** to none.
   This allows the action rule to push data.
4. Under the **Web Server** section, verify the **Site ID** is accurate. This Site ID is unique for every device and is created by the website.

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.

Chapter Contents

Chapter 10 Activating a Cellular Modem

Follow these basic steps, as detailed in this document, to activate the cellular capabilities of your DXM Controller.

1. Purchase a cellular modem kit from Banner Engineering Corp.
2. Install the cellular modem, connect the antenna cable, and connect the cellular antenna.
3. Activate a cellular plan to the SIM card, then insert the SIM card into the cellular modem.
4. Configure the DXM to use the cellular modem.

Purchase one of these cellular modem kit models

Cellular Kit Model	Kit Description	Important Notes
SXI-CATM1VZW-001	**Verizon CAT M1** cellular modem using Telit ME910 modem kit (Verizon part number SXIM1V). Includes a cellular modem, SIM card, internal adhesive antenna, external SMA antenna, and antenna cable. The SIM card is specific to the LTE-M technology and cannot be used in other cellular modems. Requires a LTE Verizon cellular wireless plan attached to the ICCID (SIM card) number and IMEI (International Mobile Equipment Identity) number. Cellular plans can be purchased through celldata.bannercds.com.	This cellular modem kit is for use in applications that require monthly data usage approaching 50 MB or 250 MB with push intervals no more frequent than every 10 minutes. This modem is only for use in the **contiguous United States** region. Please visit our support site for more details on coverage areas and cellular plan pricing.
SXI-CATM1ATT-001	**AT&T CAT M1** cellular modem using Telit ME910 modem kit (AT&T part number SXIM1A). Includes a cellular modem, SIM card, internal adhesive antenna, external SMA antenna, and antenna cable. The SIM card is specific to the LTE-M technology and cannot be used in other cellular modems. Requires a LTE AT&T cellular wireless plan attached to the ICCID (SIM card) number and IMEI (International Mobile Equipment Identity) number. Cellular plans can be purchased through celldata.bannercds.com.	This cellular modem kit is for use in applications that require monthly data usage approaching 50 MB or 250 MB with push intervals no more frequent than every 10 minutes. This modem is only for use in the **North American** region. Please visit our support site for more details on coverage areas and cellular plan pricing.

Continued on page 32

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Cellular Kit Model	Kit Description	Important Notes
SXI-CATM1WW-001	**Worldwide CAT M1** cellular modem using Telit ME910 model kit. Includes a cellular modem, SIM card, internal adhesive antenna, external SMA antenna, and antenna cable. The SIM card is specific to the LTE-M/NB-IoT technology and cannot be used in other cellular modems. Requires an LTE cellular plan attached to the ICCID (SIM card) number and IMEI (International Mobile Equipment Identity) number. Cellular plans can be purchased through celldata.bannercds.com or a local roaming SIM provider.	This cellular modem kit is for use in applications that require monthly data usage approaching 50 MB or 250 MB with push intervals no more frequent than every 10 minutes. This modem is only for use in the **European** region within those countries that are members of the EU/EEA and adopt RED/CE compliant products. Please visit our support site for more details on coverage areas and cellular plan pricing.

For additional information, refer to the Banner Cloud Data Services support center (support.bannercds.com). The support center includes video tutorials, product documentation, technical notes, and links to download configuration software.

IMPORTANT: Only the DXM100 and DXM150 models in conjunction with an SXI-LTE-001 (obsolete) cellular modem can offer SMS/text messaging capabilities directly from the device. Contact a support specialist at Banner Engineering for configuration instructions, or SMS/text messaging can be delivered using the Banner CDS web service from any DXM model.

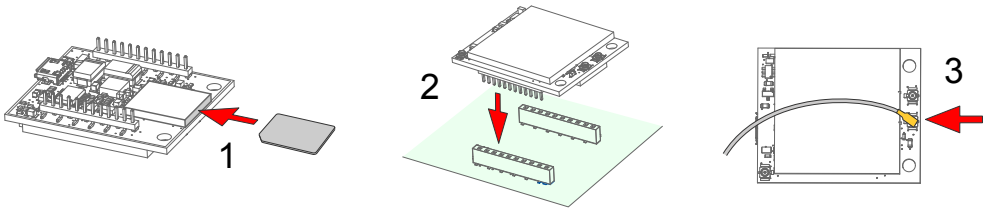
Install the Cellular Modem (DXM100, 150, 700, and 1000 Models)

Follow these steps to install the cellular modem and antenna cable.

IMPORTANT:

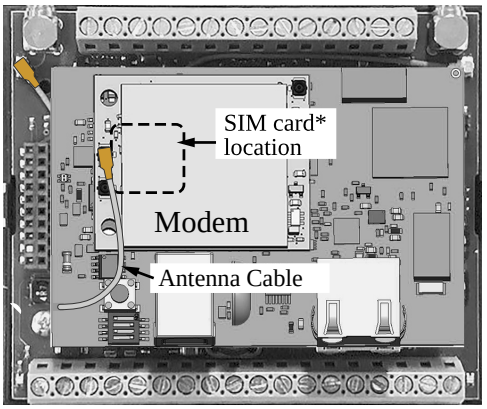
- **Electrostatic discharge (ESD) sensitive device**
- ESD can damage the device. Damage from inappropriate handling is not covered by warranty.
- Use proper handling procedures to prevent ESD damage. Proper handling procedures include leaving devices in their anti-static packaging until ready for use;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

Installing the cellular modem



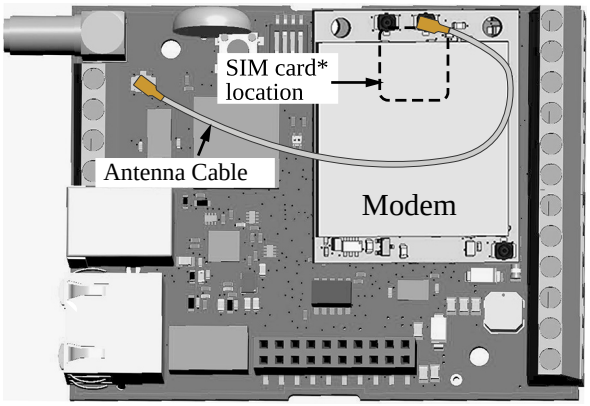
1. SIM cards come in a credit card sized carrier. Carefully snap it out of the carrier.
2. Make note of the IMEI number of the cellular modem and the ICCID number of the SIM card.
   The numbers can be found on the cellular modem and the SIM card or SIM card carrier. You will need the SIM number to associate a wireless plan to this SIM card.
3. Insert the SIM card into the socket on the underside of the cellular modem while ensuring the conductive pads on the SIM card are interfacing with the terminals of the modem.
   There is a matching notch in the socket and SIM card that will only allow the SIM to be inserted with one orientation. Do not force the SIM card into the socket.
4. Orient the cellular modem according to the pin layout.

DXM100, 150, and 1000



*SIM card is located on the underside of installed modem

DXM700



*SIM card is located on the underside of installed modem

- For the DXM100, DXM150, and DXM1000 models—Install the cellular modem board onto the processor board as shown. Use the diagram to verify the orientation is correct.
- For the DXM700 models—Install the cellular modem board onto the base board as shown. Use the diagram to verify the orientation is correct.

a. Verify the pins are properly aligned.

b. Verify the hole in the cell modem aligns with the hole on the DXM board.

c. Firmly press the modem into the 24-pin socket.

5. Attach the antenna cable between the cellular modem board to the base board as shown.
6. Install the external cellular antenna on the DXM's SMA connector located next to the antenna cable.

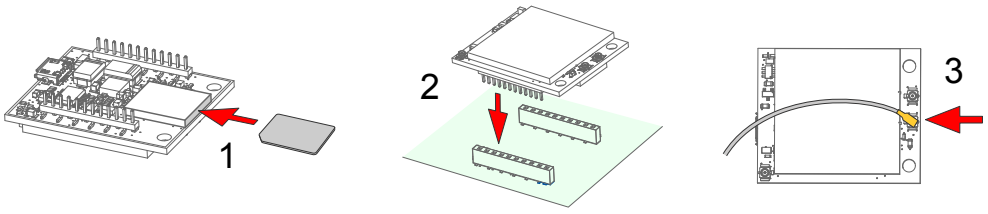
Install the Cellular Modem (DXM1200 Models)

Follow these steps to install the cellular modem and antenna cable.

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.

Installing the cellular modem

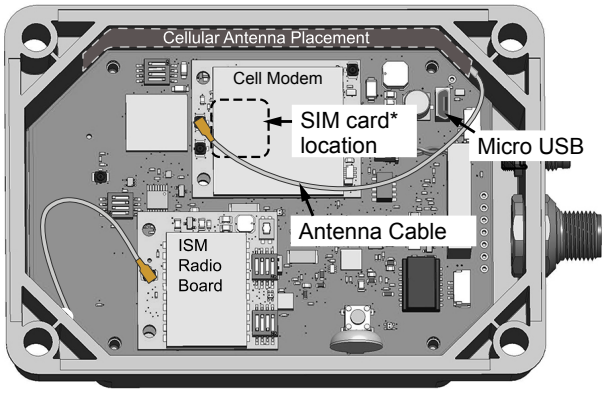


1. SIM cards come in a credit card sized carrier. Carefully snap it out of the carrier.
2. Make note of the IMEI number of the cellular modem and the ICCID number of the SIM card.
   The numbers can be found on the cellular modem and the SIM card or SIM card carrier. You will need the SIM number to associate a wireless plan to this SIM card.
3. Insert the SIM card into the socket on the underside of the cellular modem while ensuring that the conductive pads on the SIM card are interfacing with the terminals of the modem.

There is a matching notch in the socket and SIM card that will only allow the SIM to be inserted with one orientation. Do not force the SIM card into the socket.

4. Apply the internal antenna as shown paying attention to the antenna cable position.
    a. Pull back the adhesive protective paper from the middle of the antenna, only exposing the middle portion. Antenna application is easier if just a small middle portion of the adhesive is uncovered.
    b. Center the antenna on the side wall. Use the exposed adhesive in the middle of the antenna to hold the antenna in place while aligning the antenna to the full length of the housing.
    c. Slowly peel off the paper backing exposing the adhesive and stick to the plastic housing. The antenna should run below the rim of the housing.
    d. Press firmly.
5. Orient the cellular modem according to the diagram below.
   The cellular modem is inserted into the main board with the antenna cable from the applied internal antenna attached to the cellular modem PCB.

Internal view of a DXM1200



*SIM card is located on the underside of installed modem

    a. Verify the pins are properly aligned.
    b. Verify the hole in the cell modem aligns with the hole on the DXM board.
    c. Firmly press the modem into the 24-pin socket.
6. Attach the antenna cable between the cellular modem board to the base board. The antenna cable uses the top antenna connection.

Activate a 4G LTE CAT M1 Cellular Plan

Activate a cellular plan for your DXM Controller using the Banner Cloud Data Services website.

1. Go to celldata.bannercds.com to purchase cellular data plans.
2. If you have previously created an account, click **Login** and enter your username and password to continue.
3. If you are creating a login for the first time:
    a. Select the region in which the device will operate.
    b. Select the cellular subscription plan. Please use the calculator and regional coverage information to determine the plan needed for your device (https://www.bannerengineering.com/us/en/products/wireless-sensor-networks/iot-cloud-cellular-data-services/cellular-data-plans/Service-Plan-Calculator.html).
    c. Create a username and password (use an email address for the username).
    d. Enter your payment information, mailing address, agree to the terms and conditions.
4. Go to the **My Services and Equipment** section.
5. Enter the SIM Number (ICCID) and the Module Number (IMEI).

The **ICCID** is the 20-digit number of the SIM, the bottom barcode number on the SIM card carrier. If the carrier card is not available, the ICCID is also printed on the SIM card, but must be removed from its socket to be read. The **IMEI** is the 15-digit number on top of the 4G LTE device.

6. Click **Activate**.

Enter the ICCID and IMEI numbers then click Activate

Although new activations are typically functional in 20 minutes or less, it may take up to 24 hours for the cellular plan to become active on the wireless network.

Activate a Worldwide 4G LTE MNB-IOT Cellular Plan (RED-CE)

The Worldwide 4G LTE-M/NB-IOT cellular modem is operational in those European countries that are members of the EU/EEA and adopt RED/CE-compliant products.

An international roaming SIM is provided with the Worldwide module and may be activated following the steps listed in "Activate a 4G LTE CAT M1 Cellular Plan " on page 34. However, there may be regions that are not covered by the provided SIM card. In this case, a local SIM card must be activated and operated with this device to acquire connectivity services.

1. Work with the local Banner technical support person to identify and purchase machine-to-machine (M2M) (data plan only) SIM cards in 3FF 'micro' form factor.
   Typical monthly data use will be 20-50 MB per month. When choosing a plan, pay close attention to data rates.
2. When activating the SIM, note the Access Point Name (APN) that the SIM provider states to use with their SIM.
   The IMEI is the 15-digit number on top of the cell module PCB, below the words **Telit ME910G1-WW** and above the barcode. The ICCID is the 20-digit number printed on the SIM card itself.

Configure the DXM Controller for a Cellular Modem

Use the DXM Configuration Software to create a configuration using a cellular connection.

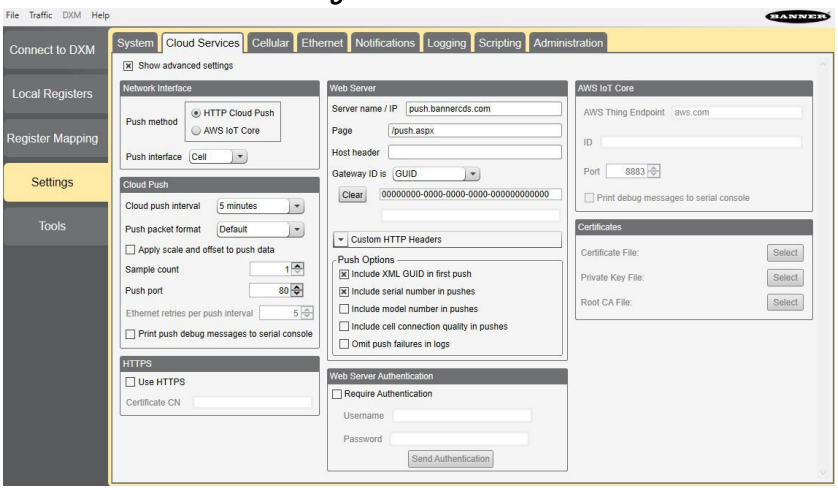
> **IMPORTANT:** Only the DXM100 and DXM150 models in conjunction with an SXI-LTE-001 (obsolete) cellular modem can offer SMS/text messaging capabilities directly from the device. Contact a support specialist at Banner Engineering for configuration instructions, or SMS/text messaging can be delivered using the Banner CDS web service from any DXM model.

1. Go to the **Settings › Cloud Services** screen.
2. Set the **Push Interface** to **Cell**
   All push data will be sent using the cellular modem.
3. Go to the **Settings › Cellular** screen. Under the **Cell Configuration** section, select the **Cell module** from the drop-down list.
   - **For the United States (contiguous)**—For Verizon LTE/CATM modems, select **SXI-LTE-001** or **SXI-CATM1VZW-001** and set the **APN** to **vzwinternet**.
   - **For North America**—For ATT LTE/CATM modems, select **SXI-CATM1ATT-001** and set the **APN** to **iot0119.com.attz**. Requires a SIM module to be purchased from a wireless carrier based on the IMEI number of the cellular modem. The wireless carrier will provide the APN parameters. Not all parameters may be required.

- **For regions outside of North America**—Select **SXI-CATM1WW-001** and set the **APN** to **m2m.tele2.com** when using the SIM card provided with the kit from Banner Engineering. When using a local roaming SIM, please use the APN as suggested by your cellular connectivity (SIM) provider.

4. To send data to the webserver, complete the parameters on the **Settings › Cloud Services** screen. Set the **Cloud push interval** and the **Web Server** settings. (For more information, refer to the DXM Configuration Software Instruction Manual (p/n 201127).

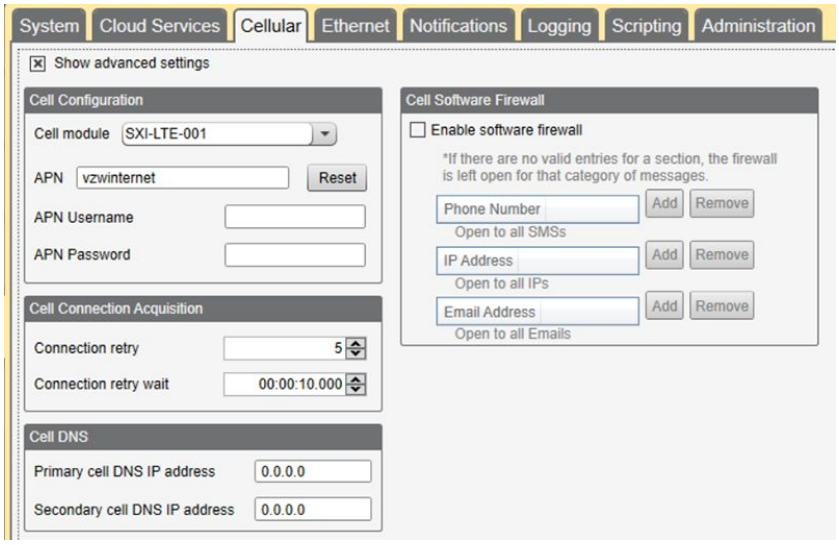
*The **Settings › Cloud Services** screen*



IMPORTANT: Banner Engineering offers several prepackaged solutions that report to the Banner Cloud Data Services web-based software platform via cellular connectivity. Many of these solutions execute the data push using a ScriptBasic file instead of the XML configuration file. If you are using a Banner prepackaged solution (ex. SOLUTIONSKIT9-VIBE), then you do not need to set the **Cloud Push Interval** on the **Settings › Cloud Services** screen. You still need to set the **Push Interface** to **Cell** and select the appropriate **Cell Module** and **APN**.

When the DXM Controller is configured to use the cellular modem, the information on the cellular modem is found on the LCD menu under **System Info › Cell**. The menu does not display values until a transaction with the wireless cell tower is complete.

*The **Settings › Cellular** screen*



If there are no webserver parameters defined, the user must force a push to retrieve the data from the cellular network. On the LCD menu, select **Push › Trigger Data Push**.

Obtaining LTE service outside of the Banner Cellular Data Plans—Customers have the option of securing a data plan for the Verizon network themselves without using the Banner cellular data portal (celldata.bannercds.com). Suitable plans would include those available from Verizon directly or from a Mobile Virtual Network Operator (MVNO) licensed to resell Verizon network data plans. (The **SXI-LTE-001** or **SXI-CATM1VZW-001** will not function on AT&T, T-Mobile, or Sprint networks.) When purchasing a data plan, it is important to refer to the modem by its official Verizon network name (for example, SEN-SX002) and give the IMEI number (found on the cellular modem) to the plan provider. To use the SIM card that comes with the cellular modem kit, give the SIM card number to the provider. The required SIM card form factor is 3FF - Micro.

Document title: Install and Activate a Cellular Modem
Part number: 205026
Revision: F

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Chapter Contents

Chapter 11 Document Information

Document title: Sure Cross® DXM Tips and Tricks
Part number: b_4508278
Revision: C

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