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You can integrate BACnet devices into an i-Vu CCN system with an i-Vu Link.

### Overview

<table>
<thead>
<tr>
<th><strong>I-Vu Link</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol port</td>
<td>E1 or S2</td>
</tr>
<tr>
<td>Module driver</td>
<td>drv_ivulink_modbus &lt;latest version&gt;.driver</td>
</tr>
<tr>
<td>Read/write capability</td>
<td>Can read from and write to the third-party equipment</td>
</tr>
<tr>
<td>Integration points supported</td>
<td>500</td>
</tr>
</tbody>
</table>

**Third party**

**Supported equipment**

Any device that supports the BACnet MS/TP (9600, 19200, 38400, or 76800) or BACnet IP protocol

The i-Vu Link driver supports BACnet MS/TP devices connected to Port S2 and BACnet devices connected on the Ethernet port simultaneously. The third party point count for the i-Vu Link is the total of the 2 ports.
Before-you-begin checklist

You need the following items, information, and skills for the integration process.

- The BACnet device's:
  - BACnet network number
  - MAC address
  - Device instance
  - Points list, including BACnet Object ID's (object type plus object instance)
- The baud rate of the BACnet devices, if running MS/TP
- Verification that all communication settings have been set on the BACnet devices
- Experience creating custom equipment with ApplicationBuilder
- Experience installing, wiring, setting up, and downloading custom equipment to the i-Vu Link

Use this document to integrate BACnet devices into an i-Vu CCN system. To install and network the i-Vu Link, see the i-Vu Link’s Installation Guide.
# Create custom equipment in ApplicationBuilder

1. Start ApplicationBuilder.
2. Select equipment type:
   - **CCN Values Only** - to read and write values on the CCN network and to display those points on a graphic
   - **Integration Values Only** - to read and write values from the third party network and to display those points on a graphic
   - **CCN Link Integration** - to share values from the third party network with the i-Vu Link on the CCN network and to display those points on a graphic
3. Click **Next**.
4. Type a name for the custom equipment (i.e., Hot Water System).
   **NOTE** The name must not exceed 21 characters!
5. Enable **English** or **Metric** units.
6. Choose engineering options for your application (**Schedule and Setpoint, Runtime**, etc..)
7. Click **Next**.
8. Add **Elements** to your application.
   **NOTE** Elements are a collection of input/output points that perform a specific operation. The input/output point that is reading or writing to the BACnet network is called an integration point. Integration points may be used in conjunction with CCN points to share data between the BACnet network and the CCN network.

The available **Elements** that you can add to your custom equipment in ApplicationBuilder are:

<table>
<thead>
<tr>
<th>Point type</th>
<th>Used for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read CCN Point</td>
<td>Reading an analog or binary value from the CCN network</td>
</tr>
<tr>
<td></td>
<td><strong>In:</strong> CCN Values, Link Integration</td>
</tr>
<tr>
<td>Carrier Text Point</td>
<td>Reading Text value from a CCN device</td>
</tr>
<tr>
<td></td>
<td><strong>In:</strong> CCN Values, Link Integration</td>
</tr>
<tr>
<td>Setpoint Write</td>
<td>Allows CCN setpoint value to be “edited” directly from graphic</td>
</tr>
<tr>
<td></td>
<td><strong>In:</strong> CCN Values, Link Integration</td>
</tr>
<tr>
<td>Link Integration Point to CCN Point</td>
<td>Reading an analog or binary value from the third party device and then writing that value to the CCN network</td>
</tr>
<tr>
<td></td>
<td><strong>In:</strong> Link Integration</td>
</tr>
<tr>
<td>Link CCN Passive Point to Integration Point</td>
<td>Exposing an analog or binary value to the CCN network so that it can be written to the third party network</td>
</tr>
<tr>
<td></td>
<td><strong>In:</strong> Link Integration</td>
</tr>
<tr>
<td>Read Integration Point</td>
<td>Reading an analog or binary value from the third party device</td>
</tr>
<tr>
<td></td>
<td><strong>In:</strong> Read Integration, Link Integration</td>
</tr>
</tbody>
</table>
1. Create custom equipment in ApplicationBuilder

<table>
<thead>
<tr>
<th>Point type</th>
<th>Used for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link CCN Point to Integration Point</td>
<td>Reading an analog or binary value from a CCN device and then writing it to the third party network</td>
</tr>
<tr>
<td></td>
<td>In: Link Integration</td>
</tr>
<tr>
<td>Link Integration Point to CCN Passive Point</td>
<td>Reading an analog or binary value from the third party device and then exposing that value to the CCN network</td>
</tr>
<tr>
<td></td>
<td>In: Link Integration</td>
</tr>
<tr>
<td>Link BACnet variable to CCN Point</td>
<td>Allows an analog or binary value from BACnet to write that value to the CCN network</td>
</tr>
<tr>
<td></td>
<td>In: Link Integration</td>
</tr>
</tbody>
</table>

9. As you add Elements, enter the requested information for the integration or CCN points:
   - Display Text - the name of the point as it will appear in i-Vu CCN (i.e., Frequency)
   - Reference Base - the name that will be added to each point that makes up the Element, so that all points have a unique identifier (i.e., input_Freq, trendFreq, output_Freq) - this name must be unique (do not copy and paste)
   - Input Address - enter the BACnet or CCN address

Define the BACnet or CCN address string using the syntax for each point in the list, as described below:
   - Input Scaling - enter variables
     - NOTE Use Scaling when the value you are reading from the BACnet or CCN device needs to be scaled before showing the value on a graphic or trend. Scaling information can be found in the third party points list.
     
     Example: You have an integration point set up to read the motor temperature of a variable speed drive. The third party points list shows that this value will be given in degrees C, but you want to display it in degrees F on a graphic. Therefore, using the formula °F = 9/5(°C) + 32, the scaling/unit conversion fields for the integration point would be filled out as follows: ([value read] + 0) x 1.8 + 32

   - Output Address - enter the BACnet or CCN address, as described below.
   - Output Scaling - enter variables
     - Continuing the example above, if you wanted the graphic to display values in °F, but then you wanted to share that value with the CCN network in °C, the scaling for the CCN Passive Point would be:
       ([value read] + 0) x 1 + 0

10. Click Next.
11. Equipment Name - type a new equipment name if desired.
12. Save Location - browse to a location where you would like to save the new custom equipment.
13. Click Save.
To format a BACnet address

Use the information below to format a valid address in each integration point that you use to read or write to a BACnet device.

⚠️ CAUTION!
When integrating third-party devices into an i-Vu CCN system, most communication problems are caused by incorrect data or typos in the custom equipment's Address field.

Address format:  \texttt{bacnet://device/object/property@priority}

\begin{itemize}
  \item \textbf{Device} - Use one of the following:
    \begin{itemize}
      \item Device instance number
      \item BACnet device name
      \item Network number: MAC address (of third-party device)
    \end{itemize}
  \end{itemize}

\begin{itemize}
  \item \textbf{Object} - Use one of the following:
    \begin{itemize}
      \item Object type: Instance number (See NOTES below)
      \item BACnet object name
    \end{itemize}
  \end{itemize}

\textbf{NOTES}

- For object type, you may type the abbreviation, the full name, or the object type number. Some standard BACnet object type numbers are listed below. See the BACnet standard for a complete list. For proprietary BACnet objects, see the object's manufacturer.

<table>
<thead>
<tr>
<th>Use...</th>
<th>Or...</th>
<th>Or...</th>
</tr>
</thead>
<tbody>
<tr>
<td>ai</td>
<td>analog-input</td>
<td>0</td>
</tr>
<tr>
<td>ao</td>
<td>analog-output</td>
<td>1</td>
</tr>
<tr>
<td>av</td>
<td>analog-value</td>
<td>2</td>
</tr>
<tr>
<td>bi</td>
<td>binary-input</td>
<td>3</td>
</tr>
<tr>
<td>bo</td>
<td>binary-output</td>
<td>4</td>
</tr>
<tr>
<td>bv</td>
<td>binary-value</td>
<td>5</td>
</tr>
<tr>
<td>dev</td>
<td>device</td>
<td>8</td>
</tr>
<tr>
<td>msi</td>
<td>multistate-input</td>
<td>13</td>
</tr>
<tr>
<td>mso</td>
<td>multistate-output</td>
<td>14</td>
</tr>
<tr>
<td>msv</td>
<td>multistate-value</td>
<td>19</td>
</tr>
</tbody>
</table>

\textbf{Property} (optional)  If you want to read or write a property other than \texttt{present_value}, type one of the following:

\begin{itemize}
  \item \textbf{Examples}
    \begin{itemize}
      \item \texttt{bacnet://.../ai:2}
      \item \texttt{bacnet://.../MyObject}
    \end{itemize}
  \end{itemize}

\textbf{NOTE}  Numeric values in a BACnet address can be entered using decimal or hexadecimal notation. Type \texttt{0x} before a hexadecimal value.
1 Create custom equipment in ApplicationBuilder

<table>
<thead>
<tr>
<th>BACnet property identifier</th>
<th>bacnet://.../cov_increment</th>
</tr>
</thead>
<tbody>
<tr>
<td>BACnet property identifier #</td>
<td>bacnet://.../.../22</td>
</tr>
<tr>
<td>Property identifier (with index)</td>
<td>bacnet://.../.../priority-array(12)</td>
</tr>
<tr>
<td>Property identifier # (with index)</td>
<td>bacnet://.../.../87(12)</td>
</tr>
</tbody>
</table>

**TIP** For standard BACnet objects, see the BACnet standard for property identifiers and property identifier numbers. For proprietary BACnet objects, see the object's manufacturer.

4 Priority (optional) If you want to write at a priority other than 16, type @ followed by a priority number.

**EXAMPLE**

Number (1–16) bacnet://.../.../@9

**NOTE** Priority levels 1 and 2 are reserved for manual and automatic life safety commands. For more information on reserved priority levels see the BACnet standard.

**Examples of BACnet addresses:**

bacnet://MyDevice/ai:2
bacnet://1234:0x23/analog-input:2/priority-array(12)@8
bacnet://2499:0x00E0C90047CA/bi:3
bacnet://2436:192.168.47.36:47806/0:2

To format a CCN address

There are three different methods for defining the CCN address strings.

1 They can be manually typed in ApplicationBuilder.

2 You can use **Copy table point** in i-Vu CCN's table interface to copy CCN point information directly from a CCN table to ApplicationBuilder's "ccn://" address field.

3 You can use **Map to Point** in i-Vu CCN's table interface to map the CCN points from your custom equipment file directly to CCN table data.

**NOTE** Your custom equipment must already be downloaded in the i-Vu Link to use this method. (Proceed to **Assign and download custom equipment in i-Vu CCN** (page 11) first).

**Method 1: Type the address manually in ApplicationBuilder**

1 If you are actively reading or writing a point on a CCN device, then manually type in the CCN device's address, **Table Name**, and **Point Name** that you wish to read or write.

ccn://link/<Table Name>/<Point Name> ("link" indicates the CCN device that the custom equipment has been mapped to)

or

ccn://<bus, element>/<Table Name>/<Point Name>
1. Create custom equipment in ApplicationBuilder

Examples:
ccn://link/HWP01-32/TEMP
ccn://0.2/HWP01-32/TEMP

2. If the point is a CCN passive point (i.e., it's just being exposed to the CCN network), then type:
ccn://passive/<point name>, where <point name> is the name that you have chosen for this CCN point.

Example: ccn://passive/freq

Method 2: Copy table point in i-Vu CCN
1. Launch i-Vu CCN.
2. Select the desired equipment in the navigation tree.
3. Expand the tables underneath that equipment.
4. Find the specific table and point that you want to read or write.
5. Click Copy in the table interface.
6. Inside of ApplicationBuilder, hit CTRL-V to copy the CCN address from the table to the "ccn://" address field.

Method 3: Map to point in i-Vu CCN
1. Launch i-Vu CCN.
2. Select the desired equipment in the navigation tree.
3. Expand the tables underneath that equipment.
4. Find the specific table and point that you want to read or write.
5. In the table interface, navigate to the Map to Point column.
6. From the drop-down menu, select the point in the custom equipment that should be mapped.
7. Click OK.

To edit an integration or CCN point address

You can edit an integration or CCN point address in the following places:
- In ApplicationBuilder
- In i-Vu CCN on the custom equipment's Properties page > Equipment tab
- In i-Vu CCN on the custom equipment's Properties page > Network Points tab
To read BACnet points

Polling or BACnet COV

If an integration point is an input, and its Address field references a BACnet object property, the integration point reads the property's value using one of the following methods.

- Polling—The integration point reads the property at the Refresh Time interval using the BACnet ReadProperty or ReadPropertyMultiple service (see "Method 1: Polling" below).
- BACnet COV (Change of Value) subscription—The integration point subscribes with the target BACnet object. An analog target notifies the integration point if the target's value changes by more than the target's BACnet COV_Increment. A binary target notifies the integration point when it changes state (see "Method 2: BACnet COV subscriptions" below).

Method 1: Polling

<table>
<thead>
<tr>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allows rapid detection of a dead device or of network problems</td>
</tr>
<tr>
<td>Does not require additional memory</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generates unnecessary network traffic if a value does not change frequently</td>
</tr>
<tr>
<td>Misses value changes that occur between pollings</td>
</tr>
<tr>
<td>Can overwhelm the target's control module if many integration points request the same property value (such as outside air temperature). The BACnet object must send the value to each integration point that polls for that data.</td>
</tr>
</tbody>
</table>

To set up

- Set the integration point's Refresh Time to 30 seconds or less.

**NOTE** A Carrier integration point will not poll at a Refresh Time interval smaller than 1 second.

BACnet ReadProperty and ReadPropertyMultiple services

See the BACnet specification for details on the ReadProperty and ReadPropertyMultiple services.

ReadPropertyMultiple occurs if:

- two or more integration points in an i-Vu Link read more than one target in the same BACnet device
- the Refresh Time in two or more integration points expires at the same time, and the remote BACnet device supports the service.

Method 2: BACnet COV subscriptions

<table>
<thead>
<tr>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can decrease network traffic by preventing unnecessary updates if the target's COV_Increment is set appropriately. See step 2 in &quot;To set up&quot; below.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can generate excessive network traffic if the target's COV_Increment property is too small.</td>
</tr>
<tr>
<td>Can delay detection of a dead device or of network problems</td>
</tr>
</tbody>
</table>


To set up

1. Set the integration point's **Refresh Time** to 31 seconds or more.

2. If the integration point's **Address** field references an analog property, set the target's COV_Increment property to the smallest amount by which the value must change for the target to notify its subscribers. The optimal COV_Increment is large enough to prevent unnecessary updates but small enough to be useful to the control program(s) receiving the updates.

**NOTE** If COV subscription fails, the integration point reads the value at the **Refresh Time** interval using the BACnet ReadProperty or ReadPropertyMultiple service. See "Method 1: Polling" above.

### COV subscription details

When an integration point subscribes with a BACnet target (object property), the input sets a 21-minute subscription Lifetime in the target. The target responds with a COV notification that includes the target’s value and time remaining from the original subscription Lifetime (TimeRemaining). The input resubscribes with the target every 10 minutes to keep the target's BACnet subscription service active. i-Vu CCN shows the time remaining until the input's next subscription in the **Next Subscription** field on the input's i-Vu CCN Properties page.

The target also sends a COV notification that includes the target’s value and subscription Lifetime TimeRemaining when the target’s value changes by more than the target’s COV_Increment.

If a Carrier target has one subscriber, the target sends COV notifications directly to that subscriber. If an Carrier target has more than one subscriber, it broadcasts its COV notifications to optimize network traffic. A third-party subscriber can participate in this broadcast scheme by subscribing for Unconfirmed COV notifications with a Process ID of 0. Otherwise, the Carrier target maintains and responds to the third-party subscription separately with its own Lifetime timer.

A Carrier input compares the TimeRemaining value in each COV notification broadcast the target sends to its (Next Subscription time + 11) to determine whether another input has subscribed since it did. If another input has subscribed more recently, the input adds 10 minutes to its **Next Subscription** time. This allows the COV Subscription request from the last subscribing input to keep the subscription service active for all subscribers to the same data.

### EXAMPLE

<table>
<thead>
<tr>
<th>Elapsed time (minutes)</th>
<th>Action</th>
<th>Target Lifetime TimeRemaining (minutes)</th>
<th>Input 1 Next Subscription (minutes)</th>
<th>Input 2 Next Subscription (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Input 1 subscribes to target</td>
<td>21 (Input 1)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Target broadcasts COV notification because Input 1 subscribed</td>
<td>21</td>
<td>21 ≤ 10 + 11, so keep current value of 10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Input 2 subscribes to target</td>
<td>21 (Input 2)</td>
<td>10 - 2 = 8</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>Target broadcasts COV notification because Input 2 subscribed</td>
<td>21</td>
<td>21 &gt; 8 + 11, so add 10 to current value of 8 8 + 10 = 18</td>
<td>21 ≤ 10 + 11, so keep current value of 10</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>21 - 3 = 18</td>
<td>18 - 3 = 15</td>
<td>10 - 3 = 7</td>
</tr>
<tr>
<td>0</td>
<td>Target broadcasts COV notification because value changed</td>
<td>18</td>
<td>18 ≤ 15 + 11, so keep current value of 15</td>
<td>18 ≤ 7 + 11, so keep current value of 7</td>
</tr>
<tr>
<td>Elapsed time (minutes)</td>
<td>Action</td>
<td>Target Lifetime</td>
<td>Input 1 Next Subscription (minutes)</td>
<td>Input 2 Next Subscription (minutes)</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------</td>
<td>----------------</td>
<td>-------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TimeRemaining</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>18 - 7 = 11</td>
<td>15 - 7 = 8</td>
<td>7 - 7 = 0 resubscribe</td>
</tr>
<tr>
<td>0</td>
<td>Input 2 resubscribes</td>
<td>21 (Input 2)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Target broadcasts COV notification because Input 2 subscribed</td>
<td>21</td>
<td>21 &gt; 8 + 11, so add 10 to current value 8 + 10 = 18</td>
<td>21 ≤ 10 + 11, so keep current value of 10</td>
</tr>
</tbody>
</table>

Input 2 keeps the subscription service active at the target with a minimum of network traffic.

**NOTE** If an input receives COV notification with a target TimeRemaining < 11, which could happen if the last subscribing input loses communication with the target, the input resubscribes immediately.

**COV notification rate**

COV notifications from a BACnet object property are controlled by that property's BACnet COV_Increment. When the absolute value of the difference between the property's Present_Value and the value sent in the last COV notification is greater than the COV_Increment, the object broadcasts a COV notification. For Carrier control modules, the rate of notifications is further limited by two internal processes.

1. The custom equipment's execution rate determines how often the check against COV_Increment is performed.
2. The i-Vu Link's pending COV Notification task has built-in delays to prevent COV notifications from consuming the control module's CPU processing time.

The built-in delays are as follows:

If more than 15 COV notifications are pending delivery, the i-Vu Link inserts a 50 millisecond delay after each set of 15 notifications. Once the entire list of pending notifications is serviced, the control module inserts another 50 millisecond delay. This results in a maximum COV notification rate of 300 COV notifications per second per i-Vu Link.

**To speed detection of a dead device**

If a BACnet object's device loses network communication, an integration point reading the object's value does not detect the failure until

- The integration point's next subscription (up to 10 minutes) if using BACnet COV subscription
- The Refresh Time expires, if polling
- You can use a small Refresh Time to poll more often, but this can generate unnecessary network traffic under normal conditions.
Assign and download custom equipment in i-Vu CCN

1. Click the menu button in i-Vu CCN, then select **System Setup**.
2. In the navigation tree, right-click the area where you want to place the custom equipment. Select **Add Equipment** from the drop-down menu.
3. Make the following entries:

<table>
<thead>
<tr>
<th>Field</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display Name</strong></td>
<td>Type an equipment name (i.e. ABB Drive).</td>
</tr>
<tr>
<td><strong>Associate with</strong></td>
<td>If your i-Vu Link is connected to CCN devices:</td>
</tr>
<tr>
<td></td>
<td>○ Enable CCN Device and fill in the bus and element number of the CCN device that this custom equipment will be linked to.</td>
</tr>
<tr>
<td></td>
<td><strong>NOTE</strong>: This &quot;association&quot; is what allows you to use the term &quot;link&quot; in CCN address strings for this custom equipment rather than manually typing in the bus, element number into each CCN address string.</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>1. Click <strong>Add</strong>.</td>
</tr>
<tr>
<td></td>
<td>2. Browse to the .equipment file that was generated in ApplicationBuilder.</td>
</tr>
<tr>
<td></td>
<td>3. Click <strong>Continue</strong>.</td>
</tr>
<tr>
<td></td>
<td>4. When message appears &quot;File uploaded successfully&quot;, click <strong>Close</strong>.</td>
</tr>
</tbody>
</table>

If you have already created a custom equipment graphic for this third party device in ViewBuilder, you can also add that graphic from this screen. Under **Views**, click **Add** and browse to your .view file. Click **Continue**. When message appears **File added successfully**, click **Close**. The custom equipment should now appear in the navigation tree.

5. Click **Exit Setup** and the custom equipment will be downloaded to the i-Vu Link.
3 Connect the i-Vu Link to the third-party device

To wire a BACnet IP device

Use one of the following CAT5 or higher Ethernet cables:

- A crossover cable to connect the i-Vu Link directly to a BACnet IP server or gateway
- A straight-through cable to connect the i-Vu Link to a hub or switch, and a second straight-through cable to connect the hub or switch to a BACnet IP server or gateway
- Maximum cable length: 328 feet (100 meters)

1 Turn off the i-Vu Link's power.
2 Check the communications wiring for shorts and grounds.
3 Wire the i-Vu Link's Port E1 to the third-party device.
4 Turn on the i-Vu Link's power.

To wire a BACnet MS/TP device

1 Turn off the i-Vu Link's power.
2 Check the communications wiring for shorts and grounds.
3 Wire the i-Vu Link's port S2 to the third party device, then set the S2 jumper.

See table and notes below:

<table>
<thead>
<tr>
<th>For...</th>
<th>Use...</th>
<th>Maximum Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIA-485, 2-wire</td>
<td>18–24 AWG twisted, shielded pair ¹</td>
<td>3000 feet (914.4 meters)</td>
</tr>
</tbody>
</table>

¹ Shielding provides noise immunity in an electrically noisy environment. Acceptable wiring types, in order of greatest to least noise immunity, are:
- 2-pair, each pair individually shielded
- 2-pair, single overall cable shield

4 Turn on the i-Vu Link's power.

NOTES

- Use the same polarity throughout the network segment.
- Repeaters are required for more than 31 devices. See your third-party device manufacturer's recommendations.
- To reduce communication and data errors, terminate each end of an EIA-485 network with a resistor whose value equals the network's characteristic impedance. Some third-party manufacturers provide a built-in resistor that you enable or disable with a jumper. Make sure that only devices at the end of a network have termination enabled.

EXAMPLE If an EIA-485 2-wire network's characteristic impedance is 120 Ohms, terminate one pair by placing a 120 Ohm resistor across the Net+ and Net- connectors of the master. Terminate the other pair by placing a 120 Ohm resistor across the + and - connectors of the furthest slave.

- A solid receive light on the i-Vu Link indicates a wiring or polarity problem.
4 Set up the BACnet driver properties if using BACnet MS/TP

1. On i-Vu CCN's navigation tree, right-click on your custom equipment.
2. Select Driver Properties.
3. Expand Protocols and select BACnet MS/TP.
4. Under Port Configuration, select S2 as the requested port.
5. Set the baud rate to match the connected BACnet MS/TP devices (9600, 19200, 38400, 76800).
6. Set the fields under Protocol Configuration using information from the third-party manufacturer's representative. Definitions for each may be found below.
7. Click Apply to save changes.
9. In the Protocol Status table, verify that BACnet shows Running on Port S2. If the status shows Not Running or the wrong port, repeat step 4.

MS/TP Station ID - Defines the MS/TP MAC address of the i-Vu Link on the MS/TP network. Valid Station IDs are 0 - 127 for master nodes and 0 - 254 for slave nodes.

NOTES
- Since the i-Vu Link can ONLY be a Master node, set the MS/TP Station ID to an address between 0 - 127. The MS/TP Station ID must be unique on the MS/TP network (i.e., if there are 3 other MS/TP nodes on the network, and they have Station IDs of 2, 3, and 4, then the i-Vu Link cannot have a Station ID of 2, 3, or 4). The default is 1.
- This software setting is NOT related to the DIP switch setting on the equipment.

Max Masters - defines the highest MS/TP Master MAC address on the MS/TP network.

For example, if there are 3 master nodes on an MS/TP network, and their MAC addresses are 1, 8, and 16, then Max Masters would be set to 16 (since this is the highest MS/TP MAC address on the network).

This property optimizes MS/TP network communications by preventing token passes and "poll for master" requests to non-existent Master nodes.

In the above example, MAC address 16 would know to pass the token back to MAC address 1 instead of counting up to MAC address 127). Each MS/TP master node on the network must have their Max Masters set to this same value. The default is 127.

Max Info Frames - defines the maximum number of responses that will be sent when the i-Vu Link receives the token.

Any positive integer is a valid number. The default is 10 and should be ideal for the majority of applications. In cases where the i-Vu Link is the target of many requests, this number could be increased as high as 100 or 200.
5 Verify the i-Vu Link is set up correctly

1 On i-Vu CCN's navigation tree, select the custom equipment.

2 On the Properties page, select the Network Points tab.

<table>
<thead>
<tr>
<th>If...</th>
<th>Then...</th>
</tr>
</thead>
<tbody>
<tr>
<td>You see the point value you expect with no errors in the Error column</td>
<td>You have successfully established communication with the third-party device.</td>
</tr>
<tr>
<td>A point shows question marks instead of values</td>
<td>i-Vu CCN is not communicating with the i-Vu Link. Troubleshoot communications. See the i-Vu Link's Installation Guide.</td>
</tr>
<tr>
<td>The point name is red</td>
<td>Look in the Error column for one of the following error codes and descriptions.</td>
</tr>
<tr>
<td></td>
<td>1 - Communications Disabled for this Microblock Enable the integration point's Communications Enabled field on i-Vu CCN's Network Points tab.</td>
</tr>
<tr>
<td></td>
<td>3 - Address Error - Unknown Protocol Specified Select the correct port on the BACnet driver page in i-Vu CCN, verify that Address in the integration point is correct.</td>
</tr>
<tr>
<td>A value is incorrect</td>
<td>Verify that:</td>
</tr>
<tr>
<td></td>
<td>• The Address in the integration point is correct.</td>
</tr>
<tr>
<td></td>
<td>• The retrieved value is scaled properly, if necessary. For example, scaled from Celsius to Fahrenheit. Refer to the third-party manufacturer's documentation for scaling information.</td>
</tr>
</tbody>
</table>

If the above solutions do not resolve the problem, gather the following information for technical support:

• A diagnostic capture. See To get a diagnostic capture below.
• A screenshot of the Driver Properties - right-click on the custom equipment in the navigation tree > select Driver Properties > Properties page and the BACnet MS/TP > Properties page
• A screenshot of the custom equipment's Properties page > Network Points tab showing addresses and errors

To get a diagnostic capture

Use BACScope, a Carrier diagnostic tool, to capture the communication between the i-Vu Link and the third-party BACnet devices into a text file.

1 Get the latest version of BACScope from the Carrier website. Select Support > Download > Engineering and Startup Tools > Utilities > BACScope.
2 Unzip the files into a folder on your hard drive.
3 Double-click WinPcap_3.0.exe.
Verify the i-Vu Link is set up correctly

1. Follow the instructions in the installation wizard.
2. If running Windows 2000, reboot the computer.
3. Double-click **BACScope.exe**.
4. Select **Configure > Setup Adapters**.
5. Click **Add**.
6. Select the **Connection Type** of the network you are connected to and troubleshooting.
7. Enter appropriate values in each field. Your **Connection Type** determines which of the fields you will see.

<table>
<thead>
<tr>
<th>Field</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connection Name</strong></td>
<td>The name that will appear in the <strong>Configure &gt; Adapter</strong> list.</td>
</tr>
<tr>
<td><strong>Read from file</strong></td>
<td>Do not select this checkbox.</td>
</tr>
<tr>
<td><strong>Capture Filter</strong></td>
<td>See WinPCap documentation.</td>
</tr>
<tr>
<td><strong>Adapter</strong></td>
<td>Select the NIC (network interface card) that is connecting your computer to the problem device's network.</td>
</tr>
<tr>
<td><strong>Baud Rate</strong></td>
<td>That matches your network.</td>
</tr>
<tr>
<td><strong>Port</strong></td>
<td>The COM port on your computer that you use for the capture.</td>
</tr>
<tr>
<td><strong>Capture Poll for Master Messages</strong></td>
<td>Select this checkbox to capture BACnet MSTP token traffic.</td>
</tr>
<tr>
<td><strong>Port Number</strong></td>
<td>The default, 47808, is the most commonly used UDP port number.</td>
</tr>
<tr>
<td><strong>Passthrough</strong></td>
<td>Do not select this checkbox.</td>
</tr>
</tbody>
</table>

8. Click **OK** in the **Setup Adapters** dialog box.
9. Select **Configure > Adapter** > (adapter you created in steps 8–11).
10. If you do not see BACnet traffic on your BACscope screen after a few seconds, reboot your computer, then repeat steps 6 and 12.

11. While BACscope is recording communications, do the following:
   - Try to recreate the problem you are troubleshooting. If possible, correlate your troubleshooting actions with particular lines in the BACscope capture.
   - Note: Record communications for about 5 times the longest refresh rate set in any integration point.
12. Select **File > Save As**.
13. Name the file with a .CBL extension, then save it to any folder.
   - Tip: Include a brief description of the problem in the file name. For example, systemname_excessive_traffic, systemname_binding_conflicts, or systemname_slow_network.
14. Attach the following to your tech support case:
   - .CBL file
   - Device instance number of the problem device
   - Description of the problem