

## Niagara AX JACE with WattNode Pulse

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### Overview

This application note describes the steps to connect a Continental Control Systems Pulse WattNode® to a Tridium® JACE® 200 running Niagara® AX.

The JACE 200 does not have built-in I/O to detect the WattNode pulse output, so an add-on module is required:

- **IO-34:** 34 point I/O module with 16 universal inputs that support pulse counting. One IO-34 module can be connected to a single JACE.
- **IO-16:** 16 point I/O module with 8 universal inputs that support pulse counting. Up to four IO-16 modules can be connected to a single JACE.
- **T-IO-16-485:** 16 point I/O module with 8 universal inputs that support pulse counting. This version is connected to the JACE using RS-485, allowing remote connections. Up to 16 T-IO-16-485 modules can be connected to a single JACE.

### Pulse Counting

The JACE IO modules can count pulses up to 20 hertz. The standard Pulse WattNode has a 4 Hz full-scale pulse frequency, which works well with the JACE. In some cases, you might prefer the WattNode with a 10 Hz or 20 Hz full-scale output:

The higher pulse output frequency results in more pulses in a fixed time interval. For example, suppose you want to compute the average power once per minute. If you count the pulses for one minute, then scale the results, you can compute the average power. But with a 4 Hz full-scale output, if the WattNode is running at 10% of full-scale, there will only be 24 pulses during the minute so your power measurement will only be accurate to roughly 4%, ignoring WattNode and current transformer (CT) errors. If you increase the pulse frequency to 20 Hz, the error would drop to 0.8%. Alternatively, you could measure the average power over a longer interval (say five minutes or fifteen minutes) to improve the accuracy.

If you order the WattNode with a full-scale output frequency of 20 Hz, and your load exceeds 100% of rated power, the WattNode pulse output frequency will exceed 20 Hz. In this case, the JACE IO board may stop counting pulses altogether. If this is a concern, you might prefer a 10 Hz full-scale frequency.

## Setup Ndio Network

### Install Ndio Software Modules to JACE

- Install the **ndio** and **platNdio** modules from **Platform > Software Manager**.
- Locate the modules in the Software Manger, left-click each module followed by a click on the **Install** button at the bottom.
- Then click on the **Commit** button. Modules will be installed and the JACE will reboot. The reboot will take several minutes.

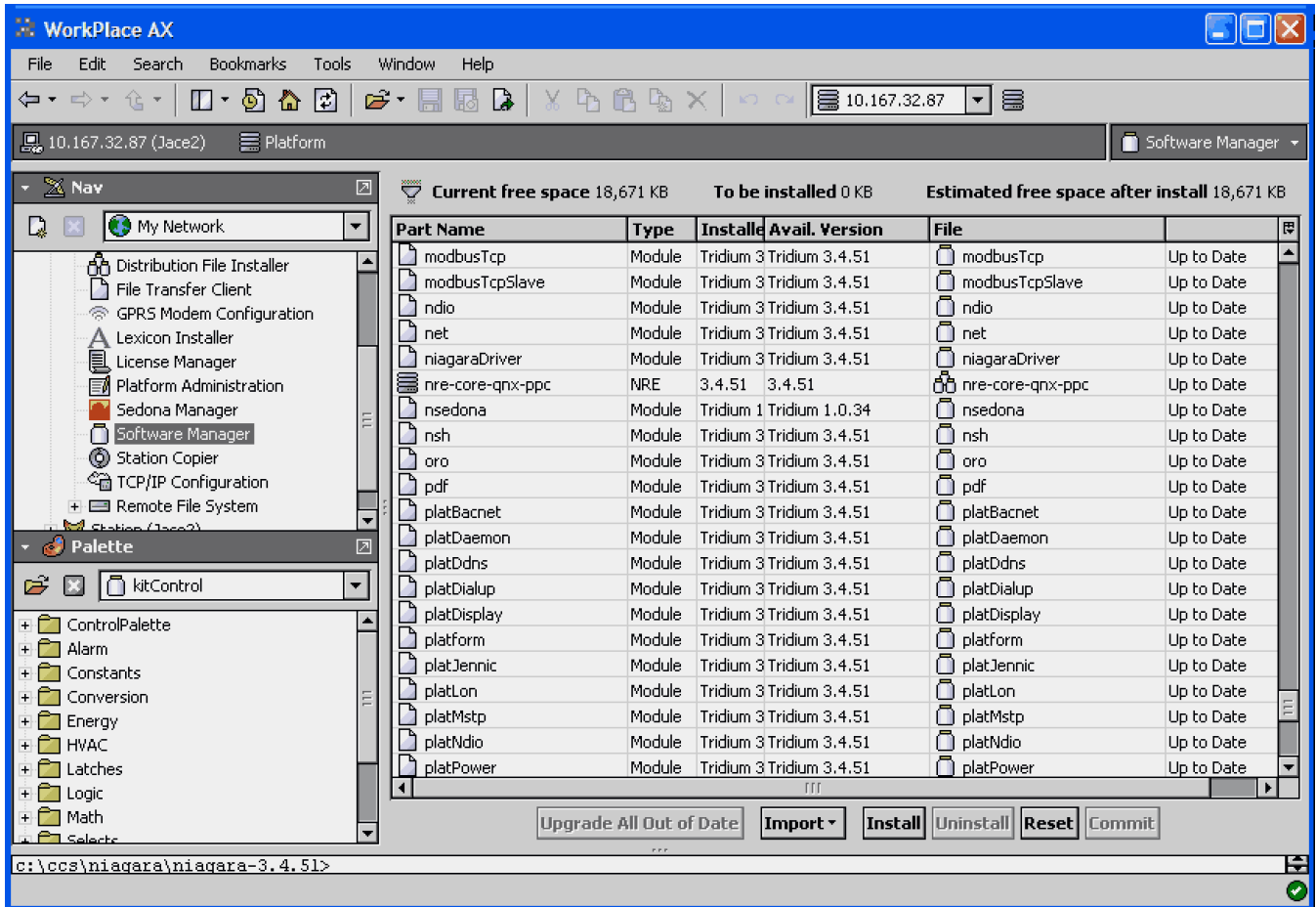


Figure 1: Install Ndio Software Modules.

## Open Station Driver Manager

- In the Nav tree right-click on folder **Station > Config > Drivers** and select **Views > Driver Manager**.

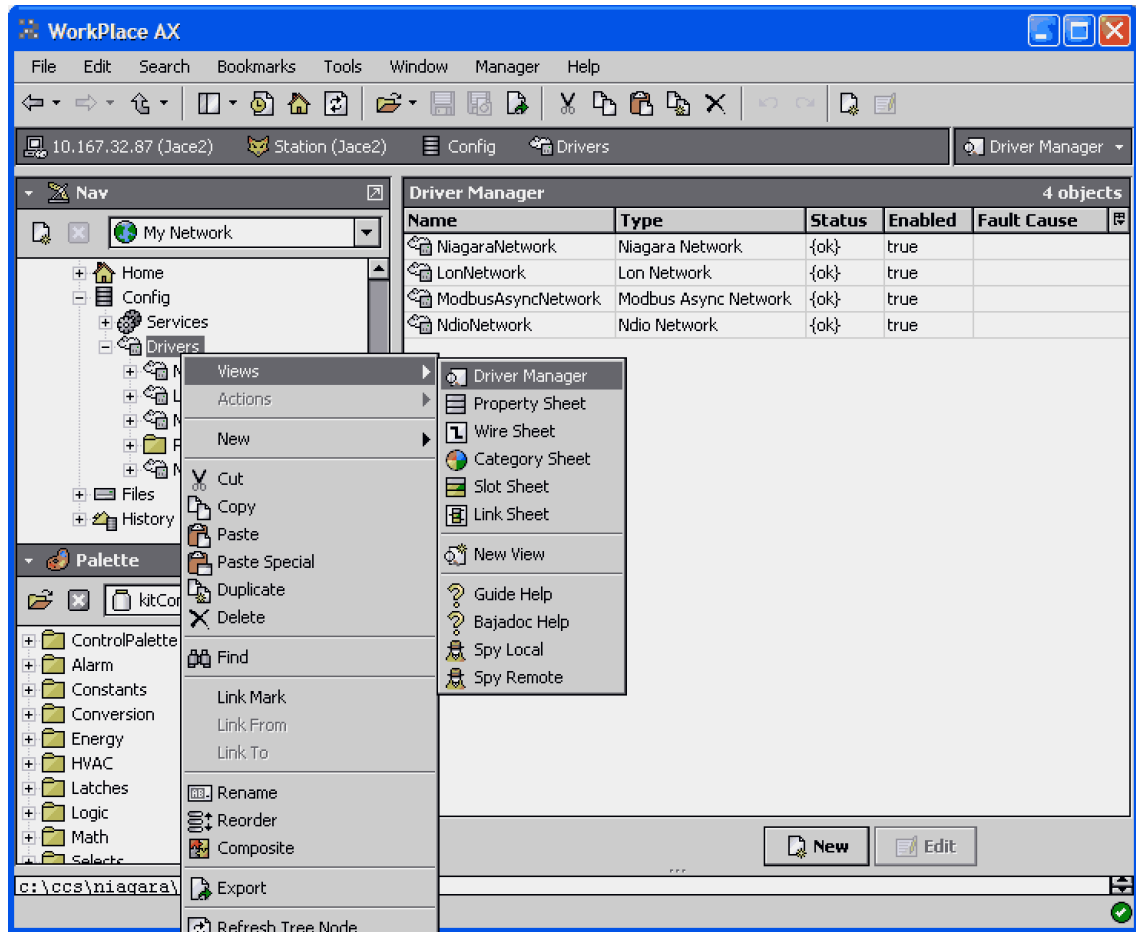


Figure 2: Open Station Driver Manager

### Add Ndio Network

- Open the Ndio palette and locate the NdioNetwork object in the Network folder.
- Drag the **NdioNetwork** to the **Driver Manager** window.

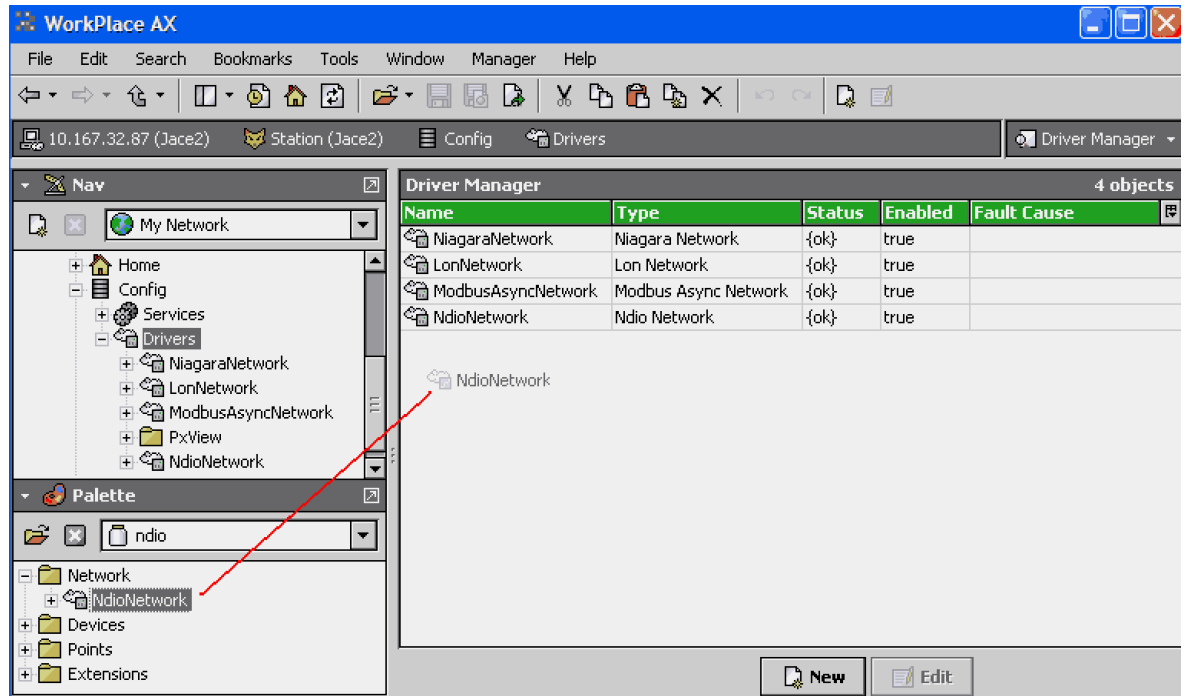


Figure 3: Add Ndio Network

### Setup Ndio Board

#### Open Ndio Board Manager

- Right-click on the NdioNetwork in the Driver Manager window pane and select **Views > Ndio Board Manager**.

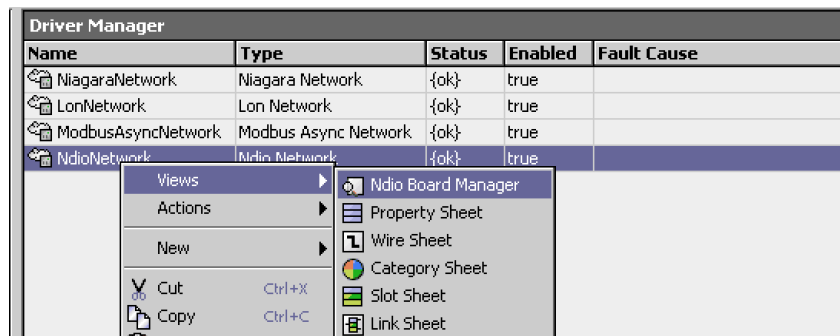


Figure 4: Open Ndio Board Manager

### Discover the Ndio Module

- Click on the **Discover** button at the bottom.
- Click and drag the discovered board from the **Discovered** pane to the **Database** pane.
- A pop-up dialog will appear, allowing you to rename the device if desired.

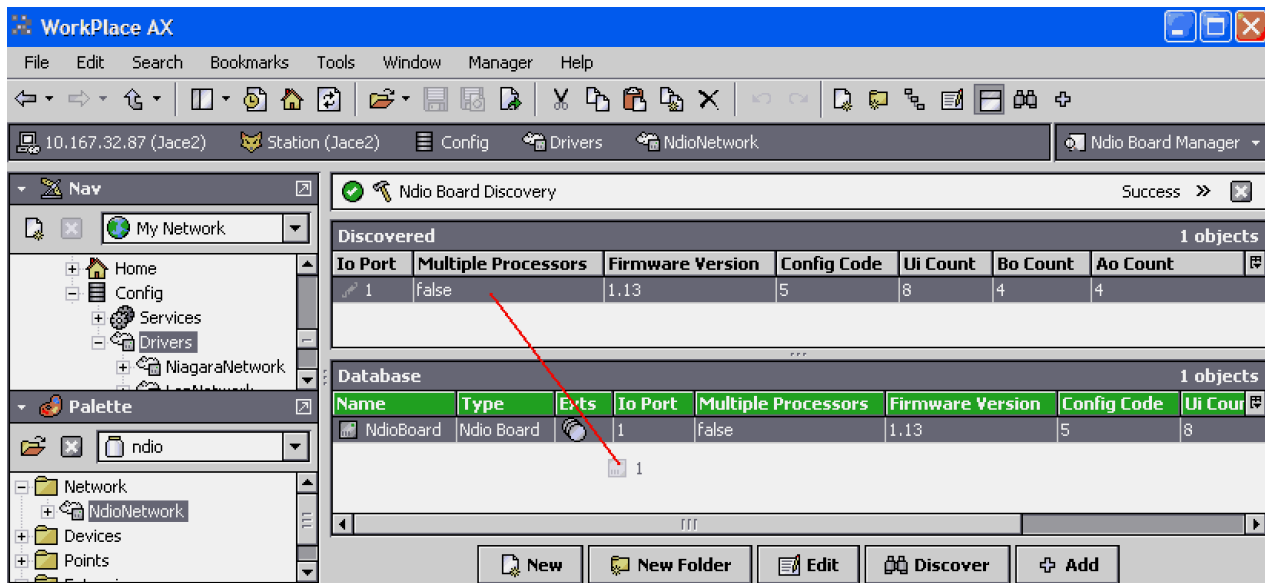


Figure 5: Discover Ndio Module

### Open Ndio Point Manager

- In the Nav tree go to **Config > Drivers > NdioNetwork > NdioBoard > Points**
- Right-click **Points** and select **Views > Ndio Point Manager**.

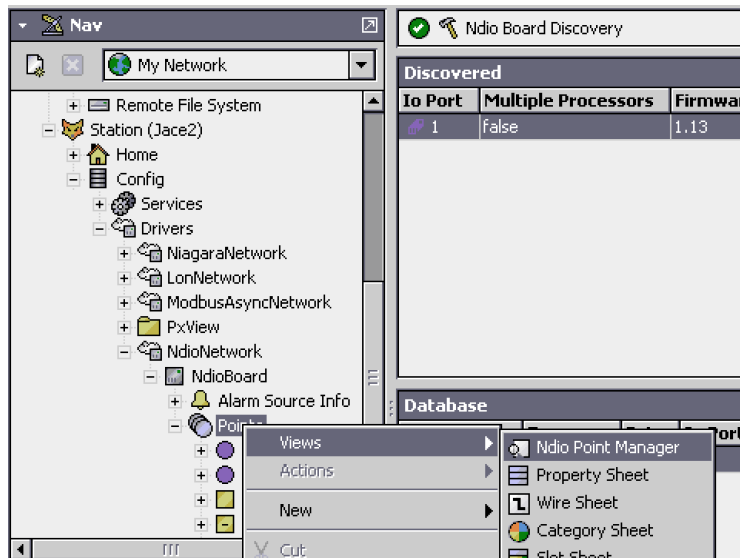
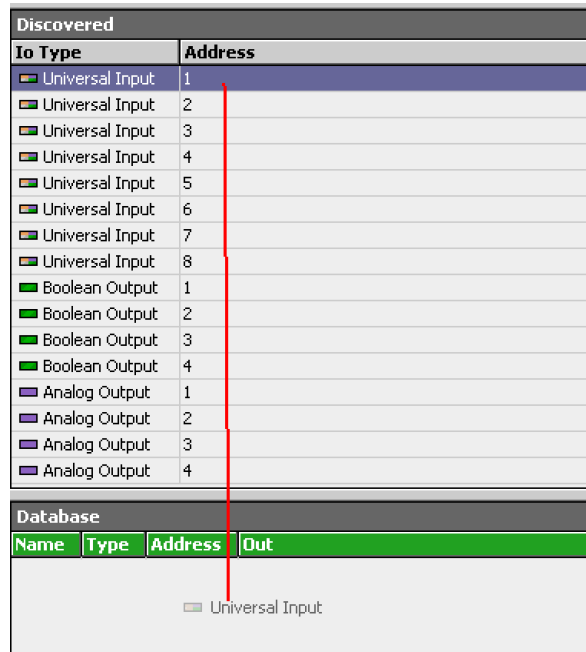


Figure 6: Open Ndio Point Manager

### Add Ndio Points

- Click the **Discover** button at the bottom of the Ndio Point manager.
- Click and drag **Universal Input 1** to the **Database** pane.

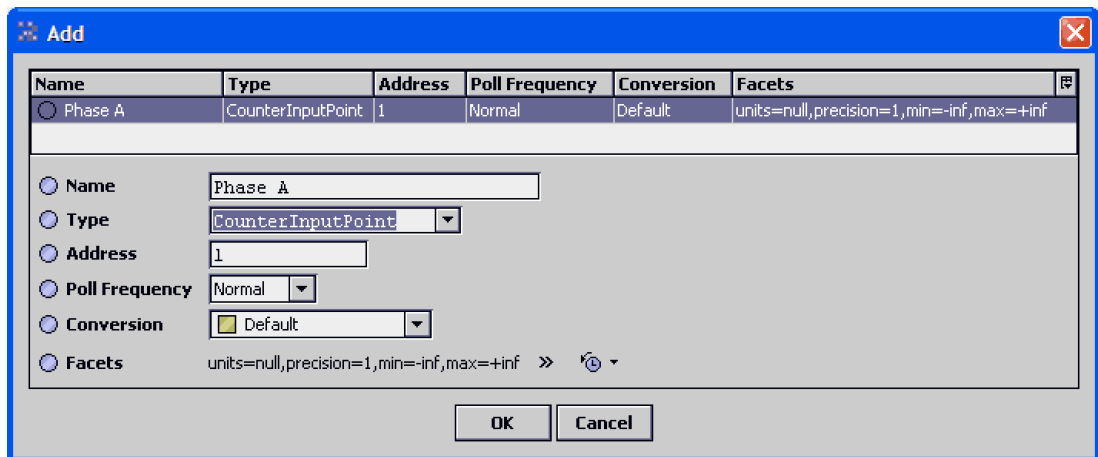


**Figure 7: Discover and Add Universal Input**

- In the **Add** pop-up enter a meaningful name (“Phase A” for this example)
- Change the **Type** to “CounterInputPoint” in the dropdown menu, then click **OK**.

From the Niagara help:

*“A CounterInputPoint is a NumericPoint with NdioCounterInputProxyExt. It configures a UI to count dry-contact pulses up to 20 Hz, as well as calculate a numeric rate. In the ProxyExt, you specify which value is to appear at the proxy point’s Out slot (either Count or Rate) as a status numeric.”*



**Figure 8: Configure Ndio Point**

## Display Power and Energy

To convert the count of pulses to energy (kWh), we must scale the pulse count. To display power (watts), we must use a rate calculation and then scale the results. We use the counter input property sheet to configure these conversions.

- In the Nav Tree pane navigate to the Point added above: **NdioNetwork > NdioBoard > Points > Phase A**.
- Right-click “Phase A”, and select **Views > Property Sheet**.

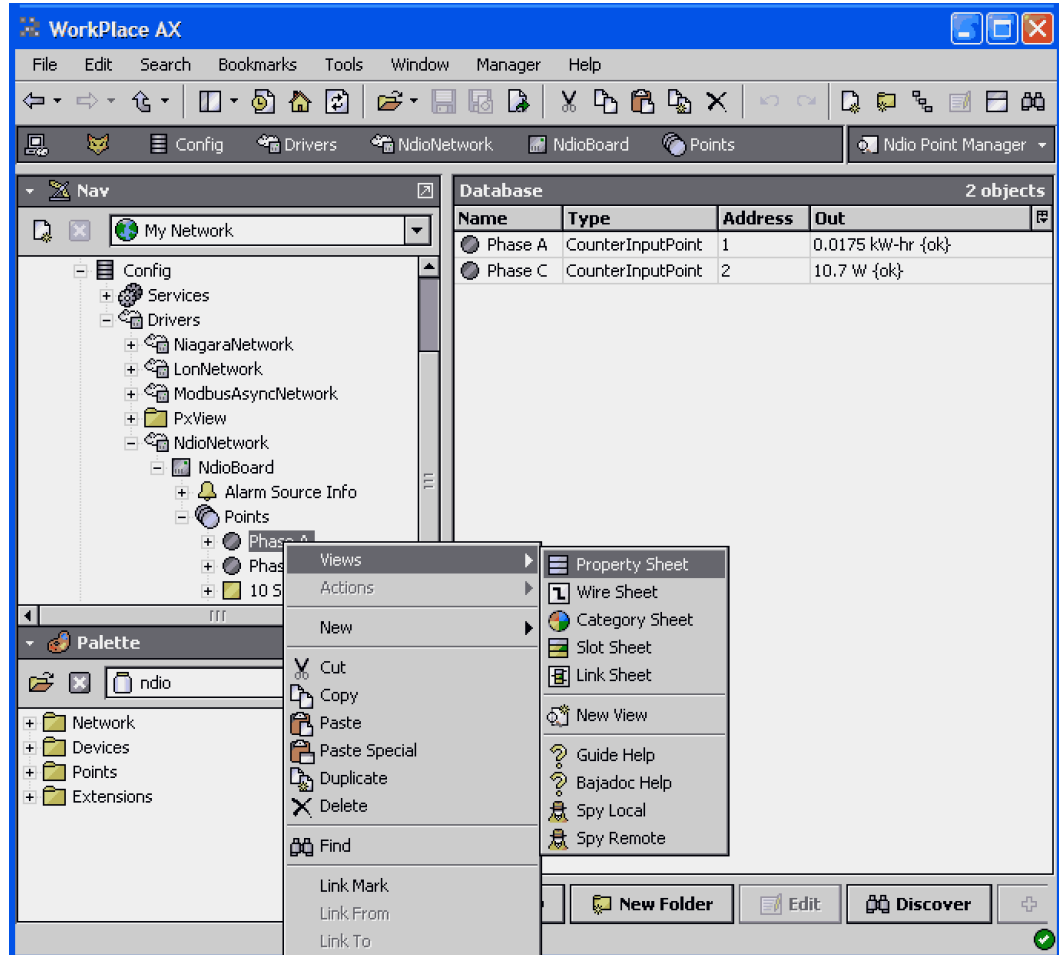


Figure 9: Open Ndio Point Property Sheet

### Scale Energy

- Set the property **Conversion** to “Linear”.
- Set the **Scale** as required for your device (refer to the WattNode manual). If you are using a 4 Hz output WattNode, you can look up the scale factors for different models and CTs in a table. Since we are using a custom pulse frequency of 20 Hz, we’ll use the following equation:

$$WHpP = \frac{PpPO \cdot NVAC \cdot CtAmps}{FSHz \cdot 3600}$$

**PpPO** = 1 for Option P3

**NVAC** = 120 for the WNB-3Y-208-P

**CtAmps** = 20 amps

**FSHz** = 20 Hz

- So the **WHpP** (watt-hours per pulse) =  $1 * 120 * 20 / (20 * 3600) = 0.03333$ .
- Convert to kilowatt-hours per pulse by dividing by 1000: **kWhpP** =  $3.333e-5$  and save this value as the **Scale**.
- Set the **Facets** units to “kW-hr”.

### Scale Power

- Change the property **Rate Calc Type** to “SlidingWindowRateType”.
- Click the **Save** button.
- Expand the **Rate Calc** options by clicking on the “+” sign.
- Set **Rate Calc** settings **Interval** to 30 seconds “00000h 00m 30s” and **Windows** to “30”. This will provide one second updates based on the average of the last thirty seconds. Refer to the Niagara documentation for more details on the SlidingWindowRateType.
- The equation for power is:

$$\text{Power (watts)} = \text{WHpP} * 3600 * \text{PulseFreq}$$

So set scale factor for power (watts) to **WHpP** \* 3600, or 120 for this application.

The screenshot shows the configuration for a Phase A Numeric Point. The 'Rate Calc' section is expanded, showing the following settings:

- Rate Calc Type:** ndio, SlidingWindowRateType
- Rate Calc:** Sliding Window Rate Type
  - Scale:** 120.00000
  - Interval:** 00000h 00m 30s [1sec - +inf]
  - Windows:** 30 [2 - max]
  - Rate Calc Time:** 20-Apr-2010 01:32 PM MDT
- Out:** 56.97 kW-hr {ok}

Other visible settings include:

- Facets:** units=kW-hr,precision=2,min=-inf,max=+inf
- Proxy Ext:** Ndio Counter Input Proxy Ext
- Status:** {ok}
- Enabled:** true
- Conversion:** Linear, Scale: 3.334E-5, Offset: 0
- Read Value:** 1708736.0 {ok}
- Write Value:** 0.0 {ok}
- Point Type:** Counter Input
- Address:** 1
- Raw:** 1866821
- Output Select:** Count
- Total:** 1708738
- Rate:** 525.30

Figure 10: Configure the Ndio Point



## Wire the WattNode to the JACE

The JACE-200 with an attached IO-16 module is shown in the figure below. There are eight universal inputs along the bottom of the module labeled U1 through U8. Connect the desired WattNode Pulse outputs channels P1, P2, and/or P3 to these universal inputs. Connect the WattNode “COM” terminal to a common point “0V” on the IO-16 module. For this application note, we used the following connections.

WattNode Outputs	IO-16 Connections
P1	U1
P2	U2
P3	U3
COM	“0V” between U1 and U3

Figure 11: WattNode Connections to IO-16



Figure 12: JACE Input Connections for WattNode

## Conclusion

At this point, you should be able to monitor power and energy from the WattNode. You can connected additional WattNodes or use Option P3 (per-phase outputs) to monitor up to three single-phase circuits with one WattNode. You can also add more IO-16 modules to support even more pulse inputs.

Using the power and energy points, you can add History to provide a log of the power and energy over time. You can also measure demand by creating a running average of the power over a longer time interval, generally 15 minutes.

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