NiagaraAX JACE with the WattNode Modbus Meter

Overview

This document describes the steps necessary to connect a Continental Control Systems WattNode® Modbus meter to a Vykon JACE-200™ running NiagaraAX Framework®. It demonstrates how to use the custom WattNode Modbus module (JAR file) to simplify setup, and how to read values from the WattNode meter.

Software Installation and Configuration

Verify Station Has Modbus License

The JACE-200 must be licensed to use Modbus communication.

1) To verify the license, look under the JACE's **Platform > License Manager**.
2) Click on the license under the **Licenses** window (i.e. "Vykon.license").
3) Click the **View** button to see if **feature name="modbusAsync"** is included.

   Contact the distributor for your JACE if the Modbus license is not installed.

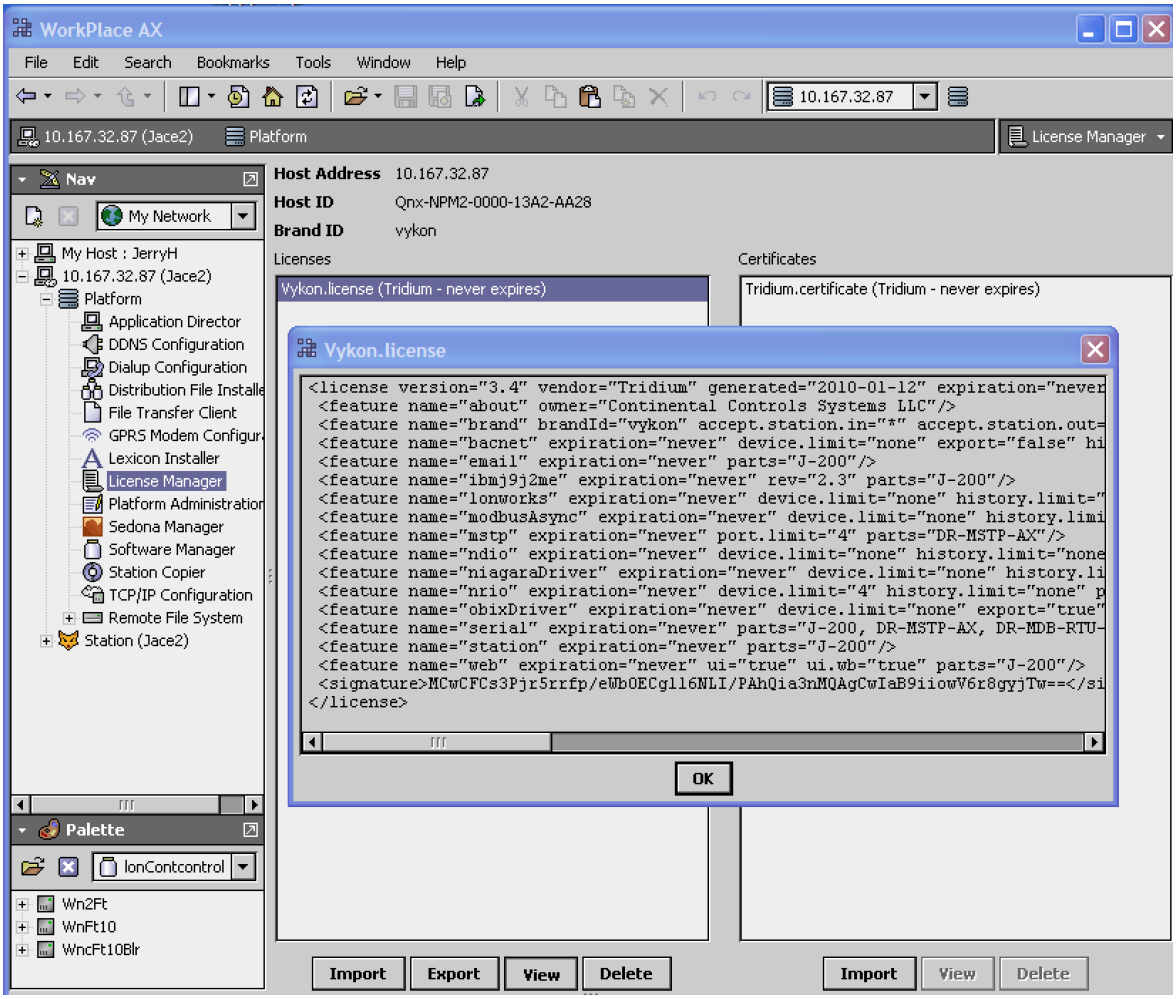

Figure 1: Verify Modbus License Installed

Install Modbus Software Modules on the JACE

If the Modbus software modules have not already been installed on the JACE, you need to install them.

1) Start by going to the JACE's **Platform > Software Manager** window.
2) Click on the module **modbusAsync.**
3) Click on the **Install** button at the bottom of the window.
4) Repeat for the module **modbusCore**.
5) Click on the **Commit** button at the bottom of the window.
   The station must reboot, which takes a few minutes.
6) After the reboot, log on again.

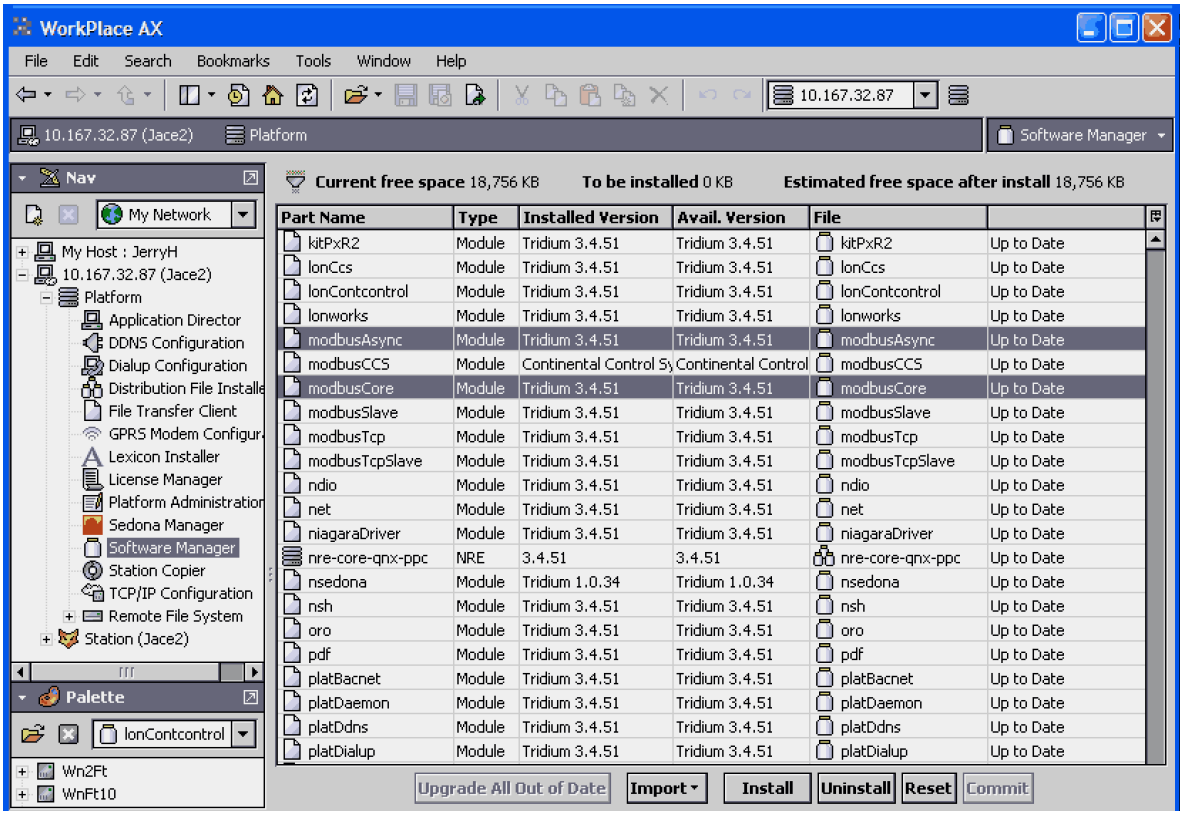

Figure 2: Install Modbus Modules

Install Modbus Network on the JACE

1) Begin installation of the Modbus network module by navigating to **Station > Config > Drivers**.
2) Right-click on **Drivers**, select **Views,** and then click on **Driver Manager**.

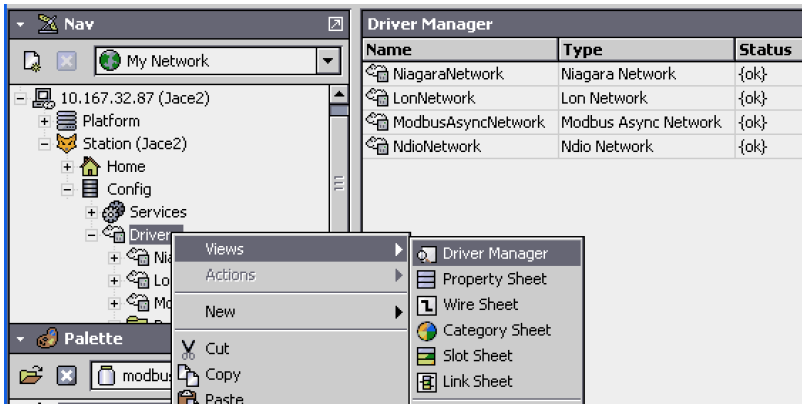

Figure 3: Open JACE Driver Manager

3) Open the **modbusAsync** module by clicking on the **Open Folder** icon in the upper-left corner of the **Palette** window.

   An **Open Palette** popup appears.
4) Select the **modbusAsync** module and click **OK.**

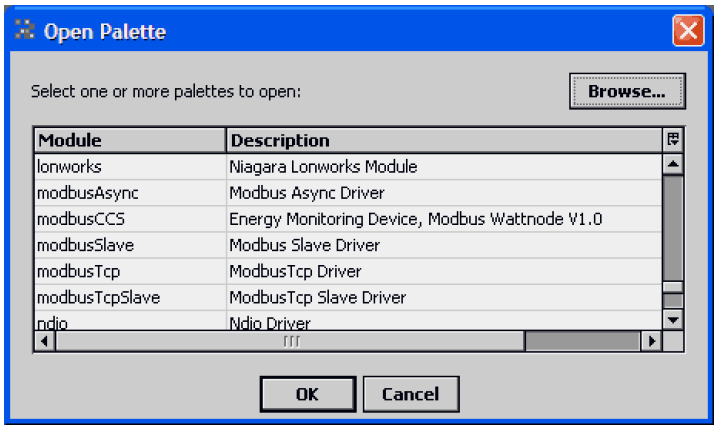

Figure 4: Select the ModbusAsync Palette

5) Drag and drop **ModbusAsyncNetwork** from the palette to the **Driver Manager** pane.
6) Expand the **Drivers** folder in the **Nav** pane, and verify that **ModbusAsyncNetwork** appears.

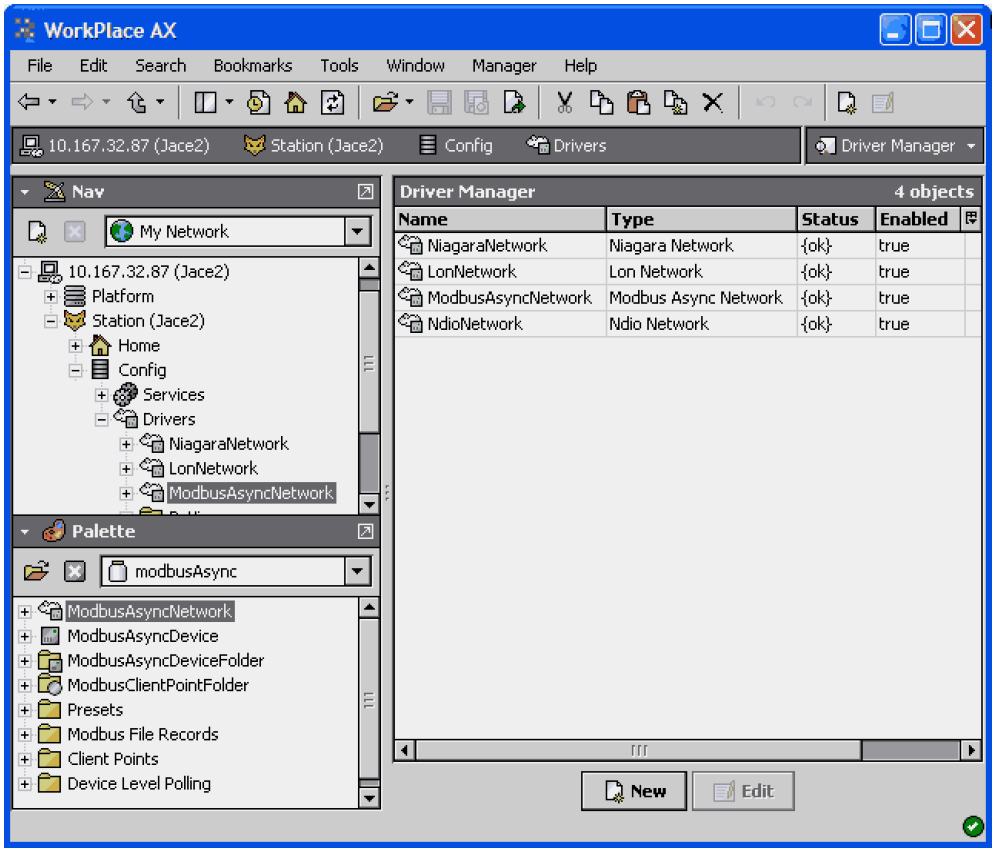

Figure 5: Verify ModbusAsyncNetwork Installed

Setup ModbusAsyncNetwork

1) In the **Nav** pane, right-click on **ModbusAsyncNetwork,** and select **Views > Property Sheet**.

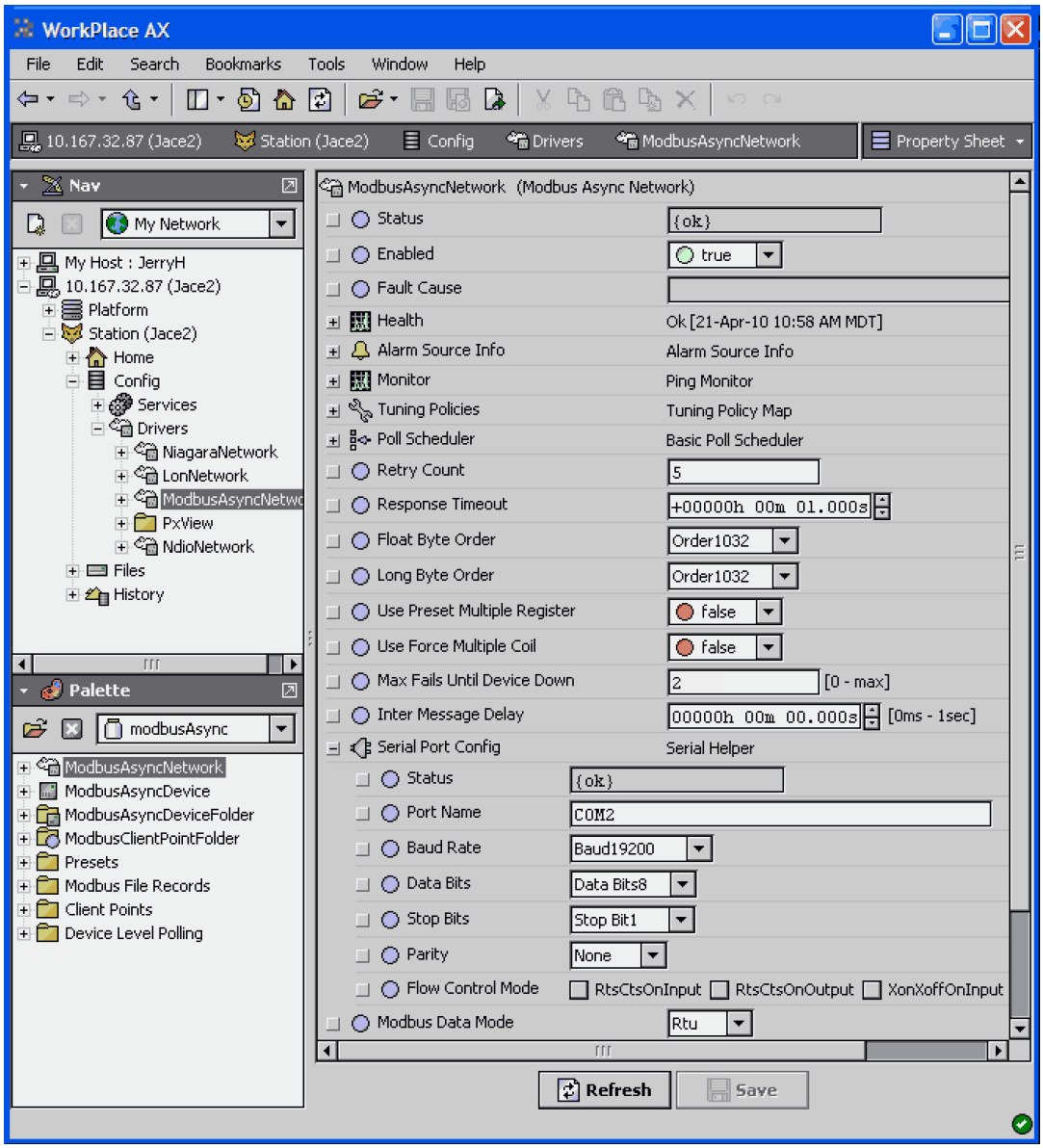

Figure 6: Settings for Modbus Network

2) Verify or change the following settings.

   Note: these settings apply to ALL Modbus devices connected to the JACE, so if you have devices in addition to the WattNode meter, you should use settings that are compatible with all devices.

   - **Enabled:** true
   - **Poll Scheduler:**
     - **Poll Enabled:** true - this enables polling of monitored data points.
     - **Fast Rate:** 1 second
     - **Normal Rate:** 5 seconds - the fast, normal, and slow rates can be independently selected for each data point being monitored. The period between polling can be configured for each of these rates. If you are monitoring a small network with less

than five meters, you should be able to monitor many data points at a five second rate. But if you are monitoring a large network, you will probably need to select a slower monitoring rate to avoid overloading the network.

- **Slow Rate:** 30 seconds

- **Monitor:** Ping Monitor - by default, this will ping all Modbus devices every five minutes to make sure they are still operational. This is skipped if the JACE has already polled a device in the last five minutes.
- **Response Timeout:** 1.0 second - this configures how long the JACE waits for a response from the WattNode meter. The meter will work with a timeout of 0.5 seconds or longer.
- **Float Byte Order:** We recommend leaving this unchanged. The WattNode Modbus module (JAR file) uses **Order1032** for the WattNode meter. Changing the value here could cause other Modbus devices on the network to stop working.
- **Long Byte Order:** We recommend leaving this unchanged. The WattNode Modbus module (JAR file) uses **Order1032** for the WattNode meter. Changing the value here could cause other Modbus devices on the network to stop working.
- **Max Fails Until Device Down:** 2 - after this many consecutive failures, the JACE will stop polling a Modbus device. It will continue the “Ping Monitor” if enabled and if this succeeds, the JACE will resume polling.
- **Inter Message Delay:** 0.000 seconds - normally, no extra delay is required between messages. If you are getting communication errors, try increasing this to 0.05 seconds.
- **Serial Port Config:**
  - **Port Name:** COM2 - this is the standard port on the JACE-200 for RS-485.
  - **Baud Rate:** Baud19200 - make sure this matches the WattNode meter’s baud rate. The meter can be configured using DIP switch position 8 for 9600 baud (0) or 19200 baud (1). It can also be configured for 38400 baud with the ***Baud*** configuration register (see the user manual).
  - **Data Bits:** Data Bits8 - the WattNode meter requires eight data bits.
  - **Stop Bits:** Stop Bit1 - the WattNode meter requires one stop bit.
  - **Parity:** None - The WattNode meter normally uses no parity. It can be configured to use even parity with the ***Parity*** configuration register, but this is rarely used.
  - **Flow Control Mode:** none checked - the WattNode meter does not support flow control.
- **Modbus Data Mode:** Rtu - The WattNode meter requires Modbus RTU mode.

3) Click **Save** button.

Install the WattNode Modbus Module

1) Obtain the WattNode Modbus software module “modbusCCS.jar” from the CCS website on the WattNode Modbus meter download page:
   http://www.ccontrolsys.com/w/WattNode_Modbus_-_Downloads
2) Install this file on your local PC with the other Niagara software modules. For example:
   - C:\CCS\Niagara\Niagara-3.4.51\modules

   These directories contain the available modules for the JACE stored as jar files.
3) After installing the module on your local PC, install the module on the JACE using the JACE **Platform > Software Manager** window.

4) Click on the module “modbusCCS”.
5) Click on the **Install** button and then the **Commit** button at the bottom of the window.

The JACE station reboots and allows you to reconnect after a few minutes.

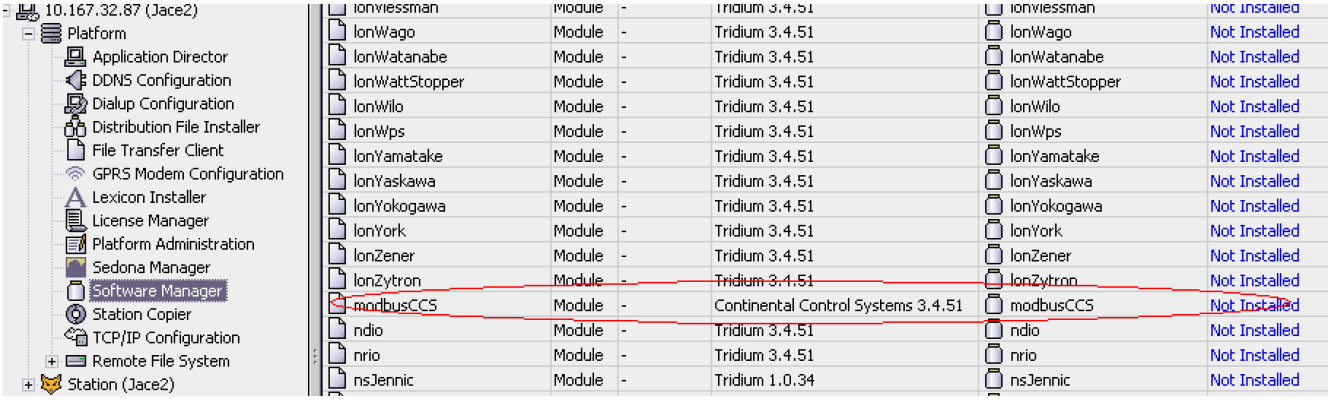

Figure 7: Install modbusCCS.jar Module

Add the WattNode Meter to the Modbus Network

1) In the **Palette** window, click on the **Open Folder** icon.

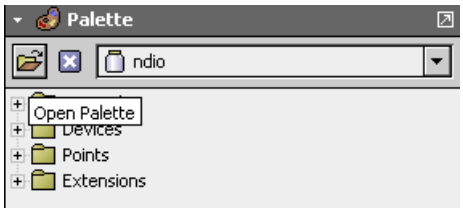

Figure 8: Select Open Folder Icon

2) In the **Open Palette** popup window, select the **modbusCCS** module and click **OK.**

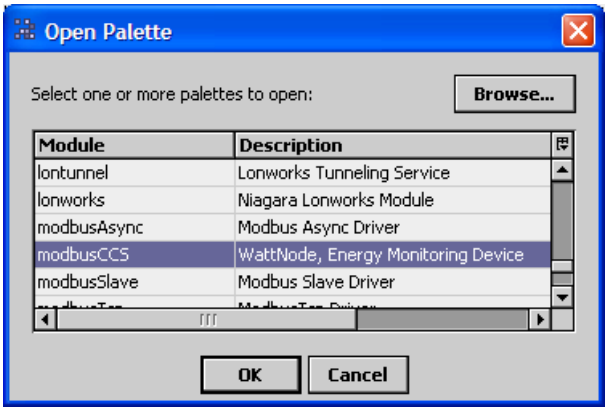

Figure 9: Select the modbusCCS Module

The Palette window now shows the WattNode devices in the modbusCCS module.

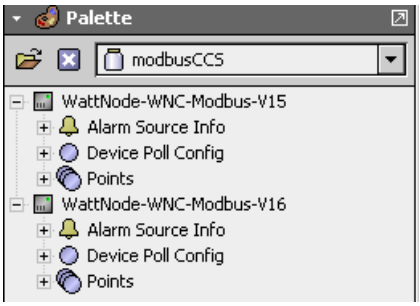

Figure 10: Palette Window for modbusCCS Device

Two devices are listed. The first device is for firmware version V15 or earlier; the second device is for firmware version V16. Firmware version V16 was released November 2010 and contains some extra Modbus registers. See http://www.ccontrolsys.com/w/WattNode_Modbus_Versions#Firmware_Version_16 for details. Version V15 will work with V16 meter, but won't provide access to the new registers. Using the V16 module on a V15 or older WattNode meter results in communication errors because the V16 module attempts to query registers that don't exist in earlier firmware versions. If unsure of your WattNode meter version, select V15 and then look at the ***Version*** point, explained below in "Verify Firmware Version".

Note: A Modbus *register* and a JACE *point* are different terms for the same thing: a data point. The ***Version*** point mentioned above is also a ***Version*** register.

3) Click and drag **WattNode-WNC-Modbus-V1x** from the **Palette** window to the **ModbusAsyncNetwork.**
4) Change the **Device Address** by right-clicking on the added device (**WattNode-WNC-Modbus-V16** for this example) and clicking **Views > Property Sheet.**

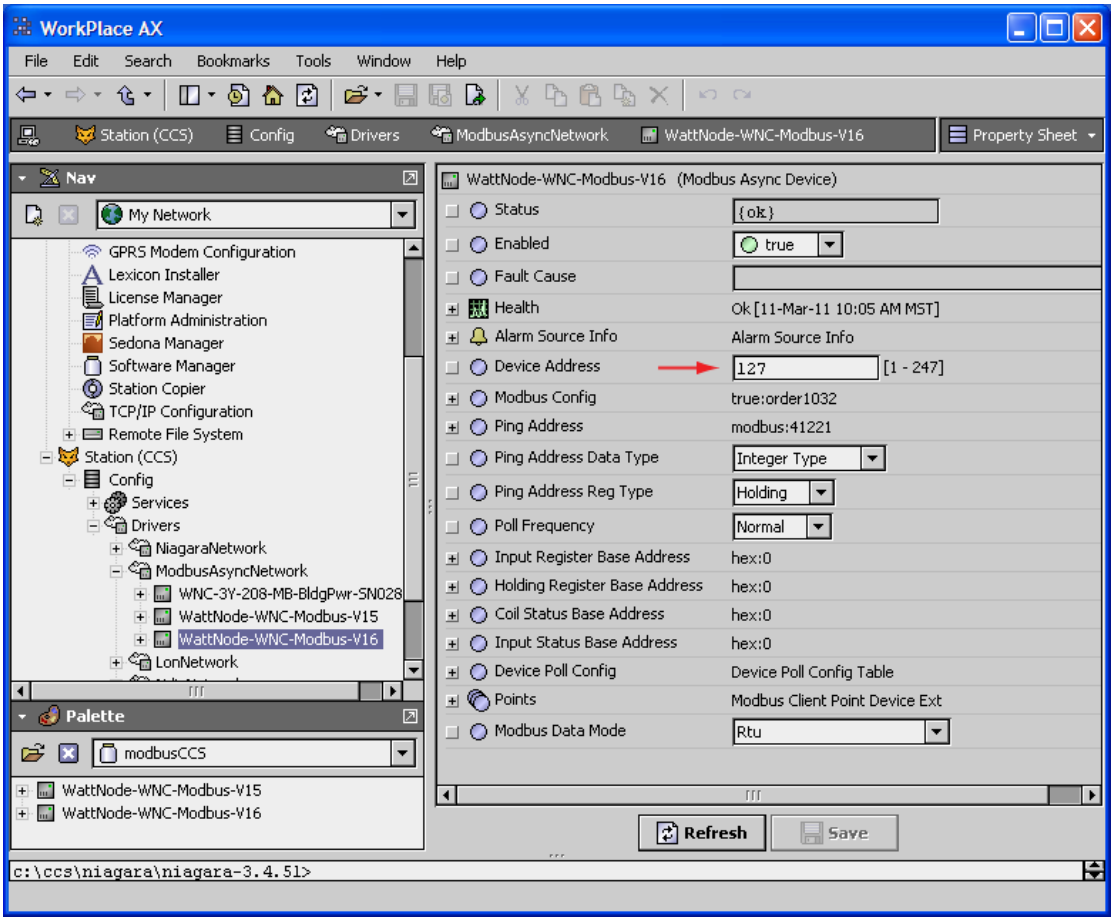

Figure 11: Add WattNode Meter to Network and Set Device Address

5) Change the **Device Address** to match the Modbus address for your device (determined by the DIP switch settings on the WattNode meter).

Verify Firmware Version

1) To determine your firmware version, go to the **WattNode-WNC-Modbus-V1x > Points > Diagnostics** folder.
2) Right-click on the **Diagnostics** folder then select **Views > Modbus Client Point Manager.**

The **Database** window includes the firmware **Version.**

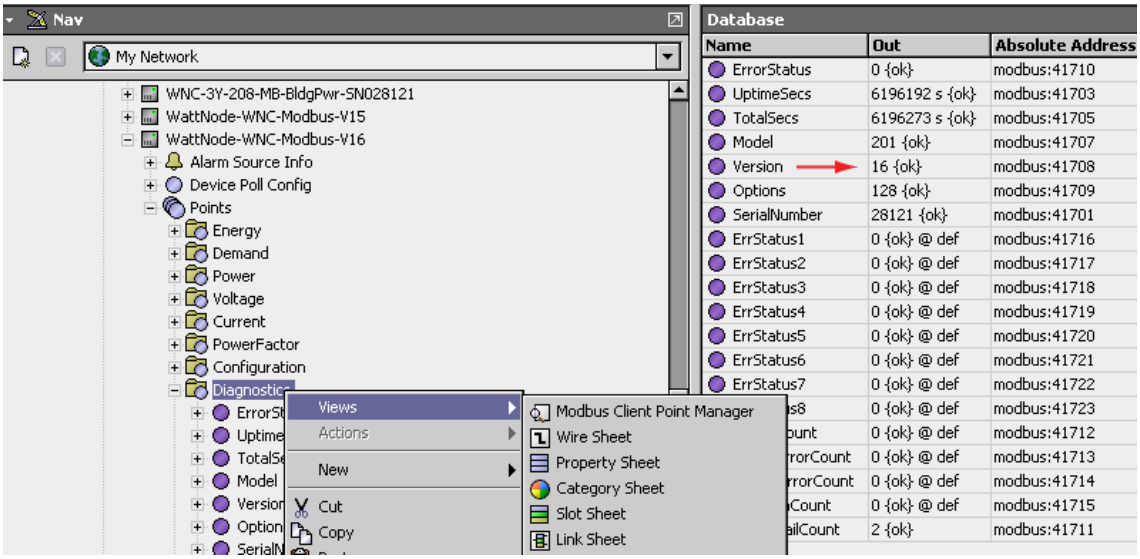

Figure 12: View Firmware Version in Diagnostics Point Folder

Hardware Setup

- Install the WattNode meters as described in the WattNode Modbus Installation and Operation Manual.
- Install the JACE as described in the **Mounting and Wiring Instructions**.

Modbus Connections from JACE to WattNode Meter

Next, you need to connect the Modbus (RS-485) terminals on the one or more WattNode meters to the JACE. The RS-485 connections on the meters are generally daisy-chained together and then run to the JACE.

An RS-485 port is provided on the JACE. See the **Mounting and Wiring Instructions** for your JACE for the correct location and pinout. The following photograph shows the RS-485 port location and pinout for a JACE-200.

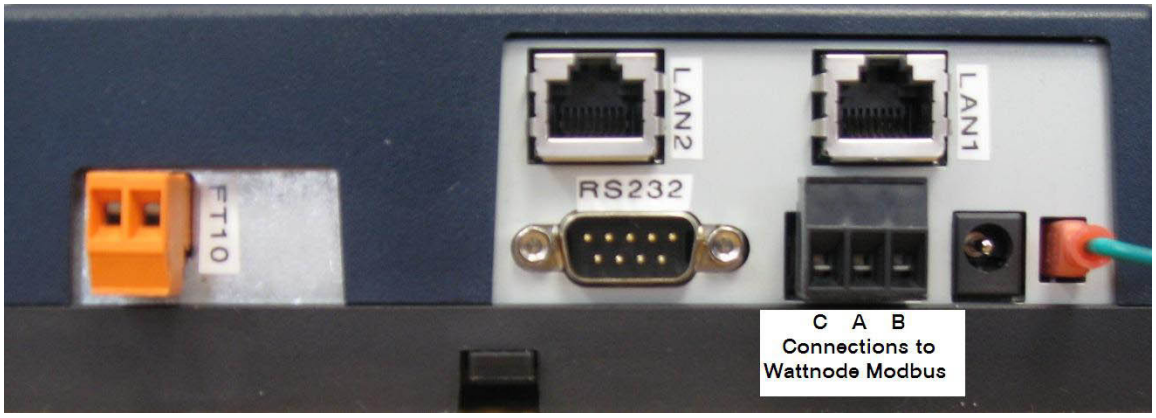

Figure 13: JACE-200 Modbus Connections for a WattNode Meter

Operation

At this point, you can start monitoring values from the WattNode meter and configuring logging (using the JACE history functions). See the JACE documentation for details on these. We also recommend that you optimize the Modbus polling as described below, because this results in big performance improvements.

Optimize Modbus Polling

Without optimized polling, the JACE will read one Modbus register at a time, resulting in extra network overhead and dramatically reduced throughput.

To improve the efficiency when monitoring registers, the JACE can group consecutive registers and read them with one Modbus packet. The WattNode Modbus module (JAR file) is pre-optimized, but you will want to optimze again any time you add or remove registers from the polling list.

1) Right-click on **Device Poll Config** under each WattNode meter and select **Actions > Learn Optimum Device Poll Config**. You need to do this for each WattNode meter and whenever you change the list of registers being polled.

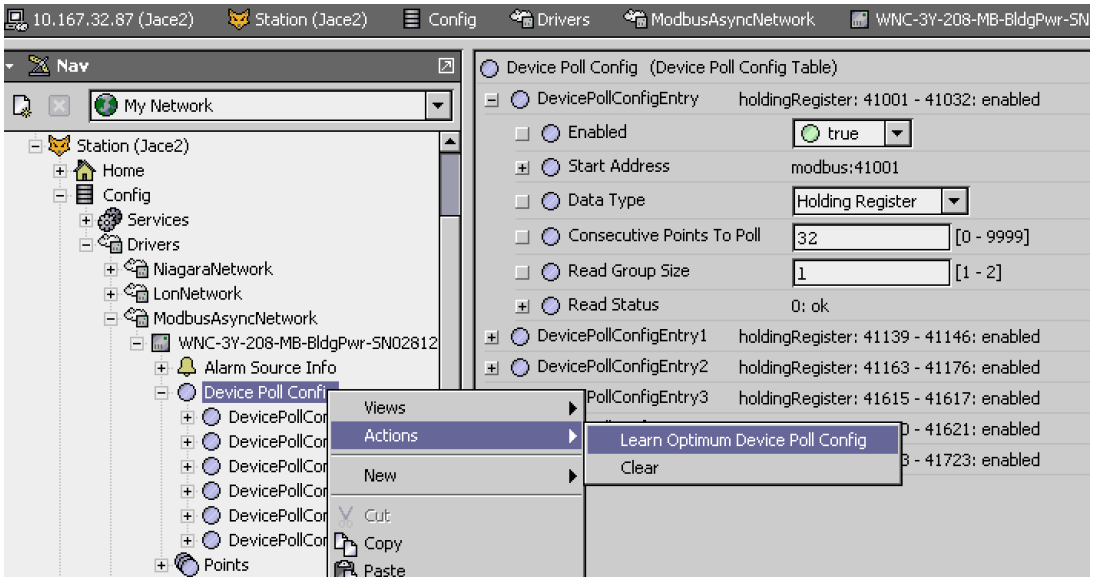

Figure 14: Learn Optimum Device Poll Config

List of Modbus Registers in CCS Software Module

"Figure 15: Register List" shows the WattNode Modbus meter registers provided by the CCS module version 15. Registers are grouped in folders. Refer to the WattNode Modbus meter manual for descriptions. The list of registers can also be downloaded in spreadsheet form from the CCS Website:
http://www.ccontrolsys.com/w/WattNode_Modbus_-_Downloads

Note: A Modbus *register* and a JACE *point* are different terms for the same thing: a data point. The list of registers in Figure 15 is also a list of points.

Many WattNode meter registers are available in floating point and integer formats. The formats have different advantages and disadvantages:

- Floating point registers provide more precision and normally require no scaling.
- Floating point registers require four bytes (two registers) each.
- Integer registers require only two bytes (one register) each, so they are more efficient to monitor.
- Integer registers generally need to be scaled before using.
- Integer registers sometimes provide less resolution, especially for power, which can vary over a wide range.
- The integer energy values are 32 bit or four bytes, so they are the same size as the floating point energy values. However, the integer energy values are preferred because

the resolution is fixed at 0.1 kWh. By comparison, the floating point energy registers start with extremely fine resolution (better than 0.1 watt-hour), but the resolution gets worse over time and can become worse the 0.1 kWh after enough weeks or months of operation.

Because of these tradeoffs, the CCS WattNode module has selected all floating point registers except for the energy registers, which are integers. If your preferences are different, you can add your own registers (points) – or edit the registers (points) provided – to switch from floating point to integer or vice versa. If you use integer registers for power, voltage, current, power factor, etc., be sure to correctly scale them as described in the WattNode meter manual.

Some of the registers are writable. They will appear as type “Numeric Writable” instead of “Numeric Point” for the read-only registers. See the WattNode meter manual for details on writable registers. This list shows register addresses with a leading “4” to indicate holding registers. The WattNode meter manual leaves off the “4”, but the addresses are equivalent.

Name	Register Address	Data Type	Units	Description
Energy Registers				
EnergySum	41201	Long	0.1 kW-hr	Total net (bidirectional) energy
EnergyPosSum	41203	Long	0.1 kW-hr	Total positive energy
EnergySumNR	41205	Long	0.1 kW-hr	Total net (bidirectional) energy - non resettable
EnergyPosSumNR	41207	Long	0.1 kW-hr	Total positive energy - non resettable
EnergyA	41301	Long	0.1 kW-hr	Net (bidirectional) energy, phase A
EnergyB	41303	Long	0.1 kW-hr	Net (bidirectional) energy, phase B
EnergyC	41305	Long	0.1 kW-hr	Net (bidirectional) energy, phase C
EnergyPosA	41307	Long	0.1 kW-hr	Positive energy, phase A
EnergyPosB	41309	Long	0.1 kW-hr	Positive energy, phase B
EnergyPosC	41311	Long	0.1 kW-hr	Positive energy, phase C
EnergyNegSum	41313	Long	0.1 kW-hr	Negative energy, sum of active phases
EnergyNegSumNR	41315	Long	0.1 kW-hr	Negative energy, sum of active phases - non resettable
EnergyNegA	41317	Long	0.1 kW-hr	Negative energy, phase A
EnergyNegB	41319	Long	0.1 kW-hr	Negative energy, phase B
EnergyNegC	41321	Long	0.1 kW-hr	Negative energy, phase C
EnergyReacSum	41323	Long	0.1 kVAR-hr	Reactive energy, sum of active phases
EnergyReacA	41325	Long	0.1 kVAR-hr	Net reactive energy, phase A
EnergyReacB	41327	Long	0.1 kVAR-hr	Net reactive energy, phase B
EnergyReacC	41329	Long	0.1 kVAR-hr	Net reactive energy, phase C
EnergyAppSum	41331	Long	0.1 kVA-hr	Apparent energy, sum of active phases
EnergyAppA	41333	Long	0.1 kVA-hr	Apparent energy, phase A
EnergyAppB	41335	Long	0.1 kVA-hr	Apparent energy, phase B
EnergyAppC	41337	Long	0.1 kVA-hr	Apparent energy, phase C
Power Registers				
PowerSum	41009	Float	watts	Real power, sum of active phases
PowerA	41011	Float	watts	Real power, phase A
PowerB	41013	Float	watts	Real power, phase B
PowerC	41015	Float	watts	Real power, phase C
PowerReacSum	41147	Float	VAR	Reactive power, sum of active phases
PowerReacA	41149	Float	VAR	Reactive power, phase A
PowerReacB	41151	Float	VAR	Reactive power, phase B
PowerReacC	41153	Float	VAR	Reactive power, phase C

Name	Register Address	Data Type	Units	Description
PowerAppSum	41155	Float	VA	Apparent power, sum of active phases
PowerAppA	41157	Float	VA	Apparent power, phase A
PowerAppB	41159	Float	VA	Apparent power, phase B
PowerAppC	41161	Float	VA	Apparent power, phase C
Voltage Registers				
VoltAvgLN	41017	Float	volts	Average phase-to-neutral voltage
VoltA	41019	Float	volts	RMS voltage, phase A to neutral
VoltB	41021	Float	volts	RMS voltage, phase B to neutral
VoltC	41023	Float	volts	RMS voltage, phase C to neutral
Power Factor Registers				
PowerFactorAvg	41139	Float		Power factor, average
PowerFactorA	41141	Float		Power factor, phase A
PowerFactorB	41143	Float		Power factor, phase B
PowerFactorC	41145	Float		Power factor, phase C
Demand Registers				
Demand	41169	Float	watts	Real power demand averaged over the demand period
DemandMin	41171	Float	watts	Minimum power demand
DemandMax	41173	Float	watts	Maximum power demand
DemandApp	41175	Float	watts	Apparent power demand
Current Registers				
CurrentA	41163	Float	amps	RMS current, phase A
CurrentB	41165	Float	amps	RMS current, phase B
CurrentC	41167	Float	amps	RMS current, phase C
Frequency Register				
Freq		Float	Hz	Power line frequency
Configuration Registers				
CtAmps	41603	Integer	amps	Common current transformer rated current
CtAmpsA	41604	Integer	amps	Phase A CT rated current
CtAmpsB	41605	Integer	amps	Phase B CT rated current
CtAmpsC	41606	Integer	amps	Phase C CT rated current
DemPerMins	41610	Integer		Demand period
DemSubints	41611	Integer		Number of demand subintervals
CtDirections	41607	Integer		Optionally invert CT orientations
PhaseOffset	41619	Integer		Nominal angle between primary voltage phases (120 or 180)
ZeroEnergy	41620	Integer		Write 1 to zero all resettable energy registers
ZeroDemand	41621	Integer		Write 1 to zero all demand values
ConfigPasscode	41601	Long		Optional passcode to prevent unauthorized changes to configuration
Averaging	41608	Integer		Configure measurement averaging
PowerIntScale	41609	Integer		Scale factor for integer power registers
GainAdjustA	41612	Integer		Power/energy adjustment for phase A
GainAdjustB	41613	Integer		Power/energy adjustment for phase B
GainAdjustC	41614	Signed Integer		Power/energy adjustment for phase C
PhaseAdjustA	41615	Signed Integer		CT phase angle adjust for phase A
PhaseAdjustB	41616	Signed Integer		CT phase angle adjust for phase B

Name	Register Address	Data Type	Units	Description
PhaseAdjustC	41617	Signed Integer		CT phase angle adjust for phase C
CreepLimit	41618	Integer		Configure minimum power for a non-zero reading
Communication Registers				
ApplyCommConfig	41651	Integer		Writing 1234 applies the configuration settings below. Reads 1 if changes not applied yet.
Address	41652	Integer		Modbus address (if non-zero, overrides DIP switches)
BaudRate	41653	Integer		0 = DIP Switch Assigned 4 = 9600 baud 5 = 19200 baud 6 = 38400 baud
ParityMode	41654	Integer		0 = N81 (no parity, one stop bit) 1 = E81 (even parity, one stop bit)
ModbusMode	41655	Integer		0=RTU; 1=TCP-RTU
Diagnostic Registers				
ErrorStatus	41710	Integer		List of recent errors and events
UptimeSecs	41703	Long		Time in seconds since last power on
TotalSecs	41705	Long		Total seconds of operation
Model	41707	Integer		Encoded WattNode meter model
Version	41708	Integer		Firmware version
Options	41709	Integer		WattNode meter options
SerialNumber	41701	Long		The unique WattNode meter serial number
ErrStatus1	41716	Integer		Newest error or event (0 = no errors)
ErrStatus2	41717	Integer		Next oldest error or event
ErrStatus3	41718	Integer		Next oldest error or event
ErrStatus4	41719	Integer		Next oldest error or event
ErrStatus5	41720	Integer		Next oldest error or event
ErrStatus6	41721	Integer		Next oldest error or event
ErrStatus7	41722	Integer		Next oldest error or event
ErrStatus8	41723	Integer		Oldest error or event
PowerFailCount	41711	Integer		Power failure count
CrcErrCount	41712	Integer		Count of Modbus CRC errors
FrameErrorCount	41713	Integer		Count of Modbus framing errors
PacketErrorCount	41714	Integer		Count of bad Modbus packets
OverrunCount	41715	Integer		Count of Modbus buffer overruns

Figure 15: Register List

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