

# WATTNODE® MODBUS

## Quick Install Guide

### Precautions

	Read, understand, and follow all instructions in the "Installation and Operation Manual" including all warnings, cautions, and precautions before installing and using the product.
	Potential Shock Hazard from Dangerous High Voltage.

Different models of the WattNode measure circuits with voltages from 120 VAC single-phase to 600 VAC three-phase. **These voltages are lethal!** Always adhere to the following checklist:

- 1) CCS recommends that a **licensed electrician** install the WattNode.
- 2) The terminal block screws are **not** insulated. Do not contact metal tools to the screw terminals if the circuit is live!
- 3) If the WattNode is installed incorrectly, the safety protections may be impaired.

### Mounting

- Protect the WattNode from moisture, direct sunlight, high temperatures, and conductive pollution (salt spray, metal dust, etc.), using a NEMA rated enclosure if necessary.
- Do not install the WattNode where temperatures fall below -30°C or above 55°C (-22°F to 131°F).
- The WattNode must be installed in an electrical service panel, a junction box, or a limited access electrical room.
- **Do not drill mounting holes with the WattNode in the mounting position** because the drill bit or chuck may damage the WattNode and leave drill shavings in the connectors.

The WattNode has two mounting holes spaced 5" (127 mm) apart (center to center). These mounting holes are normally obscured by the detachable screw terminals. Remove the screw terminals to mark the hole positions and mount the WattNode.

We recommend #8 size self tapping (sheet metal) screws (#6 and #10 should also work). Use washers if the screws could pull through the mounting holes. Don't over-tighten the screws, as long term stress on the case can cause cracking.

### Electrical Service Types

Table 1 above lists the WattNode models and common circuit types. In the "Electrical Service Types" column, when two voltages are listed with a slash between them, they indicate the line-to-neutral / line-to-line voltages.

Figure 1 above shows the connections for a three phase wye circuit. Other circuit types are similar, but with fewer connections (no neutral for delta, no phase C for 1 Phase 3 Wire 120V/240V). See the "Installation and Operation Manual" for more diagrams.

### Connect Current Transformers

- Use only UL recognized current transformers (CTs) with built-in burden resistors that generate 0.333 VAC (333 millivolts AC) at rated current.
- **Do not** use current output CTs such as 1 amp or 5 amp output models! See the User's Guide for the maximum input current ratings.
- To minimize current measurement noise, avoid extending the CT wires, especially in noisy environments. If it is necessary to extend the wires, use shielded twisted pair wire 22 - 14 AWG, rated for 300V or 600V.

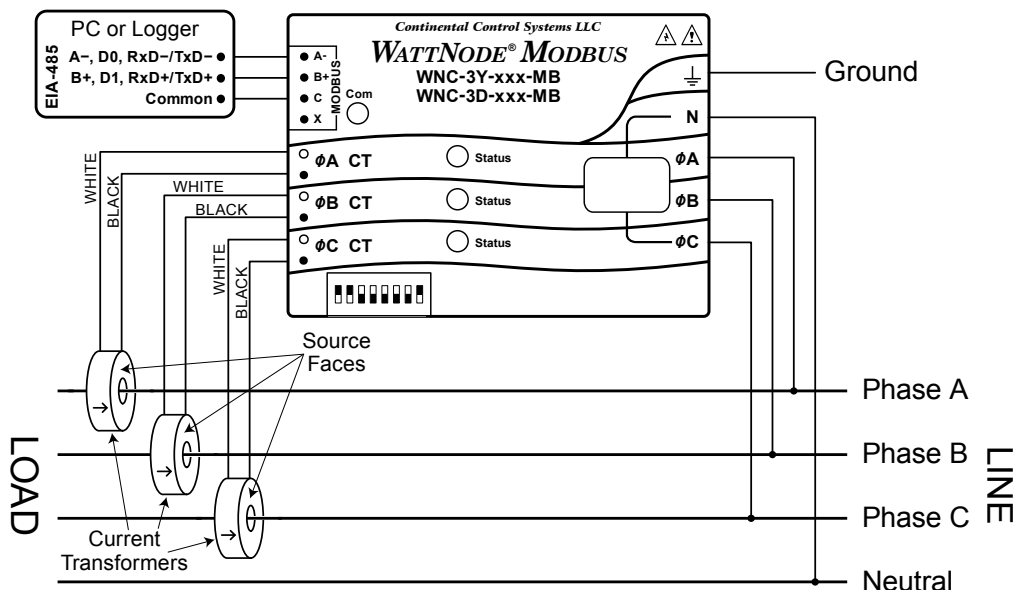


Figure 1: WattNode Wiring Diagram

Model	Type	Phase to Neutral VAC	Phase to Phase VAC	Electrical Service Types
WNC-3Y-208-MB	Wye	120	208-240	1 Phase 2 Wire 120V with neutral 1 Phase 3 Wire 120V/240V with neutral 3 Phase 4 Wire Wye 120V/208V with neutral
WNC-3Y-400-MB	Wye	230	400	1 Phase 2 Wire 230V with neutral 3 Phase 4 Wire Wye 230V/400V with neutral
WNC-3Y-480-MB	Wye	277	480	3 Phase 4 Wire Wye 277V/480V with neutral
WNC-3Y-600-MB	Wye	347	600	3 Phase 4 Wire Wye 347V/600V with neutral
WNC-3D-240-MB	Delta or Wye	120-140	208-240	1 Phase 2 Wire 208V (No neutral) 1 Phase 2 Wire 240V (No neutral) 1 Phase 3 Wire 120V/240V with neutral 3 Phase 3 Wire Delta 208V (No neutral) 3 Phase 4 Wire Wye 120V/208V with neutral 3 Phase 4 Wire Delta 120/208/240V with neutral
WNC-3D-400-MB	Delta or Wye	230	400	3 Phase 3 Wire Delta 400V (No neutral) 3 Phase 4 Wire Wye 230V/400V with neutral
WNC-3D-480-MB	Delta or Wye	277	480	3 Phase 3 Wire Delta 480V (No neutral) 3 Phase 4 Wire Wye 277V/480V with neutral 3 Phase 4 Wire Delta 240/415/480V with neutral

Table 1: WattNode Models

- You may shorten the CT wires.
- Put jumper wires across unused CT inputs.
- Find the arrow or label "THIS SIDE TOWARD SOURCE" on the CT and face toward the current source: generally the circuit breaker.
- To prevent magnetic interference, separate CTs by at least 1 inch (25 mm).

To connect CTs, pass the wire to be measured through the CT and connect the CT to the WattNode. **Always remove power before disconnecting any live wires.** Put the line wires through the CTs as shown in Figure 1 above.

CTs are directional and if mounted backwards or with their white and black wires reversed the power will be negative. The WattNode indicates negative phase power with flashing red LEDs.

Split-core CTs can be opened for installation around a wire by pulling the removable section straight away from the rest of the CT; this may require a strong pull. The removable section only fits one way, so match up the steel core pieces when closing the CT. If the CT seems to jam and will not close, the steel core pieces are probably not aligned correctly; DO NOT FORCE together. Instead, reposition or rock the removable

portion until the CT closes without excessive force. A nylon cable tie can be secured around the CT to prevent inadvertent opening.

### Wiring

Next, connect the white and black CT wires to the WattNode. Excess length may be trimmed from the wires if desired. Strip or trim the wires to expose 1/4" (6 mm) of bare wire. The current transformers connect to the six position black screw terminal block. Connect each CT with the white wire aligned with the white dot on the label, and the black wire aligned with the black dot. Note the order in which the phases are connected, as the line voltage phases **must** match the current phases for accurate power measurement.

Finally record the CT rated current as part of the installation record for each WattNode.

### Connect Voltage Terminals

#### Circuit Protection

The WattNode must be installed with a disconnect (circuit breaker, switch, or disconnect) and overcurrent protection (fuse or circuit breaker).

The WattNode only draws 10-30 milliamps, so the rating of any switches, disconnects, fuses, and/or circuit breakers is determined primarily by the wire gauge, the mains voltage, and the current interrupting rating required.

- The switch, disconnect, or circuit breaker used to disconnect the WattNode must be as close as practicable to the WattNode.
- Use circuit breakers or fuses rated for 20 amps or less.
- The circuit breakers or fuses must protect the mains terminals labeled  $\phi A$ ,  $\phi B$ , and  $\phi C$ . If neutral is also protected, then the overcurrent protection device must interrupt both neutral and the ungrounded conductors simultaneously.
- The circuit protection / disconnect system must meet IEC 60947-1 and IEC 60947-3, as well as all national and local electrical codes.

## Wiring

- For the line voltage wires, CCS recommends 16 to 12 AWG stranded wire, type MTW, THWN, or THHN, 600V.
- Do not place more than one voltage wire in a screw terminal; use separate wire nuts or terminal blocks if needed.
- Verify that the line voltages match the phase-to-phase  $\phi-\phi$  and phase-to-neutral  $\phi-N$  values printed in the white box on the front label.
- The WattNode is powered from the line voltage inputs:  $\phi A$  (phase A) to **N** (neutral), or  $\phi A$  to  $\phi B$  for delta models.

**Always disconnect power** before connecting the voltage lines to the WattNode. Connect each WattNode line voltage to the appropriate phase; also connect ground and neutral (if applicable). The neutral connection is not required on model numbers starting with WNC-3D, but we recommend connecting it to ground instead.

The screw terminals handle wire up to 12 AWG. Prepare the voltage wires by stripping the wires to expose 1/4" (6 mm) of bare wire. Connect each voltage line to the green terminal block as shown in **Figure 1** above. Verify that the line voltage phases match the CT phases. After the voltage lines have been connected, make sure both terminal blocks are securely installed on the WattNode.

When power is first applied to the WattNode, check that the LEDs behave normally: if you see the LEDs flashing red-green-red-green (see **Figure 9** below), then disconnect the power immediately! This indicates the line voltage is too high for the WattNode.

## Connect MODBUS (RS485) Outputs

- RS485 wiring can be complex when multiple devices are connected, when running wires for long distances, and when using termination and biasing resistors. If you have any questions, consult the full "Installation and Operation Manual".
- The outputs are completely isolated from dangerous voltages, so you can connect them at any time.
- Since the output wiring is near line voltage wiring, use wires or cables with a 300V or 600V rating.
- If this cable will be in the presence of bare conductors, such as bus-bars, it should be double insulated or jacketed.
- Be sure to connect the **A-**, **B+**, and **C** terminals. The **X** terminal is not used. You may use the cable shield for the **C** connection.
- For long distances, use shielded twisted-pair cable to prevent interference. If you use shielded wiring, connect the shield to earth at one end.

The WattNode MODBUS can be connected PCs with RS485 interfaces and to data loggers or other devices that accept RS485 MODBUS devices.

## Configure DIP Switch

Use DIP switches 1-7 to select the MODBUS address (1 to 127) and switch 8 to select the baud rate (OFF = 9600, ON = 19200).

## Installation Summary

- 1) Mount the WattNode.
- 2) **Turn off power** before installing toroidal CTs or making voltage connections.
- 3) Mount the CTs around the line wires being measured. Take care to orient the CTs facing the source.
- 4) Connect the twisted white and black wires from the CT to the black terminal block on the WattNode, matching the wire colors to the white and black dots on the label of the WattNode.
- 5) Install or connect appropriate circuit breakers or fuses and disconnects.
- 6) Connect the line voltage wires to the green terminal block of the WattNode, and double check that the current measurement phases match the line voltage measurement phases.
- 7) Connect the output terminals of the WattNode to the monitoring equipment.
- 8) Check that all the wires are securely installed in the terminal blocks by tugging on each wire.
- 9) Apply power to the WattNode.
- 10) Verify that the LEDs light correctly and don't indicate an error condition.

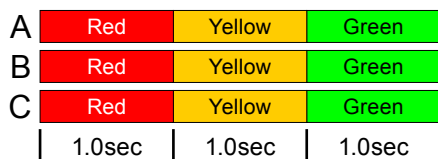
## MODBUS Com Diagnostic LED

Near the upper left corner, there is a MODBUS diagnostic LED that can indicate the following:

- **Green** A short green flash indicates a good packet addressed to this WattNode.
- **Yellow** A short yellow flash indicates a good packet addressed to a different device.
- **Red** A one second red flash indicates an invalid packet: bad baud rate, bad parity, bad CRC, noise, etc.
- **Red** Solid red indicates the address is set to zero: an invalid choice.
- **R Y R Y R Y** Rapid red/yellow flashing indicates a possible MODBUS address conflict.

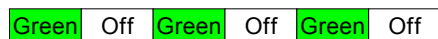
## Power Diagnostic LEDs

The three status LEDs on the WattNode can help indicate correct operation. The "A", "B", and "C" on the diagrams indicate the three phases.



**Figure 2: Normal Startup**

The WattNode displays this startup sequence whenever power is first applied.



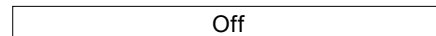
**Figure 3: Positive Power**

Any phase with the LEDs flashing green is indicating normal positive power.



**Figure 4: No Power**

Any phase with a solid green LED indicates no power, but line voltage is present.



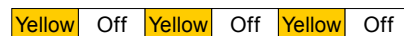
**Figure 5: No Power - Zero VAC**

Any phase LED that is off indicates no voltage on that phase.



**Figure 6: Negative Power**

Flashing red indicates negative power. Reversed CTs or swapped CT wires can cause this.



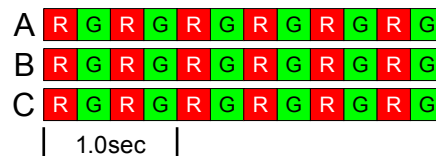
**Figure 7: Low Power Factor**

Any phase flashing yellow indicates a low power factor. This is normal for some loads, but may also indicate that the CTs are not on the correct phases.



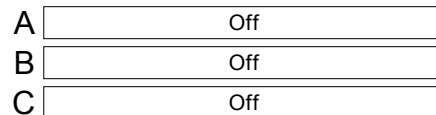
**Figure 8: Negative Power - Low Power Factor**

Negative power and low power factor generally indicates that a CT is not on the correct phase, but this may be normal when measuring power with PV (solar) panels.



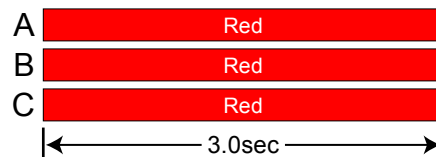
**Figure 9: WattNode LED Overvoltage Warning**

The line voltage is too high for this WattNode model. Disconnect power immediately! Check the line voltages and the WattNode ratings (in the white box on the label).



**Figure 10: WattNode Not Operating**

If none of the LEDs light, then check that the correct line voltages are applied to the WattNode. If they are, call customer service for assistance.



**Figure 11: WattNode Error**

If the WattNode experiences an internal error, it will light all LEDs red for three or more seconds. If you see this happen repeatedly, return the WattNode for service.

For other LED flashing patterns, see the "Installation and Operation Manual" or contact customer service for assistance.

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