

Using a Continental Control Systems Pulse Watt Node for Net Metering and PV monitoring.

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The process of monitoring the energy flows in a Net Metered PV home is important, but sometimes difficult to achieve. The Web Energy Logger, in conjunction with a Continental Control Systems Wattmeter can provide a wealth of information, but it's important to ensure that the right scale factors are being used to perform the measurements. These scale factors depend on several options you may have chosen, eg: the Wattnode output pulse frequency and your Current Transformer (CT) amp rating.

The following discussion chooses one set of options and describes how to calculate WEL scale factors, and how to combine the three pulse channels for useful data.

For this paper, the following assumptions are being made:

- 1) Wattnode Model: WNB-3Y-208-P Opt PV, Hz=150
- 2) Grid Tie-In CT's: 200A x 2 (Measuring both sides of split phase. One CT per Phase)
- 3) PV Inverter CT: 50A (Measuring both sides of split phase. Both phases passed through single CT*)
- 4) Wattnode Pulse outputs 1,2,3 connected to WEL pulse inputs 1,2,3 respectively.

* This hookup is shown in detail on the last page. This configuration was chosen as it measures both PV inverter phases with only one CT. Other options are shown in Manual Supplement 10 (available at http://www.ccontrols.com/w/Advanced_Pulse_WattNode_-_Options). Other configurations may require a change in the PV scale factor calculation.

The first step in calculating the WEL's scale factor is calculating the "Watt Hours Per Pulse" (WHpP) for each of the three pulse outputs. Since we are specifying an optional output frequency, we need to use an equation for WHpP. This equation is described on pages 28 and 29 of the Wattnode Manual (available here:

http://www.ccontrols.com/ww/images/archive/f/fb/20110202231347%21Manual_WNB_Pulse.pdf)

$$\text{WHpP} = (\text{PpPO} * \text{NVAC} * \text{CtAmps}) / (\text{FSHz} * 3600)$$

The PpPO is the wildcard factor when using the -PV option Wattnode. It has a value of 2 when considering the Grid measurement, but a value of 1 when considering the PV measurement. So the WHpP values for pulse outputs 1,2 & 3 are as follows:

$$\text{WHpP (P1)} = (2 * 120 * 200) / (150 * 3600) = 0.08889$$

$$\text{WHpP (P2)} = (2 * 120 * 200) / (150 * 3600) = 0.08889$$

$$\text{WHpP (P3)} = (1 * 120 * 50) / (150 * 3600) = 0.01111$$

Now, to convert these into scale factors that the WEL can use, they must be multiplied by 60, because the WEL takes a reading every minute, or 1/60 of an hour. This is because usage rate (W) is energy used (WH), divided by measurement time (H), so we must divide by 1/60 which is the same as multiplying by 60. So the WEL scale factors are:

$$\text{P1 Scale} = 0.08889 * 60 = 5.3334$$

$$\text{P2 Scale} = 0.08889 * 60 = 5.3334$$

$$\text{P3 Scale} = 0.01111 * 60 = 0.6667$$

Let's now assume that these three Pulse inputs are given names on the WEL that correspond to their function. They will be named:

P1	GridDemand	(measures power being drawn from Grid)
P2	GridSupply	(measures power being fed into Grid)
P3	PVGeneration	(measures power being supplied by PV array to where it is needed)

So each one of these device values will be posted to the website, and will represent a live load value, measured in Watts.

Now, users typically also want to know a few other things. One of these is accumulated power. This is typically wanted in kWh (kiloWattHours). This is a measure of the total amount of power consumed/generated over a period of a day or month). To get these numbers, the WEL's "Treatment" feature can be used. If the Treatment letter for these three devices is set to lower case h "h", then the WEL will automatically convert to kW and accumulate the total power usage. These values will be sent out as follows:

GridDemand_D	(Total of all power drawn from the grid for the day in KWH)
GridDemand_M	(Total of all power drawn from the grid for the month in KWH)
GridSupply_D	(Total of all power drawn supplied to the grid for the day in KWH)
GridSupply_M	(Total of all power drawn supplied to the grid for the month in KWH)
PVGeneration_D	(Total power generated by the PV array for the day in KWH)
PVGeneration_M	(Total power generated by the PV array for the month in KWH)

Note that **none** of these represent the "Net" power usage because they are all 1-way power flows.

To evaluate net power usage, you need to use the WEL's expressions to combine the discrete readings into signed values. For example, assume that you wish to calculate the home's net grid usage, where a positive number means that you have used more power than you have fed back into the grid. So Grid Demand is a positive factor, and GridSupply becomes a negative factor. To combine the two, you can simply subtract one from the other.

A WEL expression can be calculated as follows:

$NetUsage = GridDemand - GridSupply.$

This will display the real time power usage (in Watts) as a positive or negative number. Then, to determine the long term net power usage, you will simply set the treatment letter for "NetUsage" to 'h'. This will accumulate the realtime values and generate two new uploaded values:

NetUsage_D	(Net Power consumed from Grid for the day in KWH)
NetUsage_M	(Net Power consumed from Grid for the month in KWH)

Likewise you can create additional values of interest. Eg: if you wanted to know your home's actual electrical load (to see your energy footprint), you could create the following expression:

$HouseLoad = NetUsage + PVGeneration.$

Set the treatment letter for "HouseLoad" to 'h'. This will accumulate the realtime values and generate two new uploaded values:

HouseLoad_D	(Total home consumption for the day in KWH)
HouseLoad_M	(Total home consumption for the month in KWH)

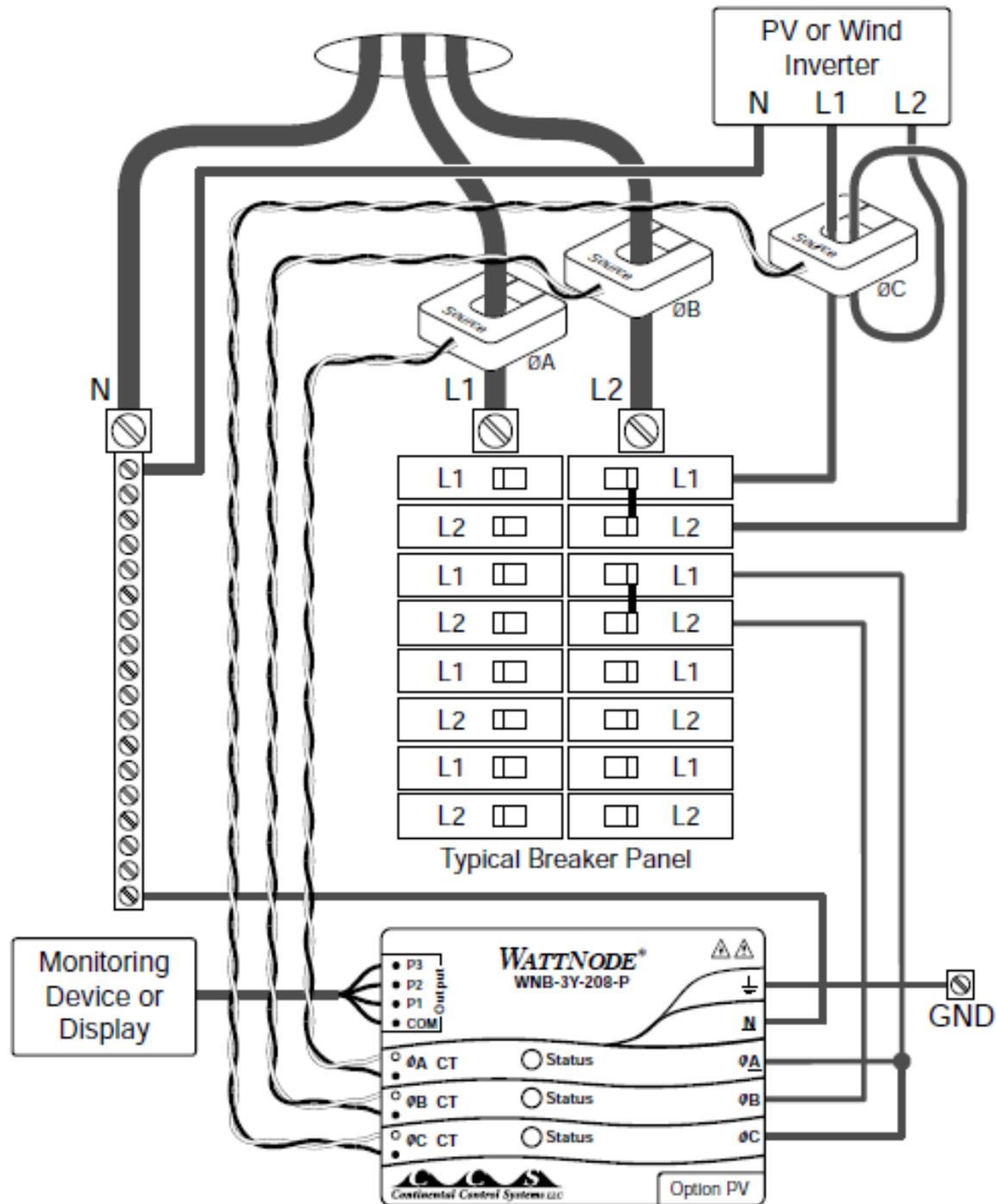


Figure 2: WattNode Installation Diagram with Two-Phase Inverter

Two-Phase Inverter

Connect the ØA and ØB WattNode phases to measure the total house consumption from the grid (see Figure 2). Jumper the ØC green screw terminal to the ØA (L1) terminal. Install the inverter CT around inverter L1 conductor with the "Source" face (or arrow) aiming toward the inverter. Then feed the inverter L2 conductor through the CT in the opposite direction. Since L2 is 180 degrees out-of-phase with L1, running it through the CT backwards inverts the phase measurement so that it matches L1. If this isn't feasible, see [Inverter CT Alternatives](#) below for other options.