Application Note: AN-115

June 2008

LCDA-EP Energy & Power Display

Overview

The energy and power display has eight digits with an adjustable scale factor and decimal point position, to allow for the accurate display of energy levels from hundredths of a watt-hour to 100,000 megawatt-hours and power levels from tenths of a watt to megawatts. By adjusting the scale factor and decimal point position, you can display energy in watt-hours, kilowatt-hours, or megawatt-hours and power in watts, kilowatts, or megawatts. The energy and power display is self-powered for use with the Advanced Pulse WattNode models with an output frequency up to 20Hz. For Advanced Pulse WattNode models with an output frequency greater than 20Hz an external DC power supply and pull-up resistor are required. The long life battery maintains the total energy value, even if power to the WattNode fails.

To switch the display between Power and Energy, press the T/R◀ button. When the display has an R in the leftmost position, it will display power (ratemeter mode). Otherwise, it will display energy (totalizer mode).

The RST▲ button resets the energy total to zero. If you wish to disable this feature, use program screen 6 as described in the Durant manual.

Wiring

Low Pulse Frequency (up to 20Hz)

Connect the WattNode's 'P1' terminal of the output to the IN B (Terminal 2) on the LCD display. Connect the WattNode's 'COM' terminal of the output to the GND (Terminal 1) on the LCD display.

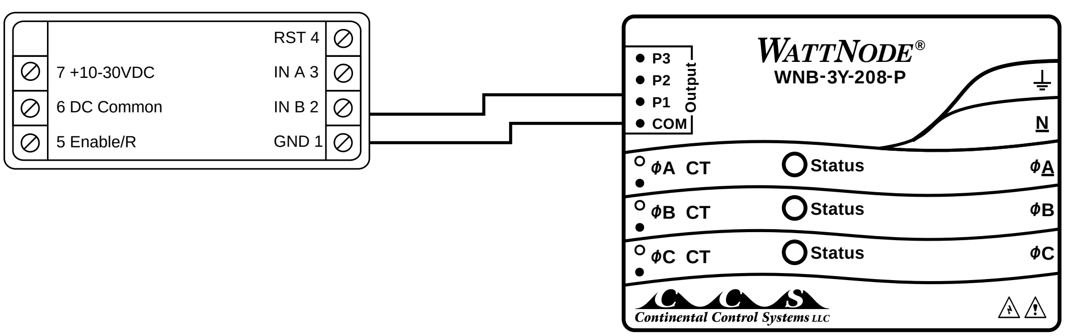

Figure 1: LCDA-EP Low Pulse Frequency Wiring Diagram

High Pulse Frequency (greater than 20Hz)

Connect the WattNode's 'P1' terminal of the output to the IN A (Terminal 3) on the LCD display. Connect the WattNode's 'COM' terminal of the output to the GND (Terminal 1) on the LCD display. Add a pullup resistor on the P1 line as shown below.

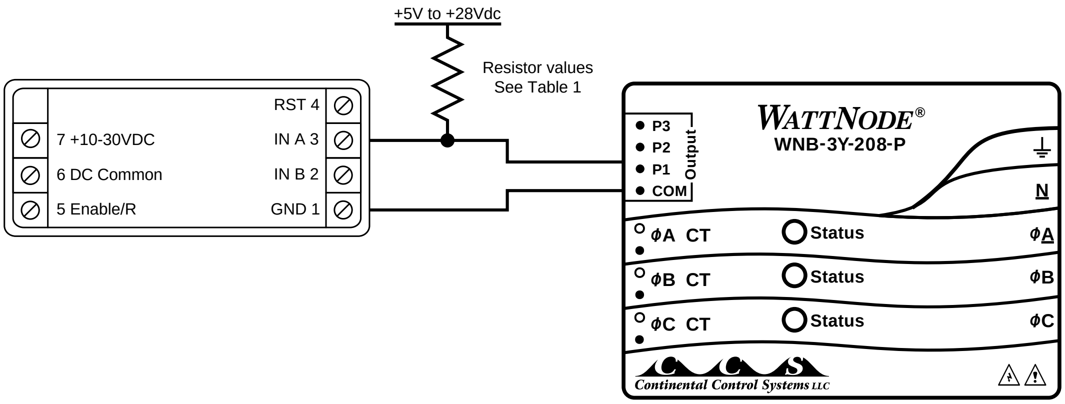

Figure 2: LCDA-EP High Pulse Frequency Wiring Diagram

Full-Scale Pulse Frequency	Pull-up to 5.0V Recd (Min-Max)	Pull-up to 12V Recd (Min-Max)	Pull-up to 24V Recd (Min-Max)
20 Hz	20kΩ (1.0k-300k)	47kΩ (2.4k-470k)	100kΩ (4.7k-540k)
50 Hz	10kΩ (1.0k-130k)	20kΩ (2.4k-200k)	47kΩ (4.7k-270k)
100 Hz	4.7kΩ (1.0k-62k)	10kΩ (2.4k-100k)	20kΩ (4.7k-130k)
200 Hz	2.0kΩ (1.0k-33k)	4.7kΩ (2.4k-47k)	10kΩ (4.7k-68k)
600 Hz	2.0kΩ (1.0k-12k)	4.7kΩ (2.4k-16k)	10kΩ (4.7k-22k)

Table 1: Recommended Pull-up Resistors

Programing the Display

The LCDA-E is shipped pre-programmed if ordered with an Advanced Pulse WattNode and current transformers. To make changes to the original program, follow the steps below:

Program Energy Display (Watt-hours, Kilowatt-hours, Megawatt-hours)

Refer to the Durant Totalizer/Ratemeter Installation manual for details on programming the scale factors and installing the LCD display.

1) Select a display format for energy from the following table. Your choice will affect both display resolution, and time until display overflow, so you may wish to try more than one format to find the optimum choice. When in totalizer mode, the LCD display will show the count of received pulses times the totalizer count scale value (*CntScale*). The decimal point is then superimposed on the displayed number—to understand this better, note that *CntScale* is the same when displaying kilowatt-hours or thousandths of megawatt-hours; the only difference is the position of the decimal point.

Display Format	Multiplier	Recommended CT Sizes
0000000.0 Watt-hours	10	5–30 amps
00000000 Watt-hours	1	5–100 amps
00000.000 Kilowatt-hours	1	5–100 amps
000000.00 Kilowatt-hours	0.1	15–600 amps
0000000.0 Kilowatt-hours	0.01	100–1500 amps
00000000 Kilowatt-hours	0.001	600–1500 amps
00000.000 Megawatt-hours	0.001	600–1500 amps

Note: Watt-hours, kilowatt-hours, or megawatt-hours will not appear on the LCD display.

2) Compute the totalizer count scale value.

$$CntScale = WHpPpA \cdot CTAmps \cdot Multiplier$$

Where *WHpPpA* is the 'Watt-hours per pulse per CT Rated Amp' from the back label of the WattNode (also found in Table 8 of the Advanced Pulse WattNode Manual). *CTAmps* is the rated current of the current transformers being used, and *Multiplier* comes from the table above.

3) If the *CntScale* is greater than 99.9999, then you will have to pick a smaller multiplier. Generally, *CntScale* values greater than 10.0000 will cause the display to overflow too quickly. If *CntScale* is less than 0.0500, then there is the possibility that the rounding error may become too large. To check the rounding error, follow step 4.
4) To compute the rounding error, round *CntScale* to four decimal places (xx.xxxx) to get *RndCntScale*. Compute the error with the following equation:

$$Error\% = 100 \bullet \frac{RndCntScale - CntScale}{CntScale}$$

Generally, it is desirable to keep the error below 0.25% so that it does not significantly affect the total system accuracy. If the error is too large, then change to a display format with a larger *Multiplier*.

5) Check the time to display overflow at continuous maximum power consumption.

$$DaysToOverflow = \frac{1150}{CntScale \bullet FSHz}$$

FSHz is the 'Full-scale pulse frequency' from the back label of the WattNode (also found in Table 7 of the Advanced Pulse WattNode Manual). Under normal conditions, the average load will be less than maximum power, so the actual time to display overflow will typically be longer than *DaysToOverflow*. When the display overflows, it wraps around to zero and starts counting up again. If the *DaysToOverflow* is too small, then change to a display format with a smaller Multiplier. Making *Multiplier* 10 times smaller will make *DaysToOverflow* 10 times larger.

6) Once you have found the desired display format and *CntScale* value, program them into the LCD as described in the Durant manual. Enter *CntScale* in programming screen 1. Position the decimal point in programming screen 2 to match the Display Format selected in the table above. Programming screens 3–6 are not used at this time.

Program Power Display (Watts, kilowatts, megawatts)

1) For the power display, the LCD will display the input pulse frequency times the scale factor. The decimal point is then superimposed on the resulting number. Start by selecting the WattNode model from the table below.

Model	Number of CTs	Vc
WNB-3Y-208-P	1, 2, or 3	120
WNB-3Y-400-P	1, 2, or 3	230
WNB-3Y-480-P	1, 2, or 3	277
WNB-3Y-600-P	1, 2, or 3	347
WNB-3D-240-P	1, 2, or 3	120
WNB-3D-400-P	1, 2, or 3	230
WNB-3D-480-P	1, 2, or 3	277

2) Compute maximum measured power:

$$Pm(watts) = Vc \cdot CTAmps \cdot NumOfCTs$$

where *Vc* comes from the above table, *CTAmps* is the rated current of the current transformers being used, and *NumOfCTs* is the number of CTs being used with the WattNode. The WattNode can measure power levels up to 50% over the rated limits, so you may want to increase *Pm* by up to 50% if you wish to allow some overhead. If the WattNode outputs a power greater than the display can handle, then the display will show '----'.

3) Choose a row so that *Pm* is less than Expected Maximum Power with the Desired Display Format.

Expected Maximum Power	Desired Display Format[1]	Display Resolution	Scale FactorEquation (20Hz Output)[2]	Rate Multiplier
999.9 W	000.0 W	0.1 W	Vc • CTAmps • 3 / 2	1
9999 W	0000 W	1 W	Vc • CTAmps • 3 / 20	1
9.999 kW	0.000 kW	1 W (0.001 kW)	Vc • CTAmps • 3 / 20	1
99990 W	00000 W	10 W	Vc • CTAmps • 3 / 200	10
99.99 kW	00.00 kW	10 W (0.01 kW)	Vc • CTAmps • 3 / 200	1
999.9 kW	000.0 kW	100 W (0.1 kW)	Vc • CTAmps • 3 / 2000	1
9999 kW	0000 kW	1 kW	Vc • CTAmps • 3 / 20000	1
9.999 MW	0.000 MW	1 kW (0.001 MW)	Vc • CTAmps • 3 / 20000	1

[1] W, kW, or MW will not appear on the LCD display.

[2] The scale factors are valid only when used with a WattNode with a 20Hz maximum frequency output.

4) Compute the scale factor. On program mode screen 3 enter your computed scale factor. Example: if your computed scale factor is 12.4137, round to 12.41, enter the four digits 1241, and then move the decimal point so that 12.41 is displayed.

5) On program mode screen 4 adjust the decimal point location to match the Desired Display Format.

6) On program mode screen 5 set the Rate Multiplier to 1 or 10 as shown in the table above.

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