

## **Application Note**

# AN0801

### WattsOn-DISP Wiring and Configuration

Associated Product: WattsOn WattsOn-DISP

#### Summary

The WattsOn-DISP provides a convenient local display option for the WattsOn Universal Power Transducer. When used with a WattsOn-1100 model (-1200 Models are not compatible with the display), it can be configured to display any two parameters that the WattsOn measures.

There are three steps required to configure the DISP for operation. By default, the WattsOn meter is not configured to communicate with the display.

**NOTE**: WattsOn firmware version **4.5** (or greater) is required for WattsOn-DISP support.

#### Step 1: Wiring / Hardware Configuration:

The WattsOn-DISP requires a 12-24VDC (*not* AC) power supply. This power supply can be shared with the WattsOn transducer, provided that the WattsOn is not being powered by an AC supply. The power terminal for the display may be wired directly to the external power supply, or spliced into the terminal on the WattsOn power supply. It is important to note that if an auxiliary power supply is used, it **MUST** share a common "ground" (negative supply) connection with the WattsOn. The power and data ports are referenced to a common ground, and must be at the same potential as the WattsOn "-" terminal.

Note: when physically mounting the display within the panel use the included bracket and screws. Take care not to over tighten the screws to avoid damage to the display and bezel.

The WattsOn uses the second pulse output (normally used for VARh pulses) as the data port for the display. The WattsOn-DISP "Data" terminal must be wired to the "A" terminal on the WattsOn 8-position output connector. The WattsOn "B" terminal must be jumpered to the WattsOn "G" terminal. The DISP GND terminal must be wired to either of the WattsOn "G" terminals, or the power supply "-" terminal. See Figure 1 for more detail.

#### Step 2: Enabling the data output stream

By default, the second WattsOn output is configured as a pulse output for VARh. For the DISP display to function properly, it is required to reconfigure the WattsOn output to send a data stream. This is done via Modbus. Bit 0 in Register 0x9E (40159) must be set to 1. Note that bit 15 is a R/O bit and is always set to one. The default register value is 0x8000. To enable the data output stream, set this register to 0x8001. See Table 1 for more details.

#### Step 3: Configuring parameter display

The DISP receives data from the WattsOn containing register data and parameter selection. Registers 0x9C (40157) and 0x9D (40158) ("ScratchPad[7]" and "ScratchPad[8]") are used to configure the data to be displayed on the top and bottom lines. The address of the floating point value to be displayed is programmed into these registers. Register 0x9C corresponds to the top line and 0x9D to the bottom line. The user must program these registers with the floating point register offset (as specified in Table 1). For example, to display *Total Real Power (kW)* on the top line and *Total Energy (kWH)* on the bottom line, the registers must be programmed as follows:

0x9C=0x0302 (770 decimal) 0x9D=0x0300 (768 decimal)

See Table 2 for register setup example summary.

| Modbus<br>Addr | Offset<br>(hex) | Offset<br>(dec) | Description                 | Modbu<br>Addr |
|----------------|-----------------|-----------------|-----------------------------|---------------|
| 40769          | 0x0300          | 768             | Total Energy Consumption    | 40833         |
| 40771          | 0x0302          | 770             | Total Real Power            | 40835         |
| 40773          | 0x0304          | 772             | Total Reactive Power        | 40837         |
| 40775          | 0x0306          | 774             | Total Apparent Power        | 40839         |
| 40777          | 0x0308          | 776             | Average Voltage (L-N)       | 40841         |
| 40779          | 0x030A          | 778             | Average Voltage (L-L)       | 40843         |
| 40781          | 0x030C          | 780             | Average Current             | 40845         |
| 40783          | 0x030E          | 782             | Total (System) Power Factor | 40847         |
| 40785          | 0x0310          | 784             | Frequency                   | 40849         |
| 40787          | 0x0312          | 786             | Sliding Window Demand Power | 40851         |
| 40789          | 0x0314          | 788             | Voltage A-N                 | 40853         |
| 40791          | 0x0316          | 790             | Voltage B-N                 | 40855         |
| 40793          | 0x0318          | 792             | Voltage C-N                 | 40857         |
| 40795          | 0x031A          | 794             | Voltage A-B                 | 40859         |
| 40797          | 0x031C          | 796             | Voltage B-C                 | 40861         |
| 40799          | 0x031E          | 798             | Voltage A-C                 | 40863         |
| 40801          | 0x0320          | 800             | Current A                   | 40865         |
| 40803          | 0x0322          | 802             | Current B                   | 40867         |
| 40805          | 0x0324          | 804             | Current C                   | 40869         |
| 40807          | 0x0326          | 806             | Real Power A                | 40871         |
| 40809          | 0x0328          | 808             | Real Power B                | 40873         |
| 40811          | 0x032A          | 810             | Real Power C                | 40875         |
| 40813          | 0x032C          | 812             | Reactive Power A            | 40877         |
| 40815          | 0x032E          | 814             | Reactive Power B            | 40879         |
| 40817          | 0x0330          | 816             | Reactive Power C            | 40881         |
| 40819          | 0x0332          | 818             | Apparent Power A            | 40883         |
| 40821          | 0x0334          | 820             | Apparent Power B            | 40885         |
| 40823          | 0x0336          | 822             | Apparent Power C            | 40887         |
| 40825          | 0x0338          | 824             | Power Factor A              | 40889         |
| 40827          | 0x033A          | 826             | Power Factor B              |               |
| 40829          | 0x033C          | 828             | Power Factor C              |               |
| 40831          | 0x033E          | 830             | Software Version            |               |

| Modbus<br>Addr | Offset<br>(hex) | Offset<br>(dec) | Description                       |
|----------------|-----------------|-----------------|-----------------------------------|
| 40833          | 0x0340          | 832             | Import Energy (+) A               |
| 40835          | 0x0342          | 834             | Import Energy (+) B               |
| 40837          | 0x0344          | 836             | Import Energy (+) C               |
| 40839          | 0x0346          | 838             | Total Import Energy (+) A+B+C     |
| 40841          | 0x0348          | 840             | Export Energy (-) A               |
| 40843          | 0x034A          | 842             | Export Energy (-) B               |
| 40845          | 0x034C          | 844             | Export Energy (-) C               |
| 40847          | 0x034E          | 846             | Total Export Energy (-) A+B+C     |
| 40849          | 0x0350          | 848             | Total Energy (+/-) A              |
| 40851          | 0x0352          | 850             | Total Energy (+/-) B              |
| 40853          | 0x0354          | 852             | Total Energy (+/-) C              |
| 40855          | 0x0356          | 854             | Total Energy (+/-) A+B+C          |
| 40857          | 0x0358          | 856             | (Same As 0x300)                   |
| 40859          | 0x035A          | 858             | Inductive Energy (+) A            |
| 40861          | 0x035C          | 860             | Inductive Energy (+) B            |
| 40863          | 0x035E          | 862             | Inductive Energy (+) C            |
| 40865          | 0x0360          | 864             | Total Inductive Energy (+) A+B+C  |
| 40867          | 0x0362          | 866             | Capacitive Energy (-) A           |
| 40869          | 0x0364          | 868             | Capacitive Energy (-) B           |
| 40871          | 0x0366          | 870             | Capacitive Energy (-) C           |
| 40873          | 0x0368          | 872             | Total Capacitive Energy (-) A+B+C |
| 40875          | 0x036A          | 874             | Total VARh (+/-) A                |
| 40877          | 0x036C          | 876             | Total VARh (+/-) B                |
| 40879          | 0x036E          | 878             | Total VARh (+/-) C                |
| 40881          | 0x0370          | 880             | Total VARh (+/-) A+B+C            |
| 40883          | 0x0372          | 882             | Total Vah A                       |
| 40885          | 0x0374          | 884             | Total Vah B                       |
| 40887          | 0x0376          | 886             | Total Vah C                       |
| 40889          | 0x0378          | 888             | Total Vah (A+B+C)                 |

Table 1





| Register     | Description              | Default (hex)  | Sample Configuration (hex/dec)                |
|--------------|--------------------------|----------------|---|
| 0x9E (40159) | Extended Config Register | 0x8000         | 0x8001 / 32769 (enable data output)           |
| 0x9C (40157) | Scratchpad Register [7]  | 0x0000         | 0x0302 / 770 (Output total kW – top line)     |
| 0x9D (40158) | Scratchpad Register [8]  | 0x0000         | 0x0300 / 768 (Output total kWh – bottom line) |
|              | Table                    | 2: Sample Regi | ster Configuration                            |

#### Using the Elkor WattsOn Console Software:

Configuring the WattsOn for use with the WattsOn-DISP can be easily handled by using the WattsOn Console Software, available for free download at

#### http://www.elkor.net/EWC setup.exe

Prior to downloading the software, ensure that you have a RS-485 interface, such as a USB-to-RS485 or RS232-to-RS485 converter. The interface must have the proper drivers installed, and present itself to Windows as a serial COM port.

After downloading and installing the software, run the application. By default, the software uses COM1. If your RS485 adapter is on a different port, click "Port" from the application menu, and select the proper COM port. Ensure that the Baud Rate is properly set (by default, WattsOn units communicate at 9600 bps).

| elect COM Port: |   |
|-----------------|---|
| COM1            | - |
| Baud Rate       |   |
| · 9600          |   |
| C 57600         |   |
| Mode            |   |
|                 |   |
| C Modbus/TCP    |   |

Once the COM port is configured, click "OK".

Click "Options > Address", and ensure that the address in the software matches the address set on the WattsOn DIP switch. By default, WattsOn units are typically shipped with the address set to "1", but this can be changed by using the DIP switch.

| 32 16 | 342 | 1          |     |  |
|-------|-----|------------|-----|--|
|       |     | <b>₩</b> = | 1   |  |
|       | C   | OMM        | OK! |  |

Assuming the wiring is correct, and the Port and Address selections have been properly defined, a message "COMM OK" should appear on the Address screen, and data should populate fields on the main screen as shown on the next page.

If data is not showing, and the status bar at the bottom of the screen is not displaying "OK" messages, then do not proceed with further steps, as the communication must work before the subsequent steps are to be followed.

In such a case, several troubleshooting steps are recommended:

- 1) Ensure that the WattsOn has the appropriate power supply -- 24VDC, 100mA recommended).
- 2) Ensure proper continuity between WattsOn and RS485 converter.
- 3) Try reversing the polarity of the +/- RS485 connection on the WattsOn.
- Confirm that the RS485 driver is properly installed, and if it requires a power supply, that it is properly connected. Support of 3<sup>rd</sup> party RS485 devices is out of the scope of this manual and support capabilities of Elkor Technologies Inc.
- 5) In some cases, a 120 ohm termination resistor is required in the line.
- 6) Ensure that no other devices are connected to the +/- RS485 port on the WattsOn.

When the communications is working properly, the main display of the WattsOn Console software will be populated with data, and the status bar at the bottom will be updated with the results of the last attempted communications poll ("OK" in the case of properly working communications).

|                   | - Measurements |        |           |        |            |        |           |        |
|-------------------|----------------|--------|-----------|--------|------------|--------|-----------|--------|
|                   | Va             | 0.0    | Vab       | 0.0    | Ia         | 0.000  | Freq      | 0.00   |
|                   | Vb             | 0.0    | Vbc       | 0.0    | ть         | 0.000  | Demand    | 0.00   |
|                   | Vc             | 0.0    | Vac       | 0.0    | Ic         | 0.000  | Version   | 4.5    |
|                   | V LN Avg       | 0.0    | V LL Avg  | 0.0    | I Avg      | 0.000  |           |        |
|                   | kWa            | 0.000  | kVAa      | 0.000  | kVARa      | 0.000  | PF a      | 1.000  |
|                   | kWb            | 0.000  | kVAb      | 0.000  | kVARb      | 0.000  | PF b      | 1.000  |
|                   | kWc            | 0.000  | kVAc      | 0.000  | kVARc      | 0.000  | PF c      | 1.000  |
|                   | TTL kW         | 0.000  | TTL kVA   | 0.000  | TTL kVAR   | 0.000  | PF ttl    | 1.000  |
|                   | kWh+ a         | 7.080  | kVAh+ a   | 15.000 | kVARh+ a   | 5.640  | kWh a     | 2.880  |
|                   | kWh+ b         | 7.200  | kVAh+ b   | 10.440 | kVARh+ b   | 5.760  | kWh b     | 7.200  |
|                   | kWh+ c         | 7.320  | kVAh+ c   | 10.440 | kVARh+ c   | 5.760  | kWh c     | 7.320  |
|                   | kWh+ ttl       | 21.600 | kVAh+ ttl | 35.880 | kVARh+ ttl | 17.160 | kWh ttl   | 17.400 |
|                   | kWh- a         | 4.200  |           |        | kVARh- a   | 2.520  | kVARh a   | 3.120  |
| ame:              | kWh-b          | 0.000  |           |        | kVARh- b   | 0.000  | kVARh b   | 5.760  |
|                   | kWh-c          | 0.000  |           |        | kVARh- c   | 0.000  | kVARh c   | 5.760  |
| the second second | kWh- ttl       | 4.200  |           |        | kVARh- ttl | 2.520  | kVARh ttl | 14.640 |

Press CTRL-G, to enter the Config Word settings screen

| General Configura  | tion   |   |   |   |                              |                            |        |
|--|--|---|---|---|------------------------------|----------------------------|--------|
| PT Ratio:  | 1  | : 1   |   |   |                              |                            |        |
| CT Ratio:  | 600  | : 5   |   | 1   | Include CT                   | r/PT Ratios                |        |
| Demand Period:   | 15   |   |   |   |                              |                            |        |
| Pulse Value:   | 0  | Wh  |   |   |                              |                            |        |
| Output A Source:   | Debug Regis  | ter (12345) [0  | x85] 👱  | OV=   | 0                            | 10V=                       | 12345  |
| Output B Source:   | Debug Regis  | ter (12345) [0  | x85] 💌  | OV=   | 0                            | 10V=                       | 12345  |
| Config Word  |  |   |   |   | 11                           |                            |        |
|  |  | (hold mouse ove   | r checkbox fo                                     | r bit descri  | iption)                      |                            |        |
|  |  |   |   |   |                              |                            |        |
| 16 15 14 13<br>T T T T<br>Extended Config  | 12 11 10 9   | 8 7 6 5<br>F F 7 7<br>e > 4.5 only)<br>(hold mouse ove  | 4 3 2   | 1 = T   | 1510 (h                      | ex)                        |        |
| 16 15 14 13<br>□ □ □ □ □ □ □<br>Extended Config 1<br>16 15 14 13<br>□ □ □ □  | 12 11 10 9<br>Vord (Firmwar<br>12 11 10 9<br>12 11 10 9<br>12 11 10 9  | $\begin{array}{c c} 8 & 7 & 6 & 5 \\ \hline & & & & \\ \hline e > 4.5 \text{ only} \end{array}$ (hold mouse ove) $\begin{array}{c c} 8 & 7 & 6 & 5 \\ \hline & & & \\ \hline \end{array}$   | 4 3 2<br>T T T<br>r checkbox fo<br>4 3 2<br>T T T | $\frac{1}{\Gamma} = \Gamma$ or bit descri   | 1510 (hr                     | ex)<br>ex)                 |        |
| 16 15 14 13  | 12 11 10 9   | $\frac{8}{1} \xrightarrow{7} 6}{7} \xrightarrow{6} 5$ $\overrightarrow{r}$ | 4 3 2<br>r checkbox fc<br>4 3 2                   | $\frac{1}{\Gamma} = \left[ \begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$ | 1510 (hr                     | ex)                        |        |
| 16 15 14 13<br>Extended Config 1<br>16 15 14 13<br>17 17 17 17<br>User Data<br>Serial Number:  | 12 11 10 9<br>Vord (Firmwar<br>12 11 10 9<br>12 11 10 9<br>12 11 0 9<br>0  | 8 7 6 5<br>re > 4.5 only)<br>(hold mouse ove<br>8 7 6 5<br>7 6 5  | 4 3 2<br>r checkbox fc<br>4 3 2<br>T T T          | $\frac{1}{\Gamma} = \left[ \begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$ | 1510 (hr                     | ex)<br>ex)                 |        |
| 16 15 14 13<br>Extended Config ™<br>16 15 14 13<br>I♥ □ □ □ □<br>User Data<br>Serial Number:<br>Scratchpad [1]:  | 12 11 10 9<br>Vord (Firmwar<br>12 11 10 9<br>12 11 10 9<br>0<br>0<br>0<br>0  | 8 7 6 5<br>(hold mouse ove<br>8 7 6 5<br>7 6 5<br>8 7 6<br>8 7 6<br>8 7<br>8 7<br>8 7<br>8 7<br>8 7<br>8 7<br>8 7<br>8 7   | 4 3 2<br>r checkbox fo<br>4 3 2                   | $\frac{1}{\Gamma} = \left[ \begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$ | 1510 (hr                     | ex)<br>ex)                 |        |
| 16 15 14 13<br>Extended Config <sup>1</sup><br>I6 15 14 13<br>I♥ □ □ □ □<br>User Data<br>Serial Number:<br>Scratchpad [1]:<br>Scratchpad [2]:<br>[                 | 12 11 10 9<br>Word (Firmwar<br>12 11 10 9<br>C C C Firmwar<br>0<br>0<br>0<br>0   | 8 7 6 5<br>re > 4.5 only)<br>(hold mouse ove<br>8 7 6 5<br>re = 5<br>Scratchpad [5]<br>Scratchpad [6]   | 4 3 2<br>r checkbox fo<br>4 3 2<br>               | $\frac{1}{\Box} = \Box$ or bit description $\frac{1}{\Box} = \Box$ $0$ 0                              | 1510 (h<br>ption)<br>8000 (h | ex)<br>ex)<br>Config for l | DISP ◀ |
| 16 15 14 13<br>Extended Config 1<br>16 15 14 13<br>IV IC IC IC IC IC IC IC<br>User Data<br>Serial Number:<br>Scratchpad [1]:<br>Scratchpad [2]:<br>Scratchpad [3]: | 12 11 10 9<br>Vord (Firmwar<br>12 11 10 9<br>12 11 10 9<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | 8 7 6 5<br>(hold mouse ove<br>8 7 6 5<br>Cratchpad [5]<br>Scratchpad [6]<br>Scratchpad [7]  | 4 3 2<br>r checkbox fc<br>4 3 2<br>               | $\frac{1}{\Box} = \Box$ or bit descrit $\frac{1}{\Box} = \Box$ $\frac{1}{\Box}$                       | 1510 (h                      | ex)<br>ex)<br>Config for I | DISP 🗲 |

The DISP module must be enabled as follows:

- 1) Click "Config For DISP" to automatically configure the values OR
- 1) Checking the "Extended Config Word" bit "1" (sets the hex value to 8001)
- 2) Set the "Scratchpad [7] / DISP Line 1" value to "770" (for kW) \*\*
- 3) Set the "Scratchpad [8] / DISP line 2" value to "768" (for kWh) \*\*
- 4) Click "Apply"

\*\* You may substitute these values for the ones in Table 1 if you wish to change the display data parameters.

The resulting screen should appear as follows:

| General Connigura   | ation  |   |   |  |                 |              |       |            |
|---|--|---|---|--|-----------------|--------------|-------|------------|
| PT Ratio:   | 1  | : 1   |   |  |                 |              |       |            |
| CT Ratio:   | 600  | : 5   |   |  | Include         | CT/PT Ratios |       |            |
| Demand Period:  | 15   |   |   |  |                 |              |       |            |
| Pulse Value:  | 0  | Wh  |   |  |                 |              |       |            |
| Output A Source:  | Debug Regist   | ter (12345) [0x   | 85] 💌   | 0V=  | 0               | 10V=         | 12345 |            |
| Output B Source:  | Debug Regist   | ter (12345) [0x   | 85] 💌   | 0V=  | 0               | 10V=         | 12345 |            |
| E E E F   | Word (Firmwar  | E E E ₽   |   |  | 1510            | nex)         |       |            |
| Extended Config 1   | Word (Firmwar<br>()<br>12 11 10 9  | F = F + 4.5  only (hold mouse over) $8 7 6 5$ $F = F = F$                     | checkbox for  | r bit descr<br>$\frac{1}{\nabla} = $                         | iption)         | (hex)        |       | -1         |
| Extended Config 16 15 14 13   | Word (Firmwar<br>(12 11 10 9   |   | checkbox for  | =  <br>r bit descr<br>$\frac{1}{\nabla} =  $                 | iption)         | (hex)        |       | -1         |
| Extended Config<br>16 15 14 13<br>IF IF IF<br>User Data<br>Serial Number:   | Word (Firmwar<br>(<br>12 11 10 9<br>           <br>0   | F F F F F<br>e > 4.5 only)<br>(hold mouse over<br>8 7 6 5<br>F F F F<br>F F F | checkbox for  | r = r<br>r bit descr<br>r<br>r<br>r<br>r<br>r<br>r<br>r<br>r | iption)         | (hex)        |       | -1         |
| Extended Config<br>16 15 14 13<br>C C C C<br>User Data<br>Serial Number:<br>Scratchpad [1]:   | Word (Firmwar<br>()<br>12 11 10 9<br>1 10 10<br>1 10 10<br>1<br>1 10 10<br>1<br>1 10 10<br>1<br>1<br>1 10 10<br>1<br>1<br>1 10 10<br>1<br>1<br>1 10 10<br>1<br>1<br>1<br>1 | scratchpad [5]:   | checkbox for  | r = r<br>r bit descr<br>r<br>r<br>r<br>r<br>r<br>r<br>r<br>r | iption)         | (hex)        |       | -1         |
| Extended Config<br>16 15 14 13<br>IF IF IF<br>User Data<br>Serial Number: [<br>Scratchpad [1]: [<br>Scratchpad [2]: [   | Word (Firmwar<br>()<br>12 11 10 9<br>[] [] [] [] []<br>[] [] [] []<br>0<br>0<br>0<br>0   | scratchpad [5]:   |   | r = r<br>r bit descr<br>$\frac{1}{\nabla} = r$               | iption)         | (hex)        | DISP  | -1         |
| Extended Config<br>16 15 14 13<br>IF IF IF<br>User Data<br>Serial Number:<br>Scratchpad [1]:<br>Scratchpad [2]:<br>Scratchpad [3]:<br>Scratchpad [3]: | Word (Firmward)<br>12 11 10 9<br>12 11 10 9<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0   | Scratchpad [5]:<br>DISP Line 1:   | checkbox for<br>4 3 2<br>1 1 1<br>1 1<br>1 1<br>1 1<br>1 1<br>1 1<br>1 1                      | r = r<br>r bit descr<br>$\frac{1}{\nabla} = r$               | iption)         | (hex)        | DISP  | (1)<br>(2, |
| Extended Config 1<br>16 15 14 13<br>User Data<br>Serial Number:<br>Scratchpad [1]:<br>Scratchpad [2]:<br>Scratchpad [3]:<br>Scratchpad [4]:   | Word (Firmwar<br>()<br>12 11 10 9<br>17 17 17<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0   | scratchpad [5]:<br>Scratchpad [6]:<br>DISP Line 2:                            | Checkbox for<br>4 3 2<br>C C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C<br>C | r bit descr<br>$\frac{1}{ V } = [$                           | iption)<br>8001 | (hex)        | DISP  | (1)<br>(2, |