

ELHOR

WattsOn
MARK II

PRECISION ENERGY METER

LCD (-D / -DL Option) USER MANUAL



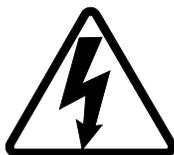
Installation Considerations

Installation and maintenance of the WattsOn device must only be performed by qualified, competent personnel who have appropriate training and experience with electrical high voltage and current installations. The WattsOn device must be installed in accordance with all Local and National Electrical Safety Codes.

WARNING

Failure to observe the following may result in severe injury or death:

- During normal operation of this device, hazardous voltages are present on the input terminals of the device and throughout the connected power lines, including any potential transformers (PTs). With their primary circuit energized, current transformers (CTs) may generate high voltage when their secondary windings are open. Follow standard safety precautions while performing any installation or service work (i.e. remove line fuses, short CT secondaries, etc).
- This device is not intended for protection applications.
- Do not HIPOT and/or dielectric test any of the digital outputs. Refer to this manual for the maximum voltage level the meter can withstand.
- Do not exceed rated input signals as it may permanently damage the device.
- The power supply input should be connected via a rated 12-30 VAC/VDC power supply and properly isolated from the line voltage.



Danger

Line voltages up to 600 VRMS may be present on the input terminals of the device and throughout the connected line circuits during normal operation. These voltages may cause severe injury or death. **Installation and servicing must be performed only by qualified, properly trained personnel.**

Limitation of Liability

Elkor Technologies Inc. ("Elkor") reserves the right to make changes to its products and/or their specifications without notice. Elkor strongly recommends obtaining the latest version of the device specifications to assure the most current information is available to the customer. Specifications and manual are available at <http://www.elkor.net>

Elkor assumes no liability for applications assistance, customer's system design, or infringement of patents or copyrights of third parties by/or arising from the use of Elkor's devices.

ELKOR TECHNOLOGIES INC. SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES SUSTAINED IN CONNECTION WITH ELKOR PRODUCTS, EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW. FURTHERMORE, ELKOR NEITHER ALLOWS NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY SUCH OBLIGATION OR LIABILITY.

Although the information contained in this document is believed to be accurate, Elkor assumes no responsibility for any errors which may exist in this publication.

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1. USING THE DISPLAY

1.1. Layout

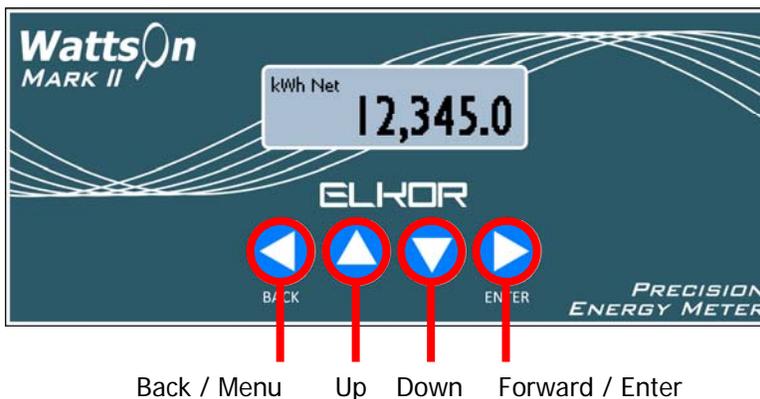
The WattsOn-Mark II "DL" model contains a 128x32 pixel backlit display and four control buttons. In its default configuration, the display shows the name and value of one or more parameters of the electrical system that the device is monitoring.



1.2. General Controls

From left to right, the four buttons correspond to the following general functions:

- Back/Menu
- Up
- Down
- Forward/Enter



By default, pressing any of the buttons turns on the backlight for 90 seconds.

The Back/Menu button performs the following functions:

- Shows the main menu, when used from the default monitor screen
- Shows the monitor screen, when used from the main menu
- Leaves the current sub-menu, when used from within a sub-menu
- Moves the cursor to the left, when editing numerical values

The Up button performs the following functions:

- Shows the previous parameter page, when used from the default monitor screen
- Moves the cursor up, when used from a menu
- Increases a digit by 1, when editing numerical values

The Down button performs the following functions:

- Shows the next parameter page, when used from the default monitor screen
- Moves the cursor down, when used from a menu
- Decreases a digit by 1, when editing numerical values

The Forward/Enter button performs the following functions:

- Shows the main menu, when used from the default monitor screen
- Selects an item from the menu
- Moves the cursor to the right, when editing numerical values

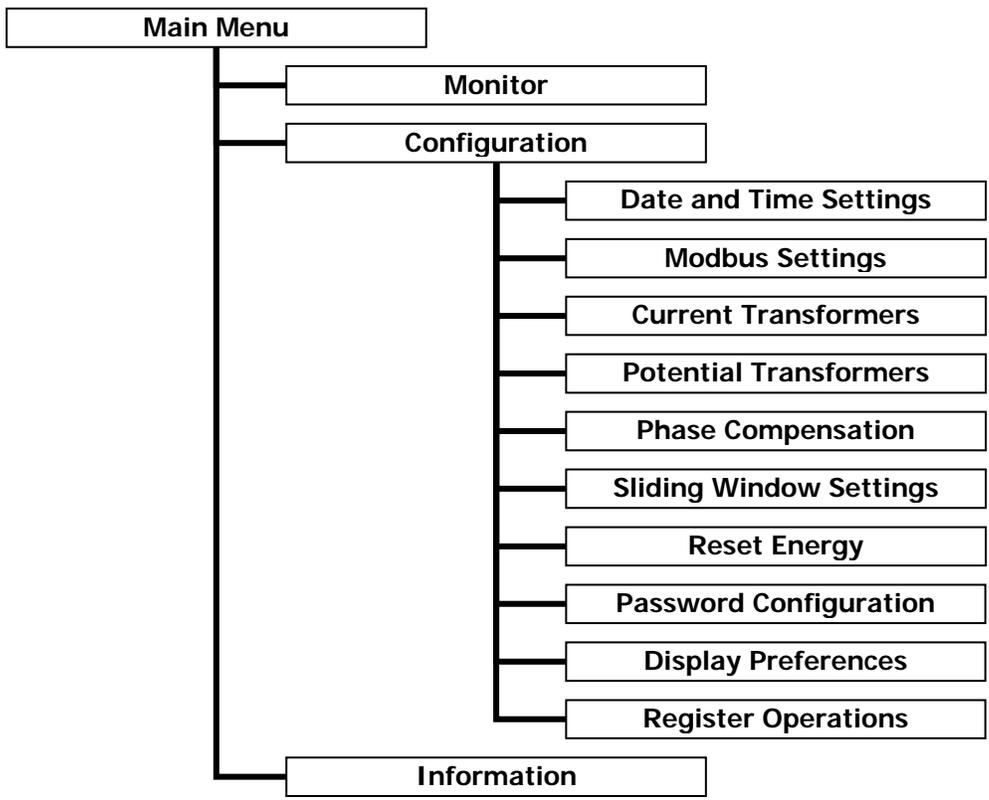
1.3. Navigating Menus

Pressing the Back/Menu button from the default monitoring screen shows the main menu. While in a menu, a triangular cursor is shown on the left-hand side of the screen, indicating which menu item is currently selected. If more than three menu items are available, a scroll bar is shown on the right-hand side of the screen, indicating the position within the larger menu.



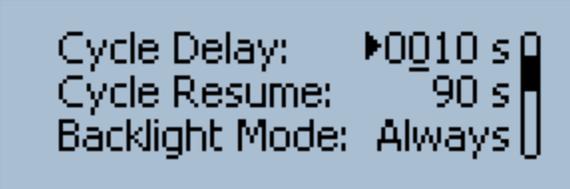
Pressing the Up / Down buttons moves the cursor to the next and previous menu items, respectively, and pressing the Forward / Enter button confirms the selection. Some menu items bring up sub-menus; pressing the Back/Menu button, leaves a sub-menu to go back to the previous menu.

A hierarchy of the menus on the device is shown below:



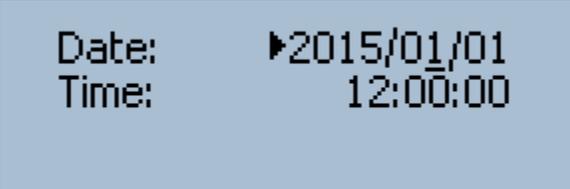
1.4. Editing Numbers

On several configuration screens, there are numerical parameters that can be changed. Pressing the Forward/Enter button will begin editing a numerical value. Use the Back/Menu and Forward/Enter button to move left and right, respectively, to select which digit to change. The currently selected digit is indicated with a line underneath the digit. Use the Up and Down buttons to change that digit to a higher or lower value, respectively.



Cycle Delay: ▶0010 s
Cycle Resume: 90 s
Backlight Mode: Always

When the number shows the desired value, press the Forward/Enter button from the right-most digit to finish editing the number. In the case of numbers with multiple parts, such as the date, time, or CT/PT ratios, this will instead move to the next part of the number (such as from the year to the month, etc.). Press Forward/Enter from the right-most part to finish editing.



Date: ▶2015/01/01
Time: 12:00:00

HINT: individual digits which form larger numbers interact with each other. Changing a specific digit will increment or decrement the entire formed number by the appropriate digit placeholder (ie: thousands, hundreds, tens, ones). That is: decrementing an individual digit, enacts the change on the entire number group.

Example 1: Suppose that the "Cycle Delay" parameter is being edited as in the above image. If the initial value is "0010", selecting the "ones" digit and decrementing by one, will change the entire number to "0009". Subsequently, sequentially incrementing "0009" in the ones place, will display "0010", "0011", "0012", and so on.

Example 2: If a "CT Ratio" is being set, and a target value of "7498" is desired, it is possible to set the "thousands" digit to "7", the "hundreds" digit to "5". At this point, "7500" will be entered. By scrolling to the "ones" digit and pressing down twice, the value will be set to "7498".

2. MONITORING

2.1. Cycling Mode (Default)

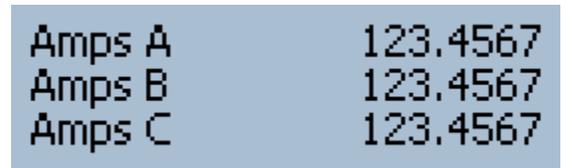
By default, the display will cycle through various parameter pages. The pages show the name and value of several electrical quantities which the WattsOn-Mark II is monitoring. The default configuration of parameter pages is as follows:

- kWh Net
- Real Power (kW)
- Power Factor Average
- Frequency (Hz)
- Amps A, B, C
- Volts A, B, C
- Volts AB, BC, AC
- kW A, B, C
- kVAR A, B, C
- kVA A, B, C
- Power Factor A, B, C

Pages showing a single parameter, such as the kWh Net parameter, show the parameter's name (and units, if applicable) at the top of the screen and the numerical value at the bottom. Some parameters also display additional information in the lower-left hand corner of the screen; see **2.1.2, Supplemental Information** (p. 8), below.



Pages showing multiple parameters, such as the per-phase current parameter, display them in a short list, with the parameter names on the left and the values on the right.



2.1.1. Controls

By default, the display shows each of the above parameter pages for 10 seconds before cycling to the next one. The user can also cycle through pages by using the Up and Down buttons. If either button is pressed, the display will not return to automatically cycling for 90 seconds (by default). This behaviour can be changed if desired from the Display Preferences screen, described in section **3.10, Display Preferences** (p. 14).

Pages can be added or removed from the list using from a PC via Modbus; See **Chapter 4, Customizing the Display** (p. 17).

Pressing either the Back/Menu button or the Forward/Enter button from this screen brings up the main menu.

2.1.2. Supplemental Information

Several parameters show additional supplemental information in the lower-left corner of the screen when in cycling mode. These parameters and the supplemental information they display is described below. Some of these parameters are not shown in the default cycling list, but may be added by the user if desired; see **Chapter 4, Customizing the Display** (p. 17) for information on adding parameters to the list.

(i) *Power Factor, A, B, C and Average*

Three icons are displayed in the lower-left hand corner of the power factor pages. Their meanings are as follows:

- | | |
|--|---|
|  | Quadrant 1, Quadrant 2, Quadrant 3, Quadrant 4 (respectively) |
|  | Inductive, Capacitive (respectively) |
|  | Lagging, Leading (respectively) |

(ii) Frequency

An icon is displayed in the lower-left hand corner of Frequency pages indicating which voltage phase the frequency is being measured on. V_A indicates the first voltage line from the left, V_B indicates the second, and V_C indicates the third.

(iii) Line-to-Line Voltage AB, BC, AC and Average

The phase angle between the two voltage lines is displayed in the lower-left hand corner of the line-to-line. For the line-to-line voltage average parameter, the average of the phase angles between phases AB, BC, and AC is displayed.

2.2. List Mode

If a more complete list of electrical parameters is desired, the display can be configured to show all parameters in a list according to categories.

In list mode, all electrical parameters are available across 4 lists. The lists are as follows:

- Real-Time Summary Parameters
- Accumulated Summary Parameters
- Real-Time Per-Phase Parameters
- Accumulated Per-Phase Parameters

kw	123.4567	
kVAR	123.4567	
kVA	123.4567	

To enable list mode, do the following:

1. From the default screen, press the Back/Menu button to enter the main menu.
2. Press Down to select Configuration, then press Forward/Enter to enter the sub-menu.
3. Press Down until the cursor reaches Display Preferences, then press Forward/Enter to enter the sub-menu.
4. Monitor Mode is the first field. Press Forward/Enter to toggle the field from Cycling to List mode.

A list can be scrolled by using the Up and Down buttons. The next list can be selected by using the Forward/Enter button, and the previous list can be selected by using the Back/Menu button. To go to the main menu, press the Back/Menu button from the first list, or the Forward/Enter button from the last list.

List mode always displays all electrical parameters – they can not be added or removed.

3. CONFIGURATION

3.1. Configuration Menu

Various aspects of the meter or the display itself can be configured through the display's menu interface. The main menu can be accessed from the default screen by pressing the Back/Menu button. From the main menu, press Down to select Configuration, and then press Forward/Enter to enter the configuration menu. The following items can be configured from the configuration menu:



Monitor
▶ Configuration
Information

- Date and Time Settings - For setting the time and date
- Modbus Settings - For changing serial port settings such as Modbus address, baud rate, etc.
- Current Transformers - For entering the ratios of the current transformers used with the meter
- Potential Transformers - For entering the ratios of the potential transformers used with the meter (if any)
- Phase Compensation - For compensating for inherent phase shift errors present in transformers
- Sliding Window Settings - For configuring the sliding window demand power parameter
- Reset Energy - For resetting the resettable energy registers to zero
- Password Configuration - For locking the meter against unwanted access with a passcode
- Display Preferences - For customizing the appearance and behaviour of the display screen
- Register Operations - For directly accessing the underlying Modbus registers of the meter

Use the Up and Down buttons to move the cursor to any of the menu items listed above, and use the Forward/Enter button to confirm your selection. This will open up a sub-menu as described in the sections below.

3.2. Date and Time Settings

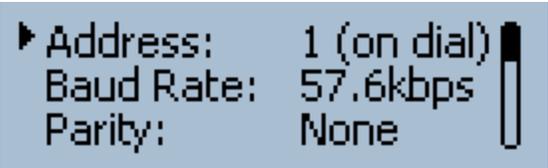
The date and time are used for data logging, and can also be displayed on screen. The date is displayed in the international *yyyy/mm/dd* format (four digit year, two digit month, two digit day) format. The time is displayed in 24-hour format, with hours, minutes, and seconds. The date and time can be editing as described in section 1.4, **Editing Numbers** (p. 5).



Date ▶ 2015/01/01
Time 12:34:56

3.3. Modbus Settings

The WattsOn-Mark II communicates using the Modbus protocol over an RS-485 serial line. The settings used by this device to communicate over the serial line can be configured on the Modbus Settings screen. The settings chosen on this screen must match the settings used by the master device that is reading the meter over Modbus, and any other devices also present on the Modbus line. The following settings can be configured on this screen:



▶ Address: 1 (on dial)
Baud Rate: 57.6kbps
Parity: None

- Modbus Address - Each device on the Modbus line must have a unique address
- Baud Rate - The speed at which the serial port communicates, in bits per second (bps)
- Parity Mode - An extra data bit can be added to each data byte to help ensure integrity
- Stop Bits - The amount of space in between each byte transmitted and received
- Delay - Minimum wait time in between receiving a message and transmitting a response

The WattsOn-Mark II defaults to the following settings:

Parameter	Value
Modbus Address	1
Baud Rate	9600 bps
Parity Mode	None
Stop Bits	1
Delay	0 ms

3.3.1. Modbus Address

By default, the number shown on the WattsOn-Mark II's physical rotary switch is used as the Modbus Address, and it can not be changed using the display. However, when the rotary switch is set to "F" (15), any address (including addresses up to 247) may be configured using this display (or using Modbus). To change the Modbus address using the display, use the following procedure:

1. Use a screwdriver to turn the physical rotary switch on top of the WattsOn-Mark II to the "F" position
2. From the Modbus Settings screen, select Address with the cursor using the Up and Down buttons, and press the Forward/Enter button.
3. Edit the number as desired as described in section **1.4, Editing Numbers** (p. 5).

3.3.2. Baud Rate

The baud rate can be set to any baud rate from the following list of supported baud rates: 9600 bps (the default), 19.2 kbps, 28.8 kbps, 38.4 kbps, 48.0 kbps, 57.6 kbps, 115.2 kbps, and 230.4 kbps. The baud rate can be changed from the Modbus Settings screen by selecting Baud Rate with the cursor using the Up and Down buttons, and pressing the Forward/Enter button to scroll through the available baud rates until the desired baud rate is shown.

3.3.3. Parity Mode

Normally, the use of parity is unnecessary on a Modbus line, because data integrity is accomplished using a checksum as part of the Modbus protocol. However, if the use of a parity bit is desired or required for compatibility with other devices on the line, the parity mode can be set to none (default), even, or odd. To change the parity mode from the Modbus Settings screen, select Parity with the cursor using the Up and Down buttons, and press the Forward/Enter button to cycle through the available parity modes until the desired parity mode is shown.

3.3.4. Stop Bits

The number of stop bits can be set to 1 or 2. To change the number of stop bits from the Modbus Settings screen, select Stop Bits with the cursor using the Up and Down buttons, and press the Forward/Enter button to toggle the number of stop bits between 1 and 2.

3.3.5. Delay

Some older Modbus master devices may have trouble receiving responses from the WattsOn-Mark II if they are sent too soon after the transmission was sent. To troubleshoot connectivity issues with such older devices, a delay from 0 to 1000 milliseconds can be set. To set the delay from the Modbus Settings screen, select Delay with the cursor using the Up and Down buttons, and press the Forward/Enter button. The number can be editing as described in **1.4, Editing Numbers** (p. 5).

3.4. Current Transformers

The WattsOn-Mark II is designed to be used with current transformers (CTs) to scale large current values down to proportionally smaller current values which can be safely measured by the meter. The turns ratio of the current transformers being used must be programmed into the meter in order for the meter to report real-world current, power, and energy values.

Current transformer turns ratios can be programmed either globally (for all three channels) or individually with different values for each channel. Because effective turns ratios can vary from part to part, Elkor typically prints exact values on the CT itself, for its line of mA style CTs. This allows for higher accuracy measurements to be obtained by programming the exact ratios into the appropriate phase of the meter. Select the Phases menu item and use the Forward/Enter button to toggle "*Identical CTs*" or "*Different CTs*" as desired. Setting "*Different CTs*" allows unique values to be entered for each of the three phases, while using "*Identical CTs*" will use the same value for all three phases.

Phases: Identical CTs
▶ CT Turns: 2500
(mA Input Version)

Phases: Identical CTs
▶ CT Turns: 600A:333mV
(mV Input Version)

Phases: Identical CTs
▶ CT Turns: 800:5
(5A Input Version)

This configuration screen is slightly different depending on whether the meter is designed for mA, mV, or 5A output CTs. Milliamp meters require a single number representing the number of turns in the CT. Sample values for various Elkor milliamp CTs are listed in the table below.

Current Transformer	Number of Turns
MCTA	2500
MCTB	4000
MSCT1	7500
MSCT2	7500
MSCT3	7500
MSCT5	11000
MS160	3000
MS360	2000

Millivolt meters require a conversion factor from Amps to millivolts, for example 200A:333mV. This indicates that 200A of current through the CT will create a 333 mV voltage on the output of the CT.

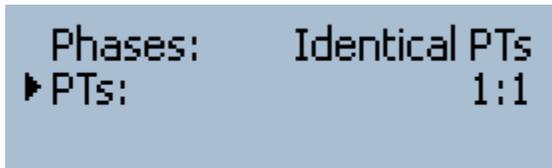
5A meters require a unit-less ratio of input current to output current, for example 200:5. This indicates 200 A of current through the CT will create 5A on the output of the CT.

CT ratios can be edited as described in section **1.4, Editing Numbers** (p. 5).

HINT: If entering different CT ratios in each channel, it is permissible to enter the ratio using the “Identical CTs” settings first, and then changing the “Phases” setting to “Different CTs”. By doing this the initial starting ratio will be set identically in all three phases, and it is thereby quicker to fine tune each ratio if required.

3.5. Potential Transformers

Potential Transformer (PT) ratios allow the device to scale the data to report the real-world voltage values on the input of the potential transformers. Because the WattsOn can accept up to 600V line-to-line voltage directly, potential transformers are often not required. In this case, PT ratios may be left at their default values of 1:1.

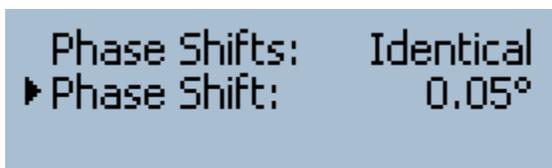


Potential transformer ratios can be programmed in either globally for all three channels or individually with different values for each channel. Select the Phases menu item and use the Forward/Enter button to toggle Identical CTs or Different CTs as desired. Setting Different CTs allows different values to be entered for each of the three phases, while using Identical CTs will use the same value for all three phases.

PT ratios can be edited as described in section **1.4, Editing Numbers** (p. 5).

3.6. Phase Compensation

Most current transformers have an inherent phase shift. This causes inaccuracies in power measurements as the power factor decreases. If the phase shift of a particular type of CT is known, the WattsOn can compensate for this phase shift either globally or per-phase.



Phase compensation values are entered with a precision of hundreds of a degree. Positive values represent compensation for a lag, negative values represent compensation for a lead. Some current transformers have the phase shift value printed on the label. Phase compensation values can be entered as described in section **1.4, Editing Numbers** (p. 5).

3.7. Sliding Window Settings

The WattsOn can measure the average power over an arbitrary interval of time, called demand power. The interval length can be programmed in seconds to any value between 1 and 65,535 seconds. Typical values are 1 minute (60 seconds), 5 minutes (300 seconds), 10 minutes (600 seconds), 15 minutes (900 seconds), 30 minutes (1800 seconds), 1 hour (3600 seconds), or any arbitrary value expressed in seconds.



```
Sub-Intervals
▶ Length:      60s
Count:        1
```

In addition, the WattsOn can be configured to measure sliding window (also called rolling demand) power. In this case, the time interval is divided into several sub-intervals. The average power over the full interval is updated each sub-interval. This device can be configured for up to 60 sub-intervals. The interval length is equal to the sub-interval length times the number of sub-intervals. If sub-intervals are not needed, set the sub-interval count to 1.

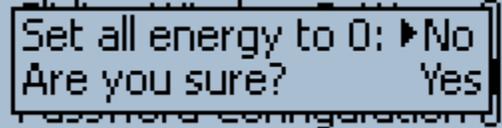
Example 1: To configure the device to record the average power over 15 minute intervals, set the Length field to 900 (15 minutes × 60 seconds) and the Count field to 1. Every 15 minutes, the *Sliding Window Power* registers will update with the average power over the previous 15 minutes.

Example 2: To configure the device to record the average power over 15 minute intervals, updating every 5 minutes, set the Length field to 300 (5 minutes × 60 seconds) and the Count field to 3 (15 minute intervals ÷ 5 minute sub-intervals). Every five minutes, the *Sliding Window Power* registers will update with the average power over the previous 15 minutes.

3.8. Reset Energy

To reset the resettable accumulated data registers to 0, perform the following procedure:

1. Select the Reset Energy menu item with the cursor using the Up and Down buttons, and press the Forward/Enter button to confirm your selection.
2. The display will prompt you to confirm. Press the Down button to move the cursor to “Yes”, and press the Forward/Enter button the reset the energy.



```
Set all energy to 0: ▶ No
Are you sure?      Yes
```

Note that the meter keeps a permanent record of all energy accumulated even if the meter is reset. By default, the energy displayed on the meter incorporates any resets. If desired, the display can be configured to display total accumulated energy despite any resets; see **Chapter 4, Customizing the Display** (p. 17) for details on this procedure.

3.9. Password Configuration

The WattsOn-Mark II features a password protection system. The device can be locked to prevent energy from being reset or any settings from being changed (with the exception of settings in the Display Preferences menu).



```
▶ Set/Change Password
Status:      Unlocked
```

3.9.1. Editing Passwords

A password is a number from 1 to 99,999,999, entered one digit at a time. To change a digit, use the Up or Down buttons to increase or decrease it by 1, respectively. To add a digit, press the Forward/Enter button to move to the next position, and use Up and Down to select a digit. To move back to a previous digit, use the Back/Menu button. To finish, select the ↵ symbol on the right-most digit. To cancel, press Back/Menu on the left-most digit.



```
Enter new password:
123456↵
```

(i) *Setting a Password*

1. From the main menu, select Configuration, and then Password Configuration.
2. Select Set/Change Password with the cursor, and use the Forward/Enter button to confirm your selection.

3. Enter a password as described above in section 3.9.1.
4. Re-enter the same password, as above, to confirm the password.
5. Confirm that the Status field now reads "Locked."

Once a password is set, attempting to change any setting will present a prompt to enter the password. After the correct password has been entered, the device has been unlocked, and will remain unlocked until 10 minutes of inactivity has passed, or until the device is either manually locked again or rebooted, whichever comes first. To permanently unlock the device, see (v) *Removing Password Protection*.

(ii) Manually Locking the Device (if a password has previously been set)

1. From the main menu, select Configuration, and then Password Configuration.
2. Select Status with the cursor, and use the Forward/Enter button to change "Unlocked" to "Locked."

(iii) Changing the Password

1. From the main menu, select Configuration, and then Password Configuration.
2. Select Set/Change Password with the cursor, and use the Forward/Enter button to confirm your selection.
3. The display will present a prompt for the password. Enter the correct password to unlock the device.
4. Now that the device is unlocked, select Set/Change Password once again.
5. Enter a password as described above in section 3.9.1.
6. Re-enter the same password, as above, to confirm the new password.
7. Confirm that the Status field now reads "Locked."

(iv) Removing Password Protection

Perform the procedure described in (iii) Changing the Password, above, but enter "0" as the new password.

3.10. Display Preferences

A number of preferences related to the screen itself can be configured from this page. Some settings are not shown if they are not applicable for the given configuration. The following is a list of parameters that can be changed from this page:

- Monitoring Mode - Which screen style to use when displaying electrical parameters, either Cycling or List
- Auto-cycling - When in Cycling mode (above), automatically move to the next parameter after some time
- Cycle Delay - When in Cycling mode (above), how long to wait before moving to the next parameter
- Cycle Resume - When in Cycling mode (above), how long to wait after a button is pressed to resume cycling
- Backlight Mode - Determines if the backlight should be always on, only after button presses, or never on.
- Backlight Time - When Backlight Mode is set to "Button," how long the backlight is on after a button is pressed
- Contrast - Higher values show darker text, lower values show lighter text
- Digit Grouping - Symbol used to group sets of three digits, for various American, European, and SI styles
- Decimal Symbol - Symbol used as the decimal point, either a period or comma

3.10.1. Monitoring Mode

The monitoring mode determines how the electrical parameters are displayed on the screen when the meter powers on or when "Monitor" is selected from the main menu. There are two modes available:

- Cycling (default): Displays single parameters or groups of three parameters on a single page, and cycles between different pages showing different parameters.
- List: Displays all electrical parameters in lists grouped according to categories.

Pressing the Forward/Enter button while Monitoring Mode is selected toggles between the two modes. For details on the two modes, see **Chapter 2, Monitoring** (p. 8).

3.10.2. Auto-cycling

This field is only displayed when the monitoring mode, described above, is set to Cycling. When the box is checked, the parameter pages will automatically cycle from one to the next without any user interaction. If the box is unchecked, the parameter pages will only cycle when with the Up and Down buttons are pressed. The default value is checked. Press the Forward/Enter button while this field is selected to toggle auto-cycling on and off.

3.10.3. Cycle Delay

This field is only displayed when Auto-cycling, described above, is checked. This field determines the number of seconds each parameter page is displayed before automatically cycling to the next one. Any value from 1 to 3600 (one hour) can be set. The default value is 10 seconds. This field can be edited as described in section **1.4, Editing Numbers (p. 7)**.

3.10.4. Cycle Resume

This field is only displayed when Auto-cycling, described above, is checked. This field determines the number of seconds each parameter page is displayed after the pages have been manually cycled by the user. Any value from 1 to 3600 (one hour) can be set. The default value is 90 seconds. This field can be edited as described in section **1.4, Editing Numbers (p. 7)**.

3.10.5. Backlight Mode

This field determines when the backlight turns on. There are three backlight modes available:

- Button (default): The backlight turns on whenever a button is pressed, and remains on for an amount of time determined by the Backlight Time parameter, described below.
- Always: The backlight is always on.
- Off: The backlight is always off.

Pressing the Forward/Enter button while Backlight Mode is selected cycles between the three modes.

3.10.6. Backlight Time

This field is only displayed when Backlight Mode, described above, is set to "Button". This field determines the number of seconds that the backlight remains on after a button has been pressed. Any value from 1 to 3600 (one hour) can be set. The default value is 90 seconds. This field can be edited as described in section **1.4, Editing Numbers (p. 7)**.

3.10.7. Contrast

This field determines the display's contrast setting. Any value from 0 to 9 can be set. Changes take effect immediately. The default value is 6. This field can be edited as described in section **1.4, Editing Numbers (p. 7)**.

3.10.8. Digit Grouping

This field determines how numbers are grouped into sets of three digits on the electrical parameter pages. Different parts of the world use different conventions when displaying numbers. Press the Forward/Enter button while Digit Grouping is selected to cycle through the available styles. The following table describes the supported styles:

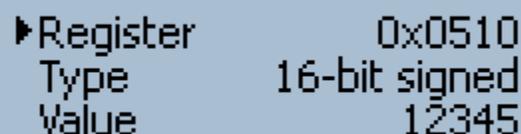
Grouping Style	Symbol	Example
None		1234567
Space		1 234 567
Comma	,	1,234,567
Period	.	1.234.567
Apostrophe	'	1'234'567

3.10.9. Decimal Symbol

This field determines which symbol is used as a decimal separator to distinguish the integer part from the fractional part of a number on the electrical parameter pages. Either a period (.) or a comma (,) may be used. Press the Forward/Enter button while Decimal Symbol is selected to toggle between a period and a comma.

3.11. Register Operations (advanced)

This page allows direct access to the WattsOn-Mark II's Modbus registers. These registers are described in detail in the **WattsOn-Mark II User Manual**. This page can be used to read or configure aspects of the WattsOn-Mark II that does not have a built-in graphical user interface available in the display. There is not normally any need to use this page, but it may be useful in certain specific situations.



▶ Register Type Value 0x0510 16-bit signed 12345

The register address (as found in the **WattsOn-Mark II User Manual**) can be entered in hexadecimal format in the first field, as described in section **1.4, Editing Numbers (p. 7)**. Note that hexadecimal digits A to F, representing 10 to 15, are available in this field. Pressing Forward/Enter while Type is selected will cycle through the available data types. The data type should match the type described for the register you are accessing as described in the WattsOn-Mark II User Manual. The following types are supported:

- 16-bit Signed
- 16-bit Positive (unsigned)
- 32-bit Signed
- 32-bit Positive (unsigned)
- 32-bit Decimal (floating-point)

Once the register address and type are chosen, the register's value is displayed in the third field. If there is no register at this address, a 0 is displayed. If the value is writable, it can be edited as described in **1.4, Editing Numbers (p. 7)**. If not, any writes to the register will be ignored and the field will return to its previous value when leaving the field.

4. CUSTOMIZING THE DISPLAY

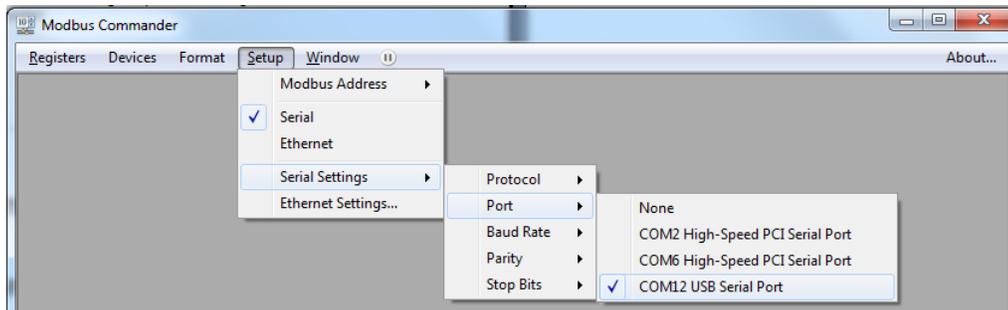
4.1. Introduction

The electrical parameters shown on the display's main screen can be customized to suit a particular application with a Windows PC connected to the WattsOn-Mark II, either via a USB-to-RS485 cable or an Ethernet gateway device. Display configuration files can be created with the free version of the Modbus Commander application, available from Elkor's website at <http://www.elkor.net>.

4.2. Getting Started

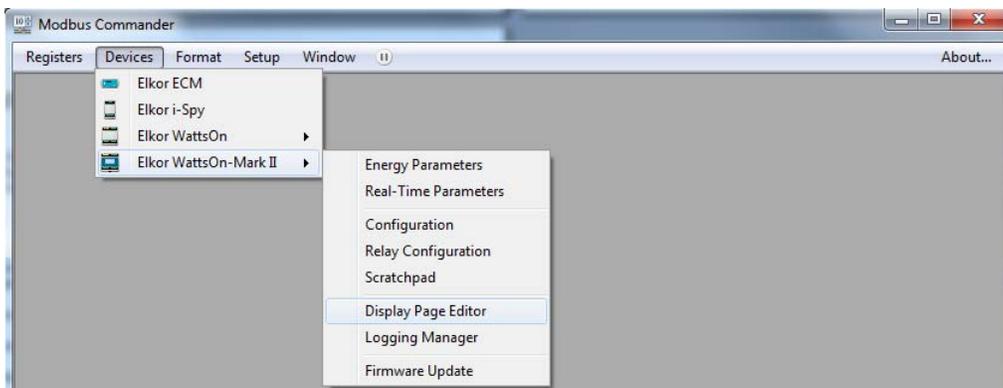
To connect to the WattsOn-Mark II via Modbus Commander, follow the procedure outlined below. The procedure assumes that the WattsOn-Mark II is connected to a PC via a USB-to-RS485 converter using default settings, but it is possible to connect using serial or Ethernet with a variety of settings.

1. Download Modbus Commander from Elkor's website, <http://www.elkor.net>.
2. Run the installer for Modbus Commander to install the program onto your computer.
3. Run the application from the desktop shortcut created by the installer.
4. Select the serial port on which the WattsOn is connected by selecting Setup → Serial Settings → Port, and clicking on the appropriate port (see screenshot below).



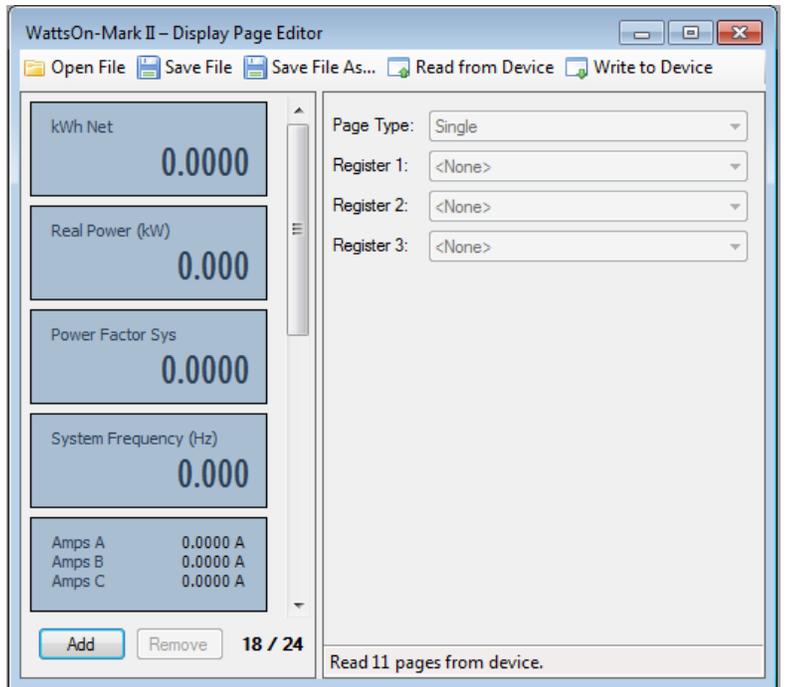
If the appropriate serial port is not obvious from its name, the Windows Device Manager can be used to determine the correct port. Otherwise, simply try each port in sequence.

5. Open the WattsOn-Mark II Display Page Editor by clicking on Devices → Elkor WattsOn-Mark II → Display Page Editor (see screenshot below).



4.3. Editing Pages

If the WattsOn-Mark II is connected correctly, the Display Page Editor will read the pages stored in the meter and display them in the interface. See the screenshot to the right.



4.3.1. Editing an Existing Page

To edit an existing page, click on the desired page in the left-hand pane. From the selection boxes on the right-hand pane, it is possible to change the page type and the register(s) shown on the page. Available page types are as follows:

- Single Shows one register on a page using a large font.
- Triple Shows three registers on a single page using the standard font.
- Pixel Test Turns on all pixels of the display, useful for ensuring that no pixels are damaged before reading.

Single-type pages may have only one register. The register being displayed can be selected from the Register 1 selection box. Triple-type pages may have three registers, which can be selected from the Register 1, Register 2, and Register 3 selection boxes.

4.3.2. Moving a Page

To move a page, drag it to a new location in the list to move a page. While dragging, a thick blue line will show the new position the page will occupy when the mouse button is released.

4.3.3. Adding a New Page

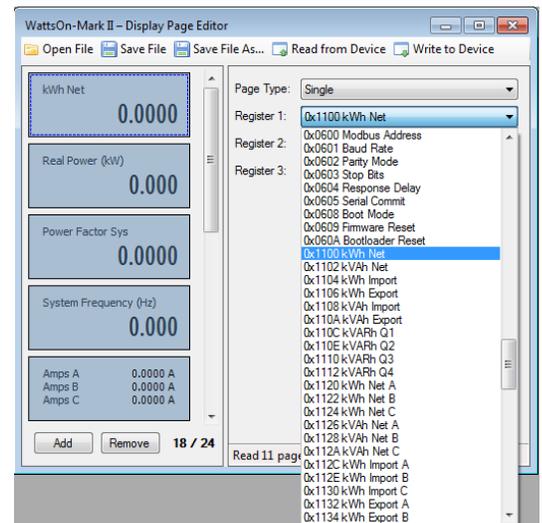
To add a new page, click the Add button in the lower-left hand corner of the window. The page can then be edited or moved as described above. A new page will be added to the bottom of the list. Up to 24 single pages or 12 triple pages can be added.

4.3.4. Removing a Page

Click on the desired page and click on the Remove button in the lower-left hand corner of the window to remove it.

4.3.5. Updating the Meter

Once the desired changes are complete, click the Write to Device button in the upper-right hand corner of the screen to write the configuration to the WattsOn-Mark II. If the main monitor screen is currently shown on the meter's display, the monitor screen must be exited in order for the changes to take effect. To do this, press the Back/Menu button to enter the main menu, then press Back/Menu again to return to the main monitor screen.



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