ELKOR

Technologies Inc.

ETnet Installation & User Guide

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1. INTRODUCTION

1.1. Documentation

This document was written and released in April 2012 (rev. 1).

1.2. Disclosure

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1.3. Product Description

The ETnet module is an internet interface for the WattsOn device. It provides a dynamic AJAX-enabled web-interface to configure the device and display real-time readings from the WattsOn Universal Power Transducer.

The ETnet can also send data collected by the WattsOn to a web server via HTTP POST at regular intervals, using a highly configurable template-based format — it can be configured to use XML, JSON, CSV, or any custom format. The ETnet will also store a backlog of data in the event of a network outage to ensure any post information is not lost due to network or server outages.

While the ETnet was designed to give internet-based monitoring and data reporting capabilities to WattsOn devices, it also functions as a general purpose Modbus/TCP to Modbus/RTU bridge, so that it can be used with existing Modbus aware software and devices. A WattsOn device can be connected directly to the ETnet's RS-485 serial port or through an external Modbus/TCP to Modbus/RTU gateway over the network.

The ETnet can read a WattsOn device directly connected to it via its built-in RS-485 serial interface or through a Modbus/TCP gateway (such as another ETnet, ETMBTCP, or a third-party product). This allows the ETnet to be in a different physical location than the WattsOn device, provided that the ETnet can reach the TCP gateway over the internet or a local area network.

The ETnet supports DHCP, BOOTP and AUTOIP. A Windows® utility is used to detect and configure the network parameters from a Windows PC. In addition, the web interface allows for full device configuration.

The ETnet is housed in a plastic enclosure intended for mounting on a DIN rail inside of an electrical panel or enclosure, near the WattsOn device being read.

1.4. Features

The following bullet points summarize the ETnet's features:

- Real-Time monitoring via web interface
- Highly customizable data posting via HTTP
- View WattsOn configuration information via web interface
- Modbus/TCP to Modbus/RTU Bridge
- Password protection, optionally with multiple levels of security
- Support for HTTP and HTTPS/SSL
- Support for DHCP, BOOTP, and static IP addresses
- Upgradable firmware

1.5. Connectors

Input/Output	
Power	9-32 VDC (100mA) or 12-24 VAC (100mA)
Bottom Connector	RJ-45 (8P8C) 10/100mbit half/full duplex Ethernet (auto-sensing) connection
Top Connector	Two-wire RS-485 serial connection

1.6. Indicators

Name	Location	Color	Description
STAT	Bottom-right	Red/Green	Illuminated green when proper power supply is applied to the device. It will blink red to indicate its status (shown in the table below).
DATA	Bottom-right	Red/Green	Indicates activity over the RS-485 port; red indicates data is being transmitted, green indicates data is being received
Link	Ethernet port – left	Green	Flashing indicates that a link is being established; solid green indicates that a link is fully established.
Activity	Ethernet port – right	Amber	Flashing indicates activity over the Ethernet port.

1.6.1. Status Indicator Codes

Indicator Activity	State	Status
Green only	Normal	Device is on and working normally.
Solid red (with green)	Normal	The reset button is being pushed.
Rapidly flashing red (with green)	Normal	The device is applying a firmware update, restoring factory default settings, or compacting its file system.
Red slowly blinks 1 time, periodically (with green)	Warning	The network is physically down, such as if a cable is unplugged.
Red slowly blinks 2 times, periodically (with green)	Warning	The network is physically connected, but an IP address has not been obtained (i.e., from the DHCP server).
Red slowly blinks 3 times, periodically (with green)	Problem	The ETnet could not acquire an IP address from a DHCP server, and so has given itself an IP address using Auto-IP protocol. It will periodically retry the DHCP server.
Red slowly blinks 4 times, periodically (with green)	Problem	There is an IP address conflict with another device on the network.
Red slowly blinks continuously	Problem	The default gateway does not appear ready

1.7. Buttons

Name	Location	Action	Description
RESET	Bottom-right	Press once	Reboots the device.
		Hold for 15 seconds	Reboots and restores the factory default settings for the device.

1.8. Default Settings

Ethernet	
IP Address	Automatically obtained via DHCP if available; Automatically configured via AutoIP if DHCP is unavailable
Subnet Mask	
Default Gateway	
Interfaces	
Web interface	Enabled, HTTP port 80, HTTPS disabled
FTP interface	Enabled (port 21)
TFTP interface	Enabled (port 69)
Modbus/TCP	Enabled, port 502 only, 500ms timeout
Username	admin
Password	admin
RS-485/Modbus	
Modbus address	1
Connection type	Internal serial port
Serial mode	Modbus/RTU
Baud rate	9600
Parity	None
Data bits	8
Stop bits	1

2. INSTALLATION

2.1. Hardware Installation

1. Connect the RS-485 wires to the A- / B+ terminal. The A- terminal of the ETnet should be wired to the WattsOn RS-485 "-" terminal, and B+ should be wired to the RS-485 "+" terminal.
2. Connect the Ethernet cable to the bottom RJ-45 (8P8C) jack.
3. Connect a DC power supply (9-32 VDC) to the +/- power terminals.
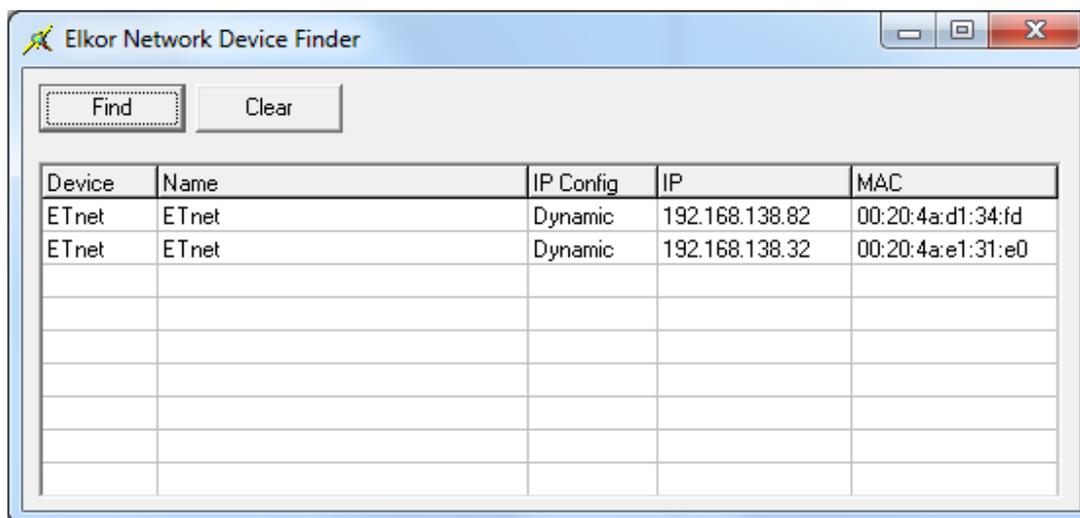
2.2. Network Discovery

By default, the ETnet is configured to automatically obtain its IP address via DHCP if available, and with AutoIP otherwise. If you are the network administrator, you may be able to determine the device's IP address by consulting your router's user interface. Otherwise, you can use the Elkor Network Device Finder utility available for the Windows operating system.

2.2.1. Network Discovery with the Elkor Network Device Finder

The Elkor Network Device Finder is a stand-alone program that runs on Microsoft Windows operating systems to assist in discovering any ETnet devices on the local area network when their IP addresses are not known. You can download the utility from Elkor's website, at http://www.elkor.net/elkor_finder.exe.

To run the utility, simply double-click on the downloaded executable. The executable is "portable" – it does not require an installer, making it easy to take with you on a USB key or similar device if it must be used in a field location that does not have full internet access.

The utility will automatically search for any Elkor devices present on the network. If the device does not show up within a few seconds, you can have the program send subsequent broadcasts by clicking the *Find* button.

2.3. IP Configuration

If you can access the ETnet's web interface, it is recommended that you configure its IP address by using a web browser (see section 3, Configuration). If you cannot access the ETnet using its default IP address settings (for example, because you do not have a DHCP server), you will first need to change it using the Elkor Network Device Finder utility.

Once you have found the ETnet with the Elkor Network Device Finder (see the previous subsection), you can double-click on it to enter the IP address configuration dialog box.

You can choose to either use a static IP configuration (i.e. one that you provide manually), or the Dynamic Host Configuration Protocol (DHCP, a router or other device on the network automatically assigns the device an IP configuration when it starts up). By default, the ETnet uses DHCP. If it has been configured to use a static IP configuration, you can set it back to DHCP by clicking the *DHCP* radio button and clicking *Apply*.

To enter a static IP configuration, click the *Static* radio button, and the other fields will be available for editing. You can enter an IP address, subnet mask, default gateway, primary and secondary DNS servers. If you are unsure as to how to configure IP address settings, consult your network administrator.

The default gateway, primary and secondary DNS server IP addresses are either supplied by your internet service provider, or the same as the address of the device you use to connect to the network (i.e. your router). The secondary DNS server is optional, and may be left blank.

3. WEB INTERFACE

3.1. Accessing the Web Interface

To access the web interface for the ETnet, open a web browser and direct it to the ETnet's IP address. (To discover the ETnet's IP address for the first time, refer to the previous section, Installation). We recommend using Mozilla Firefox or Google Chrome to access the web interface, but other standards-compliant web browsers should work fine.
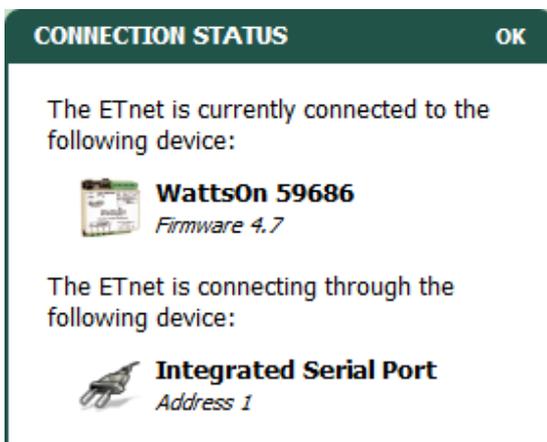

Figure 1. Accessing the Web Interface

The ETnet web interface provides a number of status indicators and configuration features for the ETnet.

> **Note — Default Password:** By default, the configuration pages are protected with a password. The first time you access the web interface, the default username and password will be **admin** and **admin**. You can change this password, remove password protection, or set up a more complex password protected scheme on the Web Interface page (see subsection 3.9).

The left-hand side of the web interface contains the different configuration pages available. They are divided into two sections, Connected Device, which contains features related to the connected WattsOn device, and Gateway, which contains features that pertain to the ETnet gateway itself. The center of the interface shows the current configuration/status page – Information, by default. At the top of the web interface are several web links that can direct you to Elkor's homepage, documentation, and support pages on the Internet.

3.2. Connection Status

On the right hand side of the web interface, there is a box titled Connection Status that shows the device that the ETnet is currently connected to, if any. The device's name, serial number, and firmware version are displayed. In addition, the method that the ETnet is using to connect to the device is also shown; this will either be the integrated serial port, or the IP address of an external Modbus/TCP gateway. The Modbus address that the ETnet is configured to use is displayed here.

This box updates in real-time, and will update to show if a device was newly connected or unplugged. The upper-right corner of the box will indicate if there is a connection problem or not.

For details on configuring the ETnet to connect to the WattsOn meter, see **Section 4, Reading the WattsOn**.

3.3. Posting Status

Below the Connection Status box is the Posting Status box. If the Web Posting feature is enabled, this box shows the status of the most recent web post that has been made since the ETnet was powered on. It will display the time of the most recent post attempt, in the local time zone of your computer. It will also display whether or not the most recent post was successful or not, including (if applicable) the HTTP error code that was returned from the server. Any connection problems are shown in the top-right corner of the box.

For details on configuring the web posting feature, as well as getting a more detailed status response, see **Section 5, Posting Data**.

POSTING STATUS   **OK**

The ETnet's most recent web post was at the following time:

09:04:17 (UTC-4)
Wednesday, April 11, 2012

The result of the ETnet's most recent post was the following:

Successful

3.4. Information Page

By default, the web interface displays general information about the ETnet, including information about the ETnet's firmware, and its current networking settings.

GENERAL INFORMATION

Name:	ETnet
Device Name:	ETnet
MAC Address (Serial No.):	00:20:4A:E1:37:1D
Uptime:	0 days 00:33:58

FIRMWARE INFORMATION

Version:	0.5.1 RC1
Release Date:	12-04-05 0911
Operating System:	Evolution 5.2.0.0.R20
Details:	Build 544; Revision 96

NETWORKING INFORMATION   **10 MBPS**

Hostname:	<None>
IP Address:	192.168.138.55/24 (DHCP)
Default Gateway:	192.168.138.1 (DHCP)
Primary DNS:	192.168.138.1 (DHCP)
Secondary DNS:	<None>

3.5. Diagnostics Page

Click "Diagnostics" to view the diagnostics page. On this page, you can view several internal details about the ETnet, including processor details, RAM details, and the processes that are currently running. Generally you will not need to check the diagnostics page unless there is a problem.

3.6. Filesystem Page

Click "Filesystem" to view the filesystem page. On this page, you can view, download, and upload files that are stored on the ETnet's flash file system, as well as enable or disable FTP and TFTP protocol access. The in-browser file explorer is provided for convenience; generally, we recommend using an FTP client to interact with the ETnet's filesystem, as that

will provide a more powerful interface. TFTP access is a simpler protocol often used in other embedded devices, which may be useful for integrating the ETnet in a larger system of embedded electronics.

3.6.1. To enable FTP access

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. In the Remote Access box, towards the bottom, click the *Change* button under the FTP Server Status heading.
3. Click in the *Enabled* box to enable the FTP server.
4. Enter a username and password for the FTP server in the text fields below.
5. Click the *Submit* button to save your changes.
6. You can now access the ETnet's file system via an FTP client.

3.6.2. To enable TFTP access

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. In the Remote Access box, towards the bottom, click the *Change* button under the TFTP Server Status heading.
3. Click in the *Enabled* box to enable the FTP server.
4. Optionally enable or disable specific features of the TFTP server as shown, such as file creation or firmware updates.
5. Click the *Submit* button to save your changes.
6. You can now access the ETnet's file system via a TFTP client.

A number of operations can be performed using the browser itself, for convenience. The following subsections describe the operations available.

3.6.3. To view or download a file using the browser

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. In the Web File Explorer box, click on the name of the file or directory you wish to view.
3. If you clicked on a file, its contents will either be shown in the browser (if it is a text file), or the browser will ask you if you wish to download the file to your computer.
4. If you wish to download a text file rather than view it, you can use your browser's "Save Page" function, which varies slightly depending on your browser:
   a. In recent versions of Mozilla Firefox, click on the Firefox button, and then click "Save Page As"
   b. In recent versions of Google Chrome, click on the wrench button, and then click "Save page as"
   c. In recent versions of Microsoft Internet Explorer, click on the gear button (tools), click on the File menu, and then click on "Save as"
   d. For other browsers, consult that browser's documentation for details on how to save a page.
5. If you clicked on a directory, the contents of the directory will be shown in the directory hierarchy. You can return to the previous directory by clicking the *Up* entry in the hierarchy.

3.6.4. To delete a file or directory using the browser

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. In the Web File Explorer box, click on the red "X" next to the name of the file or directory you wish to delete.
3. If you are deleting a directory, it must be empty before you can delete it. Delete all of the files in the directory before deleting the directory itself.

3.6.5. To create a file or directory using the browser

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. In the Web File Explorer box, click the *New* button under the Operations heading.
3. If you are creating a file, enter a file name in the text field labelled *File* and click the *Create* button.
4. If you are creating a directory, enter a file name in the text field labelled *Directory* and click the *Create* button.
5. Your file or directory will appear in the directory tree shown above.

3.6.6. To upload a file using the browser

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. In the Web File Explorer box, click the *Upload* button under the Operations heading.
3. Click on the *Browse* button (*Choose File* on Google Chrome) to select a file on your computer to upload.
4. Click on the *Upload* button.

5. Your file or directory will appear in the directory tree shown above.

3.6.7. To copy or move a file to another location on the filesystem using the browser

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. In the Web File Explorer box, click the *Copy* or *Move* button under the Operations heading, depending on which operation you would like to perform.
3. Enter the path of the source and destination filenames in the text fields.
   a. For a file that is currently displayed in the directory hierarchy, simply enter the file's name.
   b. For a file in another directory, enter a full file path. File paths start with a "/" character, indicating the root of the filesystem. For example, to indicate a file called *register_post.tpl* in the *templates* directory, use the path */templates/register_post.tpl*.
4. Click on the *Move* or *Copy* button below the text fields.

3.6.8. To transfer a file to or from an external TFTP server

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. In the Web File Explorer box, click the *TFTP* button under the Operations heading.
3. Select *Get* to transfer a file from an external TFTP server onto the ETnet's filesystem. Select *Put* to transfer a file from the ETnet's filesystem to an external TFTP server.
4. Select the desired mode. Generally, *Binary* mode is recommended.
5. Enter the path of the file on the ETnet's file system. If you are getting a file, this is the path on the ETnet where that file will be placed. If you are putting a file, this is the path to the file to be sent to the external TFTP server.
6. Enter the path of the file on the external TFTP server's file system. If you are putting a file, this is the path on the external TFTP server where that file will be placed. If you are getting a file, this is the path to the file to be sent to the ETnet.
7. Enter the host name or IP address of the external TFTP server.
8. Enter the port number of the external TFTP server. By default, this is usually port 69.
9. Click the *Transfer* button.

3.6.9. Formatting the File System

> **Note — Not Recommended:** We do not generally recommend formatting the entire filesystem. Use with caution.

Formatting removes all files and directories from the filesystem, and reboots the ETnet. Certain files and directories required by the ETnet's firmware will be rebuilt with default settings after formatting. In general, we do not recommend formatting the filesystem.

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. In the Filesystem Information box, click on the *Format* button under the Current Usage heading.
3. Formatting the filesystem can take some time. You will be directed to a different page while the formatting and rebooting operations take place. Wait for the countdown to complete, and you will be automatically redirected back to the browser's main page.
   a. If the ETnet acquires its IP address automatically using DHCP, it is possible that your router will assign a different IP address to the ETnet after a reboot, and you will need to enter that IP Address manually in your browser to return to the web interface. For details on discovering the ETnet's IP address, see **Section 2, Installation**.

3.6.10. Compacting the File System

> **Note — Automatic:** The compacting process normally occurs automatically. Starting the process manually is generally not necessary.

The ETnet's flash memory is divided into two equal-sized banks. To extend the lifetime of the ETnet's flash memory, data is the filesystem is overwritten as rarely as possible. Instead, each time a file is written to the flash memory, new data is written to the end of the file system; space occupied by deleted or changed files is not freed immediately. This space is referred to as being "dirty." Once the end of the filesystem is reached, the ETnet will copy all of its files to the second

memory bank, and erase the first bank, freeing up space used by deleted or changed files. This process is called *compacting*.

The compacting process occurs automatically, there is generally no need to start the process automatically. The process can take a few minutes, however, so to avoid a delay in the future, you may wish to compact the filesystem sooner if a large number of files are dirty. The process for doing so is described below:

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. In the Filesystem Information box, click on the *Compact* button under the Dirty Space heading.
3. Compacting the filesystem can take some time. Please wait until this process has completed – progress messages will show on the page as the process completes.

3.7. <u>Network Page</u>

The network page allows you to configure how the ETnet gets its IP address, and lets you set the hostname and domain. The ETnet supports automatic acquisition of an IP address using either DHCP or BOOTP, as well as setting a static IP. The process for doing so is described below:

3.7.1. To set the ETnet's IP address statically
1. Click "Network" on the left-hand side of the web interface to access the network configuration page.
2. Enter a hostname and/or domain into the corresponding text fields, if desired. (Optional)
3. Click in the *Static (Set Manually)* checkbox under the IP Configuration heading.
4. Enter the IP information. The values that are currently in use by the ETnet will be present in the text fields by default.
5. Click the *Submit* button to save your changes. The ETnet will reboot and then reload the web interface automatically.
   a. If the ETnet acquires its IP address automatically using DHCP, it is possible that your router will assign a different IP address to the ETnet after a reboot, and you will need to enter that IP Address manually in your browser to return to the web interface. For details on discovering the ETnet's IP address, see **Section 2, Installation**.

3.7.2. To set the ETnet's IP address automatically
1. Click "Network" on the left-hand side of the web interface to access the network configuration page.
2. Enter a hostname and/or domain into the corresponding text fields, if desired. (Optional)
3. Click in the *DHCP* (default) or *BOOTP* checkbox under the IP Configuration heading.
4. Click the *Submit* button to save your changes. The ETnet will reboot and then reload the web interface automatically.
   a. If the ETnet acquires its IP address automatically using DHCP, it is possible that your router will assign a different IP address to the ETnet after a reboot, and you will need to enter that IP Address manually in your browser to return to the web interface. For details on discovering the ETnet's IP address, see **Section 2, Installation**.

3.8. <u>System Page</u>

The system page allows you to reboot the ETnet, restore its settings to the factory default configuration, or change the firmware that is installed.

> **Note — Not Recommended:** We do not generally recommend changing the firmware unless absolutely necessary, as a power failure during the process could corrupt the firmware. Use with caution.

> **Note — Reset Button:** You can also reset the ETnet by pressing the physical RESET button on the front of the device. You can also restore the ETnet to its factory default settings by pressing and holding the physical RESET button for 15 seconds.

3.9. <u>Web Interface Page</u>

The web interface page allows you to configure the internal web server, authentication, and SSL certificates. You can protect all or part of the web interface by using a password.

3.9.1. To change the settings for the HTTP/HTTPS server

1. Click "Web Interface" on the left-hand side of the web interface to access the web interface configuration page.
2. In the HTTP/HTTPS Configuration box, under the Current Settings, click the *Edit Settings* button.
3. To disable the web server, click the *Disabled* radio button under the Edit HTTP Settings heading.
4. To change the port number that the HTTP web server uses, enter a new number in the *Port* text field under the Edit HTTP Settings heading. The default is port 80.
5. To change the port number that the HTTPS web server uses, enter a new number in the *Port* text field under the Edit Secure HTTP Settings heading. The default port is 443.
6. To enable or disable HTTPS authentication protocols, click the corresponding check box next to SSL 3, TLS 1.0, or TLS 1.1 under the Edit Secure HTTP Settings heading.
7. Click the *Submit* button to save your changes.

> **Note — HTTPS and Certificates:** The HTTPS server will not work until you configure an SSL certificate in the SSL Certificates box.

3.9.2. To remove password protection from the web interface

1. By default, one protected directory is listed under the Protected Directories heading in the Authentication box.
2. To remove password protection, click the *Delete* button next to this entry.

3.9.3. To password-protect the web interface

1. In the Authentication box under the Protected Directories heading, click the *Add Realm* button.
2. Under the Add Protected Directory heading, enter the directory of the web interface to be protected. To protected read-only pages, enter **/config** (unprotected by default). To protect read-write pages, enter **/protected** (protected by default). To protect both sets of pages, you will need to add two realms, one for each.
3. Enter a display name for this protection realm. This is just for display purposes, and can be any name.
4. Enter the type of authentication protocol to be used. The SSL authentication types are available only if an SSL certificate has been created or uploaded to the ETnet. Select at least "Basic".
5. Enter the username and password of a user in this realm.
6. Click the *Submit* button.

> **Note — Security Concerns:** When using "Basic" or "Digest" authentication without SSL, passwords transmitted over the network may be visible to observers. These methods are easy to set up, but are easily broken and suitable for basic interface-level security only. For serious security concerns, use SSL, or do not expose the web interface to the un-trusted individuals (i.e. with a firewall).

3.9.4. To add a user to an existing protection realm

1. In the Authentication box under the Protected Directories heading, click the [add user] link.
2. Under the Add Protected Directory heading, enter a username and password for this new user.
3. Click the *Submit* button and the user will appear in the Users list.

3.9.5. To upload an SSL Certificate

1. In the SSL Certificates section, under the Upload Certificate heading, next to *New Certificate* click the *Browse* button (*Choose File* on Google Chrome), and select your SSL certificate file.
2. Next to *Private Key*, click on the *Browse* button (*Choose File* on Google Chrome), and select your private key file.
3. Click the *Submit* button.

3.9.6. To upload a certificate authority certificate:

1. In the SSL Certificates section, under the Upload Authority section, click the *Browse* button (*Choose File* on Google Chrome) and select an authority certificate file.
2. Click the *Submit* button.

3.9.7. To create a self-signed certificate:

1. Under the Create Self-Signed Certificate heading, fill out the form with information about your organization, which can be seen by visitors to the web interface.
2. Choose a key length. Note that longer keys are more secure, but take much longer to create and increase access times to the server.
3. Chose a key type. DSA is recommended.
4. Click the *Submit* button.

4. READING THE WATTSON

4.1. <u>Connecting to the WattsOn</u>

To configure the ETnet's connection to the WattsOn device, access the web interface (see **Section 3, Web Interface**), and click on *Modbus Setup*. The ETnet can connect to a WattsOn that is either connected directly to the ETnet's integrated serial port, or through an external Modbus/TCP gateway.

4.1.1. Connect via Serial

By default, the ETnet is configured to connect to a WattsOn that is connected to its integrated serial port. In the Connection Setup box, under the Connection Gateway heading, the text should read "Integrated Serial Port." If it does not, use the following procedure.

1. In the Connection Setup box, under the Connection Gateway heading, click on the *Change* button.
2. Click on the radio button next to the *Integrated Serial Port* heading.
3. Click on the *Submit* button.

Typically, you will not need to change the serial parameters (i.e. the baud rate), as they are already configured to communicate with a WattsOn using its default serial parameters (Modbus/RTU, 9600 bps, no parity, 8 data bits, 1 stop bit). If you have changed the WattsOn's baud rate from the default, or are using a custom configuration, you can change the serial parameters as desired.

1. In the Connection Setup box, under the Serial Configuration heading, click on the *Change* button.
2. Select the serial parameters that match the serial parameters of your WattsOn device.
3. Click on the *Submit* button.

4.1.2. Connect via an External Gateway

The ETnet is also capable of connecting to a WattsOn via an external Modbus/TCP gateway, such as another ETnet, an ETMBTCP, or a third-party device. To connect to an external gateway, use the following procedure.
1. In the Connection Setup box, under the Connection Gateway heading, click on the *Change* button.
2. Click on the radio button next to the *External Modbus/TCP Gateway* heading.
3. Enter the external gateway's IP address in the *Gateway IP Address* field.
4. Enter the external gateway's port number (502 by default) in the *Gateway Port* field.
5. Click on the *Submit* button.

4.1.3. Modbus Address

By default, a WattsOn ships with the default Modbus address of 1. If its address has been configured to something other than 1 (via the DIP switch on the top of the WattsOn), you will need to indicate that here.
1. In the Connection Setup box, click on the *Change* button under the *Modbus Address* heading.
2. If you know the Modbus address of the WattsOn device, enter it into the text field under the Set Modbus Address Manually heading, and click the *Apply* button.
3. If you do not know the Modbus address of the WattsOn, click on the *Automatically Detect* button. The ETnet will attempt to detect all WattsOn devices that are connected to it. As it detects devices, they will be shown in a list. If your WattsOn device appears in the list, click the *Select* button next to it.

If you use the *Automatically Detect* feature, but the ETnet does not detect your device, you may need to troubleshoot the connection. If the WattsOn is connected via RS-485, ensure that the two devices are connected correctly (see **Section 2, Installation**) and determine the address of the WattsOn by looking at the DIP switch on the top of the WattsOn unit, as described in the WattsOn documentation. If the WattsOn is connected through a Modbus/TCP bridge, devices may not be detected if the timeouts of the bridge are set too high.

4.2. Viewing Real-Time Data

To monitor real time sensor data from the WattsOn, access the web interface (see **Section 3, Web Interface**), and click on *Monitor*. Data will begin to appear after a moment or two. If it does not, verify that the ETnet is configured to connect to the WattsOn, as described in subsection **4.1, Connection to the WattsOn**.

In the first box, titled Reading Timestamp, a timestamp of when the WattsOn's data was last read is displayed. The timestamp is shown in your local time zone (as determined by your computer's system time).

The second box displays the current real-time parameters that the WattsOn is measuring, including instantaneous voltage, current, and power. The third box displays accumulated energy values. These values accumulate over time. For a detailed description of the values measured by the WattsOn, refer to the WattsOn's documentation.

4.3. Viewing the WattsOn's Configuration

To view configuration settings from the WattsOn, access the web interface (see **Section 3, Web Interface**), and click on *View Config*. Data will begin to appear after a moment or two. If it does not, verify that the ETnet is configured to connect to the WattsOn, as described in subsection **4.1, Connection to the WattsOn**.

The current values programmed into the WattsOn are displayed. These values can help you debug configuration issues with the WattsOn.

5. POSTING DATA

5.1. Introduction

The ETnet device can periodically transmit data from the connected WattsOn meter to a local or remote web site. This is done by sending an HTTP POST message to a given URL (website address, such as http://www.your-server.com/). This message can be interpreted by server-side scripts, such as those written in PHP, ASP, JSP, CGI, and similar technologies. Such scripts could log the information, upload it to a database, control some other device with the information, and so on.

The format of the HTTP POST is customizable using a template. By default, the ETnet ships with a template that posts in JSON format, but by customizing the template, you could post in any other format, such as XML, CSV, or proprietary formats specific to your company or organization. Details for customizing your template are provided in **Subsection 5.4, Customizing the Format**.

5.2. Examples

Hyper-Text Transfer Protocol (HTTP) is the protocol used on the internet to request web pages and upload information back to them. While the details of the HTTP protocol are beyond the scope of this document, an example POST is shown below.

```
POST /post/ HTTP/1.0
Host: elkor
Content-type: application/x-www-form-urlencoded
Content-length: 1484

payload={
  "device": "ETnet-00:11:22:33:44:55",
  "device_firmware_version": "1.0.0 R100 B600 (12-05-10 1628)",
  "meter_serial": 50001,
  "meter_firmware_version": 2.4,
  "time": "2012-05-15T18:22Z",
  "data": {
    "net_total_energy_cumulative_kWh": 26086.6,
    "real_power_ab_total_kW": 2.240,
    "reactive_power_ab_total_kVAR": 0.090,
    "apparent_power_ab_total_kVA": 2.410,
    "power_factor_ab_total_none": 0.929,
    "frequency_instantaneous_Hz": 60.0,
    "real_power_demand_ab_average_kW": 2.2,
    "voltage_a_instantaneous_V": 118.9,
    "voltage_b_instantaneous_V": 116.2,
    "voltage_ab_instantaneous_V": 235.1,
    "current_a_instantaneous_A": 7.100,
    "current_b_instantaneous_A": 13.780,
    "real_power_a_instantaneous_kW": 0.799,
    "real_power_b_instantaneous_kW": 1.442,
    "reactive_power_a_instantaneous_kVAR": 0.145,
    "reactive_power_b_instantaneous_kVAR": -0.055,
    "apparent_power_a_instantaneous_kVA": 0.845,
    "apparent_power_b_instantaneous_kVA": 1.561,
    "power_factor_a_instantaneous_none": 0.945,
    "power_factor_b_instantaneous_none": -0.924,
    "import_energy_a_cumulative_KWh": 11436.0,
    "import_energy_b_cumulative_KWh": 14650.7,
    "ttl_import_energy_ab_total_KWh": 26086.6,
    "export_energy_a_cumulative_KWh": 0.0,
    "export_energy_b_cumulative_KWh": 0.0,
    "ttl_export_energy_ab_total_KWh": 0.0,
    "net_real_energy_a_cumulative_KWh": 11436.0,
    "net_real_energy_b_cumulative_KWh": 14650.7,
    "status": 0
  }
}
```

While the details of server-side scripting are beyond the scope of this document, a sample script written in the PHP scripting language is provided below for reference. The script reads the data from the HTTP POST and appends that data to the end of the log file called "posts.log".

```php
<html>
<body>
<?php

    // Place the contents of the HTTP POST into a variable
    $postdata = file_get_contents("php://input");

    // Save the data to a log file
    $handle = fopen("posts.log", "a");
    fwrite($handle, $postdata);
    fclose($handle);

?>
</body>
</html>
```

5.3. Enabling Web Posting

To configure the web posting feature on the ETnet, you must access the web interface (see **Section 3, Web Interface**), and click on the *Web Posting* button on the left-hand side of the page.
1. In the Web Posting box, under the Current Posting Settings heading, click the *Change* button.
2. Check the *Enable Posting* box.
3. Choose how often the ETnet will post its data to the server. To select, for instance, every 15 minutes, enter "15" into the text field, and select "minutes" from the drop-down box. You can enter times in seconds, minutes, or hours.
4. Enter the URL (web address) of the web server to which posts should be made.

> **Note — Trailing Slashes:** If the URL you are entering does not end in a file extension (like .htm or .html), some web servers require that you end it with a trailing slash **/**. For instance, http://www.your-server.com/data**/**

5. Click the *Submit* button to save your changes.

If the ETnet previously had web posting disabled, it will immediately make its first post after the settings are applied, and then make subsequent posts after the designated interval. You can test your configuration by clicking the *Post Now* button at the bottom of the Web Posting box.

5.4. Enabling HTTP Authentication

If your web server requires basic HTTP authentication, you can enable it by entering a username and password.

1. In the Web Posting box, under the HTTP Authentication heading, click the *Change* button.
2. Click the *Enable* check box.
3. Enter the username and password in the text fields
4. Click the *Submit* button to save your changes.

5.5. Testing The Configuration

You can test your configuration by clicking the *Post Now* button at the bottom of the Web Posting box. The Previous Post Response box will display the HTTP response, if any, of the previous posting attempt. You can use this to help debug connection or formatting problems with the post or posting template.

5.6. <u>Customizing the Format</u>

The format that the ETnet uses to post data to the web server can be completely customized by editing a template. The template is stored on the ETnet device, and can be viewed or downloaded using the web interface, or using the File Transfer Protocol. The file is called register_post.tpl, and can be found in the /templates directory. For details on how to view or download a file using the web interface, or how to enable the File Transfer Protocol, see **Subsection 3.6, Filesystem Page**.

5.6.1. Editing the Template

The template can be opened and edited in any simple text editor, such as *Notepad* on Microsoft Windows. The template contains both text that will be posted to the web server verbatim, and variables which will be replaced with values read from the WattsOn meter (or other information) when the data is posted.

Variables are inserted into the template, which are replaced with real-time values each time the data is posted. Variables start with a dollar sign $ to separate them from the text content of the template; if you need to use a literal $ in your template, enter it using two dollar signs $$, which will be replaced with a single $ when the data is posted. The following sections list the variables that you can use in your template.

General Variables

The following variables provide general information about the ETnet device and the WattsOn meter to which it is connected.

Variable	Description
$dev_name	Name of the device, including the MAC address. For example, ETnet-00:11:22:33:44:55
$etnet_version_firmware	The firmware version of the ETnet.
$dev_serial	The serial number of the WattsOn device to which the ETnet is connected.
$time_unix	Timestamp of the last set of values read from the meter, given in Unix format. If the time could not be acquired from the internet, the variable is replaced with "Time Not Available."
$time_ISO8601	Timestamp of the last set of values read from the meter, in ISO8601 format. If the time could not be acquired from the internet, the variable is replaced with "Time Not Available."
$dev_uptime	Number of seconds that the ETnet has been on.
$dev_time_sync_age	Number of seconds since the ETnet last synchronized its clock via the internet. By default, it synchronizes the clock on boot-up, and subsequently every 24 hours.
$$	Replaced with $. Use this if you need to insert a literal dollar sign into the template.

WattsOn Register Variables

The following variables correspond to specific floating-point registers on the WattsOn. Internally, they are represented as 32-bit floating point values. They are displayed as decimal numbers with a number of decimal places appropriate for the accuracy of the specific value, i.e., `1.23`.

Variable	Units	Description
`$r300`	kWh	Total Energy Consumption
`$r302`	kW	Total Real Power
`$r304`	kVAR	Total Reactive Power
`$r306`	kVA	Total Apparent Power
`$r308`	V	Average Voltage (L-N)
`$r30A`	V	Average Voltage (L-L)
`$r30C`	A	Average Current
`$r30E`		Total (System) Power Factor
`$r310`	Hz	Frequency
`$r312`	kW	Sliding Window Real Power Demand (Total of phases)
`$r314`	V	Voltage A-N
`$r316`	V	Voltage B-N
`$r318`	V	Voltage C-N
`$r31A`	V	Voltage A-B
`$r31C`	V	Voltage B-C
`$r31E`	V	Voltage A-C
`$r320`	A	Current A
`$r322`	A	Current B
`$r324`	A	Current C
`$r326`	kW	Real Power A
`$r328`	kW	Real Power B
`$r32A`	kW	Real Power C
`$r32C`	kVAR	Reactive Power A
`$r32E`	kVAR	Reactive Power B
`$r330`	kVAR	Reactive Power C
`$r332`	kVA	Apparent Power A
`$r334`	kVA	Apparent Power B
`$r336`	kVA	Apparent Power C
`$r338`		Power Factor A
`$r33A`		Power Factor B
`$r33C`		Power Factor C
`$r33E`	Fixed	Software Version
`$r340`	KWh	Import Energy (+) A
`$r342`	KWh	Import Energy (+) B
`$r344`	KWh	Import Energy (+) C
`$r346`	KWh	Total Import Energy (+) A+B+C
`$r348`	KWh	Export Energy (-) A
`$r34A`	KWh	Export Energy (-) B
`$r34C`	KWh	Export Energy (-) C
`$r34E`	KWh	Total Export Energy (-) A+B+C
`$r350`	KWh	Net Total Energy (+/-) A
`$r352`	KWh	Net Total Energy (+/-) B
`$r354`	KWh	Net Total Energy (+/-) C
`$r356`	KWh	Net Total Energy (+/-) A+B+C (Same As $r300)
`$r358`	kVARh	Inductive Energy (+) A
`$r35A`	KVARh	Inductive Energy (+) B
`$r35C`	KVARh	Inductive Energy (+) C
`$r35E`	KVARh	Total Inductive Energy (+) A+B+C
`$r360`	KVARh	Capacitive Energy (-) A
`$r362`	KVARh	Capacitive Energy (-) B
`$r364`	KVARh	Capacitive Energy (-) C
`$r366`	KVARh	Total Capacitive Energy (-) A+B+C
`$r368`	KVARh	Net Total VARh (+/-) A
`$r36A`	KVARh	Net Total VARh (+/-) B
`$r36C`	KVARh	Net Total VARh (+/-) C
`$r36E`	KVARh	Net Total VARh (+/-) A+B+C
`$r370`	KVAh	Total VAh A
`$r372`	KVAh	Total VAh B
`$r374`	KVAh	Total VAh C
`$r376`	KVAh	Total VAh (A+B+C)

Computed Variables

The following variables are computed based on the above variables.

Variable	Units	Value
`$dev_volts_ab`	V	The sum of the voltage on phase A and phase B, useful for split-phase metering.

5.6.2. Uploading the Modified Template

To upload a modified template, you can use either a program supporting the File Transfer Protocol, or the web interface. A procedure using the web interface is as follows:

1. Click "Filesystem" on the left-hand side of the web interface to access the filesystem configuration page.
2. Click on the "templates" directory.
3. In the Web File Explorer box, click on the red "X" next to the existing template file register_post.tpl (if any).
4. In the Web File Explorer box, click the *Upload* button under the Operations heading.
5. Click on the *Browse* button (*Choose File* on Google Chrome) to select the modified template file on your computer to upload. This file **must** be named **register_post.tpl**.
6. Click on the *Upload* button.
7. Your file will appear in the directory tree shown in the Web File Explorer box.

5.7. Time Synchronization

The ETnet does not have a battery-backed real time clock. To obtain the timestamps used in the $time_ISO8601 and $time_unix variables, the ETnet synchronizes the time over the internet. The ETnet attempts to synchronize the time when it first boots up, and will subsequently synchronize the time at least every 24 hours.

If the ETnet fails to acquire the time, it will attempt to reacquire the time before it makes a post. All time-related variables are replaced with "Time Not Available" if no time has been acquired since boot up. The $dev_time_sync_age reports the number of seconds since the ETnet last synchronized its clock.

5.8. Buffering and Failure Handling

If the ETnet cannot successfully post to the configured web server due to a connection problem, the ETnet will store failed posts in its internal memory and retry that post later on. Posts are retried at the same interval that is configured for making new posts. The ETnet has four megabytes of internal storage available for buffered posts, with each post being approximately the size of the posting template.

Buffered posts can be viewed by exploring the /buffer directory in the ETnet's filesystem (see **Section 3.6, Filesystem Page**).