

# XW-110 & XW-110 Plus

Wireless Temperature Monitoring



## USERS MANUAL

Revision 2.3

For models: XW-110, XW-110P

**Wi-Fi Temperature Monitoring & Alerting • No Wiring Needed**

## Features

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- ▶ Monitor 1 or up to 3 (XW-110 Plus) temperature sensors
- ▶ Wireless Wi-Fi 802.11 b/g/n
- ▶ Transmission range up to 250ft
- ▶ Built-in web server and WPS for setup, configuration and remote monitoring
- ▶ Air or submersible temperature probes available - Sensors are interchangeable and need no calibration
- ▶ Powered from internal battery or external DC power adapter
- ▶ Small data packets provide long battery life
- ▶ Control relays on other ControlByWeb devices
- ▶ Log temperature data (XW-110 Plus only)
- ▶ Simple and easy to use
- ▶ Two models available: (1) XW-110, (2) XW-110 Plus

**CONTROL by  
WEB™**  
www.ControlByWeb.com

a division of Xytronix Research & Design, Inc.  
located in Nibley, Utah, USA

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XW-110 User Manual Revisions	
Revision	Description
1.0	Initial release.
1.1	Added Canadian IC declaration.
2.0	Split the combined <i>XW-110</i> and <i>XW-111</i> user manual into two separate manuals. Added support for the <i>XW-110-Plus</i> features. Added Modbus documentation. Changed to 5-year warranty.
2.1	Added Test Email error messages and explanations.
2.2	Clarified remote services features and added network discovery protocol description. Updated recommendations for stainless steel temperature probe. Removed XCD and other slave mode features from <i>XW-110-Plus</i> .
2.3	Added to mounting instructions. Added temperature sensor daisy-chain diagram and wiring tips

**Notes:** The *XW-110-Plus* is generally identical to the *XW-110* but has additional features and capabilities. The differences are noted in *Section 3*. The screen images throughout this manual are for the *XW-110-Plus* version. The settings however, are generally identical to the *XW-110* except where noted.

## Section 1: Introduction

The XW-110 and XW-110-Plus are easy-to-use Wi-Fi temperature sensors that measure and report real-time temperature. The XW-110 monitors temperatures using a precision internal digital temperature sensor (included), or an external temperature probe (not included.) The XW-110-Plus™ supports monitoring of up to three external temperature sensors. It is ideal for applications where temperatures must be monitored and Ethernet wiring is not accessible or practical to install.

The XW-110 is powered by an external wall transformer (5VDC), or by two internal AA batteries. In the case both are installed, the XW-110 will use the wall transformer and automatically switch to the batteries in the event of a power failure. Only use batteries to provide backup power, or for modes where the web server is not being used. If the internal web server is enabled in the XW-110, the unit will need to be powered by an external wall transformer. Some configurations consume more power than others leading to some scenarios where battery operation is not practical. For example, measuring and transmitting the temperature every five seconds could result in depleting the batteries very quickly. Having more features enabled and/or increased reporting rate leads to lower battery life.

The XW-110 can utilize one of two modes of operation. The first being the "Stand-Alone" mode which makes the XW-110 a self-contained device that requires no additional servers or ControlByWeb devices. In this mode the XW-110 products can provide live, real-time temperatures directly to users through web browsers or the CBW Mobile app. In addition, the stand-alone mode offers the ability to monitor temperature and send out email alerts (which can be converted to text message alerts) whenever an alarm condition occurs.

The second mode of operation is "Slave" mode which is used for measuring and reporting the temperature status of other ControlByWeb devices. In this mode, the XW-110 is not directly accessible to the user. Temperature readings are transmitted to a server or another ControlByWeb device such as the X-600M controller which acts as a "master." The master device uses the information provided by the XW-110 as it would use information collected by any other sensor. **Note:** *the XW-110-Plus is targeted for stand-alone applications and the Slave mode is not available with the XW-110-Plus version.*

A three-position terminal strip provides connections for up to three temperature sensors. No other cables, interfaces, or PC utility programs are needed.

Two user accessible push-button switches aid in provisioning the module. Press the "Access Point" button anytime to active the access point mode. With a PC or smart phone you then connect to and access the internal web server no matter what mode the unit is currently set to. Using the web server, you configure the measurement interval, access port, name, and other setup parameters. Alternatively, add the XW-110 to an existing network by pressing the "WPS" (Wi-Fi Protected Setup) button on both the XW-110 and on your access point (i.e., router).

The XW-110-Plus is generally identical to the XW-110 but has additional features and capabilities for extra sensors and remote services. The XW-110-Plus can be configured to automatically connect to [ControlByWeb.cloud](http://ControlByWeb.cloud). This feature allows internet access to an XW-110-Plus which is installed behind a network router, without the need to setup port forwarding in the router. This also allows easy installation using DHCP without the need to assign a specific IP address. Since the connection from the XW-110-Plus is outgoing, rather than incoming, the local router on the network where the XW-110-Plus resides doesn't need to be configured to forward sockets. This simplifies the installation since the router configuration is not modified.

Additionally, the XW-110-Plus allows for logging time and temperature data to temporary memory. Once per day at a time configured by the user, the XW-110-Plus will generate and send an email with all the logged data to an email account set by the user. This allows for long-term accumulation of temperature data.

### 1.1.1 Features

- Wireless Wi-Fi 802.11 b/g/n
- Transmission range up to 250ft
- Temperature sensors:
  - 1 temperature sensor (XW-110)
  - 3 temperature sensors (XW-110-Plus)
- Built-in web server for configuration and remote monitoring
- Temperature sensor is accurate to +/-0.5°C from -10°C to +85°C
- Air or submersible temperature probes available, sensors are interchangeable and need no calibration
- Powered from two “AA” batteries or external DC power adapter
- Small data packets provide long battery life
- Temperature status can control relays on other ControlByWeb devices
- Send email alarms and weekly status alerts (up to 3 addresses)
- Send encrypted emails.
- Temperature data can be logged and periodically send to an email account for long-term storage
- The XW-110-Plus includes auxiliary protocols including XML, Modbus/TCP and Remote Services
- Simple and easy to use
- 5-year warranty

### 1.1.2 Part Numbers and Accessories

Device	Description	Part Number
<b>XW-110</b>	Wi-Fi temperature sensor with built-in web server	XW-110B
<b>XW-110-Plus</b>	Wi-Fi temperature sensor with built-in web server	XW-110P
<b>Temperature Sensor</b>	Digital temperature sensor with short wire leads (connects directly to the terminal strip)	X-DTS-U
<b>Temperature Sensor</b>	Digital temperature sensor with 3 foot wire leads (housed in submersible stainless steel probe)	X-DTS-S3C
<b>Temperature Sensor</b>	Digital temperature sensor with 32 foot wire leads (housed in submersible stainless steel probe)	X-DTS-S32C
<b>Power Supply</b>	Wall Transformer, 120VAC in, 5V, 1A out	PS5VW1.0-2.5mm

### 1.1.3 Wireless Communication Notes

Due to the nature of wireless communications, transmission and reception of data can not be guaranteed. Data may be delayed, have errors, or be lost. Although delays or losses of data are rare with a well constructed network, data can be lost due to interference, noise, reflections, or other environmental conditions. The XW-110 should not be used in situations where failure to transmit or receive data could result in damage to property, equipment, direct, indirect, consequential, or incidental damage, including damage for loss of business profit, business interruption, loss of data, life, and the like.

## Section 2: Installation and Setup

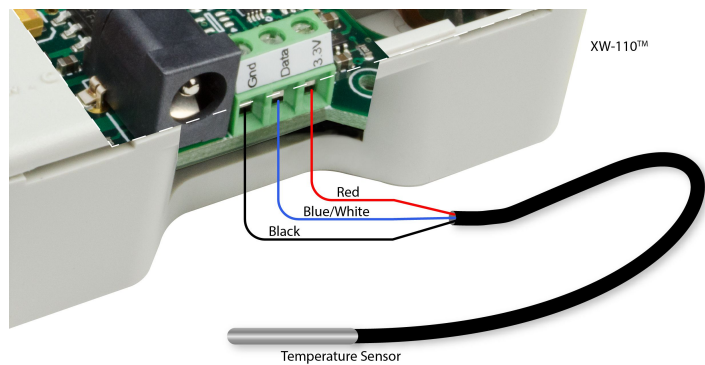
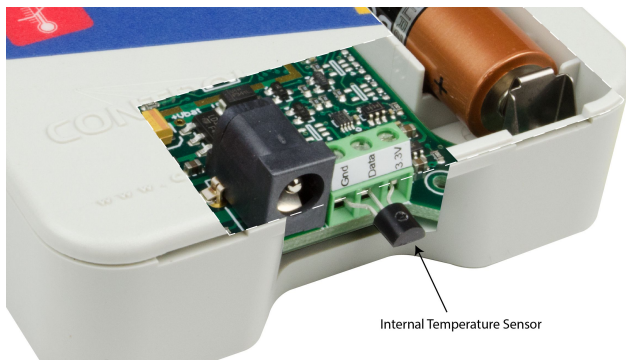
### 2.1 XW-110 Temperature Sensor Connections

The XW-110 uses “1-Wire” digital temperature sensors. The XW-110 supports one sensor and the XW-110-Plus supports up to three sensors. The sensors are interchangeable and require no calibration. The sensors accuracy is +/-0.5°C (-10°C to +85°C). The sensor requires three connections for communications and power (+3.3V, Ground, Data). The temperature sensor is available in several configurations.

For monitoring room temperature, the bare sensor can be connected directly to the terminal strip. When installing the bare sensor, make certain the flat side is oriented towards the bottom. The encapsulated version has a stainless steel probe and can be used in outdoor applications however, the probe is not suitable for immersion or use in pressure vessels.

For immersion and other demanding applications use a thermowell to protect the sensor. The basic sensor (non-encapsulated) must used in protected locations. The XW-110 will work with cable lengths up to 50-feet and should not be routed near motors or AC wiring.

The enclosure can be mounted to a wall or panel with screws (not included). The two screw holes are located underneath the batteries. When ControlByWeb modules are to be used in applications where they could be exposed to water, high amounts of dust, bugs, or other environmental factors, we recommend mounting them inside a sealed plastic enclosure.



Sensor Wire Color	Connection
Red	+3.3Vout
Black	GND
Blue (or White)	Data

## Extending Temperature Sensors

Many factors can determine the maximum length of the cable, including the sensor network topology, the type of cable used, the number of sensors and ambient electromagnetic noise.

Multiple sensors can be connected to the XW-110 Plus in two ways: directly connected (star topology) or “daisy chained” (linear topology), shown below.

Combined cable lengths to all sensors of 50 ft using Cat 5e cable have been successful; however, due to the uniqueness of installation environments, results may vary. Please test in the desired environment before making a permanent installation.

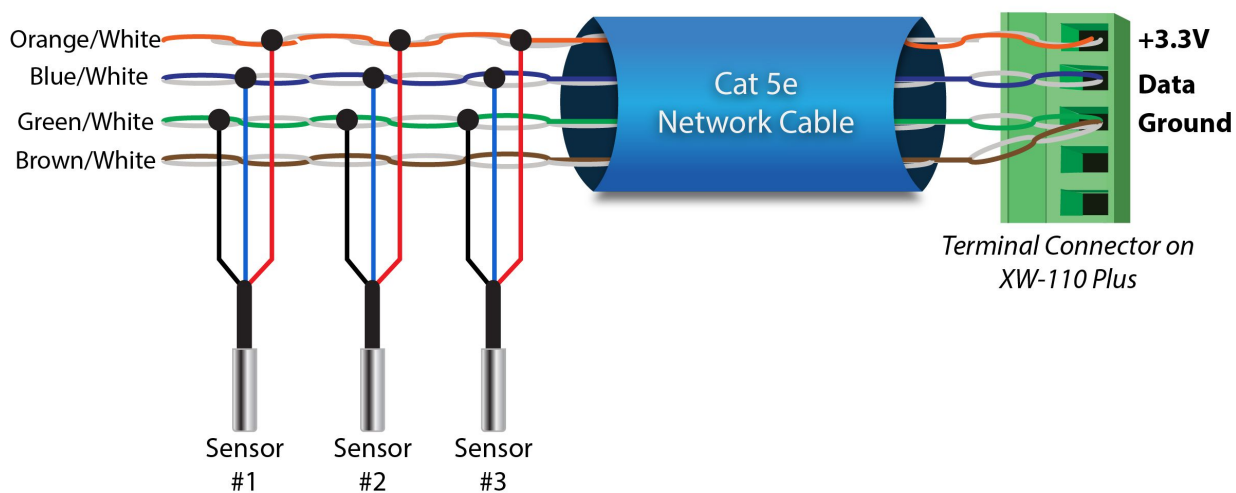
The following are general recommendations that will maximize sensor runs and minimize problems:

- Use small gauge 3-conductor wire (Cat 5e, 18-3 thermostat wire, etc).
- Cat6 wire can be used, but Cat 5 and Cat 5e network cable is recommended, and has proven to be an effective and low-cost solution for long runs. Cat 5e is more tolerant of different wiring configurations.
- Non-shielded works best for longer runs (shielding limits run length).
- The 1-Wire bus is "single-ended" and has no intrinsic noise protection. It is susceptible to interference if the cable is routed near power lines, fluorescent fixtures, motors or other noise sources. Keep the cable wiring short and avoid routing it near other electrical equipment.

The illustration below shows the recommended connection using Cat 5 network cable. Connect all unused conductors to ground on the XW-110 or XW-110 Plus.

A linear (daisy chain) topology will minimize signal reflections, providing a more reliable connection and will allow longer cable length than a star topology.

### Temperature Sensor Wiring - Daisy Chain Topology

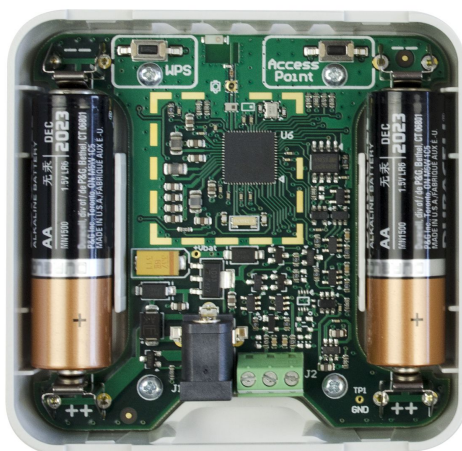


*Daisy chain up to 3 temperature sensors to the XW-110 Plus using a Cat 5e network cable.  
(The XW-110 supports only 1 temperature sensor.)*

## 2.2 Power / Batteries

The XW-110 is powered from either a 5-volt DC wall transformer or two internal 1.5V “AA” batteries. If the wall adapter is connected, no power is drawn from the batteries. If the external power fails the module automatically switches to the internal batteries. No jumpers or switches are needed. The wall adapter should be used for certain modes with high current demands such as: “Stand-Alone mode” with HTTP server enabled, “Slave mode” with high reporting rates, or when “access point” is active.

Install the batteries as shown. Observe the “+” and “-” markings molded in the enclosure underneath the batteries. Both batteries should be replaced at the same time. Do not install the XW-110 inside a freezer or where low temperature conditions would severely diminish the battery capacity.



*Battery Installation*



## 2.3 Provisioning

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After making the sensor connections and providing power, you must provision the XW-110 for use on your wireless network. The goal is to configure the XW-110 such that it can recognize and attach to your Wi-Fi access point. There are two methods for doing this:

### 1. Access Point

By default, the XW-110 comes up as a wireless access point when powered for the first time. Pressing the "access point" push button any time also activates the access point mode. It isn't really an access point because it will not provide internet connectivity to your computer or smart phone, but it will appear as an access point meaning that your computer or smart phone will detect it as an access point and display it as such. When acting as an access point, the XW-110 broadcasts an SSID of "XW110-XXXXXX" where XXXXXX are the last six digits of its MAC address.

With your wireless device (laptop computer or smart phone) scan for, and attach to the XW110 wireless network. Next, access the web server in the XW-110 using a web browser. To access the setup pages, enter the following URL in the address bar of your web browser:

```
http://192.168.1.2/setup.html
```

After the page is requested, a password prompt will appear. Enter the username and password. The username is `admin` and the password is `webrelay` (password is case sensitive). The next chapter explains each of the setup tabs and screens. Use the *WiFi Networks* tab for making the proper settings to allow the XW-110 to connect to your access point.

#### **Notes About Access Point Mode:**

- Operates at full power and will consume large amounts of energy and drain batteries quickly. It is recommended that you use a wall-transformer to power the unit when operating in access point mode or configure the XW-110 quickly.
- As an *Access Point* the XW-110 functions independently of other wireless networks. It broadcasts beacons and services WiFi packet requests. In this mode, your computer or smart-phone is "connected" directly with the XW-110 on a private network and is NOT using another wifi network. Typically you would use this for configuration and not for normal operation.
- The XW-110 has no hardware "restore defaults" button, to prevent the installer from being locked out, the default username (`admin`) and password (`webrelay`) always work in the access point mode, even if the password is changed. If the password has changed via the *Password* tab, both the new password and the `webrelay` password will work.
- Only one client (computer or smart-phone) can be connected to XW-110 at a time.
- SSID and password cannot be customized (once again this mode is intended for configuration only).
- Access point is unsecured and open.

### 2. WPS (Wi-Fi Protected Setup)

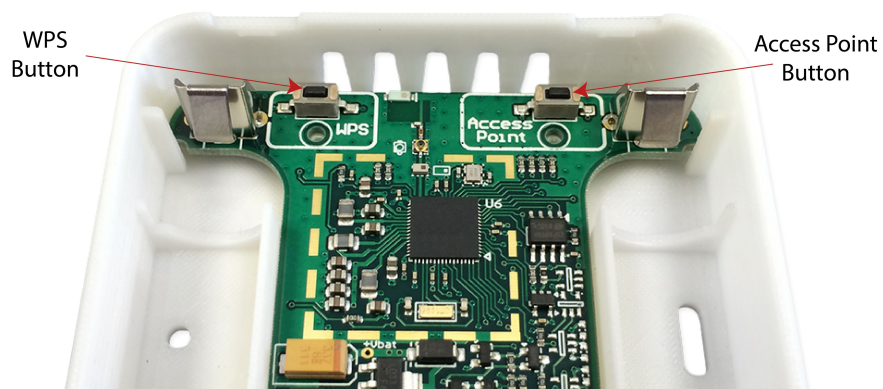
The *WPS Push button method*, provides a simple method for attaching the XW-110 to a wireless network without needing to use any setup pages. Although using this method to connect the XW-110 to the network is simple, you will not be able to access the XW-110 web server unless you know the IP address that was assigned by the DHCP sever (router) or unless mDNS services are available on your device. For this reason, it is recommended that you use this method of configuration only when the XW-110 units have been pre-configured to operate in a non-web-server mode or when you have full access

to the DHCP server so you can obtain the IP address that was assigned.

To begin, press the WPS button on your wireless router or access-point. You will generally have about two minutes to connect wireless devices to the network with WPS. Now remove the cover of the XW-110 and press the “WPS” push button. After a few seconds, the XW-110 should register itself with the router or access-point. If WPS fails, the XW-110 will automatically enter the access point mode.

The XW-110 will use DHCP to obtain an IP address after a successful WPS association. Additionally, the connection information is also broadcast using mDNS. If you need to access the XW-110 using its internal web server you will need to obtain the IP address that was assigned to the XW-110 through your DHCP server or router. Alternatively, if using an mDNS capable device, it may be accessed by entering the appropriate URL into the address bar of your web browser:

```
http://xw-110.local/setup.html  
http://xw-110p.local/setup.html
```



## 2.4 Application Examples

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The XW-110 can be configured for many different applications. Applications which require long battery life require careful planning and setup. Four examples are described below:

### Greenhouse Temperature Example

You wish to activate a warning light and receive an email if the temperature in your greenhouse becomes too low or too high. No AC power is available.

Mount an XW-110 in a protected location inside the greenhouse. In this application the XW-110 is workable with batteries because transmissions are infrequent. Use the bare air temperature sensor which comes with the XW-110. Install a WebRelay™ or WebSwitch™ in your office and connect it to your Ethernet network. Connect a warning light to the WebRelay. The WebRelay must be accessible from your WiFi network and be assigned a fixed IP address. Your WiFi network must have adequate coverage in the greenhouse.

First, the XW-110 must be configured to access your WiFi network. If no network profiles have been configured, the XW-110 will automatically enter the access point mode and you can access the XW-110 directly with a computer or smart device with a wireless connection. If the XW-110 has been previously configured for other uses, press the Access Point button. Scan for, and attach to the XW110-XXXXXX wireless network. Access the setup pages with the following URL: <http://192.168.1.2/setup.html>

For this application, configure the XW-110 for the *stand-alone* mode. Configure the XW-110 to connect to your wireless network. Navigate to the WiFi Networks tab and fill in the appropriate settings for your WiFi network. Obtain the IP address from your network administrator. To increase battery life, disable the HTTP web server and avoid using DHCP. Press the submit button at the bottom of the page.

Navigate to the sensor tab. Enter the period with which the XW-110 should monitor the temperature as well as the temperature thresholds for the alarm. To prolong the battery life set the update interval to 30 minutes or more. Set the remote relay action to *Turn On*. With this setting the relay will turn Off when the temperature alarm condition is no longer met. Upon selecting an action, the remote relay options for specifying the IP address, port, relay number and other options will show. Enter the IP settings for the WebRelay. On the *Email Option* setting, select *Send email on High and Low Alarm*. Click the submit button at the bottom of the page.

Navigate to the email tab and enter the SMTP server settings as well as the username and password (if required). You may need to contact your email provider for the exact settings to use. To provide assurance the XW-110 is working, enable the *Weekly Status Email* option. Click the submit button at the bottom of the page.

Once all the appropriate settings have been applied, click on the Reboot button, the XW-110 will reboot and begin low power operation. The XW-110 will no longer broadcast an SSID and the web page will no longer be accessible. The XW-110 will periodically awaken, measure the temperature and check for an alarm condition. If an alarm occurs it will connect to your WiFi access point, activate the remote relay and send an email message. Once each week the XW-110 will send an email with temperature and battery information.

If you wish to change the alarm settings the web server must be re enabled. To enable the web server press and hold the WPS button for 10 seconds. This will temporarily enable the web-server for 5 minutes or until the unit is rebooted. You can access the control or setup pages during this time by entering the IP address that was assigned to the device (<http://xxx.xxx.xxx.xxx/setup.html>) in the address bar of your web browser.

### Warehouse Temperature Example with no Access Point

You wish to monitor the temperature of a warehouse with a your smart phone. You don't have a Wi-Fi access point.

Mount an XW-110 inside the warehouse. Power it with a DC wall adapter because the Access Point mode requires more power than the batteries can provide. If no network profiles have been configured, the XW-110 will automatically enter the access point mode and you can access the XW-110 directly with a computer or smart device with a wireless connection. If the XW-110 has been previously configured for other uses, press the Access Point button. Scan for, and attach to the XW110-XXXXXX wireless network. Access the setup pages with the following URL: <http://192.168.1.2/setup.html>

Click the *Restore Defaults* button on the Main setup page. Scan for and reattach to the XW110-XXXXXX network again. The XW-110 is workable for this application with the default settings, no further settings are needed. Note, only one device can be connected to the XW-110 at a time when it is in the Access Point mode. The XW-110 will continue to broadcast an SSID and you can connect to the XW-110 anytime with your smart phone and view the temperature on the Control page (<http://192.168.1.2>). Since the XW-110 is not connected to the internet, you must be within 250 feet or so with your smart phone to receive the WiFi signal from the XW-110. The XW-110 cannot send emails or remote relay commands because it is not connected to the internet. Be aware that the Access Point is unsecured and open and the default passwords cannot be changed.

### Warehouse Temperature Example with an Access Point

You wish to monitor the temperature of a warehouse with your smart phone or office computer. You have a Wi-Fi access point in the warehouse. The HTTP web server is enabled to provide continuous access to the control page.

Mount an XW-110 inside the warehouse. Power it with a DC wall adapter because the web server requires more power than is practical with batteries.

First, the XW-110 must be configured to access your WiFi network. If no network profiles have been configured, the XW-110 will automatically enter the access point mode and you can access the XW-110 directly with a computer or smart device with a wireless connection. If the HTTP web server has been previously turned off, press the Access Point button. Access the setup pages with the following URL: <http://192.168.1.2/setup.html>

For this application, configure the XW-110 for the *stand-alone* mode. Leave the HTTP server enabled. Configure the XW-110 to connect to your wireless network. Navigate to the WiFi Networks tab and fill in the appropriate settings for your WiFi network. Obtain the IP address from your network administrator. Press the submit button at the bottom of the page.

Once all the appropriate settings have been applied, click on the *Reboot* button. Since the HTTP server was enabled, the XW-110 will connect to, and remain connected to your access point. The XW-110 will now be accessible from the IP address configured on the WiFi Networks tab. The XW-110 will no longer broadcast an SSID. You can access the control page any time to monitor the warehouse temperature by entering the IP address that was assigned to the device in the address bar of your web browser. Since your access point is connected to the internet, you can monitor the temperature from any computer in the building. If the XW-110 does not connect within a period of time, press the Access Point Button and repeat the above steps to verify the network settings.

### Freezer Temperature Example

You want to monitor the temperature of a walk-in freezer and receive an email if the temperature is too high. The freezer is within range of a WiFi access point. The HTTP web server is disabled to provide long battery life.

Mount the XW-110 on a wall next to the freezer. Use an X-DTS-S3C temperature probe to monitor the temperature inside the freezer. The XW-110 will not work inside the freezer because the WiFi radio signal will not propagate thru the metal walls and the low temperature would severely diminish the battery capacity. In this application, the XW-110 is workable with batteries because transmissions are infrequent and the HTTP web server is disabled.

For this application, configure the XW-110 as a stand-alone device with the internal HTTP web server disabled. Configure the XW-110 to connect to your WiFi network as explained in the previous examples.

Navigate to the sensor tab. Enter the period with which the XW-110 should monitor the temperature as well as the temperature threshold for the alarm. To prolong the battery life set the update interval to 30 minutes or more. On the *Email Option* setting, select *Send email on High Alarm*. Click the submit button at the bottom of the page.

Navigate to the email tab and enter the SMTP server settings as well as the username and password (if required). You may need to contact your email provider for the exact settings to use. To provide assurance the XW-110 is working, enable the *Weekly Status Email* option.

Once all the appropriate settings have been applied, click on the *Reboot* button, the XW-110 will then reboot and begin low power operation. The XW-110 will no longer broadcast an SSID and the web page will no longer be accessible. The XW-110 will periodically awaken, measure the temperature and check for an alarm condition. If an alarm occurs it will connect to your WiFi access point and send an email. Once each week the XW-110 will send an email with temperature and battery information.

## Section 3: Web Server

The internal web server presents two classes of web pages; *Setup* pages and *Control* pages. *Setup* pages are used by an installer to provision and configure the XW-110. The *Control* pages (in comparison with other ControlByWeb devices) don't control anything; however, it displays temperature status information. The Control Page displays measurement and status information for the user.

To access the *setup* pages, enter the following URL in the address bar of your web browser:

```
http://192.168.1.2/setup.html
```

To access the *control* page, enter the following URL in the address bar of your web browser:

```
http://192.168.1.2
```

The internal web server is enabled by default in the stand-alone mode and disabled in the slave mode. If you wish to access to the web server when it is disabled, press and hold the WPS button for 10 seconds. This will temporarily enable the web-server for 5 minutes or until the unit is rebooted.

Note that if you are accessing the unit as an access point the above IP address will work even if you have changed the IP address in the setup pages. If you are accessing the unit through the network after it has been configured (and the web server remains enabled) you will use the IP address that was assigned to the device.

If the XW-110 has been added to a network using WPS, it will use DHCP and you will need to use the IP address assigned to it. This can be found in the DHCP server, or by using mDNS. The mDNS name is `http://xw-110.local/` for the XW-110 and `http://xw-110p.local/` for the XW-110-Plus.

### 3.1 Main Tab

This is the initial page that is displayed when `setup.html` is entered in the address bar of the browser. It displays model and serial number information, and has navigation tabs which allow access to the configuration and setup settings.

The web pages and communication settings for the XW-110 and XW-110-Plus have many common settings. Unique settings specific for each model are shown where applicable.

The screenshot shows the XW-110™ Wireless Temperature Sensor web interface. At the top, the title "XW-110™ Wireless Temperature Sensor" is displayed. Below the title is a navigation bar with tabs: "Main", "WiFi Networks", "Email", "Password", "Sensor", and "Control Page". The "Main" tab is selected. The main content area is divided into two sections: "SET MODE" and "GENERAL INFORMATION".

**SET MODE**

Mode: Stand-alone  Slave   
*\*Mode will not take effect until reboot.*

**GENERAL INFORMATION**

Part Number: XW-110  
 Firmware Revision: 1.05  
 Serial Number: 00:0C:C8:00:00:00

Power Supply: Power Supply: Batteries (100% Remaining)  
 Signal Strength: RSSI: -29 dBm

At the bottom right of the main content area are two buttons: "Reboot" and "Restore Defaults".

For product support go to [www.ControlByWeb.com](http://www.ControlByWeb.com)  
 Xytronix Research & Design, Inc.

*The XW-110-Plus has an extra tab (Date/Time) and Slave mode is not available.*

## Mode

The XW-110 operates in two fundamental modes designated “*Stand-alone*” and “*Slave*.” Depending on this setting the menu tabs change to reflect the relevant settings. Select “Stand-Alone” if the XW-110 is to simply monitor the temperature and provide this information to users through its built-in web pages, send e-mail alerts or control a remote relay. Select “Slave” if the XW-110 is to make measurements and send data to a master device such as an X-600M™. The XW-110-*Plus* is targeted for stand-alone applications and the “Slave” mode is not available with the XW-110-*Plus* version.

The *Mode* setting will not take effect until the XW-110 is rebooted. To do this click the *Reboot* button after making a change to the *Mode*.

### ► **Stand-Alone:**

In this mode the XW-110 is self-contained and is used without other master devices. It can be configured to operate in low power mode and periodically check temperatures and send alarm messages directly to users via email or control remote relays. In stand alone mode it can also be used as a stand-alone web server that users can access at any time to view current temperature status.

- Internal web server can be enabled which allows users to access this device directly using a web browser or the CBW Mobile app. Users can view real-time temperatures. *Note: Enabling the web server requires considerably more power and battery operation is not practical.*
- The email tab is visible and Remote Master is suppressed.

### ► **Slave (XW-110 only):**

In this mode the XW-110 makes measurements and sends data to a master device such as an X-600M. In this mode the XW-110 sleeps most of the time to conserve power. It periodically awakens, makes simple measurements and transmits (pushes) the data to a remote server. The “master” ControlByWeb device uses the XW-110 just like other wired sensors that may be attached.

- In this low power mode the XW-110 sleeps most of the time. It periodically awakens, makes measurements, connects to a Wi-Fi network and transmits data to the master device.
- Use longer interval for long battery life.
- No emails are supported
- The internal web server is not accessible
- The email tab is suppressed, Remote Master tab is shown

**Part Number**

This is the full model number of the XW-110

**Firmware Revision**

This is the current product revision of the internal software

**Serial Number**

This is the serial number of the XW-110. The serial number is also the MAC address of the unit.

**Power Supply**

This field shows if the XW-110 is currently being powered by batteries or the DC wall transformer. The battery voltage is periodically measured and an estimate is made of the remaining battery life. If the module is powered by the DC wall transformer the voltage is measured with no load on the battery. The calculations are made for alkaline "AA" batteries with a usable capacity of 2000mAH. When using other types of batteries or in cold conditions, the displayed estimate may be in error. Depending on the activity, the battery life estimate may fluctuate (perhaps even increase) as the load current changes. The battery voltage may recover (increase) when the XW-110 enters its low power sleep mode after a period of high current operation.

**Signal Strength**

This indicates the current receive Wi-Fi signal strength. The more negative the number the less signal is being received. -30dBm is a strong signal, and -90dBm is a very weak signal.

**Reboot**

After showing a confirmation message, this button will send a command to reboot the device.

**Restore Defaults**

After showing a confirmation message, this button will erase all user settings and return the module to its factory defaults.



### 3.2 WiFi Networks Tab

As a Wi-Fi client device, the XW-110 attempts to automatically connect to configured Wi-Fi access points. The settings on this page tab are used to configure this connection.

**XW110™ Plus** Wireless Temperature Sensor

Main WiFi Networks Email Password Date/Time Sensor Control Page

**WiFi SETTINGS**

SSID: wireless Strength: 83% Refresh

Security: Open  WEP  WPA/WPA2

Security Key: ●●●●●●●●

**IP SETTINGS**

Use DHCP: Yes  No

**HTTP SERVER**

HTTP Server Enabled: Yes  No\*

HTTP Port: 80

**MODBUS SERVER**

Modbus Server Enabled: Yes  No\*

**REMOTE SERVICES**

Remote Services Enabled: Yes  No\*

*\*Best setting for battery operation.*

Submit Submit & Reboot Reset Changes

**Note: Reboot required for WiFi and IP settings to take effect.**  
The XW-110 Plus contains additional settings than the XW-110. If you have the XW-110, your screen may differ slightly.

#### **WiFi SETTINGS**

##### **SSID**

The SSID (Service Set Identifier) is the name of your WiFi network. Click the *Refresh* button to make a fresh scan of available networks. **Note:** The *Refresh* button is inactive if the XW-110 itself is an access point.

##### **Security**

Type of authentication used by the access point for connections.

**Security Key**

Enter the security key or password for the WiFi network to connect to. (Hidden when not applicable)

**IP SETTINGS****Use DHCP**

This option allows DHCP to be enabled or disabled. If this option is set to *Yes*, the XW-110 will wait for an IP address from a DHCP server each time it is powered. The default setting is *No* (this is recommended for most installations). If DHCP is set to *Yes*, the Network page must be submitted and the XW-110 must be rebooted before an IP address will be assigned. Once the XW-110 is assigned an IP address by the DHCP, the new IP address can be found through the clients list kept by the DHCP server. For most instances, this is found on the local gateway or router. Alternatively, the device will broadcast its information via mDNS. By not using DHCP, battery life is extended as the device does not expend energy for transmitting requests and receiving responses every time it connects to the WiFi network.

**Brief Notes About DHCP:** All devices on an IP network require an IP address. This is a unique address that identifies each device on the network. DHCP (Dynamic Host Control Protocol) is a mechanism that automatically assigns an IP address to a computer (or other devices) when it is connected to a network. This eliminates the need to manually enter the IP address. When a computer is connected to the network, another device on the network called a DHCP server detects the presence of the computer and dynamically assigns the IP address to that computer. On many small networks, the DHCP server is built into the router.

DHCP works well for "client" devices such as computers, but is not ideal for servers. This is because servers usually don't initiate communications with other devices, but rather they wait for a request from "clients." To make this request, the client must know the IP address of the server. If a server gets its IP address dynamically, the IP address may not always be the same so client devices may not be able to find the server. For this reason, servers usually use an IP address that is fixed and does not change. The XW-110 is a server and manual IP address assignment is usually recommended.

**IP Address**

Enter the IP address for the XW-110 in this field. The IP address is specific to the network where the XW-110 will be installed and is obtained from the network administrator. The default setting for this field is 192.168.1.2.

**Subnet Mask**

The subnet mask defines the size of the local network. This can be obtained from the network administrator. For additional information about sub-netting and IP networking, many tutorials are available on the Internet. The default setting for this field is 255.255.255.0.

**Gateway**

This specifies the IP address of the gateway router. This can be obtained from the network administrator. The default setting for this field is 192.168.1.1.

**DNS Server**

The IP address of the DNS server is specified here. When DNS services are required, this is the address that will be used. The default setting for this field is 192.168.1.1. An alternate DNS server is not supported.

## HTTP SERVER

### HTTP Server Enabled

This option can turn the internal HTTP web server on or off when in stand-alone mode. In Slave mode the HTTP web server is automatically disabled. When the web server is on, the XW-110 can be accessed using a web browser or the CBW Mobile app and you can view the current temperature measurements. When the web server is off, temperature data is obtained when the XW-110 transmits (pushes) the data. For example, you can turn the web server off but get temperature information through email alerts. Turning the web server off will allow the device to make use of more power saving features. With the web server turned off, the device will be allowed to disconnect from the WiFi network or at the very least service beacons selectively to save power.

### HTTP Port

The TCP port used for HTTP communications with the XW-110 can be customized here. The default setting for this field is 80, which is the standard HTTP port. It is recommended that the port be left unchanged unless the user has an understanding of TCP/IP and ports.

## MODBUS SERVER (XW-110-Plus only)

### Modbus Server Enabled

XW-110-Plus can support Modbus/TCP. Modbus is a messaging structure protocol used in industrial manufacturing control and automation. It is an open protocol and offers interoperability with software and devices from other manufacturers. This is enabled by selecting *Yes* in this field. The default setting for this field is *No*. (See *Section 5.1: Modbus Operation* for more information on using XW-110 on a Modbus network.)

Note: Modbus communications are disabled whenever the Control Password is enabled as Modbus does not have support for Passwords.

## REMOTE SERVICES

### Remote Services Enabled

This option enables or disables Remote Services. If *Yes* is selected, Remote Services will be enabled as soon as the submit button is pressed and XW-110 will immediately attempt to make a connection with a custom remote server (power cycle not required). Once a connection is established, the connection will remain until it is disconnected by the remote server (see *Remote Services Notes* below). Proper connection with the remote server can be verified by checking the remote server. The default setting for this field is *No*. If Remote Services is enabled, the default settings will connect to the [ControlByWeb.cloud](http://ControlByWeb.cloud) cloud service. Users will need to supply either a token from their account or upload SSL certificates. Most users should leave these settings at their default. (See *Remote Services* at the end of this section for more information.)

If remote services is set to *Yes*, the following settings are shown:

Note: Reboot required for WiFi and IP settings to take effect.

**Hostname/IP Address**

Specify the name or IP address of the Remote Services server here. If the IP address is specified, enter it in this format aaa.bbb.ccc.ddd. For numbers that are less than 100, preceding zeros should not be included (for example, enter 80 rather than 080). This field can be up to 40 characters long and has no default setting.

**Remote Services Port**

Enter the TCP port used for the Remote Services server. This can be set within the range of 1-65535. The default setting for this field is 8000.

**Connection String**

This text is sent to the Remote Services server when the connection is established. This string should include any information required by the server at connection. For example, it may include an ID number, customer number, password, etc. The format is entirely dependent upon the server requirements. This field can be up to 80 characters long. Default text is provided only as an example placeholder. The default text is [`<Serial Number>`]:ControlByWeb,XW-110.

**Connection Interval**

This field specifies the periodic interval in which the XW-110 attempts to connect to the remote server, or if XW-110 is already connected, it is the interval in which XW-110 sends the connection string. This field can be set within the range of 1 to 55 minutes. The default setting for this field is 1 minute.

**Version**

This field specifies the version of the remote services protocol to use. Version 1 of the protocol sends the connection string after successfully connecting to the remote server and then periodically per the connection interval specified. Version 2 of the protocol sends the connection string in addition to the MAC address, connection interval, model number and then immediately sends the state.xml file of the device. Version 2 of the protocol requires the remote server to reply to the connection string with a 3 byte packet containing the text "ACK". If the "ACK" is not received within 10 seconds of sending the connection string, the XW-110 will close the connection. Version 2 continues to send the connection string and the state.xml file periodically per the connection interval specified.

**Use SSL Certificate**

This option enables encryption of the remote services connection with the remote services server as well as authentication of the XW-110 to the server by a client certificate and key. Custom certificates and keys can be loaded into the XW-110 for this purpose. (See *Remote Services* at the end of this section for more information.)

By default, the XW-110 does not come with any SSL certificates already installed. The certificates will need to be installed either manually by uploading the files or automatically with a token. The SSL certificates must be in the PEM format. SSL encryption is only available with Version 2.

**Certificate Request Token**

When the XW-110 has a valid Certificate Request Token entered, it will automatically attempt to request and download its Client Certificate, Key, and CA. Once successful, the token will be erased and the XW-110 will stop its requests. (See *Remote Services* at the end of this section for more information.)

**Certificate Request Port**

The certificate server is a server that has been configured to deliver the Client Certificate, Key, and CA when requested by the XW-110. For the XW-110 to request a Certificate, Key, and CA from the certificate server, it must have a previously issued Certificate Request Token. The field specifies what port the Certificate Server listens on. The server is found at the same host name as the remote services server. (See *Remote Services* at the end of this section for more information.)

## **Manual Certificate Upload**

### **Client Certificate**

A client certificate is used with custom remote services servers for device authentication. To upload a custom client certificate to the XW-110, click the *Browse* button, find the PEM formatted certificate file, and select *Submit*.

### **Client Key**

A client key is used with custom remote services servers for device authentication. The key that is uploaded must be the correct key associated with the Client Certificate. Care should be taken with where this client key is stored as it is meant only to be known to the XW-110. To upload a custom client key to the XW-110, click the *Browse* button, find the PEM formatted file, and select *Submit*.

### **Client CA**

A CA (Certificate Authority) is used by the XW-110 to verify the authenticity of the remote services server it is connecting to. It is important to note that this CA does not need to be the CA that signed the Client Certificate used by the XW-110. Rather the CA needs to be the one used to sign the certificate used by the remote services server. To upload a custom CA to the XW-110, click the *Browse* button, find the PEM formatted file, and select *Submit*.

**Remote Services Notes:** Remote Services initiates an outgoing connection to a server at a remote location. This can be used in an environment where a web server on the Internet provides a custom web page to XW-110 and other ControlByWeb products. Users access the XW-110 through the web server rather than communicating directly with it. This method is sometimes referred to as “web services” and allows programmers to create powerful, custom web pages to multiple devices using the web programming languages of their choice.

Remote Services initiates the connection to the external web server (rather than the web server initiating communications to the XW-110). This has two main benefits. First, the web server does not need to know the IP address of XW-110. This means that XW-110-Plus can get its IP address dynamically from a DHCP server, simplifying the installation. Second, since the connection from XW-110 is outgoing, rather than incoming, the local router on the network where XW-110 resides doesn't need to be configured to forward sockets. This simplifies the installation. Since the router configuration is not modified, the risk of compromising security on the local network is eliminated.

In order to allow remote services to operate in a power conscious fashion, remote services will disconnect from the remote services server if it is the only enabled service (modbus and web server are disabled) and external power is not available. If externally powered, remote services will be fully available until external power is lost. However, if remote services is enabled but disconnected due to no external power, it will still connect and push the state.xml if a temperature alarm occurs that has remote services state message enabled. Once the message is sent, remote services will disconnect and low power modes will be resumed. If power is restored, remote services will reconnect to the server and stay connected.

### 3.3 Email Tab (STAND-ALONE MODE ONLY)

When configured as a *Stand-Alone* device this tab is visible. When temperature alarms occur and an email option is enabled, an email is sent. This page is used to configure the email settings for up to three email addresses. The same message is sent to each email address. For email notification to work, the XW-110 must have a properly configured network connection and a SMTP server must be defined. Emails only work if the XW-110 is connected to an access point and can send messages on the internet.

*The XW-110 Plus contains additional settings than the XW-110. If you have the XW-110, your screen may differ slightly.*

#### **STATUS NOTIFICATION**

##### **Email on Low Battery**

When the estimated battery life reaches 15%, an email alert is sent. To conserve already meager energy resources, only one low battery message is sent until the estimated battery life goes above 50%.

##### **Weekly Status Email**

When checked, the XW-110 will send an email at least once a week with temperature and battery information. This is to assure the user the unit is functioning properly. The weekly emails are sent 7-days from the last email that was successfully sent, including alarm or low battery emails. If you are receiving regular email alerts, the weekly email may never be sent.

**Email on AC Power Fail (XW-110-Plus only)**

When enabled, the XW-110-Plus will send a status email when it detects loss of the +5V input power source. This feature only works if batteries are installed and power to the access point and internet is still available. Another power loss email will not be sent until power has been restored for a period of time.

**EMAIL SETTINGS****SMTP Server**

The SMTP mail server host name. To save energy, DNS lookups are only performed the first time after the settings are submitted, or after a failure to send an e-mail.

**SMTP Server Port**

The port number of the SMTP mail server. This is generally 25 for non-encrypted SMTP servers. If using SSL/TLS, this port number is generally 465.

**SSL**

Check this check box if the server and port you have configured is expecting a SSL connection.

**User Name**

Email user name (if required).

**Password**

Email password (if required).

**Return Email**

The emails address that will get notification if the sent email does not get sent.

**Email 1-3**

When an alert occurs an email message is sent to these addresses.

**Email Length (XW-110-Plus only)**

*Full Message* includes all sensor data in the email alert. *Short Message* only includes the status of the temperature that triggered the email alert to be sent. Short messages can be easier to read when sent to cell phones as text messages.

**Test Email**

Pressing this button will submit any changes to the email settings and trigger an alert email to be sent to the configured email addresses.

The result of the test email will be displayed directly below the Test Email button along with the last message received from the SMTP server (if applicable).

The following are typical responses you may see along with a description of what they mean:

- Error initiating communications: Did not receive the expected HELO from SMTP server. Ensure you are using the proper port and host/IP settings.
- Error with EHLO: Error sending or error receiving proper response to the SMTP EHLO command. Server may be unavailable or port and IP address settings are not correct.
- Error authenticating: Error sending or error receiving proper response to the SMTP AUTH PLAIN command. This may indicate the use of an incorrect username or password.

- Error with FROM field: Error sending or error receiving proper response to the SMTP MAIL FROM command. Ensure the Return Email address has been properly specified.
- Error with RCPT(To) field: Error sending or error receiving proper response to the SMTP RCPT TO command. Ensure the To email addresses are using valid characters and formatted properly.
- Error sending DATA command: Error sending or error receiving proper response to the SMTP DATA command. This error generally indicates a problem with the SMTP server.
- Error sending message body: Error sending or error receiving proper response to sending the content of the email. This error generally indicates a problem with the SMTP server.
- Error resolving DNS: Error resolving the hostname in the SMTP Server field on the setup pages. If this field is an IP address, ensure no numbers are greater than 255, there are four numbers separated by dots, and there are no alphabetic characters. If the SMTP Server field is a host name, ensure the DNS Server on the WiFi Networks tab or DNS server issued via DHCP is valid and has a proper DNS record for the SMTP Server host provided.
- Error establishing connection: Error configuring security on SSL socket or error creating socket.
- Error with SSL handshake: Could not successfully negotiate a cipher or protocol version to use for the SSL connection to the SMTP server. Ensure the configured port is indeed expecting an SSL connection.
- No SMTP server configured: No valid SMTP Server has been specified. Enter the host name or IP address of the SMTP Server you would like to use.
- No To address configured: No recipients of the email alerts has been configured. Enter at least one email address into any of the Email fields.
- Success: The test email was sent successfully.

*Note: When the XW-110 is in Access Point mode, your smart-phone or computer connects directly to it and the XW-110 is not connected to the Internet. In this mode, no email messages can be sent and the Test Email button is disabled.*



### 3.4 Remote Master Tab (XW-110 SLAVE MODE ONLY)

When configured as a *Slave* device this tab is visible. In this low power mode the XW-110 periodically awakens, makes simple measurements and transmits (pushes) the data to a remote server (usually another ControlByWeb device). This tab is used to set which server the data is to be sent and how. No alarms or emails are supported and the web server is disabled.

*Remote Master tab visible when in Slave mode.*

#### Master Host/IP

The Hostname or IP address of the server you wish to send (push) data to. To save energy, DNS lookups are only performed the first time after the settings are submitted, or after a failure to send data to the remote master.

#### Port Number

The TCP port used for communications with the remote server. For pushing data to a Xytronix device, the port number must be 65430.

#### Push Type

Data is sent to the remote server with one of three HTTP protocols:

##### **XCD Method** (Xytronix Compact Data)

This method is used to send data to Xytronix devices (ControlByWeb devices) such as the X-300. The CBW method condenses the information into binary data to reduce the amount of energy needed by the XW-110 to transmit the information (see *Section 5.3: Xytronix Compact Data (XCD) Format.*)

##### **GET Method**

The HTTP GET method is used to send the data to the path specified in the *Path* field. The *Path* field is hidden unless the GET or POST methods are selected.

##### **POST Method**

The HTTP POST method is used to send the data to the path specified in the *Path* field. The *Path* field is hidden unless the GET or POST methods are selected.

##### **Path**

This option appears when either the GET or POST method is selected. This setting

defines the location of a script or page that can accept the data being sent via POST or GET. For example, if the script is located at *www.example.com/xw110/logger.php*, the path would be *xw110/logger.php*

With POST or GET requests, the information is sent using key-value pairs. An example of what this request would look like is listed below:

```
XW-110:  
serial=XXXXXXXXXXXX&sensor=71.2&unit=F&batteryLife=100
```

### **Enable XCD Encryption**

If the *XCD Method* is selected, checking this box will enable the encryption of the XCD communications. If the receiving device has the control page password enabled, you must use encryption and enter the control page password in the Password field.

### **Password**

This password is used to generate the encryption keys used for XCD when encryption is enabled. If encryption is used, this password must be the control page password for the master device.

## 3.5 Password Tab

The XW-110 has separate passwords for the Setup and Control pages. The passwords can be changed on this page. The username (admin) is fixed and cannot be changed.

The screenshot shows the 'Password' tab of the XW-110 Plus Web Server interface. At the top, there is a navigation bar with buttons for 'Main', 'WiFi Networks', 'Email', 'Password' (selected), 'Date/Time', 'Sensor', and 'Control Page'. Below the navigation bar, the interface is divided into two sections: 'SETUP PAGE' and 'CONTROL PAGE'. The 'SETUP PAGE' section contains two password input fields: 'Setup Password:' and 'Re-enter Setup Password:', both with masked characters. The 'CONTROL PAGE' section contains a radio button for 'Enable Control Password:' (set to 'No'), and two password input fields: 'Control Password:' and 'Re-enter Control Password:', both with masked characters. At the bottom, there are two buttons: 'Submit' and 'Reset Changes'.

### Setup Password

The Setup Password, which is required to access the setup pages, can be modified by entering a new password here. Passwords that are 8 characters or longer (up to 13 characters can be entered in this field) with both alphabetic and numeric characters are recommended. For security purposes, the password will not be displayed as it is entered.

### Re-enter Setup Password

When the Setup Password is changed, it must be entered twice. One time in the previous field and a second time in this field. If the password is not entered identically in both fields, the password will not be changed.

### CONTROL PAGE

#### Enable Control Password

The user (control) web page is normally viewed without entering a password. For security purposes, a password can be enabled. When this field is set to Yes, a password will be required to view the control page. The default setting for this field is No.

#### Control Password

The password for the control page can be modified by entering a new password here. Passwords that are 8 characters or longer (up to 13 characters can be entered in this field) with both alphabetic and numeric characters are recommended. For security purposes, the password will not be displayed as it is entered.

#### Re-enter Control Password

When the Control Password is changed, it must be entered twice. One time in the previous field and a second time in this field. If the password is not entered identically in both fields, the password will not be changed.

### 3.6 Date/Time Tab (XW-110-Plus Only)

XW-110-Plus uses the time of day for logging (a time stamp is included with each logged event.) The time is stored and displayed in 24-hour time format. The XW-110-Plus does not have an event scheduler. If battery's are installed, time in the XW-110-Plus is battery backed and will not be lost if the device loses power. However, it is recommended to use NTP as it will retrieve the time from the NTP server at power-up and periodically thereafter. This avoids the need to reconfigure the time if the batteries fail, are removed or the internal clock drifts over time.

The screenshot shows the XW-110 Plus web interface. At the top, the logo 'XW110 Plus Wireless Temperature Sensor' is displayed. Below the logo is a navigation menu with buttons for 'Main', 'WiFi Networks', 'Email', 'Password', 'Date/Time' (which is highlighted), 'Sensor', and 'Control Page'. The main content area is divided into two columns. The left column has a dark blue background and contains the following sections: 'Current Date/Time:' with a text input field containing 'Fri, 01 Jan 2016 08:56:28'; 'DATE/TIME SETTINGS' with a 'Set Time:' dropdown menu set to 'Manually'; 'Date:' with a calendar for January 2016; 'Time (24 Hour Format):' with a text input field containing '08 : 56 : 17'; and 'DAYLIGHT SAVINGS' with 'Daylight Savings Enabled:' set to 'No' (radio button selected), 'Daylight Savings Start:' set to '2nd Sun Mar', and 'Daylight Savings End:' set to '1st Sun Nov'. The right column is light gray and contains the same text input fields for the date and time. At the bottom of the interface are 'Submit' and 'Reset' buttons.

*XW-110 Plus Only*

**Current Date/Time:**

This is the current date and time stored in XW-110-Plus. The time is stored and displayed in 24-hour format.

**DATE/TIME SETTINGS**

**Set Time:**

This drop-down list offers two options for setting the time: *Manually* or *Sync with NTP server*.

The options that follow this field will change based upon how this option is set.

**Manually:** Requires the user to enter the time and date.

**Sync with NTP server:** Allows the user to set the clock automatically by using an NTP (Network Time Protocol) server.

## MANUAL TIME CONFIGURATION

### Date:

The current date is entered by first selecting the correct month and year, using the left and right arrows at the top of the calendar. The single arrows (< and >) change the month and the double arrows (<< and >>) change the year. Once the current month and year are displayed, select the correct day, which will then be highlighted.

### Time (24-Hour Format):

Enter the time as HH:MM:SS. (HH represents hours in 24-hour format [00-23], MM represents minutes [00-59], SS represents seconds [00-59].)

The screenshot shows the web interface for the XW-110 Plus Wireless Temperature Sensor. At the top, the logo 'XW110 Plus' is displayed next to the text 'Wireless Temperature Sensor'. Below the logo is a navigation bar with tabs: Main, WiFi Networks, Email, Password, Date/Time (selected), Sensor, and Control Page. The main content area is divided into two sections: 'DATE/TIME SETTINGS' and 'DAYLIGHT SAVINGS'. In the 'DATE/TIME SETTINGS' section, the 'Current Date/Time' is shown as 'Fri, 01 Jan 2016 08:56:57'. The 'Set Time' dropdown is set to 'Sync with NTP server'. Below this is a text input field for 'Server Name/IP Address', a 'Sync With Server' section with radio buttons for 'Once' (selected), 'Daily', 'Weekly', and 'Monthly', and a 'UTC Offset' field set to '00 : 00'. The 'DAYLIGHT SAVINGS' section has radio buttons for 'Yes' and 'No' (selected). Below are three dropdown menus for 'Daylight Savings Start' (2nd, Sun, Mar) and 'Daylight Savings End' (1st, Sun, Nov). At the bottom of the form are 'Submit' and 'Reset' buttons.

*XW-110 Plus Only*

## SYNC WITH NPT SERVER

### Server Name/IP Address

This field is used to specify the name or IP address of the NTP server. If a name is specified, a working DNS server address must be entered into the Network settings. If the IP address is specified, it should be entered in the following format `aaa.bbb.ccc.ddd` where each of the letters represents a number between 0 and 255. This field can be up to 40 characters. There is no default value for this field.

Many NTP Internet servers are available. In addition, many desktop computers will function as an NTP server (both Mac and PC). If a desktop computer is used, firewall settings may need to be adjusted to allow for NTP communications on UDP port 123.

Public NTP servers can be found at [www.pool.ntp.org](http://www.pool.ntp.org). Some of these are listed below.

US Servers (<http://www.pool.ntp.org/zone/us>):

0.us.pool.ntp.org  
1.us.pool.ntp.org  
2.us.pool.ntp.org  
3.us.pool.ntp.org

North America (<http://www.pool.ntp.org/zone/north-america>):

0.north-america.pool.ntp.org  
1.north-america.pool.ntp.org  
2.north-america.pool.ntp.org  
3.north-america.pool.ntp.org

Europe (<http://www.pool.ntp.org/zone/europe>):

0.europe.pool.ntp.org  
1.europe.pool.ntp.org  
2.europe.pool.ntp.org  
3.europe.pool.ntp.org

Australia (<http://www.pool.ntp.org/zone/au>):

0.au.pool.ntp.org  
1.au.pool.ntp.org  
2.au.pool.ntp.org  
3.au.pool.ntp.org

South America (<http://www.pool.ntp.org/zone/south-america>):

0.south-america.pool.ntp.org  
1.south-america.pool.ntp.org  
2.south-america.pool.ntp.org  
3.south-america.pool.ntp.org

Africa (<http://www.pool.ntp.org/zone/africa>):

1.africa.pool.ntp.org  
1.pool.ntp.org  
3.pool.ntp.org

### Sync With Server

This option allows the user to specify how often the time on XW-110-Plus will be synchronized with the time server. When the submit button on this page is pressed, XW-110-Plus will immediately synchronize with the time server. If Daily, Weekly, or Monthly options are selected, XW-110-Plus will thereafter re-synchronize with the time server at the period interval specified starting at the time of day the settings were submitted. The default value of this setting is Once (the unit will immediately sync with the NTP server, but will not automatically sync again until power cycled).

### UTC Offset

Time servers return the current time in Universal Time (GMT). It is common for many servers and data loggers to use GMT as their official time, even when they are not located within the GMT time zone. The default value for this field is -7 (Mountain Standard Time). For convenience, the time can be converted to local standard time by entering the offset here. This manual cannot include the UTC Offset for all parts of the world, but the offset for GMT time and the four major US Time zones are listed here.

GMT Time: 00:00  
Eastern Standard Time: -5:00  
Central Standard Time: -6:00  
Mountain Standard Time: -7:00  
Pacific Standard Time: -8:00

---

## **DAYLIGHT SAVINGS**

### **Daylight Savings Enabled:**

In many parts of the United States and in some other countries, the time is shifted forward by one hour during the summer months. This is an effort to conserve energy by making the daylight last longer into the evening hours. If this option is set to *Yes*, the time on *XW-110-Plus* will automatically be shifted forward by one hour between the hours of 12:00 AM – 5:00 AM on the Daylight Savings Start date set below, and it will shift back to standard time between the hours of 12:00 AM – 5:00 AM on the Daylight Savings End date set below. The time change is made at a random time within the previously mentioned, five-hour time frame, in order to prevent several different devices from simultaneously requesting a time and overwhelming the NTP server. The default setting is *Yes*.

Note: Logged data includes a time stamp based upon the current time in the device, so it is possible to duplicate log times in the spring and miss log times in the fall. To avoid confusion, many servers and data loggers are set to remain on GMT time and do not shift for daylight savings.

### **Daylight Savings Start:**

This is the date that daylight savings will start. Note that on this date, between the hours of 12:00 AM – 5:00 AM, the current time will be shifted forward by one hour (i.e. the time will jump from 12:02 AM [00:02] to 1:02 AM [01:02]). By default this is set to the 2nd Sunday in March which is the date used in the United States.

### **Daylight Savings End:**

This is the date that daylight savings will end. On this date, between the hours of 12:00 AM – 5:00 AM, the current time will be shifted backward by one hour (i.e. time will jump from 12:02 AM [00:02] to 11:02 PM [23:02] the day before). By default this is set to the 1st Sunday in November which is the date used in the U.S.

### 3.7 Sensor Tab

The screenshot displays the 'Sensor' tab of the XW110 Plus web interface. At the top, the title 'XW110™ Wireless Temperature Sensor Plus' is shown. Below the title is a navigation bar with tabs: Main, WiFi Networks, Email, Password, Date/Time, Sensor (selected), and Control Page. The main content area is divided into three sections: 'MODULE SETTINGS', 'SENSOR 1', and 'SENSOR 2' (with 'SENSOR 3' partially visible). The 'MODULE SETTINGS' section includes fields for 'Module Description' (XW-110P), 'Temperature Update Interval' (5 Minutes), 'Units' (Fahrenheit), and 'Logging' (On). Each sensor section (SENSOR 1, 2, 3) contains fields for 'Sensor Description', 'Sensor Address', 'Offset', 'Alarm 1', 'Alarm 2', and 'Deadband'. Additionally, there are checkboxes for 'Include Temperature' (On Control Page and In Log File), a dropdown for 'Email Option' (No email messages), a dropdown for 'Remote Services' (No action), and a dropdown for 'Remote Relay Action' (No Action when Alarm 1). At the bottom of the form are 'Submit' and 'Reset Changes' buttons.

*The XW-110 Plus contains additional settings when compared to the XW-110. If you have the XW-110, your screen will differ.*



### Module Description

This text will appear in email messages when email alerts are enabled as well as on the Control Page. This field may be up to 35 characters long.

### Temperature Update Interval

The XW-110 normally operates in a low power sleep mode and is programmed to periodically awaken and measure the temperature. This setting selects how often this occurs. Depending on how emails are configured an email may or may not be sent. When operating from a DC wall power supply this setting can be set to most any value. Realize that every measurement requires energy from the battery. To obtain the best battery life set the update for as long as possible for your application. For example, when monitoring the temperature of a freezer use 15 minutes or so, for outdoor temperature which changes slowly use a longer interval such as 30 minutes or more.

While the control page is open, this setting is temporarily ignored and every three seconds the browser requests the state.xml along with a command to update the temperature and battery information. The same is not true when just the state.xml is requested.

To save power in *Slave* mode the XW-110 normally disconnects from the access point. If the sleep interval is less than 35-seconds the XW-110 remains connected since the energy required to re-connect is greater than the energy saved by disconnecting.

### Units

This allows the user to select between the temperature units of *Fahrenheit* and *Celsius*. All settings entered and displayed on subsequent pages will be in the units selected.

### Logging (XW-110-Plus only)

When this option is set to *Yes*, XW-110-Plus will record temperature data as configured on this page (see *Section 5.2: Log File.*) The default setting for this option is *No*.

### Daily Email Log Send Time (XW-110-Plus only)

If logging is enabled, this setting determines the time each day when the data file is emailed.

### Log Email Address (XW-110-Plus only)

If logging is enabled, this setting determines what Email addresses the daily data log is sent to. For Email notification to work, the XW-110-Plus must have a properly configured network connection and a SMTP server must be defined.

## SENSOR 1-3

Up to three sensors can be connected to the XW-110-Plus. Separate setup fields for each sensor are provided.

### Sensor Description

The text in this field appears to the left of the corresponding temperature reading on the Control Page of the XW-110-Plus and as the header of the XW-110. This text also appears in the email status message when email is enabled. This field can be up to 14 characters in length. The default text in this field is "Sensor #" for the XW-110-Plus and XW-110 for the XW-110.

### Sensor Address (XW-110-Plus only)

Each sensor connected to the XW-110-Plus should be associated (or assigned) to a sensor number. This identifies the name, location, and function of the sensor. Every temperature sensor comes from the factory with a unique, non-changeable address. When the sensors tab is selected (or the Refresh List button is pressed), the XW-110 scans the bus for sensors. The addresses of the sensors that are found on the bus are listed in the drop-down list. For each sensor number (Sensor 1... Sensor 3), select the address of the appropriate sensor from the drop-down list.

Selecting sensors is simplest when the sensors are connected to the bus one at a time. The procedure is to start with one sensor and associate it with the appropriate sensor number by selecting the sensor address within the appropriate drop-down list. Submit the page, connect a second sensor, and press the Refresh List button. Associate the second sensor to the appropriate sensor number. Continue this procedure until all sensors are set up.

**Offset**

The value of the offset will be added to the sensor's reading. Normally this should be set to zero.

**Alarm 1 (XW-110-Plus only)**

This setting is used to set the trigger point for an alarm condition. The number field specifies the temperature at which the alarm is triggered. The “High” and “Low” radio buttons indicate whether the alarm is triggered as a high or low alarm. A high alarm is triggered when the sensor reading exceeds the alarm value, and a low alarm occurs when the sensor reading falls below the alarm value.

**Alarm 2 (XW-110-Plus only)**

This is a second alarm trigger that works similar to Alarm 1.

**High Alarm (XW-110 only)**

This setting is used to set the trigger point for a high alarm condition. A high alarm is triggered when the sensor reading exceeds the specified temperature value.

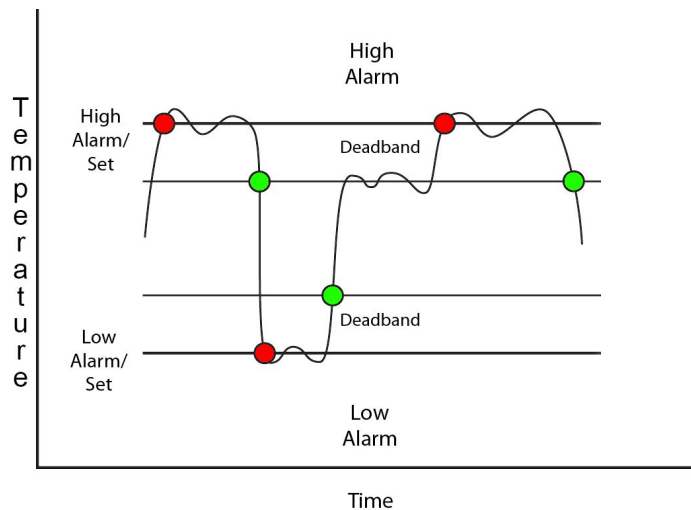
**Low Alarm (XW-110 only)**

This setting is used to set the trigger point for a low alarm condition. A low alarm is triggered when the sensor reading falls below the specified temperature value.

**Deadband**

The deadband (hysteresis) prevents alarms from triggering excessively when the measurement value vacillates around the trigger point. With high alarms, the measurement must fall below the high alarm point minus the dead band before the high alarm will be triggered again. Likewise the deadband on the low alarm requires the measurement to rise above the low alarm point plus the deadband before the low alarm will be triggered again.

For example, if the dead band is set to 0.5°C, and a high alarm is set at 13°C, the high alarm will occur at 13°C; however, it will not turn off until the temperature drops below 12.5°C (13°C - 0.5°C).



### Include Temperature (XW-110-Plus only)

**On Control Page:** Check this box to display the temperature measurements from this sensor on the control page.

**In Log File:** If logging is enabled (described above), check this box to include temperature measurements from this sensor in the log file.

### Email Option

Simple email messages can be sent in response to alarm conditions. This parameter is used to specify what alarm conditions, if any, will cause email messages to be sent. Email notifications will work only if email is correctly setup in the following settings.

**Note:** Below is a list of options for the XW-110-Plus, similar options are available on the XW-110.

**No email Messages:** No email messages will be sent due to alarm conditions.

**Send email on Alarm 1:** Email notifications will be sent due to Alarm 1 conditions

**Send email on Alarm 2:** Email notifications will be sent due to Alarm 2 conditions

**Send email on Alarm1 and Alarm2:** Email notifications will be sent due to Alarm 1 or Alarm 2 conditions

**Send email on Alarm1, Alarm2 and normal:** Email notifications will be sent due to Alarm1 or Alarm1 condition or when Normal conditions are restored.

### Remote Services

The XW-110 can be configured to send messages to other ControlByWeb™ products or servers that are located at a remote location and running the remote services server software. This field specifies the action taken due to a temperature alarm condition.

**Note:** Below is a list of options for the XW-110-Plus, similar options are available on the XW-110.

**No Action:** No action is taken.

**Send state on Alarm 1:** state.xml will be sent when Alarm 1 occurs.

**Send state on Alarm 2:** state.xml will be sent when Alarm 2 occurs.

**Send state on Alarm 1 or Alarm 2:** state.xml will be sent when Alarm 1 or Alarm 2 occurs.

### Remote Relay Action

The XW-110 can be configured to control relays on other ControlByWeb™ products that are located at a remote location on the network. This field specifies the action taken by the Remote Relay due to an alarm condition. The following actions are available:

**No Action:** No action is taken by the relay.

**Turn On:** Turns the relay On due to an alarm condition. The relay will turn Off when alarm conditions are no longer met.

**Turn Off:** Turns the relay Off due to an alarm condition. The relay will turn On when alarm conditions are no longer met.

**Pulse:** Pulses the relay for a specified amount of time due to an alarm condition.

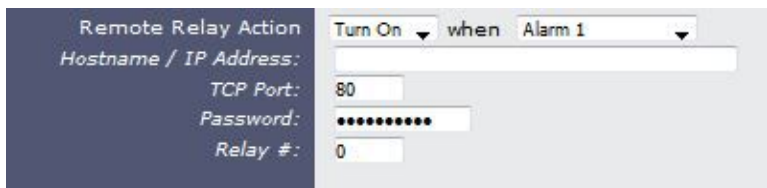
**Latch On:** Turns On the relay due to an alarm condition. Once the relay is On, it will stay On (unaffected by alarm conditions) until it is turned Off via the web by a user or the device is powered off. This option is useful for alarming functions.

**Latch Off:** Turns Off the relay due to an alarm condition. Once the relay is Off, it will stay Off (unaffected by alarm conditions) until it is turned on via the web by a user or the device is powered off. This option is useful for alarming functions.

**When**

This field specifies when the relay Action occurs. On the XW-110-Plus you can choose for the action to occur on Alarm1, Alarm2, or Alarm1 or Alarm2. (Similar options are available on the XW-110.)

If a remote relay action is enabled, the following settings appear:



**Hostname / IP Address**

Enter the IP address or Host Name of the device on which the remote relay is located. To save energy, DNS lookups are only performed the first time after the settings are submitted, or after a failure to send a remote relay command.

**TCP Port**

Specify the TCP Port. By default this is set to port 80.

**Password**

Enter the Control Page password (if applicable) of the device on which the remote relay is located.

**Relay#**

Specify the number of the relay you would like to control on the device. (Note: To control WebRelay's relay, enter in the number 0.)

## Section 4: Control Page

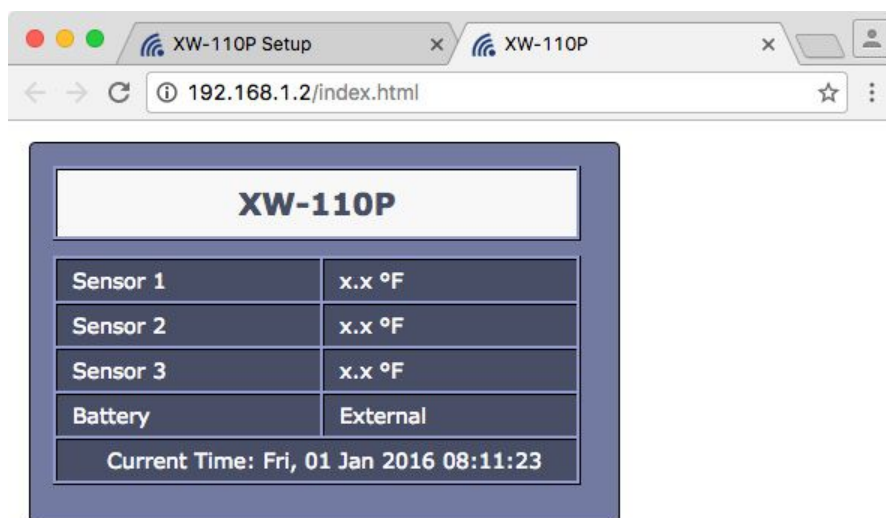
In the Stand-Alone mode, and when the internal HTTP web server is enabled, the temperature status can be monitored by using a web browser, the CBW Mobile app, and/or by sending text commands to an XML status/control page.

### 4.1 Browser Operation

Once the XW-110 is set up, users can access the Control Page by either clicking the *Control Page* tab from within the setup pages, or by using a web browser and typing the IP address of the XW-110 into the web browser address bar. For example, using the default IP address, the user would enter `http://192.168.1.2`. If the IP address is changed from the default, the user must use the new IP address. Note that if any port is used other than the default port 80, the port must also be included in the request. For example, to access the device at port 8000 enter: `http://192.168.1.2:8000`.

#### 4.1.1 XW-110 Temperature Sensor Display

While the control page is open, the temperature and battery information will update every three seconds.



*XW-110 Plus Control page will contain up to three sensors. The XW-110 Control Page will contain one sensor.*

The Control Page is normally what users see and use and it can be configured to fit your needs. The Sensor tab (*Section 3.7: Sensor Tab*) has a setting for the device title (*Module Description*.) Each sensor name can be customized with a 14-character description such as “Freezer” or “Outdoor Temp”.) Check boxes determine if a specific resource is displayed or not displayed.

## Section 5: Modbus/TCP (XW-110-Plus only)

XW-110-Plus can be controlled and monitored using Modbus/TCP protocol. This provides a standard means of using XW-110-Plus with devices and software from other manufacturers. This section is not a tutorial on Modbus and it is assumed that the reader is already familiar with Modbus. Detailed Modbus information can be found at <http://www.modbus.org>.

*Note: Modbus communications are disabled whenever the Control Password is enabled. This is because Modbus/TCP does not provide a mechanism for password protection. Make sure the Control Password is disabled (default) and Modbus functionality is enabled on the WiFi Network tab.*

XW-110-Plus functions as a Modbus slave. Host devices, such as PLCs, open a connection with XW-110-Plus on port 502 (configurable under *WiFi Network* tab) and then send requests to read sensor values. The XW-110-Plus has no write registers. When XW-110 receives a command, it will perform the desired function and return a response.

The following sections provide an overview and explanation of Modbus operation.

### 5.1 XW-110-Plus Modbus Function Code Summary

XW-110-Plus supports the following function codes:

Code Name	Modbus Function	XW-110 Feature	XW-110 Start Address	
			Hexadecimal	Decimal
Read Battery Voltage	03	Battery Voltage	0x0010	16
Read Sensors	03	Sensors 1-3	0x0110-0x0114	272-276

Multiple commands may be sent without closing and re-opening the connection, but if no data is transferred for 50 seconds, the connection will time out and close. To keep the connection open, a read request can be sent periodically.

XW-110-Plus has two TCP sockets available for Modbus/TCP. This allows two connections to be open at one time. Requests for more than two open connections will be rejected.

When errors occur, an error code is returned. Most Modbus client software will interpret this code in a human readable form. The code is comprised of the original function code plus 0x80. For example, an error during the read coils function 0x01 would return 0x81. Each error has a qualifying exception number. The following are the possible exception codes and their meanings:

- 0x01 - Function code not supported (also when Modbus is disabled in the setup pages).
- 0x02 - Incorrect starting address/quantity of output combination.

## 5.2 PLC Device Addressing

There are generally two schemes for accessing Modbus devices. The first is by specifying the Modbus function code, memory type, and address. The second, sometimes called PLC addressing, requires only the address.

Modbus protocol uses four different address ranges for discrete inputs, coils, input registers, and holding registers. The function code determines the address range of the message. The following are common function codes and their respective address ranges.

Code Name	Modbus Function	Data Type*	PLC Address Mode 485	PLC Address Mode 584/984
Holding Registers (Read only)	03	32 bits	4001-5000	40001-50000

\* Data types may be implemented at the discretion of the manufacturer. Address ranges may also overlap. Discrete is a binary or boolean value, 1 or 0.

Function codes, memory types, and addresses can be converted to the PLC addressing equivalent using the table below. To use the table, look up the row corresponding to the Modbus function code. Then take the desired XW-110-Plus feature address and add to it the address offset in the PLC address mode column.

$$\text{Input Address} + \text{PLC Base Address} = \text{PLC Address}$$

For example, to read discrete Input 2

Input Address	1
PLC Base address	1001
PLC Address	1002

Programming the PLC to read from 1002 will return the value of Input 2.

Code Name	Modbus Function	XW-110 Addresses	Data Type	PLC Address Mode 485	PLC Address Mode 584/984
Read Holding Registers	03	16 (Battery Voltage)	32-bit float	Addr + 4001	Addr + 40001
		272-278 (Sensors 1-3)	32-bit float	Addr + 4001	Addr + 40001

For 32-bit numbers or floats, two registers must be read starting at the desired address, examples of each are given for the applicable functions.

## 5.3 XW-110 Full Address Table

---

The table below gives commonly used function codes, memory types, data sizes, and equivalent PLC addresses for accessing the XW-110. The data size will be the same regardless of the addressing mode.

	<b>Function Code</b>	<b>Address (Decimal)</b>	<b>Data Size</b>	<b>PLC Address Mode 485</b>	<b>PLC Address Mode 584/984</b>
<b>Read Battery Voltage</b>	03	16	32-bit Float	4017	40017
<b>Read Sensor 1</b>	03	272	32-bit Float	4273	40273
<b>Read Sensor 2</b>	03	274	32-bit Float	4275	40275
<b>Read Sensor 3</b>	03	276	32-bit Float	4277	40277



## 5.4 Read Sensors – Modbus Function Code 03 (0x03)

---

The Read Holding Registers function is used for the temperature sensors.

### Request

32-bit sensor values are read from 16-bit register pairs. Consequently, sensor addresses and registers must be even numbers.

#### Vin Start Addresses

Start Address: 0x0010 (Vin)

Input Quantity: 0x0002

#### Temperature Sensor Start Addresses

Start Address: 0x0110 (Sensor Input 1) to 0x0114 (Sensor Input 3)

Input Quantity: 0x0002 to 0x0006

### Response

32-bit floating-point values are returned, either as little-endian or big-endian numbers, depending on the configuration in the **WiFi Networks** tab.

With little-endian ordering, a temperature reading of sensor 1 (0x0110) would return 0x800042A2. The least significant word would be 8000 hex and the most significant word would be 42A2. This hexadecimal value converts to a temperature reading of 81.25 degrees.

If a temperature or humidity sensor is not installed, a value of 0xFFFFFFFF (NaN) is returned. Other inputs will show measured values of the open circuits.

### Errors

Sensor Read Error Function Code (1 byte): 0x83

Exception Codes (1 byte):       0x01 – Function not supported.  
                                      0x02 – Incorrect combination of start address and input quantity

## Section 6: Log File (XW-110 Plus)

The XW-110-Plus logs temperature information to the file log.txt. The log file is a spreadsheet compatible text file and is stored in volatile memory; this data will be lost due to power failure. The log file is stored in a circular buffer which writes from the beginning of the allocated memory space to the end and then repeat from the beginning (over-writing the original data). If valid settings for sending an email are configured, the log file will try to be sent several log entries before over-writing occurs. By default temperature logging is disabled and must be enabled with a setting in the *Sensor Tab* (see *Section 3.7: Sensor Tab*.) The same tab has settings for each sensor which controls which temperature measurements are stored in the log file.

The log file can be either periodically emailed or uploaded with an HTTP request as explained below. To periodically email the log file, enable the logging check box and configure the *Daily Email Log Send Time* and *Log Email Address* settings which subsequently appear (see *Section 3.7: Sensor Tab*.) Email transmissions are useful for example, where an archive record is needed of food temperature in a retail display case.

### Data Log File – log.txt

The temperature log file be up to 1800 log entries long and is stored using a comma-separated value formatting scheme. The file is read by requesting the log.txt file from XW-110-Plus. For example, using the default IP address the following command would be used to request the log file:

```
http://192.168.1.2/log.txt
```

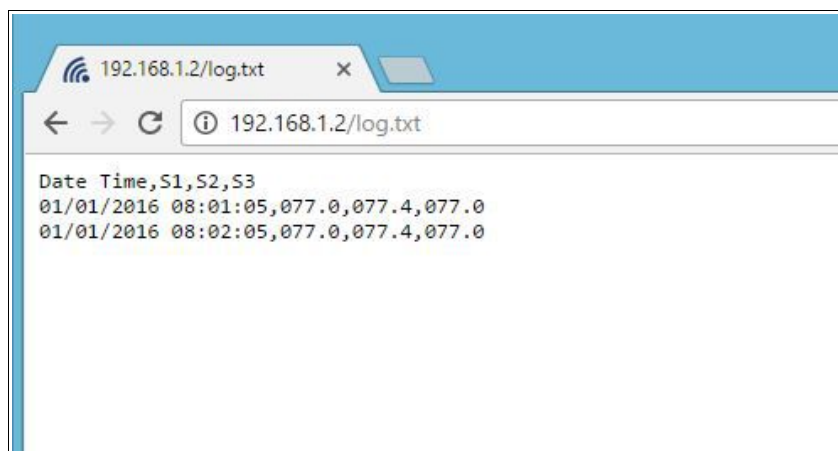
#### File Format:

```
MM/DD/YYYY HH:MM:SS, Sensors 1-3
```

#### Date and Time Format:

MM – Month (1-12)  
DD – Day (1-31)  
YYYY – Year (1970 - 2106)  
HH – Hour in 24 hour time (0 -23)  
MM – Minutes (0-59)  
SS – Seconds (0-59)

#### Sample File:



The file can then be saved using the 'Save As...' option under the 'File' menu of the web browser. If the TCP port has been changed (not port 80), the port will be required to read the file. For example, using the default IP address, and port 8000, the log file would be read as follows:

```
http://192.168.1.2:8000/log.txt
```

The log.txt file may be erased with the following command:

```
http://192.168.1.2/log.txt?erase=1
```

After erasing the file, it might be necessary to refresh the page.

*Note: If the Control Password is enabled in the setup pages, the password will be required to access the log file.*

## Section 7: Xytronix Compact Data (XCD) Format (XW-110)

The XW-110 sensors send data contained in a TCP/IP packet. To keep the packets small, and conserve battery power, they are not XML/HTTP.

### XW-110 Temperature Sensor Packet

Function Code	MAC Address	Salt	Interval	Battery	Temperature	CRC (4C11DB7)
2 bytes	6 bytes	4 bytes	4 bytes	1 byte	4 byte IEEE-754 float	4 bytes

#### Function Code

Indicates how the packet should be interpreted. If the MSb of the first byte is set, the packet is encrypted. If the 2<sup>nd</sup> MSb is set, the packet is a salt request. Both the encrypted and salt request bits should not be set at the same time.

Function Description	Code
XW-110 Packet	0x0001

#### MAC Address

The MAC address used by the wireless interface, MSB first. This also matches the serial number of the device.

#### Salt

Random number requested from the master to be included in the information packet sent back to the master. This salt is included to prevent replay attacks to the master. Only used when using encryption.

#### Interval

Indicates the period of the transmissions in seconds.

#### Battery percentage

Indicated the estimated battery life remaining. The MSb, if set, indicates the device is being externally powered.

#### Temperature

Temperature as recorded by the connected sensor as an IEEE-754 floating point value, MSB first. For the XW-110-Plus the temperature values start with sensor 1 and end with sensor 3.

#### CRC

The CRC is computed over the entire packet minus the 4 bytes reserved for the CRC result. The CRC is computed using the 0x4C11DB7 polynomial and is included to make sure the packet has not been tempered with. CRC is only present when encryption is used.

#### Procedure

The XW-110 will send the packet as described above once the interval has expired. The CRC is not included in unencrypted packets and the salt field is not used.

## Section 8: Network Discovery

XW-110 and XW-110-Plus has implemented a network discovery and provisioning protocol to aid in accessing the device. With this protocol, a user may connect the device to a network without knowing the IP address, search and identify the IP address, query basic information and if not yet configured send the desired network and remote services configurations. This feature can be utilized in the latest versions of the Android and iOS apps.

The network discovery protocol listens for specific requests on UDP port 65431 sent to the IP broadcast address 255.255.255.255. All requests must have the proper header and, when applicable, the correct MAC address. This header is the first 12 bytes of all messages and is simply the string 'ControlByWeb'.

*Note: Due to resource constraints, the Network Discovery feature is not available when Modbus is enabled.*

Header											
C	o	n	t	r	o	l	B	y	W	e	b
0x43	0x6f	0x6e	0x74	0x72	0x6f	0x6c	0x42	0x79	0x57	0x65	0x62

### 8.1 Initial Contact

The initial contact request is sent to discover ControlByWeb devices on the network. It is recommended to send this message multiple times in environments where many ControlByWeb devices are present due to potentially lost traffic where collisions occur as UDP does not guarantee deliver of packets.

#### Request:

Header (12 bytes)	ASCII String	ControlByWeb
Message ID (1 byte)	Initial Contact Request	0x00

#### Response:

Header (12 bytes)	ASCII String	ControlByWeb
Message ID (1 byte)	Initial Contact Response	0x01
MAC Address (6 bytes)	Binary version	0x00 0x0c 0xc8 0x00 0x00 0x00
Device Info (2 bytes)	Bit[15-7] Reserved	0b0
	Bit 6 – Mode	0b0=Station, 0b1=AP
	Bit 5 – Reserved	0b0
	Bit 4 – Remote Services Status	0b0=Disconnected, 0b1=Connected
	Bit 3 – DHCP Status	0b0=Waiting, 0b1=Success
	Bit 2 – Remote Services Enabled	0b0=Disabled, 0b1=Enabled
	Bit 1 – DHCP Enabled	0b0=Disabled, 0b1=Enabled
	Bit 0 – Configuration Allowed	0b0=Not Allowed, 0b1=Allowed
Model Code (2 bytes)		0x0024=XW-110, 0x002B=XW-110-Plus
IP Address (4 bytes)	Network endianness	0xc0 0xa8 0x01 0x02 (192.168.1.2)

## 8.2 Setup Information

The Setup Information request allows the device to receive IP network, remote services and WiFi network configuration data that it should use. Once this request is properly received, the device will apply the settings and reboot. There are two variants of this request, one has message ID 0x03 and the other has message ID 0x06. The only difference in these requests is message ID 0x06 includes fields for WiFi SSID, security and password.

Once the device has received this command or after the user has configured the device through the web-pages, this request will be ignored and will return an error. The only way to re-enable this request, is to reset the device to factory defaults, or re-associate the device to a WiFi network via WPS.

### **Request:**

Header (12 bytes)	ASCII String	ControlByWeb
Message ID (1 byte)	Setup Information request	0x03 -or- 0x06
MAC Address (6 bytes)	Binary version	0x00 0x0c 0xc8 0x00 0x00 0x00
DHCP (1 byte)	Enable DHCP	0x00=Disabled, 0x01=Enabled
Enable Remote Services (1 byte)	Enable Remote Services	0x00=Disabled, 0x01=Enabled
Token (32 bytes)	ASCII String, no null terminator	"xx"
IP Address (4 bytes)	Network endianness	0xc0 0xa8 0x01 0x02 (192.168.1.2)
Subnet (4 bytes)	Network endianness	0xff 0xff 0xff 0x00 (255.255.255.0)
Gateway (4 bytes)	Network endianness	0xc0 0xa8 0x01 0x01 (192.168.1.1)
Primary DNS (4 bytes)	Network endianness	0x08 0x08 0x08 0x08 (8.8.8.8)
Alternate DNS (4 bytes)	Not used by the XW-110-(Plus)	0x08 0x08 0x04 0x04 (8.8.4.4)
Remote Services Version (1 byte)	Specify protocol version	0x01=1.0, 0x02=2.0
Remote Services port number (1 byte)	Port Remote Services server is listening on (Network Endianness)	0x1f 0x40 (8000)
Remote Services Connection Interval (2 bytes)	Time in minutes between connection attempts and pushing state.xml	0x00 0x01 (1 minute)
Remote Services uses SSL (1 byte)	Only applicable to Remote Services Version 2.0	0x00=No SSL, 0x01=Use SSL
Certificate retrieval port number (2 bytes)	Port used to pass token information to retrieve certificates	0x01 0xbb (443)
Remote Services host	Null terminated ASCII string	devices.controlbyweb.cloud
Remote Services Connection String	Null terminated ASCII string	
WiFi Security option (1 byte)	Message ID 0x06 only	0x00=none, 0x01=WEP, 0x02=WPA(2)
SSID	Null terminated ASCII string	

	(message ID 0x06 only)	
Password	Null terminated ASCII string (message ID 0x06 only)	

**Successful Response:**

Header (12 bytes)	ASCII String	ControlByWeb
Message ID (1 byte)	Setup successful response	0x04
MAC Address (6 bytes)	Binary version	0x00 0x0c 0xc8 0x00 0x00 0x00

**Error Response:**

Header (12 bytes)	ASCII String	ControlByWeb
Message ID (1 byte)	Command not recognized response	0x05
MAC Address (6 bytes)	Binary version	0x00 0x0c 0xc8 0x00 0x00 0x00

## Appendix A: Specifications

### Wireless Specifications

Network Standards:	IEEE 802.11b/g/n
Frequency Band	2.412 – 2.462 GHz
Wi-Fi Security Standards	Open, WEP, WPA, WPA2
Network Settings:	DHCP or Static
Wireless Range	Up to 250ft (typical for Wi-Fi devices) depends on environment
Antenna:	Integral chip antenna, 1.9 dBi.
RF Output Power (typ)	14dBm (802.11b/g), 12dBm (802.11n)

### Operation

Provisioning:	Via internal web server (no cables or PC utilities needed)
Access Point:	Yes, push button activated (setup via web page)
WPS:	Yes, push button activated (Wi-Fi Protected Setup)
Connectivity:	Intermittently connected or always connected
XCD Data Packet:	TCP, 16 to 34 bytes (See <i>Section 5.3: XCD Format</i> )
Remote Server:	ControlByWeb's X-600™, X-300™ or cloud-based server
Remote Relays:	Control relays on other ControlByWeb™ products
Polling:	state.xml (only when web-server is active)

### Power

External:	5VDC ±10%, 500ma max (via DC power wall adapter)
DC Jack:	5.5mm barrel x 2.5mm center pin (positive)
Internal:	Two replaceable 1.5V "AA" cells
Power Consumption:	27-770uA sleep, 59mA active RX, 229mA TX (at +12dBm)
Battery Usage:	Battery voltage is measured and periodically reported.
Battery Life:	<i>Battery life is affected by model, mode, reporting interval, security, DHCP, DNS, battery temperature and other variables.</i>

XW-110: Intermittently connected, 2-min push interval via XCD, with encryption, no DHCP, no DNS: 140,000 transmissions.

XW-110: Always connected, 15-second push interval via XCD, with encryption, no DHCP, no DNS: 200,000 transmissions.

### Internal Push Buttons

Button 1:	Force access-point mode
Button 2:	Activate WPS mode

### Temperature Sensors

XW-110:	1-temperature sensor
XW-110 Plus:	3-temperature sensors
	Digital "1-wire" thermometer probe
	Interchangeable, no calibration needed
	Dallas Semiconductor DS18B20 digital 1-wire thermometer
	Measurement Range: -55°C to 125°C (-67°F to 257°F)
	Accuracy: +/-0.5°C from -10°C to +85°C
	Available in non-submersible (air) or submersible versions
	(air temperature sensor included)
	Maximum cable length 50 ft (15m)



**Configuration**

Celsius/Fahrenheit:	User configurable
Temperature Reports:	Interval
Report Rate:	User configurable

**Email alerts**

Email Alerts:	Configurable
Encrypted Email Alerts:	Yes
Temperature Alerts:	High or low temperature

**Logging**

Storage:	Volatile RAM
Buffer Architecture	Circular Buffer
Log File Size:	1800 Entries

**Environmental**

Location:	Indoor use or NEMA-4 protected location
Using Alkaline Batteries:	-18°C to 55°C (0°F to 130°F)
Operating Temperature:	-40°C to 65°C (-40°F to 150°F)
Storage Temperature:	-40°C to 85°C (-40°F to 185°F)
Humidity:	5-95%, non-condensing

**Mechanical**

Mounting:	Wall mount
Material	Polycarbonate plastic
Size:	3.16 x 3.04 x 0.93 in. [80 x 77 x 24mm]
Weight:	2.4 oz [68g], no batteries

**Electromagnetic Compliance**

FCC ID: 2AE4Z-XWD001  
FCC 47CFR15 (Class B)  
IEC CISPR 22, CISPR 24  
EN55024 ITE Immunity (2010)  
EN55022 Emissions (2010)  
IC: 21441-XWD001

**Product Safety Compliance**

UL 61010-1 (Electrical Equipment for Measurement, Control, and Laboratory Use)



## Appendix B: Trademark and Copyright Information

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## Appendix C: Warranty

This Xytronix Research & Design, Inc. product is warrantied against defects in material and workmanship for a period of five years from the date of shipment. During the warranty period, Xytronix Research & Design, Inc. will, at its option, either repair or replace products that prove to be defective. This warranty is extended to the original purchaser of the equipment only.

For warranty service or repair, customer must contact Xytronix Research & Design, Inc. technical support ([support@ControlByWeb.com](mailto:support@ControlByWeb.com)) and obtain a Return Authorization number (RA#). Before issuing an RA#, a support technician will work with customer to try to resolve the issue without returning the product. If technician determines that product must be returned for service an RA# will be issued. Next, the product must be properly packaged and returned to Xytronix Research & Design, Inc. with the RA# clearly marked on the package. The purchaser shall prepay all charges for shipping to Xytronix Research & Design, Inc. For warranty repairs of products less than one year old, Xytronix Research & Design, Inc. will pay the shipping charges to return the product to the purchaser as long as the product is shipped within the continental United States. If the product is shipped outside of the continental United States or the product was shipped more than one year earlier, the purchaser shall pay all shipping charges, duties, and taxes.

### Limitation

The foregoing warranty shall not apply to defects or damage resulting from improper use or misuse, unauthorized repair, tampering, modification, improper connection, or operation outside the electrical/environmental specifications for the product. Further, the warranty does not cover Acts of God, such as fire, flood, hurricanes, and tornadoes. This warranty does not cover damage to property, equipment, direct, indirect, consequential, or incidental damage (including damage for loss of business profit, business interruption, loss of data, and the like) arising out of the use or misuse of this product.

UNDER NO CIRCUMSTANCES WILL THE LIABILITY OF XYTRONIX RESEARCH & DESIGN, INC. TO THE PURCHASER OR ANY OTHER PARTY EXCEED THE ORIGINAL PURCHASE PRICE OF THE PRODUCT, REGARDLESS OF THE FORM OF THE CLAIM. No other warranty is expressed or implied. Xytronix Research & Design, Inc. specifically disclaims the implied warranties or merchantability and fitness for a particular purpose. Some jurisdictions may not allow the exclusion of limitation of liability for consequential or incidental damage.

## Appendix D: FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

### Warning

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not in-stalled and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into a relay on a circuit different from where the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### Notice

Changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### RF Exposure Information

This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. The antennas used with this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be located or operating in conjunction with any other antenna or transmitter.

### Canadian License-Exempt Radio Apparatus (RSS-GEN)

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

## Appendix E: Mechanical Dimensions

