WEBRelay™ 10+

Users Manual

WebRelay-10 Plus (X-WR-10R12-IEP)
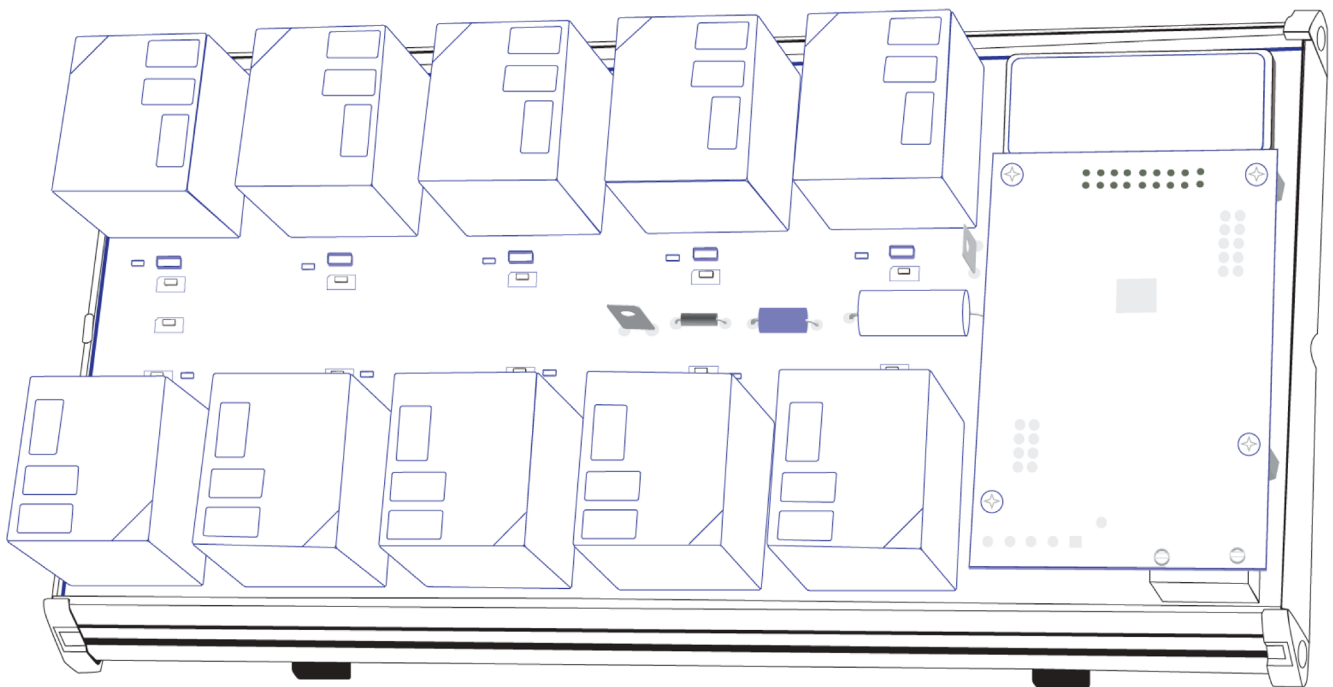
Table of Contents

Section 1: Introduction

WebRelay-10 Plus™ is a robust, 10-relay module with a built-in web server. It can be controlled and/or monitored over any IP network including private networks, IP-based industrial control networks, and the Internet. Users can operate WebRelay-10 Plus™ using a web browser or a custom application. Computers, PLCs, or automation controllers may control and monitor WebRelay-10 Plus™ without user intervention. This works by sending text commands over the network and reading XML status pages from WebRelay-10 Plus™, or by using Modbus/TCP protocol.
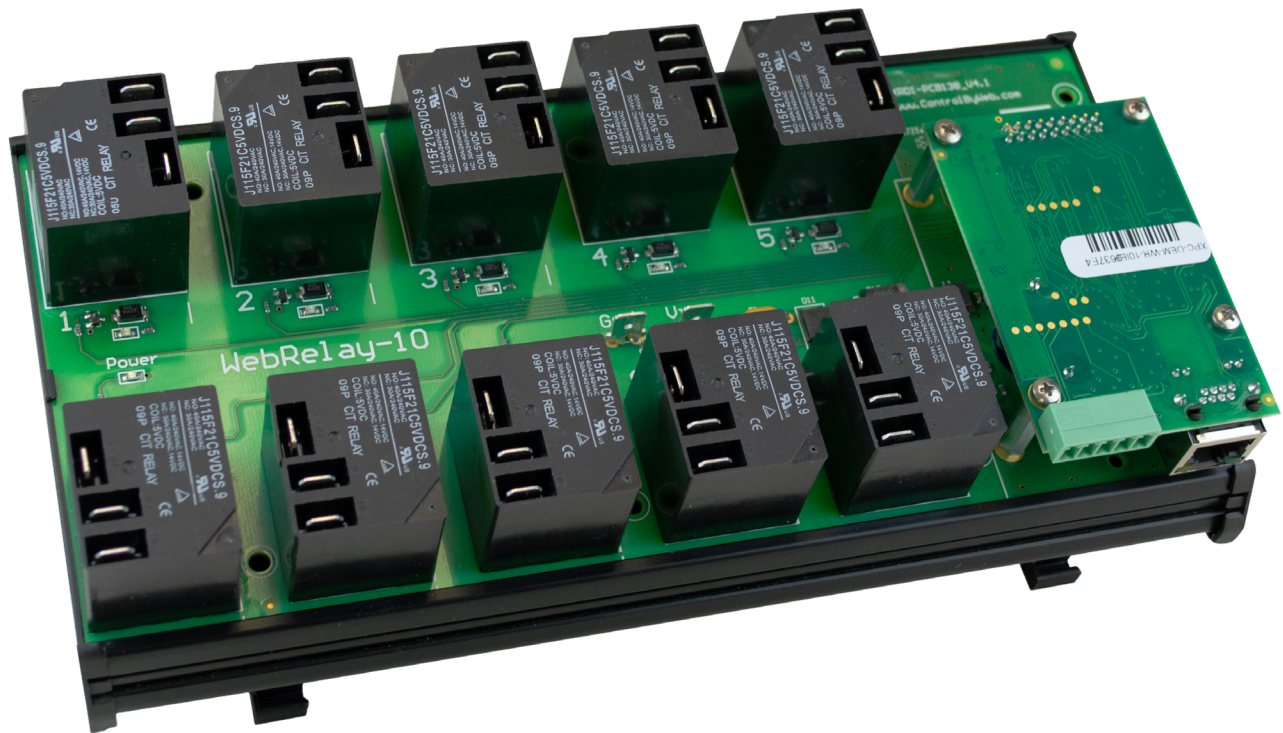
1.1 Features

WebRelay-10 Plus™ includes the following features:

- Ten independent 15-Amp Relays (Form C, SPDT).
- Built-in Web server for browser-based setup and control.
- No special software or device drivers required.
- Customizable email alerts.
- XML/JSON status and **Control Page** make communications with custom computer applications simple.
- Can operate as a Modbus/TCP slave.
- On/Off and Pulse modes.
- Advanced functionality through BASIC scripts.
- Wide power supply range (9-28 VDC).
- DIN-Rail Mountable.
- LED relay state indicators.
- ¼ inch tab-connectors.
- UL/CUL listed relays (E197852).
- Event scheduler with yearly calendar. Schedule up to 100 events.
- Up to sixteen temperature and/or humidity sensors can be added for environmental monitoring.
- Dry-contact sensors or switches can be connected for local control of relays or for monitoring external devices.
- Logging: log relay changes, events, Modbus requests, high/low temperatures, input changes, network traffic, and more.
- Real-time clock, can automatically adjust for daylight savings time, **Sync with NTP server**.
- System log provides detailed diagnostic information.
- Configure manually or with DHCP.

Note: WebRelay-10 Plus™ sends out email messages only. Most wireless carriers provide free services to convert email messages to text messages.

1.2 Applications

WebRelay-10 Plus™ has many applications. It works very well as a stand-alone device that can be controlled using a web browser, or as a convenient way to add I/O to a computer. It can be used in industrial applications to control motors, lights, coils, pumps, valves, etc.

Using the additional features found on WebRelay-10 Plus™, you can monitor temperature and/or humidity, control multiple relays using an input, schedule reoccurring events, log relay state changes, and much more.

1.3 WebRelay-10 Plus™ Models Available

X-WR-10R12-IEP	WebRelay-10 Plus™ includes temperature/humidity monitoring (humidity monitoring requires optional humidity sensor), discrete inputs, real-time clock, event scheduling, capacitor power backup, and logging.

1.3.1 Optional Accessories

| Accessory	Description	Part Number
Temperature Sensor	Digital temperature sensor with 12 inch wire leads. Note: Leads may be extended	X-DTS-U
Temperature Sensor (Wall Mount)	Digital temperature sensor housed in vented plastic enclosure	X-DTS-WMX
Temperature/Humidity Sensor (Wall Mount)	Digital temperature and humidity sensor housed in vented plastic enclosure.	X-DTHS-WMX

1.4 Connectors & Indicators
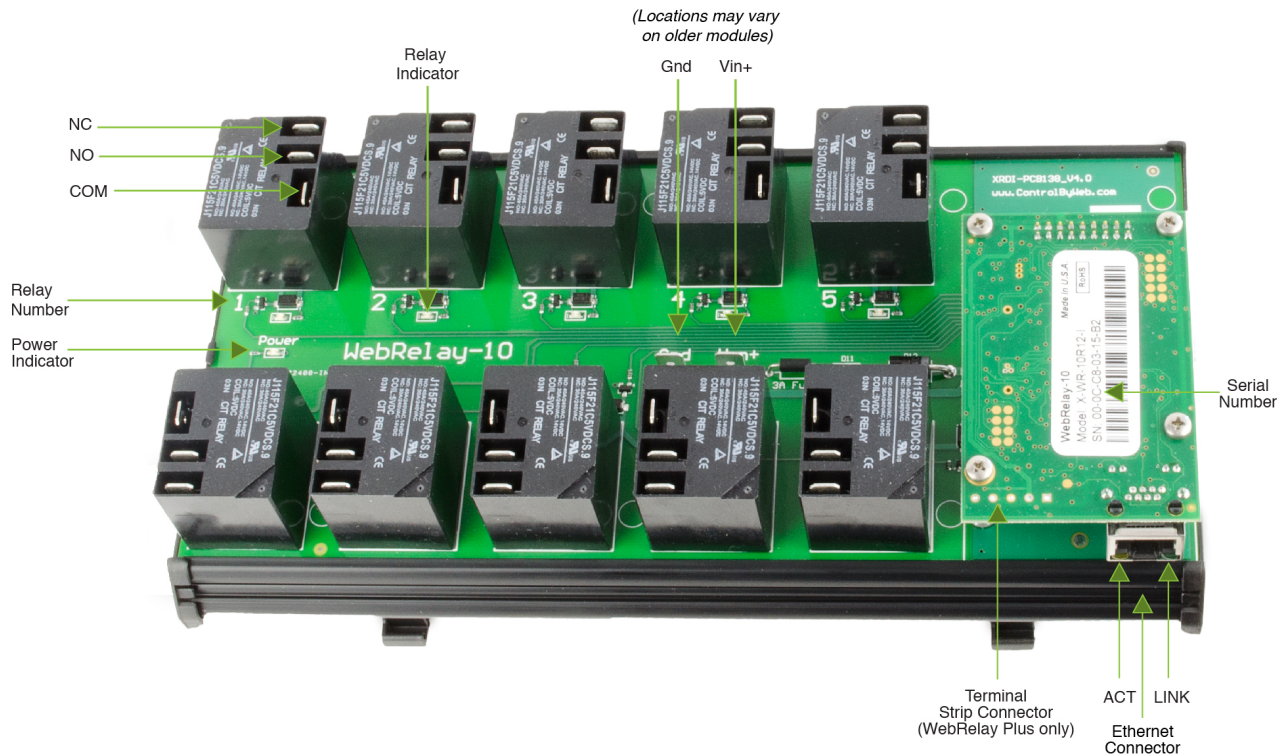
Figure 1.4a - Connections & Indicators

Module Power Connectors
Two 1/4" tab connectors located on the circuit board are used to apply power to the module.

Relay Connectors
Each relay has three ¼" tab connectors for common, normally open, and normally closed contacts. Female mating connectors (not included) are required for connecting user circuits.

Network Connector
The Ethernet connector is located on a small CPU daughter card that is mounted to the main relay board.

I/O Connector
WebRelay-10 Plus™ includes a 5-position removable terminal connector for discrete inputs and temperature and/or humidity sensors.

Relay Indicators
Ten green LEDs indicate when each relay is energized. The LEDs are located next to the corresponding relays. When the relay is energized, the common and normally open contacts are closed. When the relay is not energized, the common and normally closed contacts are closed.

Module Power Indicator
The green power LED indicator is located on the main relay board in between relays 1 and 6.

Ethernet Indicators
The LINK LED is illuminated green when the module is properly connected to an Ethernet network and is ready to communicate. Network communications will only occur if this LED is illuminated. The ACT LED flashes amber when activity is detected on the network.

1.5 Accessing WebRelay-10 Plus™

Standard Access Using a Web Browser

WebRelay-10 Plus™ has a built-in web server that provides simple web pages that can be accessed directly using a standard web browser. This allows users to access the unit with NO SPECIAL SOFTWARE installed on their computer. This is ideal for applications that require a quick, simple solution that does not need to be accessible to more than a few people. This configuration is simple to setup, simple to use, and can be accessed from any computer.

*Note: Network routers may need to be configured to allow access from computers outside of the local network (see **Appendix C: Accessing WebRelay-10 Plus™TM Over The Internet**).*

Section 2: Installation and Setup

Installation consists of mounting WebRelay-10 Plus™, connecting it to an Ethernet network, providing power, configuring via a web browser, and wiring relay contacts to the device that will be controlled.

For WebRelay-10 Plus™ models, inputs and sensors can be wired to the device using the 5-position terminal connector.

Installation Guidelines (Read Before Installing)

- This unit must be installed by qualified personnel.

- This unit must not be installed in unprotected outdoor locations.

- The WebRelay-10 Plus™ must installed inside an NRTL certified industrial control panel or similar NRTL certified fire/electrical enclosure.

- If the WebRelay-10 Plus™ is used in a manner not specified by Xytronix, the protection provided by the equipment may be impaired.

- This unit must not be used for medical, life saving purposes, or for any purpose where its failure could cause serious injury or the loss of life.

- This unit must not be used in any way where its function or failure could cause significant loss or property damage.

- The relay tab terminals are 1/4" x .032". Use UL listed quick-connect connectors suitable for field connections. Use a suitable crimping tool as specified by the connector manufacturer. Use wire rated for 75ºC (min) for connections to the relays.

Security Notes

WebRelay-10 Plus™ does not employ a general purpose computer operating system and does not have features, such as telnet, FTP, SSH, nor uncontrolled open ports. This means it is unlikely for someone to 'break in' to WebRelay-10 Plus™ and access other devices on your local network. The simplicity of WebRelay-10 Plus™ makes it a inherently secure device. Nevertheless, as with any device installed on a network, appropriate security precautions should be observed.

If WebRelay-10 Plus™ is installed on the Internet, it is recommended that passwords be enabled for the **Control Page**. Passwords should be at least 8 characters in length and use a combination of upper and lower case letters and numbers. For additional security, a firewall may be used to limit access to selected IP addresses. Another option may be to set up a Virtual Private Network (VPN) between the network where WebRelay-10 Plus™ resides and the client machine (web browser, another, ControlByWeb™ product, etc.).

Final Installation Notes

This ControlByWeb™ product supports connection to *10 Mbps* and *100 Mbps* networks. Although 100Mbps networks are faster, the amount of data transferred to and from this device is very minimal and little, if any, performance increase will be gained by setting it to *100 Mbps*. There are advantages, however, to operate this device at *10 Mbps*. At *10 Mbps*, less power is required, the unit runs cooler, and the lifetime of the product will be extended.

Any changes to the Ethernet settings will require a removing and re-applying power to WebRelay-10 Plus™.

2.1 Mounting

WebRelay-10 Plus™ can be mounted to a standard (35mm by 7.55mm) DIN-Rail. Attach the module to the DIN-Rail by placing the top hooks on the back of WebRelay-10 Plus™ to the DIN-Rail and then snapping the bottom hooks into place. Remove from the DIN-Rail by depressing the latch-release on the mounting bracket.

See **Appendix L: Mechanical Information** for additional mechanical details.
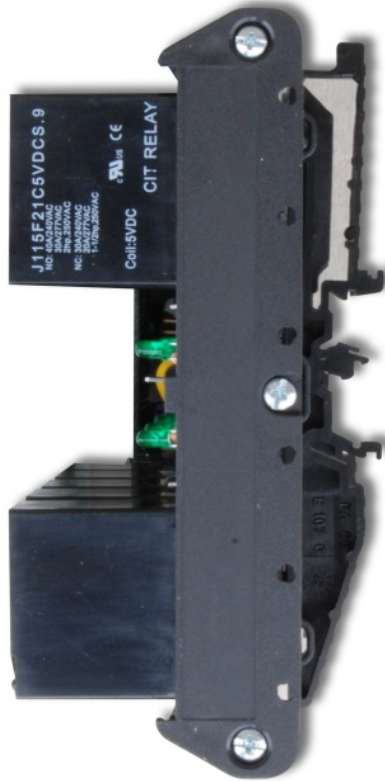

Figure 2.1a - DIN-Rail Mount

2.2 Connections

CAUTION: MAKE SURE POWER IS SHUT OFF BEFORE WIRING!

CAUTION: THIS UNIT SHOULD BE INSTALLED BY A QUALIFIED TECHNICIAN.

MIS-WIRING OR MIS CONFIGURATION COULD CAUSE PERMANENT DAMAGE TO THE WebRelay-10

Plus™ AND/OR THE EQUIPMENT TO WHICH IT IS CONNECTED.

Relay connections are made through the ¼ inch male tab connectors. Mating connectors (¼ inch female tab connectors) can be purchased at electrical supply stores.

It is recommended that the load (device to be controlled) not be connected to WebRelay-10 Plus™ until after WebRelay-10 Plus™ has been configured and tested. By doing this, wiring and configuration mistakes will not cause the attached devices to turn on unexpectedly.

IMPORTANT: WIRES SHOULD BE PROPERLY CRIMPED TO THE CONNECTORS, AND CONNECTORS SHOULD BE PROPERLY ATTACHED TO THE CIRUCIT BOARD OR RELAYS!

2.2.1 Power Supply Connection

WebRelay-10 Plus™ requires power for its internal logic circuits. Connect a 9-28VDC power supply to the Vin+ and Gnd terminals. Note that a regulated power supply is recommended, such as a wall-mount AC-DC adapter. Verify that the adapter is rated for the operating current of WebRelay-10 Plus™ (See **Appendix H: Specifications** for current requirements.)

Multiple WebRelay-10 Plus™ units may be connected to a single power supply by connecting the power supply input terminals in parallel. The power supply must have a high enough current rating to power all units connected. (See **Appendix H: Specifications** for current requirements.)

The power input tab terminals are 1/4" x .032". Use UL listed quick-connect connectors suitable for field connections. Use a suitable crimping tool as specified by the connector manufacturer. Use wire rated for 75ºC (min) for the power connections.

2.2.2 Relay Connection

Direct connection to relay contacts is provided through tab connectors located on the top of the relays. Do not exceed the specified load ratings for relay contacts (see **Appendix H: Specifications** for load ratings). The relay tab terminals are 1/4" x .032". Use UL listed quick-connect connectors suitable for field connections. Use a suitable crimping tool as specified by the connector manufacturer. Use wire rated for 75ºC (min) for connections to the relays.

2.2.3 Network Connection

Connect the Ethernet port to a 10 Base-T or 10/100 Base-T Ethernet connection. This typically connects to an Ethernet hub, switch, or router. For configuration, WebRelay-10 Plus™ may be connected directly to the Ethernet port on a computer using a "crossover" cable. Otherwise, for connection through a hub or router, a standard "straight-through" cable should be used.
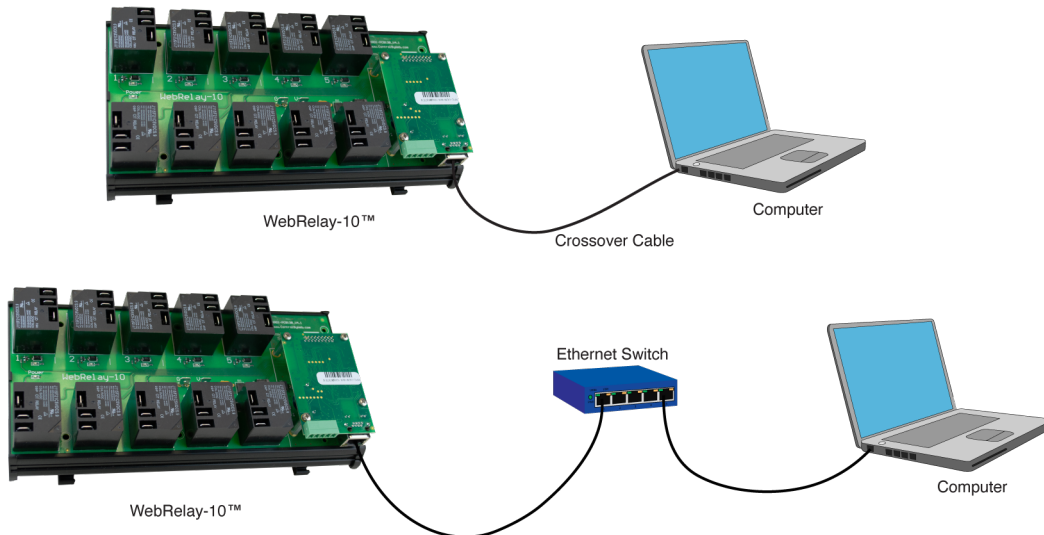
Figure 2.2a - Network Connection

WebRelay-10 Plus™ can be used on a wireless network by connecting through an Ethernet bridge or a wireless router. WebRelay-10 Plus™ is connected directly to the wireless device.
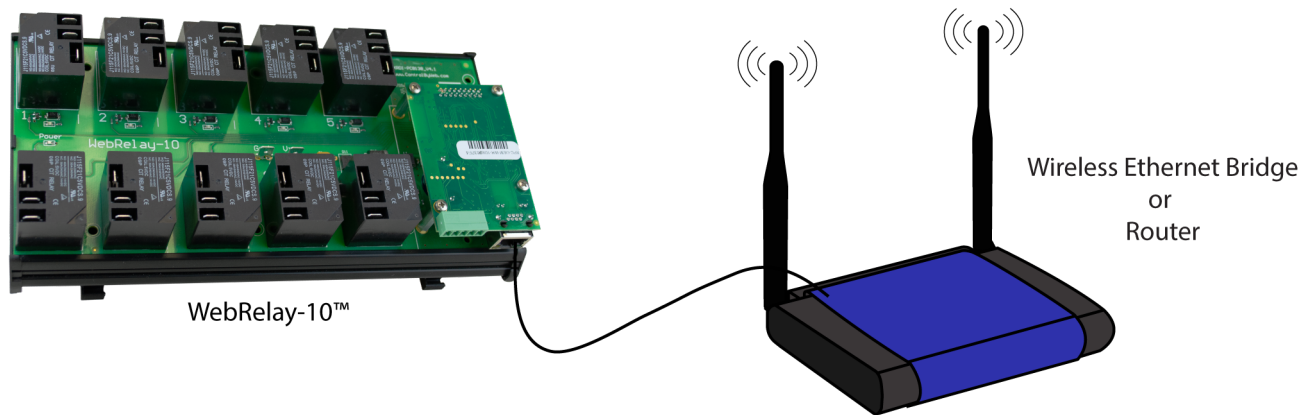

Figure 2.2b - Wireless Connection

Note: The wireless Ethernet bridge or router must be properly configured for the wireless network. Refer to the installation instructions for the wireless device.Terminal Connector.

The removable 5-position terminal connector is used for connecting temperature sensors, humidity sensors, or discrete inputs. The terminals are described in the table below.

IMPORTANT: MAKE SURE WIRES ARE PROPERLY ATTACHED TO THE TERMINALS AND THAT THE SCREW TERMINALS ARE TIGHT!

5-pin connector pinout	
Pin	**Description**
Data	Temperature/Humidity Data. This is the data line connection for the digital temperature/humidity sensors.
+5V Out	This output voltage is used to provide power for the digital temperature/humidity sensors.
Ground	Ground connection for 5VDC output, and Inputs.
Input 1 & 2	Discrete Inputs.

Terminal Connector

Ethernet Connection

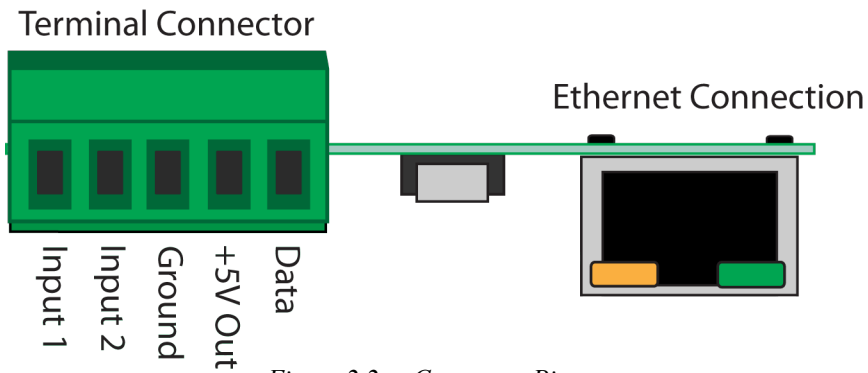Input 1 | Input 2 | Ground | +5V Out | Data

Figure 2.2c - Connector Pinout

Input Connection
Two discrete inputs can be connected to dry contact sensors or switches. Third party sensors can be used for monitoring alarm conditions such as door access switches or transducer thresholds. Inputs can also be used for operator switches and the unit can be configured such that they control the relays.
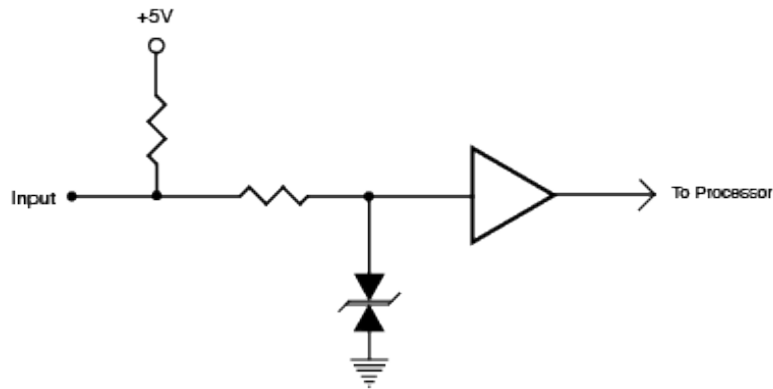

Figure 2.2d - Input Schematic

Connect one terminal of sensor or switch to the input terminal (Input 1 or Input 2). Connect the other terminal to the ground terminal on WebRelay-10 Plus™. When contacts are closed the input is connected to ground and the input is considered to be *ON*. Switch current is less than 2 mA.
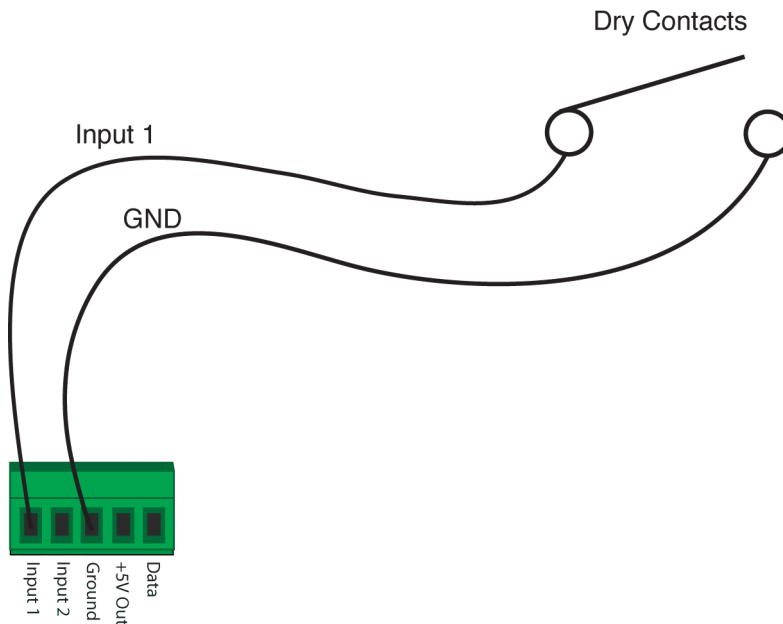
Figure 2.2e - Input Connector

Temperature/Humidity Sensor Connection

Temperature and/or humidity sensors can be used for monitoring environmental conditions. The digital sensors use a one-wire data bus, which allows up to eight sensors to share the same terminals (+5V, Ground, Data). Every sensor on the one-wire bus is assigned a unique serial number when it is manufactured. That number is used to address the device during communication.

The sensors have three wires; the wire color is show in the table below.

Figure 2.2f - Temperature Sensor

Sensor Wire Color	Connection
Red	Vout
Black	Gna
Blue (or White)	Data

Multiple sensors can be connected in two ways, directly connected to the unit (star topology) or "daisy chained" (linear topology) as shown in Figure 2.2g.
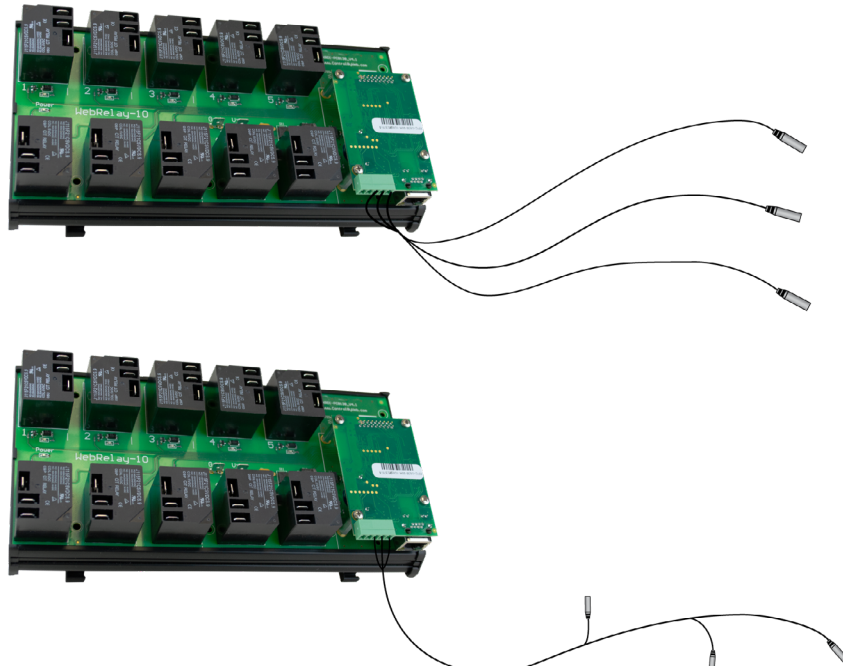

Figure 2.2g - Direct Connection (Star) and Daisy Chain Connection (Linear)

Many factors will determine the maximum length of cable used to connect sensors to WebRelay-10 Plus™. Some of these factors include, but are not limited to, the type of cable used, the number of sensors, ambient electromagnetic noise, and sensor network topology. Combined cable lengths to all sensors of 600 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 permanent installation.

The following are general recommendations that will maximize sensor runs and minimize problems.
Cat 5 and Cat 5e network cable has proven to be an effective and low-cost solution for long runs. Other cable types can be used, but cable capacitance may limit the length. Figure 2.2h shows the recommended connection using Cat 5 network cable.
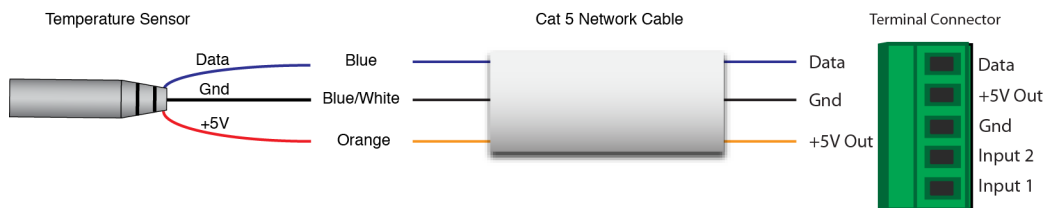

Figure 2.2h - Recommended connection using Cat 5 cable

A linear (daisy chain) rather than a star (direct connection) topology will minimize signal reflections. Appropriate strain relief should be used at the WebRelay-10 Plus™ and other connections that may be subjected to vibration, movement, or repeated handling.

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.

Protect any electrical connections with appropriate weather shielding.
Due to the broad range of applications and environments were the WebRelay-10 Plus™ may be employed, installation success on long sensor runs may vary significantly.

2.3 Establishing Communications for Setup

The WebRelay-10 Plus™ is set up using a web browser. The first task is to establish communications between a computer and the WebRelay-10 Plus™ so that the browser-based configuration can begin. To do this, the computer and the WebRelay-10 Plus™ must be physically connected to the same network and both must have IP addresses on the same network. There are two ways to set up the computer and the WebRelay-10 Plus™ so that they are on the same network. The first (Option 1) is to change the IP address of the WebRelay-10 Plus™ to an address that is on the same network as the computer. The second (Option 2) is to change the IP address of the computer to an address that is on the same network that the WebRelay-10 Plus™ is set to by default.

2.3.1 Option 1: Assign a temporary IP address to the WebRelay-10 Plus™

This option is used to TEMPORARILY assign an IP address to the WebRelay-10 Plus™ without the need to change the IP address of the configuration computer. Note that the WebRelay-10 Plus™ will only use this IP address as long as power is maintained. Once power is lost and restored, the WebRelay-10 Plus™ will use the IP address assigned in the setup page and not the temporary address assigned here. This means that once communications are established, the desired IP address should be entered into the Network setup tab using the browser.

To assign the temporary IP address...

1. Make sure the WebRelay-10 Plus™ and the configuration computer are connected to the same network. This will not work through routers or gateways.
2. Assign the address as follows:

Windows:
Open a Command Prompt (select START, then RUN, then type "cmd").

Note: For Vista, the Command Prompt should be run as administrator (select Start, then type "cmd" and right click on "cmd" and select "Run as administrator").

Type:
> *arp -s {new IP address} {serial number of the WebRelay-10 Plus™ }*
> *Note: IP address format is xxx.xxx.xxx.xxx*
> *Serial number format is ss-ss-ss-ss-ss-ss*
>
> For example, to set the WebRelay-10 Plus™ (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:
>
> ```
> arp –s 10.10.10.40 00-0c-c8-01-00-01
> ```

Next, type:
> *ping -l 102 {new IP address}*
> For example, if the new IP address is 10.10.10.40, the following command would be used:
>
> ```
> ping –l 102 10.10.10.40
> ```

Linux/Unix:
Open a terminal, change to root user (su -, then enter root password).

Type:
>
> *arp -s {new IP address} {serial number of the WebRelay-10 Plus™ }*
>
> *Note: IP address format is xxx.xxx.xxx.xxx*
> *Serial number format is ss:ss:ss:ss:ss:ss*
>
> For example, to set the WebRelay-10 Plus™ (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

```
arp -s 10.10.10.40 00:0c:c8:01:00:01
```

Next, type:
>
> *ping -s 102 {new IP address}*
>
> For example, if the new IP address is 10.10.10.40, the following command would be used:

```
ping -s 102 10.10.10.40
```

Mac OS X:
Open a terminal.
Note: The terminal is in the "Utilities" directory, which is in the "Applications" directory.

Type:
>
> *sudo arp -s {new IP address} {serial number of the WebRelay-10 Plus™ }*
>
> *Note: Administrator password is required.*
> *IP address format is xxx.xxx.xxx.xxx*
> *Serial number format is ss:ss:ss:ss:ss:ss*
>
> For example, to set a the WebRelay-10 Plus™ (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

```
sudo arp -s 10.10.10.40 00:0c:c8:01:00:01
```

Next, type:
>
> *ping -s 102 {new IP address}*
> For example, if the new IP address is 10.10.10.40, the following command would be used:

```
ping -s 102 10.10.10.40
```

2.3.2 Option 2: Assign a temporary IP address to configuration computer

If the first option above is not used, you can use this option to communicate with the WebRelay-10 Plus™. By default, the WebRelay-10 Plus™ comes from the factory with an IP address of 192.168.1.2. Communications with the WebRelay-10 Plus™ may be established by assigning an IP address to the configuration computer that is on the same network as the WebRelay-10 Plus™ (for example, the configuration computer could be assigned to 192.168.1.50)

The following example is for those running the Windows operating system:

Step 1: Open the control panel by clicking on the start menu and then clicking on Control Panel (Figure 2.3a).

Note: The control panel shown (Figure 2.3b) is in "Classic View." If the control panel is in "Category View," select the "Classic View" option before proceeding.
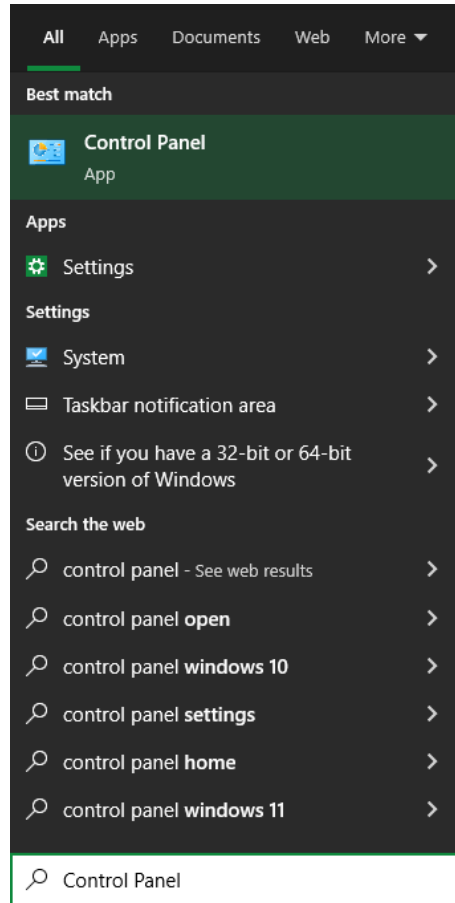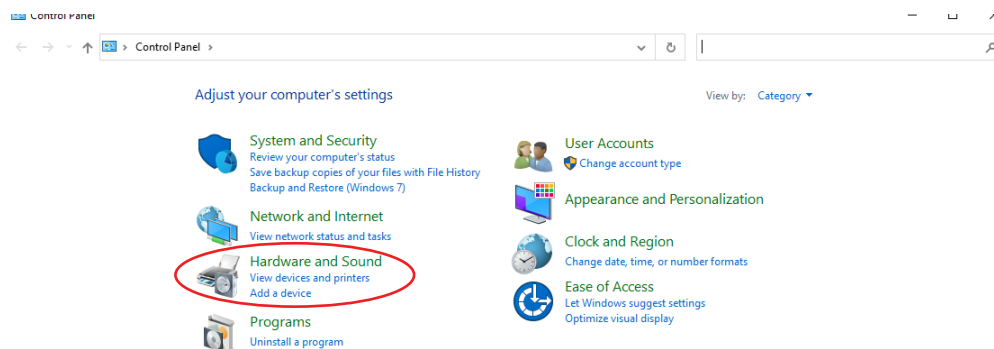

Figure 2.3a - Start Menu

Figure 2.3b - Control Panel

Step 2: Double click on the icon labeled Network Sharing Center. The window shown below will pop-up.

Note: To access the Network Connections folder in Windows Vista, select the Windows Icon (Start Menu) and enter ncpa.cpl into the search bar and press Enter.
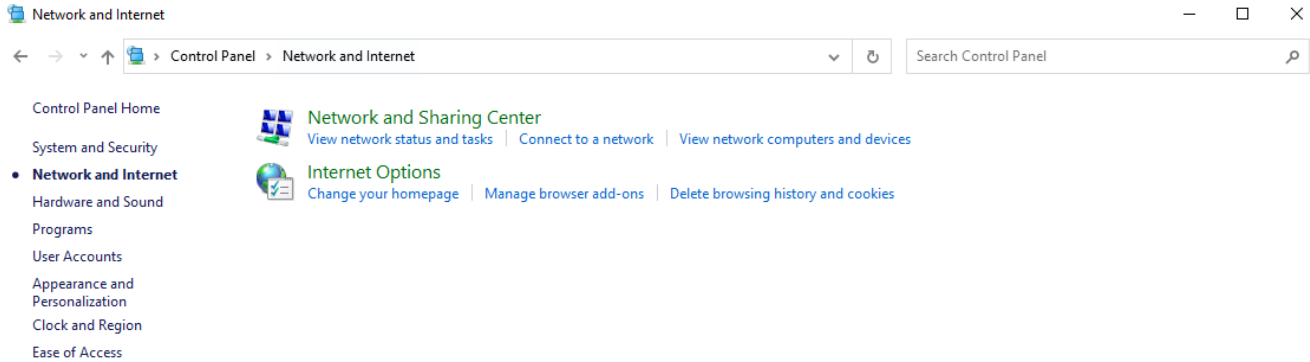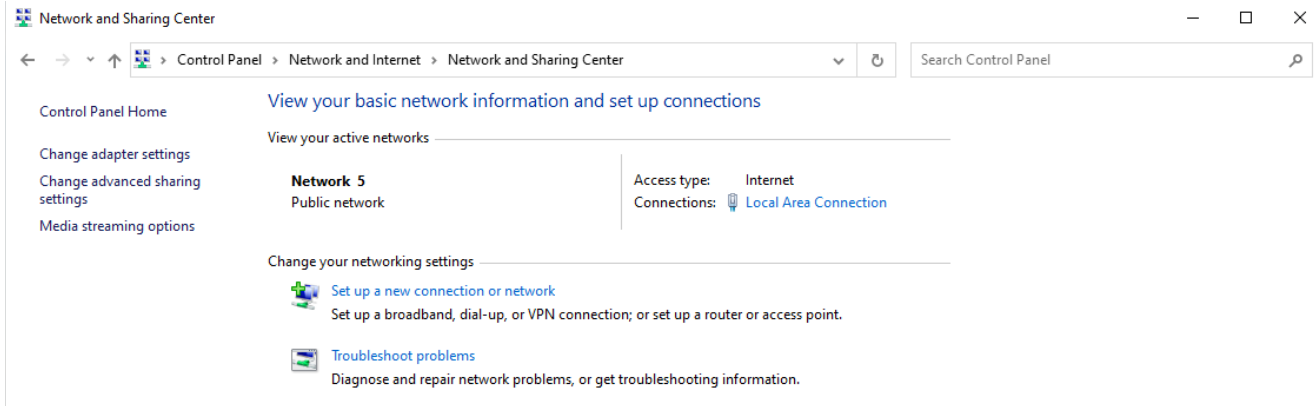

Figure 2.3c - Network and Internet

Figure 2.3d - Network and Sharing Center
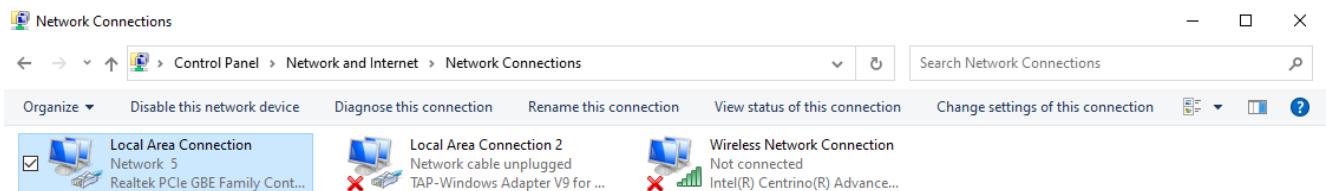
Figure 2.3e - Network Connection

Step 3: Right click on the icon labeled Local Area Connection. In the menu that follows, select the option at the bottom of the menu labeled Properties. The Local Area Connection Properties window will appear. Scroll down to and highlight "Internet Protocol (TCP/IP)," then click the button labeled "Properties."

Figure 2.3f - Local Area Connection

Step 4: The following "Internet Protocol (TCP/IP)" Properties menu appears:
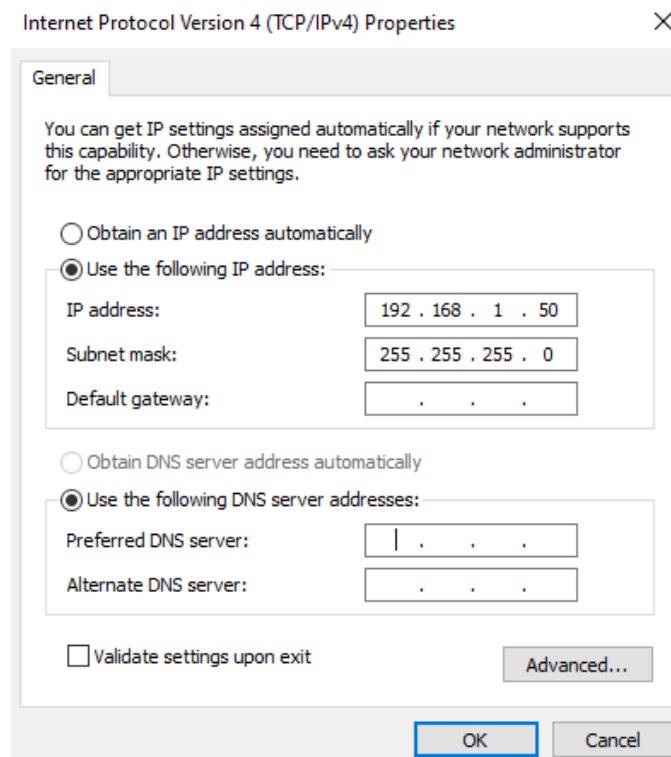
Figure 2.3g - TCP/IP Properties

Step 5: Select the radio button labeled "Use the following IP address" and type in the IP address `192.168.1.50`. Type in a subnet mask of `255.255.255.0`. No need to change the default gateway field. Click OK to accept the new settings.
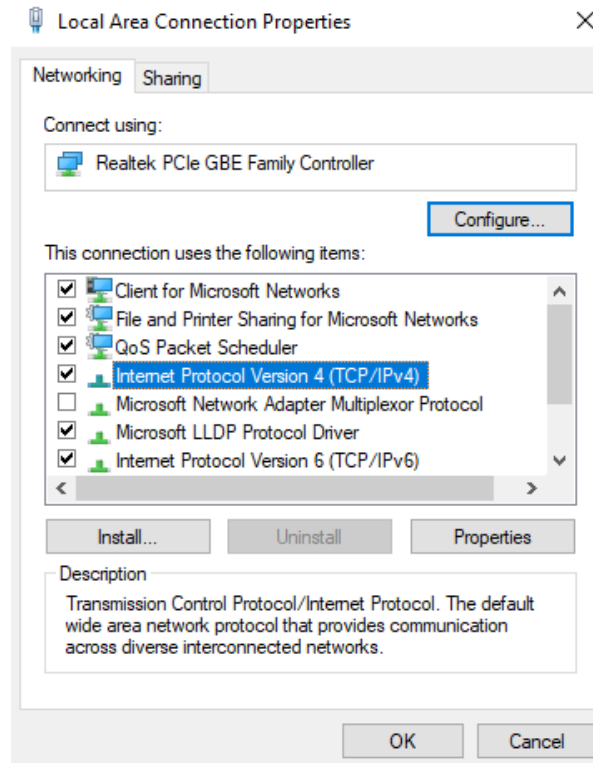
Note: If "Use the following IP address" is already selected, the values need to be recorded, then reentered once the IP address of the WebRelay-10 Plus™ is successfully changed.

2.3.3 Open Configuration Web Page

Once the network is set up, open the setup page as described in section 2.4. If the setup pages are not accessible, verify that the WebRelay-10 Plus™ is powered on and that the LINK light is illuminated. Check all network connections and settings. Another way to check communications is to ping the WebRelay-10 Plus™ (from the command prompt by typing `ping {WebRelay-10 Plus™ Plus IP address}`).

Appendix A: Restoring Factory Default Settings

In the event that the IP address or passwords are forgotten, WebRelay-10 Plus™ may be restored to its original factory default settings.

1. Remove the DC power from the unit. This will also de-energize any relay coils.

2. Use a thin, non-conductive object (such as a toothpick) to press and hold the small button located next to the RJ-45 connector and Ethernet port. When the object is inserted, a tactile feedback can be felt as the button is pressed.

    CAUTION: DO NOT USE METAL OBJECTS FOR THIS FUNCTION.

3. While depressing the button, the green and yellow network LEDs will flash, apply power and wait for about 10 seconds before releasing the button. All settings will be back to the original factory defaults. log.txt and syslog.txt are retained.

4. Refer to **Section 2.3 Establishing Communications for Setup** to begin reconfiguration of the device.

Reset
Button

Figure Appendix A.1 - Restore Factory Defaults

Appendix B: Installing New Firmware

From time to time, updates are made to the module's firmware. As an industrial device and unlike many consumer products, firmware updates are recommended only on an as-needed basis. The firmware can be updated in the field. The procedure for updating the firmware is outlined below. Please note that it is important that this procedure is followed precisely.

Requirements

The firmware update software requires Windows 7/8/10.

Setup

1. Updating firmware will not automatically save settings, scripts, etc. Before proceeding with the firmware update, please back up all settings files and Basic scripts.

2. Contact technical support if a firmware update is needed and a download link will be provided. Only a module's image can be installed on the module, so make sure the correct image is being downloaded.

3. bootloader.exe will connect to the module using default IP address 192.168.1.2, not the address currently assigned to the module. After the update, all settings will be lost and the device will return to its default IP address of 192.168.1.2. Configure the PC to the same subnet as the IP address 192.168.1.2, such as 192.168.1.10. For instructions on doing this see *Section Establishing Communications for Setup*.

   Note: The IP address of the module will automatically be set to the default 192.168.1.2 during the update process. Since the module supports Auto Negotiation, a crossover cable is not necessary.

4. Open the bootloader.exe utility on the computer by double clicking on the downloaded file.

5. Within the ControlByWeb™ Programmer utility programmer, select File, then Open. Specify the firmware image downloaded from the ControlByWeb™ web site.

Device Upgrade Procedure

Carefully follow the following steps to put the module into bootloader mode and perform the upgrade:

1. Remove DC power from the module.

2. Using a small, non-conductive tool, press and hold the reset button.

3. While holding the reset button, apply power to the module. The LINK and ACT lights will flash. Continue to hold the reset button for the next step.

4. While holding the reset button, press the Upload Firmware button at the bottom of the ControlByWeb™ Programmer window. After the programming process begins, the reset button can be released.

5. Programming will take approximately 60 seconds, the LINK LED will stop flashing and remain lit. The module will be set to factory defaults with an IP address of 192.168.1.2.

6. Refer to *Section Establishing Communications for Setup* to reconfigure the device. Verify the new version of firmware has been installed by viewing the default setup page with a web browser (http://192.168.1.2/setup.html).

Appendix C: Accessing WebRelay-10 Plus™ Over the Internet

WebRelay-10 Plus™ can be monitored and/or controlled from a remote location over the Internet. Once WebRelay-10 Plus™ can be accessed on the local network, almost all of the settings required to provide remote access are in the router and not in WebRelay-10 Plus™. This guide is not meant to be a tutorial in router setup, but rather to provide a basic overview of remote access. For specific details, the user should refer to the instruction manual for the router on the local network. Users not familiar with basic IP networking should study one or more basic IP networking tutorials before proceeding (many tutorials are available on the Internet).

IP Addresses

Every device on the Internet is identified by a unique address called an IP (Internet Protocol) address. IP addresses are somewhat similar to mailing addresses in that they identify the precise logical location of the device on the Internet. The IP address identifies the global region down to the network and then the specific device on that network. IP addresses are globally maintained and assigned by an entity called the Internet Assigned Numbers Authority (IANA). IP addresses consist of four sets of numbers that range from 0 to 255 and are separated by a decimal. For example, 192.168.200.167 is an IP address.

Every device that is "directly" connected to the Internet uses a "public" IP address. WebRelay-10 Plus™ can be assigned a public IP address for direct connection to the Internet. Typically, a public IP address to would only be assigned to WebRelay-10 Plus™ when it is the only device on the local network. The IP address would be obtained from an Internet Service Provider (ISP).

Due to the limited number of public IP addresses, private networks can be set up with "private" IP addresses. These addresses are used within a local network and have no global designation, they are not routed on the Internet. The following address blocks are designated for private networks (where x represents decimal numbers from 0 to 255): 192.168.x.x, 10.x.x.x, and 172.16.x.x.

A Simple Local Area Network

A small Local Area Network (LAN), can be made up of two or more computers or other devices connected to an Ethernet switch. Each device on the network is assigned a unique private IP address. For example, consider a simple network that consists of a computer, an WebRelay-10 Plus™, and a WebRelay. In this example, the computer is assigned an IP address of 192.168.1.10, WebRelay-10 Plus™ has the IP address of 192.168.1.25 and a WebRelay has and IP address of 192.168.1.26. A person using the computer can access WebRelay-10 Plus™ by entering its IP address in the URL line in the browser,http://192.168.1.25. Similarly, WebRelay™ can be accessed by entering its unique private IP address in the URL line in the browser, http://192.168.1.26.
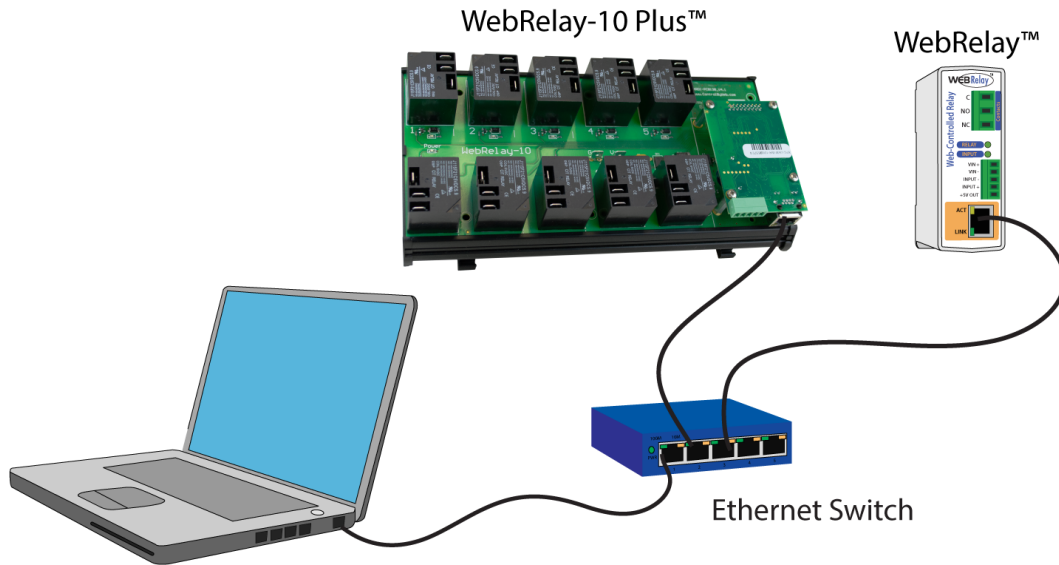
Figure Appendix C.1 - Local Area Network

A Simple LAN connected to the Internet

The LAN in the example above can be connected to the Internet by adding a router and an Internet connection. The router has two network connections. It has an Ethernet network connection that connects to the LAN, and it has another connection that connects to the Internet (this is called the WAN or Wide Area Network connection). Each network connection on the router has an IP address. In our example, the IP address on the LAN side of the router has an address of 192.168.1.1. The IP address on the WAN side of the router has an IP address that has been assigned by the Internet Service Provider such as 266.70.164.97 (note that this is not a valid IP address because each number cannot be larger than 255, but it is used in this example for illustration purposes only).
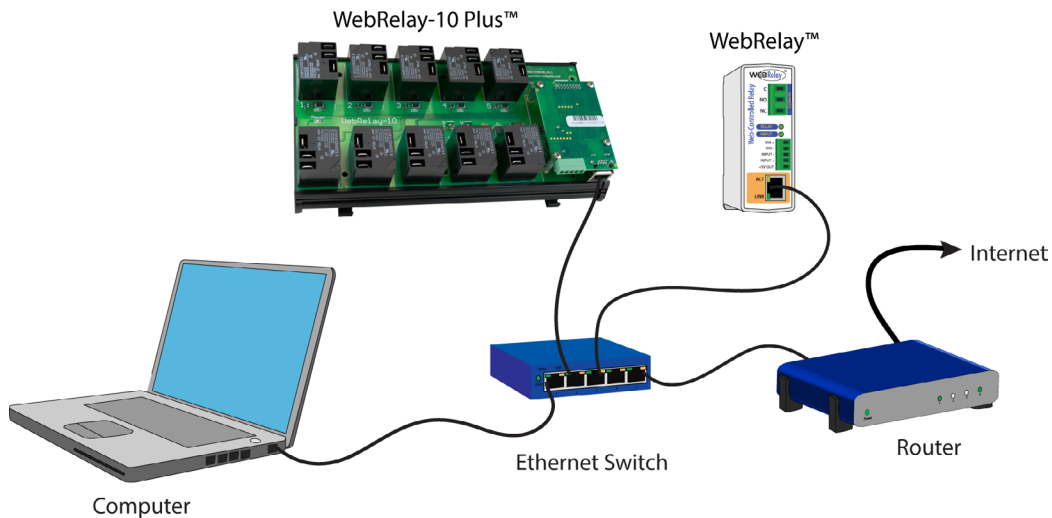
Figure Appendix C.2 - LAN Connected to the Internet

In the example, when a user on the computer needs to access a server on the Internet, the computer sends the request to the router at 192.168.1.1. The router sends the request to the server on the Internet. The server does not send the response directly to the computer on the LAN, but to the router at the IP address of 266.70.164.97. The router then forwards the response to the computer. This way, all devices on the LAN share a single public IP address. This is called Network Address Translation.

Port Forwarding

The router can be configured to allow outside access to the ControlByWeb devices. All requests from the Internet to any device on the local network must use the public IP address (203.0.113.254). With only a single IP address, TCP ports are used to identify the intended device for the incoming message.

Using the mailing address analogy, the port is similar to a post office box. The IP address specifies the location, and the port specifies the specific recipient. Port numbers can be set to any number between 1 and 65535. However, many port numbers are reserved for specific applications and should be avoided. As a general rule, numbers above 8000 are safe to use. All of the ControlByWeb™ devices come from the factory with the HTTP port set to 80, which is the standard port for HTTP. In the example above, the WebRelay-10 Plus™ HTTP port will be changed to port 8000 and WebRelay™ port will be changed to 8001. Once the ports are changed in the two ControlByWeb™ devices, the router must be set up for port forwarding.

Port forwarding associates the IP address of each local device with an assigned port. In the above example, the address 192.168.1.25 for the WebRelay-10 Plus™ would be associated with port 8000. The address 192.168.1.26 for WebRelay™ would be associated with port 8001. The WebRelay-10 Plus™ would be accessed from the Internet by entering the public IP address of the router, plus the port number assigned to the WebRelay-10 Plus™ in the URL window of the browser, http://203.0.113.254:8000. All Internet requests to the router for port 8000 would be forwarded to the WebRelay-10 Plus™. Similarly, all request for port 8001 would be forwarded to WebRelay.

Note: When an HTTP request comes in to the router without the specific port specified (http://203.0.113.254), the router will handle this as a port 80 request (default HTTP port). In other words, http:// 203.0.113.254 is exactly the same as http://203.0.113.254:80.

Router configuration can vary widely. Some routers have the capability of translating the addresses and the ports, which would require no port configuration change on the ControlByWeb device. For example, the router would be configured so that messages sent to http://203.0.113.254:8000 would be forwarded to http://203.0.113.254:80, which is the default HTTP port.

An example screenshot of a router configuration is given below. This setup allows the two ControlByWeb™ devices in the above example to be accessed remotely from the Internet.

Figure Appendix C.3 - Port Range Forwarding   *Note: Routers will vary, this is an example.*

Accessing Setup Pages

After changing ports, the setup pages are accessed on a local network as described below:

```
http://(ControlByWeb Device's Local IP Address):(Port Number)/setup.html
```

For example, to access the setup pages when the port is set to 8000, the following command would be used:

```
http://192.168.1.25:8000/setup.html
```

To access the ControlByWeb™ devices from the Internet, enter the public IP address of the router plus the port number of the desired device in the following format:

```
http://(Public IP Address of Router):(Port Number of Device)/setup.html
```

Using the example above, the following line would be used to access the setup page of the device:

```
http://203.0.113.254:8000/setup.html
```

Appendix D: Log Files

WebRelay-10 Plus™ logs information to two different log files; log.txt and syslog.txt. Both log files are text files and are stored in non-volatile memory; this data will not be lost due to power failure. The log files are stored in circular buffers which write from the beginning of the allocated memory space to the end, and then repeat from the beginning (over-writing the original data). The non-volatile memory is divided into 4K byte sectors. Each time data gets erased to make room for new data, a full sector (4K bytes) is erased at one time.

Data log file: log.txt

This log file is user-configurable under the **Logging** setup tab, and stores real-world data such as temperatures and events such as relay state changes (see section **2.4.6 Logging Tab** for more information). It can be up to 3072K bytes long and is stored using a comma separated value formatting scheme.

Digital Inputs, Relays, Analog Inputs, and Sensors will only be displayed if they are selected in the **Logging** setup tab. The file is read by requesting the log.txt file from WebRelay-10 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, Input 1, Input 2, Relay 1, Relay 2, ..., Relay 10,
Sensor 1, Sensor 2 ... Sensor 8, Source: State
```

Date and time of event:
      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)

Example:
```
Date Time,I1,I2,R1,R2,R3,R4,R5,R6,R7,R8,R9,R10,S1,S2,S3,Source
11/15/2010 11:00:46,0,1,1,1,1,0,1,0,1,0,1,1,078.0,076.4,082.7,Input02:(on)
11/15/2010 11:00:48,0,0,1,1,1,0,1,0,1,0,1,1,078.0,076.4,082.7,Input02:(off)
11/15/2010 11:01:08,0,0,0,0,0,0,1,0,1,0,1,1,078.0,076.5,082.9,Relay03:(off)
11/15/2010 11:02:04,0,0,0,0,0,1,1,0,1,0,1,1,077.7,076.4,083.4,Relay04:(on)
```

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
```

To erase the file, use the following parameter in the address bar:

```
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 (control password) will be required to access this file.

System log file: syslog.txt

The syslog.txt file records various system events, which can be used for diagnostics and troubleshooting purposes.

File Format:

```
MM/DD/YYYY HH:MM:SS, (category to which message applies): (message)
```

Sample File:

```
01/02/2010 04:08:13 DEVICE: Power Up.
01/01/2010 00:41:05 DEVICE: Reset factory defaults.
```

Listed below is a description of messages that a user may see:

Category:	Message:	Description:
DEVICE	Power Up	Device has been properly powered.
	Initialize	Device is ready.
	Reset Factory Defaults	Device has been reset to factory defaults.
EMAIL	Failed DNS Lookup	Unable to lookup mail server due to an incorrect DNS setting.
	Bad Username	Email was not sent due to an incorrect user name.
	Bad Password	Email was not sent due to an incorrect password.
	Authentication Required	A user name and password are required by the mail server.
	No Response	No response from SMTP server.
CLOCK	RTC Reset	Real Time Clock has been reset.
NTP SERVER	Request Attempt	Device attempting to connect to NTP Server.
	Failed DNS Lookup	Unable to lookup NTP server name due to an incorrect DNS setting.
	Success	Device successfully connected to NTP Server.
REMOTE SERVER	Failed DNS Lookup	Unable to lookup Remote Server due to an incorrect DNS setting.
	Connection Attempt Started	Connection port with Remote Server has ben opened.
	Connection Closed	Connection port with the Remote Server has been closed.
DHCP	Address Acquired	IP address request successful, and IP address assigned.
	Lease Renewal	IP address assigned to device was renewed.
MAIN_MCU	New Firmware Loaded	New firmware has been loaded to the device.

This file is read by requesting the syslog.txt file. For example, using the default IP address the following command would be used:

```
http://192.168.1.2/syslog.txt
```

Note: The setup user name and password are required to access this file.

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/syslog.txt
```

To erase the file, use:

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

Appendix E: External Server and Remote Services

Note: The following methods are supported by WebRelay-10 Plus™; however, Xytronix Research & Design, Inc. does not provide or support custom third party applications, or external web servers.

Accessing WebRelay-10 Plus™ with Custom Software or Third Party Applications

WebRelay-10 Plus™ provides a programming interface that allows applications running on a computer to have full access to it. Custom applications can send commands to WebRelay-10 Plus™ for monitoring and control. They can also be used to provide a custom user interface, provide access to multiple units in a single screen, and allow for automation, logging, etc.

Using an External Web Server

Rather than accessing WebRelay-10 Plus™ directly from a computer, an external web server can be used. The term "external" web server is used here to mean a separate web server (such as Apache or IIS) that is not the web server built into WebRelay-10 Plus™. In this scenario, users access custom web pages that reside on the external web server and the external web server communicates with WebRelay-10 Plus™. This means users would not communicate directly with WebRelay-10 Plus™.

Using an external web server to provide a custom user interface is beneficial because multiple WebRelay-10 Plus™ devices (or other ControlByWeb™ products) can be integrated into a single control page or set of pages so they appear as part of a larger system rather than individual devices. In other words, the user may not be aware that he/she is using multiple ControlByWeb™ devices, but rather the user sees a custom control page that shows the entire system. In addition, the use of an external web server allows programmers to create custom user interfaces that take advantage of the additional resources typically available on larger web servers, including more memory and various web programming languages.

There are two approaches that an external server can use to communicate with WebRelay-10 Plus™ and other ControlByWeb™ devices, Direct Server Control and Remote Services.

Direct Server Control

The first approach is for the external server to create a TCP connection whenever it needs to access WebRelay-10 Plus™. In this case, the external server opens the connection, sends commands and/or reads the device, and closes the connection.

This method is ideal when the web server and all of WebRelay-10 Plus™ devices are on the same network (without routers between them). In this case, the server can communicate with WebRelay-10 Plus™ directly and securely since data never has to leave the local network. When the server and WebRelay-10 Plus™ are on different networks, routers must be configured to allow appropriate access. If a public network is used, such as the Internet, security precautions should be considered.

Remote Services

The second approach is for WebRelay-10 Plus™ to initiate a connection using the "Remote Services." The settings under the Advanced Network tab in the setup pages will enable the WebRelay-10 Plus™ to open a TCP connection with an external server. Once the connection is open, the external server can send commands and/or read the device. The external server can leave the connection open (so that it never closes) or close the connection.

"Remote Services" is ideal for installations where the server and WebRelay-10 Plus™ are installed on different networks. This is especially useful when each WebRelay-10 Plus™ is installed on a separate private network. For example, if the user doesn't control the network connections where WebRelay-10 Plus™ is installed, "Remote Services" would initiate a TCP connection over the Internet with the control computer. Since WebRelay-10 Plus™ initiates the connection, the control computer doesn't have to know the IP address of WebRelay-10 Plus™. This means that WebRelay-10 Plus™ can be installed using DHCP. In addition, no special router configuration is required. This makes the network installation of WebRelay-10 Plus™ very simple, and since no incoming ports need to be opened in the router, security is not compromised. See the **Advanced Network** Tab for more information.

WebRelay-10 Plus™ can be configured to establish a connection when triggered by an event, such as an Outlet state changing. This is done by setting the Remote Service/SNMP checkbox in the setup tabs.

When an event occurs and a connection is open, the state.xml file is sent.

If a connection is not open and Remote Services is enabled, a connection will be established by sending the connection string. Once the connection is established state.xml will be sent.

Connection String

With Remote Services enabled, a connection attempt will be made periodically according to the Connection Interval setting in the **Advanced Network** setup tab. The Connection String is a user-defined character string configured in the **Advanced Network** tab.

The connection string is also sent at the same interval once the connection is open. The external server is responsible for closing the connection when it is done.

Appendix F: Specifications

Power Requirements:

- Voltage: 9-28VDC
- Max Current: 477mA - 1391mA

Relay Contacts:

- Number of Relays: 10
- N.O.
    - 40A @ 240VAC resistive
    - 30A @ 277VAC General Purpose
    - 2hp @ 250VAC
- N.C.
    - 30A @ 240VAC, 30VDC resistive
    - 20A @ 277VAC General Purpose
    - 1-1/2 hp @ 250VAC
- Contact Type: SPDT (Form 1C)
- Load Type: General Purpose
- Contact Resistance: < 30 milliohms initial
- Contact Material: AgSnO2
- Electrical Life: 100K cycles (Typical)
- Mechanical Life: 10M cycles (Typical)
- Environmental Rating: Over voltage Category II,
- Pollution Degree 2
- Relay Modes: ON/OFF or Pulse
- Pulse Timer Duration: 0.1 to 86,400 Seconds (1-day)
- Relay Connections: 1/4" Tab Terminals

Digital Inputs:

- Number of Inputs: 2
- Type: Non-Isolated
- Voltage Range: 0-5VDC
- Current: 47K Pullup
- Minimum Hold Time: 20ms
- Input Isolation: Non-Isolated
- Input Functions: Counters, Email Alerts, SNMP Traps
- Maximum Count: 32-bit
- Max Count Rate: 25Hz
- Edge Trigger: Rising, Falling or Both

Temperature Sensors:

- Maximum Number of Sensors: 16
- Type: Dallas Semiconductor DS18B20
- Temperature Range: -67°F to 257°F (-55°C to +125°C)
- Accuracy: ±0.5°C (from -10°C to +85°C)
- Sensor Functions: Monitor Temperature, Log Temperature, Email Alerts, SNMP Traps
- Humidity Type: Xytronix Model X-DTHS-P sensor
- Humidity Range: 0-100% RH
- Accuracy: ±2%
- Max Cable Length: 600 feet (180m) maximum combined cable length

Real-Time Clock:

- Manual or NTP(Network Time Protocol) setup
- NTP Sync Period: Once, Daily, Weekly, On Powerup
- Auto Daylight Savings Adjustment
- Battery (capacitor) Power Backup

Capacitor Power Backup:

- Backup Functions: Retain Real-Time Clock, 1 Register, 2 Counters, 16 Relay States
- Backup Duration: 2 weeks minimum

Network:

- Type: 10/100 Base-T Ethernet Port
- Setup: Static or DHCP IP address configuration

Connectors:

- Accessory Connector: 5-Position, 3.81mm terminal spacing, Removable. For 16-28 AWG wire
- Network: 8-pin RJ-45

LED Indicators:

Number of LEDs: 13 - Power on, Relay coil energized 1-10, Network linked, Network activity

Physical:

- Size:
    - 9.125in (232mm) wide
    - 4.25in (126mm) tall
    - 2.425in (62mm) deep
- Weight: 22 oz (626 grams)
- Enclosure Material: PVC
- Enclosure Flame Rating: UL94 V1
- Operating Temperature: -40°F to 150°F (-40°C to 65.5°C)

Protocols:

- HTTP(S), XML, Modbus, JSON, SNMP, Remote Services, and Remote Monitoring

Logging:

- Log File Size: 3072K (Max 50688 logs)
- Storage: Nonvolatile Flash
- Buffer Architecture: Circular Buffer
- Log data can be periodically read and stored on a computer

Password Settings:

- Password protection on setup page: Yes
- Password protection on control page: Optional
- Password Encoding: Base 64
- Password Length: 6-18 Characters

Electromagnetic Compliance:

- IEC CISPR 22, CISPR 24
- FCC 47CFR15 (Class B)
- EN55024 ITE Immunity (2010)
- EN55022 Emissions (2010)

Product Safety Compliance:

- IEC 61010-1

Appendix G: 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) 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 both ways.

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 damage from Acts of God, such as lightning, 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 H: FCC Statement

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

- This device may not cause harmful interference.
- 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. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause interference to radio communications. There is no guarantee, however, 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.

Appendix I: Trademark and Copyright Information

Appendix J: Mechanical Information