daq™ data acquisition series

Five-Input Module
Users Manual

Revision: 1.6

Covers: **X-DAQ-5I5-5**
         X-DAQ-5I5-I
         X-DAQ-5I24-I
         X-DAQ-5I5-E

CONTROL by WEB™
www.ControlByWeb.com

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Xytronix Research & Design, Inc.

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Trademark and Copyright Information

Warranty

This Xytronix Research & Design, Inc. product has a warranty against defects in material and workmanship for a period of one year 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, the product must be properly packaged, and returned to Xytronix Research & Design, Inc. The purchaser shall prepay all charges for shipping to Xytronix Research & Design, Inc., and 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 United States. If the product is shipped outside of the United States, 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.

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 (Class A for POE models) 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. 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 an outlet on a circuit different from that to which 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.

Installation Guidelines (Read Before Installing)

- Do not open the Five Input Module enclosure. This will void the warranty.
- This unit must be installed by qualified personnel.
- This unit must not be installed directly outdoors.
- 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.

Notes about security

By design, the DAQ Series™ products are very secure. They do not support terminal or file transfer programs such as telnet, ftp, ssh, etc. This means that it is not possible for someone to 'break in' to this module and access other devices on your local network. These products do not support remote firmware updates which means that it is not possible for someone to remotely install malicious software. The simplicity of this series of products makes them very secure. As with any device to be installed on a network, there are some security precautions that should be observed. If this module is installed on the Internet, it is recommended that passwords be enabled for the control page. Make sure secure passwords are used. Passwords should be at least 8 characters in length and should be a combination of upper case letters, lower case letters, and numbers. Don't use passwords that would be easy to guess. For additional security, a firewall may be used to limit access only to selected IP addresses. Another option may be to set up a Virtual Private Network (VPN) between the network where the module resides and the client machine (web browser, PLC, etc.).

Final installation note

 This ControlByWeb™ product supports connection to 10Mbps and 100Mbps 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 100Mbps. There are advantages however, to operate this device at 10Mbps. At 10Mbps, less power is required, the unit runs cooler, and the lifetime of the product will be extended.

Section 1: Introduction

The DAQ Series™ Five Input Module is an industrial grade, Ethernet data acquisition module with five optically-isolated, digital inputs. Each input can be used to monitor the state of a digital signal via a web browser, a custom control application, a Programmable Logic Controller (PLC), or an automation controller. The inputs can be used to trigger email alerts based on a single change of state or after a number of state changes. The inputs can also be used as counters, or can be used to control the relay contacts of other ControlByWeb™ products (such as WebRelay™) that are located at a remote location.

The Five Input Module is very easy to set up using a web browser. It has a simple "Control Page", which displays the status of the inputs. If counters are enabled, the control page can also display the current count and can provide a button which allows users to reset the counter if desired. The control page is very simple, but text colors and specific inputs displayed can be customized in the setup pages.

The Five Input Module provides an XML status page for easy integration with custom monitor and control applications. For interoperability with devices and software produced by other manufacturers, the Five Input Module incorporates Modbus/TCP functionality.

1.1 Features

The Five Input module is very simple but has many features. Some features include...

- No programming required.
- Easy to use as a stand alone device or as part of a large control system.
- Built-in web server provides simple, web based configuration and control.
- Control page can be customized with appropriate text, colors, and buttons.
- 10/100 Ethernet connectivity.
- Five, optically-isolated inputs (de-bounced in firmware).
- Counter for each input.
- Removable terminal connectors (included) simplifies wiring and service.
- XML Status page for simple communications with custom applications.
- Modbus/TCP functionality for systems integration.
- Password protection.
- Selectable TCP ports.
- Inputs can be used to control contacts of remote WebRelay™ devices.
- Power up flag (XML readable only) indicates power failure.

1.2 Available Models

The Five Input module is currently available in four models. There are only two differences between the four models. One difference is the power supply requirements and the other difference is the input voltage range on the optically-isolated input.

Part Number	Power Supply Requirements	Optically-Isolated Input Voltage Range
X-DAQ-5I5-5	5VDC	5-12VDC
X-DAQ-5I5-I	9-28VDC	5-12VDC
X-DAQ-5I24-I	9-28VDC	11-24VDC
X-DAQ-5I5-E	Power Over Ethernet or 5VDC	5-12VDC

1.3 Connectors & Indicators

The input module has a removable 14-position terminal connector and an Ethernet connector. The 14-position terminal connector is used to provide power to the module and is used for all input connections. In addition, a 5 VDC output is provided as a convenient voltage source for the inputs when they are used with dry contact switches or sensors.

There are eight LED indicators on the input module. Five of the indicators are labeled Input 1 through Input 5 and indicate that a signal voltage is applied to the corresponding input. The power indicator is illuminated when the module is powered. Two of the LEDs are located on the Ethernet connector. These LEDs are labeled labeled LINK and ACT. LINK means that the module is properly connected to an Ethernet network. Note that no communications can take place with the module if this LED is off. ACT flashes whenever the module detects network activity. All of the LEDs are green except for ACT which is yellow.
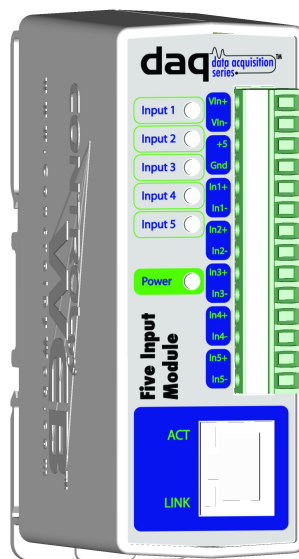
1.4 Example Configurations and Applications

The Five Input Module is very versatile and can be used in many applications. Several basic installation schemes are illustrated in this section.

1.4.1 Basic Configuration

The illustration below shows a simple example of using the input module to monitor a device (or devices) over an IP network. In this example five dry-contact sensors are connected to the five inputs. A voltage for the dry-contacts is provided by the 5V output of the Five Input Module.
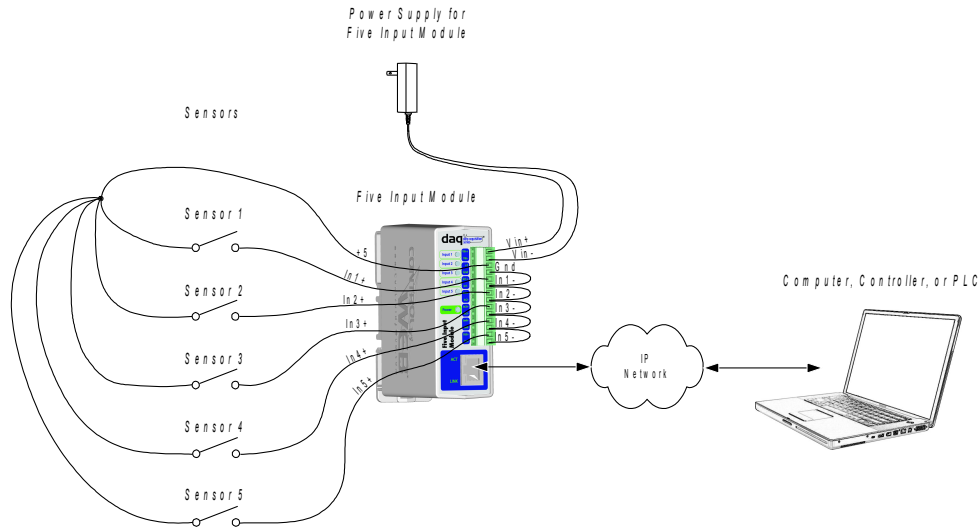
The illustration below shows a simple example connecting digital outputs from a PLC to a Five Input Module. In this example, the voltage for the inputs is provided by the PLC so the 5V output from the module is not used.
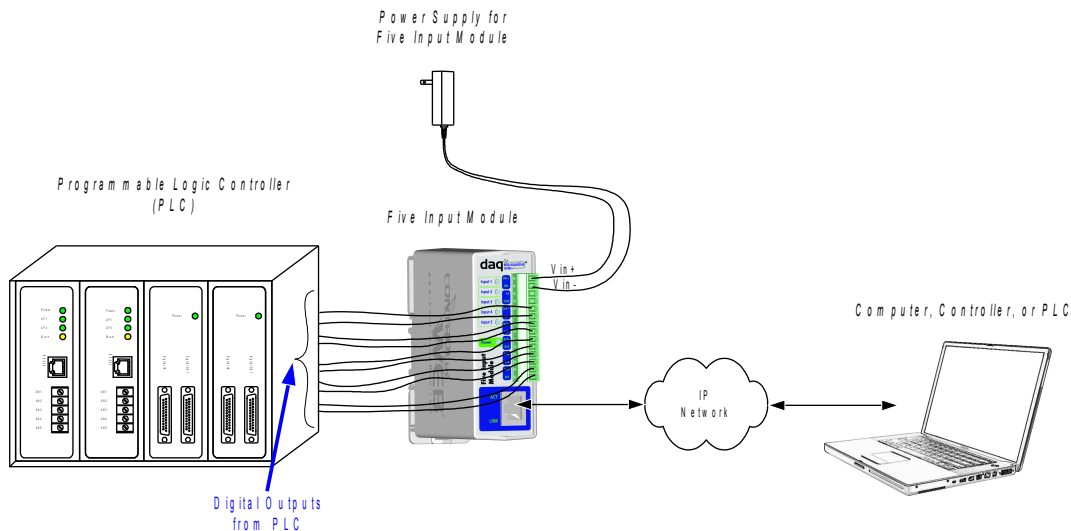
1.4.2 Five Input Module used with other ControlByWeb™ Products

This configuration is used to control devices remotely without a browser, or to extend a digital signal to a remote location on the network. A control voltage applied to the input module controls the relay contacts of WebRelay-Quad™ (or other ControlByWeb™ device) at a remote location. This configuration has may uses. It allows switches to be placed very far away from the devices that they control and sensors to sound alarms at distant locations.
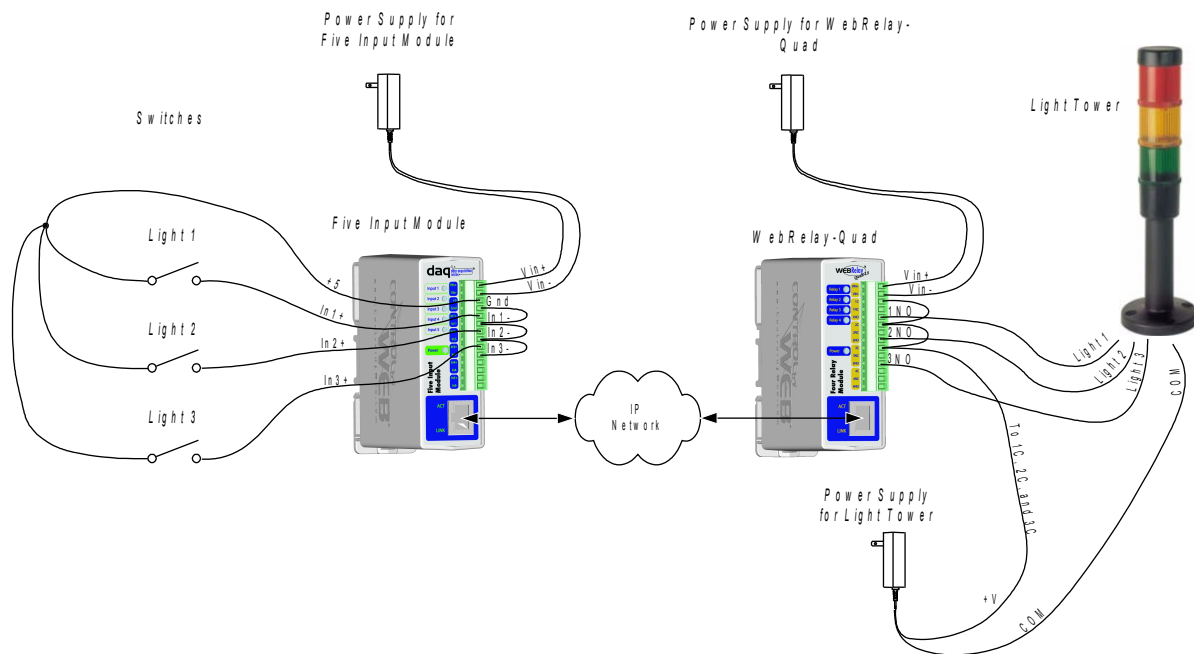
For security applications, the switches in the example could be replaced with sensors, and the device to be controlled could be a buzzers or chimes. A business owner, for example, could set up sensors at his/her office and chimes at his/her home. The chimes at the home would announce each time the sensors detects entry to the office (which may be miles away). When the chime indicates office entry late at night, the business owner can take appropriate action.

Another way this configuration is useful is to extend the outputs of a PLC (Programmable Logic Controller) in a factory to control motors and other devices in another building. The outputs of the PLC are connected to the inputs of the input module and the motor and other devices to be controlled are connected to the relay contacts of a WebRelay-Quad™ (most likely using external relays to switch the loads). This allows any PLC to control devices across an IP network.

The illustration below shows how the input module and WebRelays can be used together to control devices at multiple locations. In the example, a single switch controls four different remote devices.
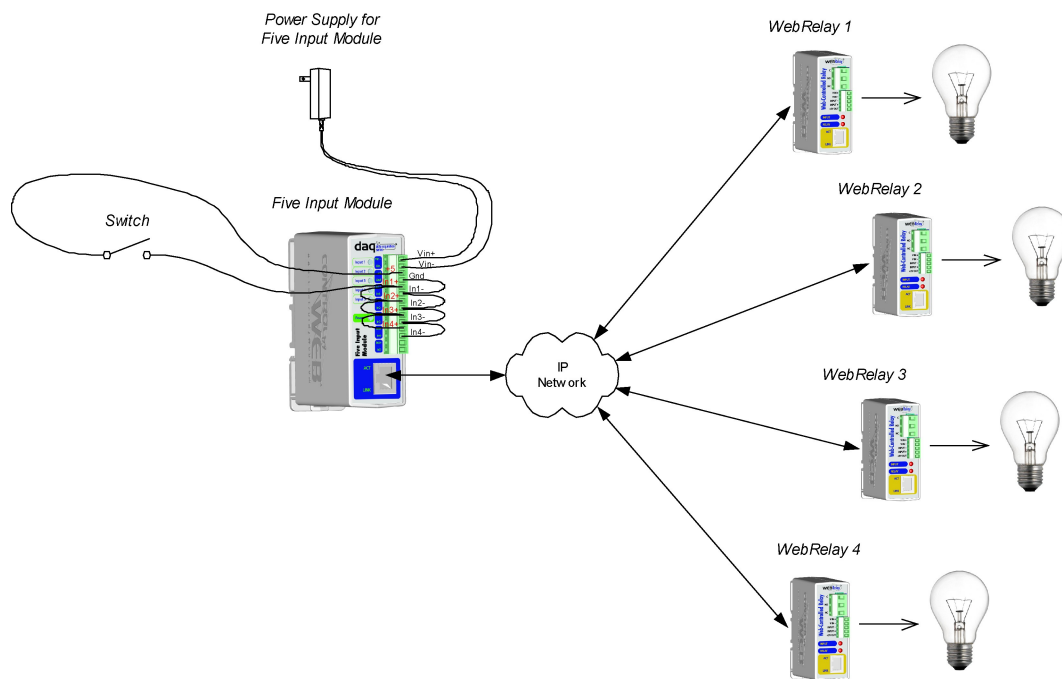
Section 2: Installation and Setup

Installation consists of mounting the input module, connecting to an IP network, connecting inputs, providing power, and configuring via a web browser.

2.1 Mounting

The Five Input Module can be be wall mounted or DIN rail mounted. It should be mounted in a clean dry location where it is protected from the elements. Ventilation is recommended for installations where ambient air temperature is expected to be high.

2.1.1 Wall Mounting

Mount the input module to a wall by using two #8 screws. Attach the screws to the wall vertically spaced exactly 2.5 inches apart. The head of the screws should be about 1/10 inch away from the wall. See **Appendix D** for mechanical details.

2.1.2 DIN-Rail Mounting

The Five Input Module can be mounted to a standard (35mm by 7.55mm) DIN rail. Attach the input module to the DIN rail by hooking the top hook on the back of the enclosure to the DIN rail and then snap the bottom hook into place. Remove the input module from DIN rail using a flat-head screwdriver. Insert the screwdriver into the notch in the release tab and pry against the enclosure to release the bottom hook.
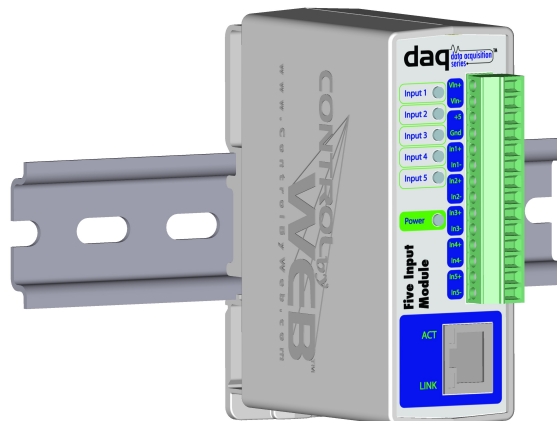
2.2 Connection

CAUTION: MAKE SURE POWER IS SHUT OFF BEFORE WIRING!

A removable14-terminal connectors is provided for simple wiring to the input module. The correct wiring procedure is as follows;

1. Make sure power is turned off.

2. Remove terminal connectors from the input module and make wiring connections to the terminals.

3. Reconnect terminal connectors.

4. Apply power.

IMPORTANT: MAKE SURE WIRES ARE PROPERLY ATTACHED TO THE TERMINALS!

Bad Connector Example.

Strand(s) of wire are loose

Wires are stripped too far back

Good Connector Example.

Wires are stripped correct amount and there are no loose strands that can cause shorts

14-Pin Connector Pinout	
Pin	**Description**
VIn+	Power supply input +. Connect to the positive side of the appropriate power supply. DO NOT EXCEED MAXIMUM POWER SUPPLY VOLTAGE. Model X-DAQ-5I5-5 5VDC Power supply Model X-DAQ-5I5-I and X-DAQ-5I24-I 9-28VDC Power supply Model X-DAQ-5I5-E Power Over Ethernet model. These units do not require a power supply to be connected to this pin when the unit is connected to an 802.3af compliant network. Alternatively, this model can be powered using a 5VDC power supply.
VIn-	Vin- Negative power supply input.
+5	+5VDC Out. This voltage is provided as a convenient voltage source for the optically-isolated inputs (only for 3-12V input models). This is used, for example, when dry contacts (such as a switch) are needed to control the input state. This can be used by connecting the INPUT– directly to Gnd, and then connecting this terminal to INPUT+ through a switch. Do not use this output for other purposes.
Gnd	Ground connection for 5V DC output.
In1+	Optically-Isolated Input 1 +. This is the positive side of the optically-isolated input. Internally, this terminal connects to an opto-isolator through a resistor (no external resistor is necessary as long as the input signal is within the proper range).
In1-	Optically-Isolated Input 1 - : This is the negative side of the optically-isolated input. Internally, this terminal connects directly to an opto-isolator.
In2+	Optically-Isolated Input 2 +. This is the positive side of the optically-isolated input. Internally, this terminal connects to an opto-isolator through a resistor (no external resistor is necessary as long as the input signal is within the proper range).
In2-	Optically-Isolated Input 2 - : This is the negative side of the optically-isolated input. Internally, this terminal connects directly to an opto-isolator.
In3+	Optically-Isolated Input 3 +. This is the positive side of the optically-isolated input. Internally, this terminal connects to an opto-isolator through a resistor (no external resistor is necessary as long as the input signal is within the proper range).
In3-	Optically-Isolated Input 3 - : This is the negative side of the optically-isolated input. Internally, this terminal connects directly to an opto-isolator.
In4+	Optically-Isolated Input 4 +. This is the positive side of the optically-isolated input. Internally, this terminal connects to an opto-isolator through a resistor (no external resistor is necessary as long as the input signal is within the proper range).
In4-	Optically-Isolated Input 4 - : This is the negative side of the optically-isolated input. Internally, this terminal connects directly to an opto-isolator.
In5+	Optically-Isolated Input 5 +. This is the positive side of the optically-isolated input. Internally, this terminal connects to an opto-isolator through a resistor (no external resistor is necessary as long as the input signal is within the proper range).
In5-	Optically-Isolated Input 5 - : This is the negative side of the optically-isolated input. Internally, this terminal connects directly to an opto-isolator.

2.2.1 Power Supply Connection

The input module requires power for its internal logic circuits. Connect appropriate power supply to the Vin+ and Vin- terminals. Alternatively, the input module units with the Power Over Ethernet option may be powered through the Ethernet connection instead of using an external power supply.

Multiple input modules (and other ControlByWeb™ products) 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 specifications for current requirements for a specific model number).

Five Input Module units with the Power Over Ethernet option may be connected to an 802.3af compliant Ethernet port instead of connecting an external power supply. In this case, the input module is powered through the network port. In 802.3af compliant networks, a 48 Volt power source is injected into the Ethernet line. This power source is provided by an 802.3af compliant hub, switch, or power injector which may be located in a utility closet which could be a distance away from the input module. This option is very useful for installations where local power is not available. The power injector may inject the 48 Volt power source through the data lines or the spare lines in the Ethernet cable. DO NOT USE A POWER INJECTOR THAT APPLIES A VOLTAGE TO BOTH THE DATA LINES AND THE SPARE LINES.

2.2.2 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, the input module 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-thru" cable should be used.

2.2.3 Optically-Isolated Input Connections

The optically-isolated inputs can be used to monitor the state of digital signals, they can be used as counters, or they can be used to control relay contacts in other ControlByWeb™ products (for example WebRelay™) over the network. Connect a DC signal voltage directly to the inputs. A current limiting resistor is provided internally, so no external resistor is required. If an AC signal, or a signal greater than the maximum rated input voltage needs to be connected to the input module, use a signal conditioner to convert the signal to the appropriate levels.

Several connection schemes are shown below.

This illustration shows a basic input connection. Here an automation controller with 5 volt outputs is connected to an input module with a 5-12V range.
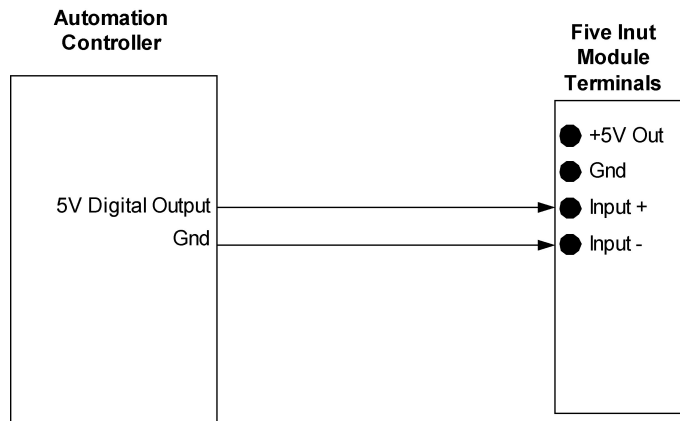
The illustration below shows an input connected to a dry contact. In this case, the 5V output from the input module is used to provide the voltage necessary to activate the input.
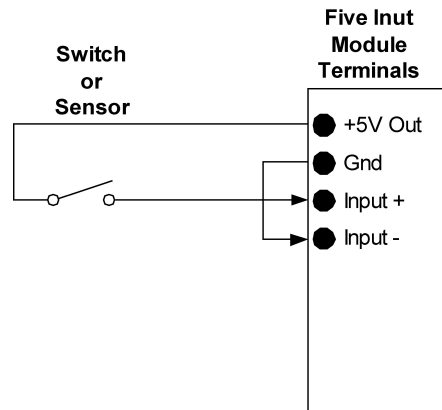
This illustration below shows the input connected to an automation controller with a 24 volt output connected to an input module with a 5-12V range. In this case an external resistor is required. Note that the resistor could be eliminated by using an input module with a 11-24V range.
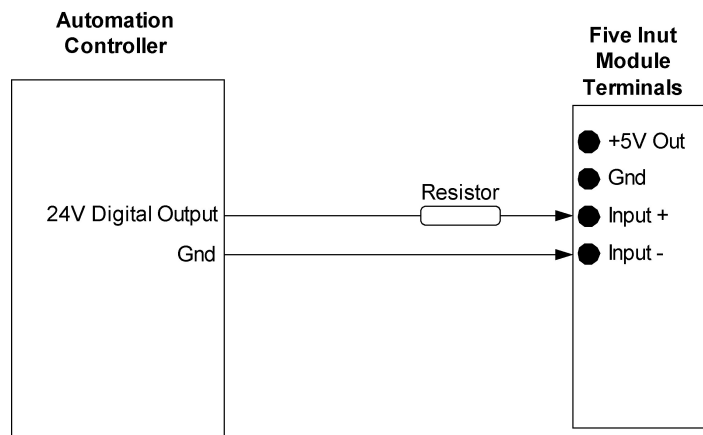

For applications where detection of 120VAC or 240VAC voltages is necessary, a simple DC power supply may be used for signal conditioning. To do this, connect the input of the DC power supply to the 120V or 240V signal and connect the output of the power supply (+5V output) to the input of the Five Input Module.

To connect an AC voltage to the input of WebRelay™, a diode (or bridge rectifier) and a capacitor can be used to convert the AC signal to a DC signal. Signal conditioners can be purchased at industrial automation distributors. A simple voltage converter module manufactured by www.redlion.net is workable.

To connect a voltage to the input of WebRelay™ that is greater than the input is rated, a resistor of the appropriate value and power rating can be used to reduce the voltage. The formulas to calculate external resistor values is provided below:

For Five-Input™ models with a **5-12VDC** input range have an internal 680 ohm resistor. The forward voltage drop of the photo-coupler is approximately 1.2V and works well with an input current of 10mA.

R =((Vin-1.2)/0.01)-680

Where:

- *R = External resistor value required*

- *Vin = Desired input voltage*

- *1.2V = forward voltage drop of the LED in the photo coupler*

- *.01A = workable LED current*

- *680ohm = Internal resistor*

For example:

To connect a 24VDC signal voltage to the Five-Input Module with a 5-12VDC input range:

R = ((24-1.2)/0.01)-680 = 1600 Ohms (use a 1600 ohm resistor)

Check the power dissipated by the resistor:

P = I x I x R, The resistor must be at least .01 x .01 x 1600 = 0.16 Watts, so use a 1/2 Watt resistor

For Five-Input™ models with a **11-24VDC** input range have an internal 2K resistor. The forward voltage drop of the photo-coupler is approximately 1.2V and works well with an input current of 10mA.

R =((Vin-1.2)/0.01)-2000

Where:

- R = External resistor value required

- Vin = Desired input voltage

- 1.2V = forward voltage drop of the LED in the photo coupler

- .01A = workable LED current

- 2000ohm = Internal resistor

For example:

To connect a 48VDC signal voltage to the WebRelay™ with a 11-26VDC input range:

R = ((48-1.2)/0.01)-2000 = 2680 Ohms (use a 2700 ohm resistor)

Check the power dissipated by the resistor:

P = I x I x R, The resistor must be at least .01 x .01 x 2000 = 0.20 Watts, so use a 1/2 Watt resistor

2.3 Establishing Communications for Setup

The Five Input Module is set up using a web browser. The first task is to establish communications between a computer and the the input module so that the browser-based configuration can begin. To do this, the computer and the input module 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 input module so that they are on the same network. The first way (Option 1), is to change the IP address of the input module to an address that is on the same network as the computer. The second way (Option 2) is to change the IP address of the computer to an address that is on the same network that the input module is set to by default.

2.3.1 Option 1: Assign a Temporary IP Address to the Input Module

This option is used to TEMPORARILY assign an IP address to the input module without the need to change the IP address of the configuration computer. Note that the input module will only use this IP address as long as power is maintained. Once power is lost and restored, the input module 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 page using the browser.

To assign the temporary IP address...

  1.   Make sure the input module and the configuration computer are connected to the same physical network. This will not work through routers or gateways.

  2.   Assign the address as follows...

       <u>Windows</u>**:**
       Open a Command Prompt (on Windows XP, select START, then RUN, then type "cmd").
       Type...
            arp -s {new IP address} {serial number of the input module }

          Note: IP address format is: xxx.xxx.xxx.xxx
                 Serial number format is: ss-ss-ss-ss-ss-ss

          For example, to set an input module (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
```

       <u>Linux/Unix:</u>
       Open a terminal, change to root user (su -, then enter root password).
       Type...
            arp -s {new IP address} {serial number of the input module }

          Note: IP address format is: xxx.xxx.xxx.xxx
                 Serial number format is: ss:ss:ss:ss:ss:ss

          For example, to set the IP address of an input module (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 that the terminal is in the "Utilities" directory which is in "Applications" directory.

type
sudo arp -s {new IP address} {serial number of the input module }

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 the IP address of an input module (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 input module. By default, the input module comes from the factory with an IP address of 192.168.1.2. Communications with the input module may be established by assigning an IP address to the configuration computer that is on the same network as the input module (for example the configuration computer could be assigned to 192.168.1.5) .

Instructions for changing the IP address of the computer that will be used for the input module configuration are given here. Note that these instructions are specifically for computers with the Windows XP operating system. For setup using other operating systems, refer to the appropriate users manual.

Step 1:

Open the control panel by clicking on the start menu and then clicking on Control Panel. (Note that control panel shown is in "Classic View". If control panel is in "Category View" select the "Classic View" option before proceeding.)
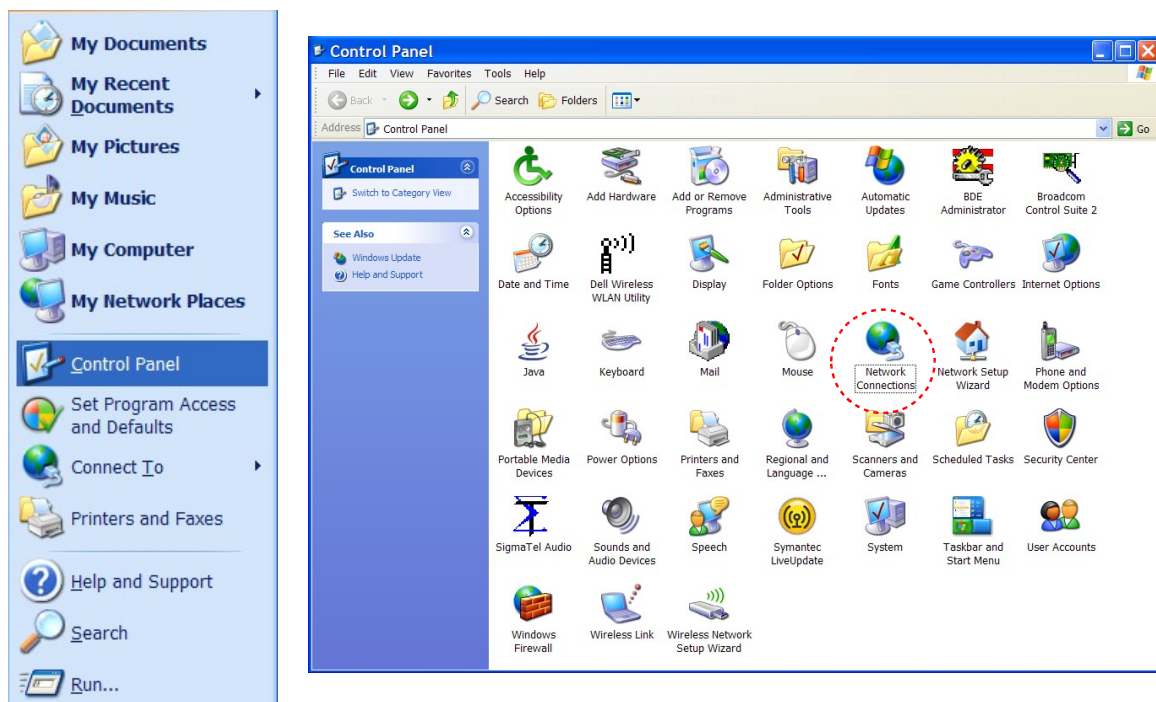
Step 2:

Double click on the icon labeled Network Connections. The following menu will pop up.
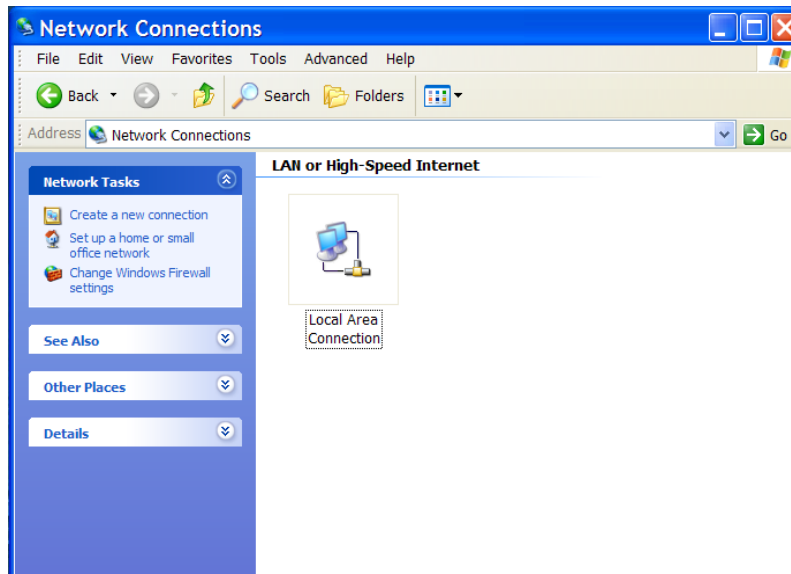
Step 3:

Right click on the icon labeled Local Area Connection. Another menu will appear. Select the option at the bottom of the menu labeled Properties. The Local Area Connection Properties window will appear.

Step 4:

On the Local Area Connection Properties page scroll down to Internet Protocol (TCP/IP), select it, and

then click the button labeled Properties.

Step 5:

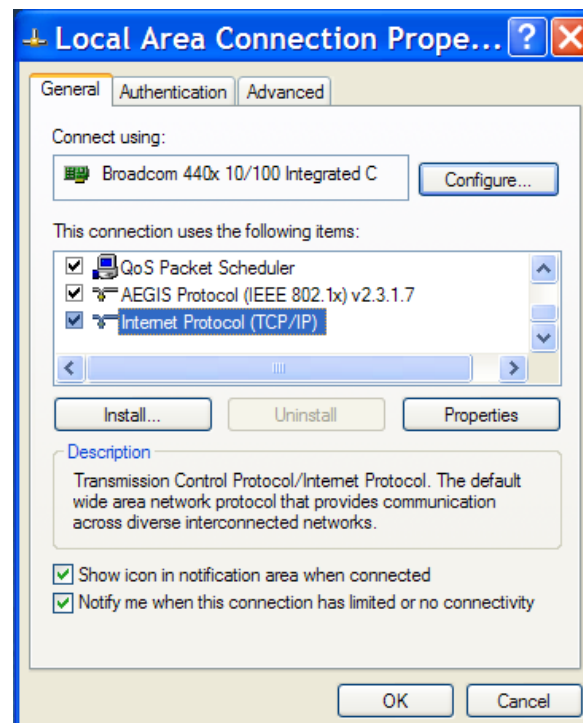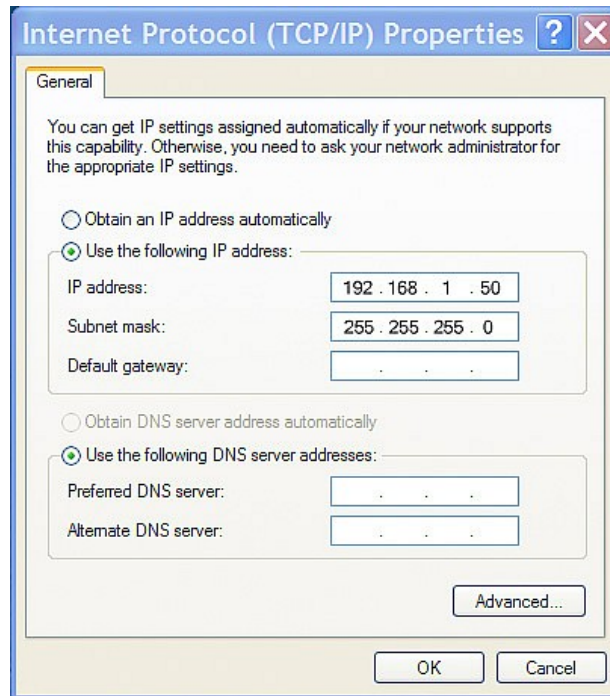Before making any changes to the network settings, write down the current settings so that they can be restored once the input module is configured. Next, select the radio button labeled "Use the following IP address," and type in the IP address 192.168.1.50. Type in a subnet mask of 255.255.255.0. Leave the default gateway field blank. Click OK to apply the new settings.

2.3.3 Open Configuration Web Page

Once the network is set up, open the configuration setup page by typing the following URL into the browser: http://192.168.1.2/setup.html (note that if option 1 above was used for initial configuration, replace the IP address given here with the newly assigned IP address). A password is required to change any parameters. The default password is 'webrelay' (do not include quotes, password is case sensitive).

2.4 Web-Based Setup

The Five Input Module is fully configurable through HTML 4.0 compliant web browsers such as Internet Explorer and Mozilla Firefox. It's easy to use tab based menu system has been designed to allow the unit to be configured easily. Note that in this chapter, the default IP address of 192.168.1.2 is used in all examples. If the IP address has been changed, substitute the new IP address for the address shown in the examples.

Before proceeding, make sure a network connection has been established between the computer and the input module. This is done by typing the following URL into the web browser: http://192.168.1.2/setup.html. Another way to check communications is to ping the input module (from the command prompt (type ping 192.168.1.2)). Each setup page is described below.

2.4.1 Main Setup Page

This is the initial page that appears when the URL http://192.168.1.2/setup.html is entered into the web browser. It provides basic information about the the unit.

Navigating between setup pages is done by clicking on the tabs at the top of the page. All setup pages require a password. The default password is 'webrelay' (no quotes, all lower case) and no username is required.
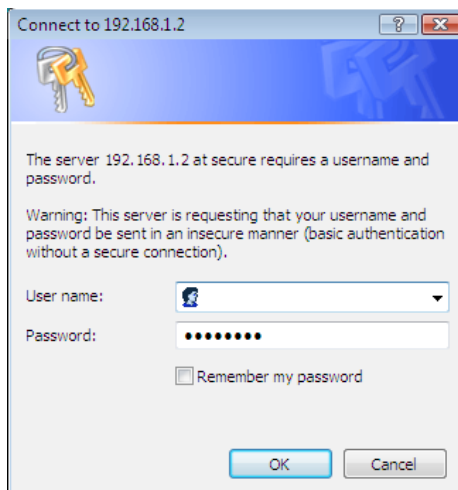
Each setup page has a "Submit" button and a "Reset" button at the bottom of the page. After entering the desired parameters into each page, the "Submit" button must be pressed before any parameters will be saved. If a mistake is made in entering the parameters, the "Reset" button may be used to restore all parameters on the page to their current settings. The "Reset" button is only effective before the "Submit" button is pressed.

2.4.2 Network Setup Page

The network parameters are changed on this page. Note that if multiple ControlByWeb™ products are used on the same network, install one device at a time and set the IP address of each unit before connecting the next unit to the network. This avoids having multiple ControlByWeb™ products installed on the network with the same factory default IP address at the same time. It may be necessary to clear the arp cache each time you swap the input moduleunits on the network (this is because each unit has the same default IP address but different mac address). This is done by typing `arp -d` in the command prompt of a Windows computer (`arp -d -a` as super user on Apple OSX). Also note that the unit must be power-cycled (power disconnected, then reconnected) before network settings take effect. No other setup page requires power-cycling for the settings take effect.

IP Address

The Five Input Module requires a static IP address. This is a unique address that identifies the input module on the network. Dynamic IP address assignment is not supported. The lack of dynamic IP addressing support is intentional because a dynamically changing the IP address would make it difficult for a client to access the web server built into the input module. The IP address is specific to the network where the input module will be installed, and must be obtained from the network administrator.

This guide is not meant to be a tutorial on IP addressing, however, a few comments about IP addressing are given here.

If the input module will be used over the Internet, the IP address must be a routable address assigned by the upstream Internet Service Provider (ISP). In cases where the ISP only provides a single routable IP address for the entire network (this is typical with ISPs such as cable providers), a proxy server (or gateway router) may be used. A proxy server allows multiple devices to connect to the Internet using a single routable IP address. Many small routers from LinkSys, Dlink, and Netgear perform proxy server functions. If a proxy server is used, the input module will not be accessible from the Internet until the proxy server is properly configured (forward proper port to the input module). This information is mentioned for convenience but details of setting up a configuration such as this is beyond the scope of this manual.

If the input module is used on a private network only and is NOT used over the Internet, a routable IP address is not necessary.

If the input module will be installed on a simple, private network that does not connect to the Internet, the default IP address may be used as long as no other device on the network uses the same address. If multiple input module units are installed on the same network, each unit must have its own unique IP address. For example, the input module comes from the factory with a default IP address of 192.168.1.2. If multiple units are used, change the IP address for each unit (192.168.1.3, 192.168.1.4, 192.168.1.5 etc.).

Netmask

This specifies the size of the local network. This must be obtained from the network administrator. By default, the netmask is set to 255.255.255.0.

Broadcast

This specifies the broadcast address. This must be obtained from the network administrator. By default, this is set to 192.168.1.255.

Gateway

This specifies the IP address of the gateway router. This must be obtained from the network administrator. By default, this is set to 192.168.1.1.

TCP Port

This specifies the TCP port used for communications with the input module. By default, the port is set to 80 which is the standard http port. It is recommended that the port not be changed without an understanding of TCP/IP and ports.

Changing the port can be useful for accessing multiple ControlByWeb™ devices which are installed behind a gateway router on a private network that uses private IP addresses (192.168.x.x, 10.x.x.x, and 172.16.x.x through 172.31.x.x are non-routable or private IP addresses).   In this case, each ControlByWeb™ device would be assigned a different port (for example 8000, 8001, 8002, etc). The gateway router would be set up to forward all traffic for each of the assigned ports to the IP address of the ControlByWeb™ unit which uses that port. The ControlByWeb™ device could then be accessed from outside the private network by entering the IP address of the gateway and the port for the desired module. Note that whenever any port is assigned other than port 80, all communications with that ControlByWeb™ device must include the port. For example, if the input module is assigned port 8000, access to the setup page would require the following URL to be entered; http://192.168.1.2:8000/setup.html.

An example screenshot of a gateway router configuration is given below.   This setup allows seven ControlByWeb™ products to be accessed on a private network behind a gateway router. Note that this screenshot is simply an example of a typical router setup page.

Routers will vary.
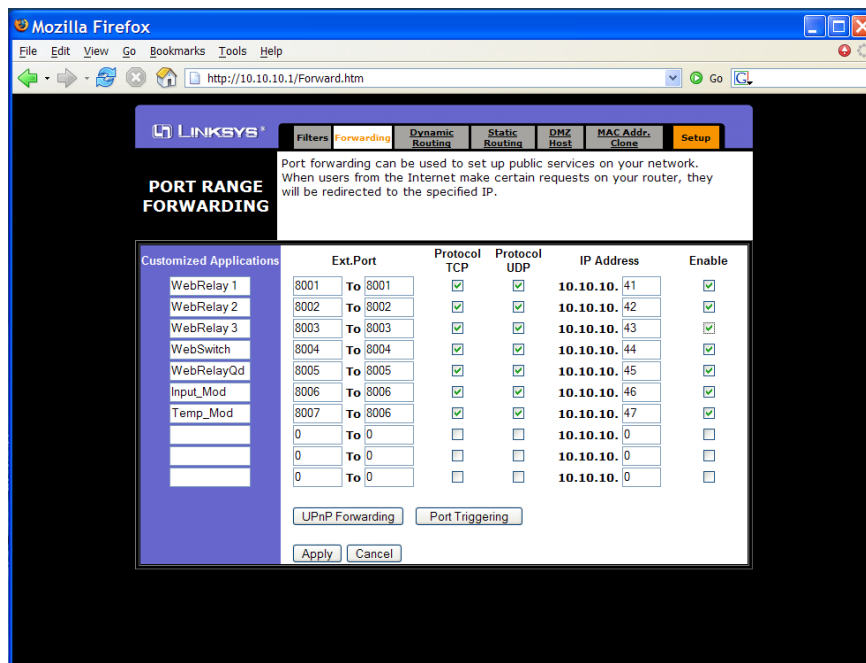
In the example, the seven ControlByWeb™ products are assigned IP addresses of 10.10.10.41 to 10.10.10.47. The first device labeled WebRelay 1 has an IP address of 10.10.10.41 and is assigned port 8001. Note that in the WebRelay™ setup page (under Network settings tab), TCP Port 8001 must be specified for this device.   The second device, labeled WebRelay 2 has an IP address of 10.10.10.42 and is assigned port 8002.   This WebRelay™ must have its TCP Port set to 8002 in it's network settings page. This pattern continues through 10.10.10.77 which is assigned the port 8007. To access the ControlByWeb™ units from the Internet, enter the IP address of the gateway plus the port number of the desired device.

Modbus Port

This specifies the port used for Modbus/TCP communications with the input module. By default this is set to port 502 which is the standard Modbus port. For users not familiar with Modbus, 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. If Modbus is not used, this setting can be ignored. Modbus communications are disabled whenever the control password is enabled.

Speed

This option sets the data rate of the Ethernet port. Both 10Mbps and 100Mbps can be selected. The 100Mbps option offers faster communications but the amount of data to and from the input module is so small that users will not likely notice much of a difference. When the input module is set to 10Mbps, it draws less power and runs a little cooler which translate into a longer product life. IT IS RECOMMENDED THAT THIS SETTING BE LEFT AT 10MBPS UNLESS THE USER HAS A SPECIFIC REASON TO USE 100MBPS.

Mode

This option allows the Ethernet port to be set to Half Duplex or Full Duplex. Legacy Ethernet operates in Half Duplex mode which means that devices can either send data or receive data, but not both at the same time. Full duplex means that devices can send and receive data at the same time.

MTU Setting

To change the MTU, manually enter the advSetup.html (case sensitive) page into the address bar. (http://192.168.1.2/advSetup.html). This new setup page will have a text box that will allow the MTU to be changed. The valid range is 256 to 1476 bytes. MTU is a network parameter that stands for Maximum Transmission Unit. This defines the max size, in bytes, of the TCP packets sent out from the device. This normally can be left alone, but there are some circumstances where it might be beneficial to change it. One of these circumstances is when the device is to be used over a VPN (virtual private network). VPN's add extra information to TCP packets, if the new packets are too big to physically travel across the network (greater than about 1500 bytes) then the packets will be split up. This causes problems for some firewalls and those firewalls will just discard the packets. To fix this, the MTU can be adjusted until the TCP packets do not get split up.

2.5.3 Email Setup Page

The settings on this page are used when the device has been configured to send email messages. The Five Input module requires a SMTP server to send email messages and can be configured to use basic authentication.

DNS Address

If Email notification will be used, enter the IP address of a DNS server. The DNS server is used to look up the IP address of the mail (SMTP) server. If the IP address of the SMTP server is known, the DNS server can be bypassed by leaving the Mail Server field blank and entering the IP address of the SMTP server directly into the DNS Address field.

Mail Server (SMTP)

If email notification will be used, enter the SMTP email server in this field. This is the name of the server (for example... mail.example.com). To use this SMTP server, the Five Input module must first determine the IP address of the SMTP server. This is usually done by using a DNS server. If the IP address of the SMTP server is known, the use of a DNS server can be eliminated. This is done by leaving this field blank and entering the IP address of the SMTP server directly into the SMTP Address field. This will skip the domain name lookup.Mail Server Port

If email notification will be used, enter the port number used by the SMTP server. Port 25 is the standard port for SMTP.

Domain

If email notification will be used, enter a domain name that will be used when communicating with the SMTP server.

User Name

 Most ISPs require authentication to access their mail servers from outside the network, but do not require authentication from inside the network. If authentication is required, enter the user-name here. If authentication is not required, leave this field blank.

Password

 Most ISPs require authentication to access their mail servers from outside the network, but do not require authentication from inside the network. If authentication is required, enter the password here. If authentication is not required, leave this field blank.

Return Email

If email notification will be used, enter the return email address (sender email address) here. Note that the Five Input Module cannot receive email messages so this address is not meant to provide a way to send email messages back to the Five Input Module.

Email 1 Address

If email notification will be used, enter the email address of the first recipient of notification messages.

Email 2 Address

If email notification will be used and messages will be sent to at least two recipients, enter the email address of the second recipient of email notification messages.

Email 3 Address

If email notification will be used and messages will be sent to three recipients, enter the email address of the third recipient of email notification messages

2.4.4 Password Setup Page

The password setup page is used to change and enable passwords. A password is required for the setup pages but is optional for the control page. The password is enabled or disabled for the control page by using the *Yes* or *No* radio buttons. Enabling the control page password also enables the requirement for a password when reading/writing XML pages. Enabling the control page password also disables the ability to communicate with the input module using Modbus. Note that when the password is changed, the password may be displayed in the browser's history in clear text. It is advisable to clear the browsers history after setting the password. Passwords may be alpha-numeric passwords up to 10 characters.

2.4.4 Input Setup Pages

These pages (Input 1 through Input 5) define how the inputs function and create the control page. All five pages are identical with the exception of the Input 1 page which also includes some additional settings for the control page.

The first three parameters only appear on the Input 1 page.

Main Header Text

The text entered here appears at the top of the control page. It also appears in the header of the email text when the email notification is used. This field can be up to 25 characters in length.

Auto Refresh Page

Web pages traditionally display static information. The input module control page, however, displays information that is dynamic. Each time the control page is loaded to the browser, it displays a snapshot of the current status of the unit. Whenever the state of an input changes, the control page will be obsolete until the page is refreshed. The input module can not force the web page to be updated when the input changes. The 'Auto Refresh Page' option will cause the control page to continually update its contents by setting a timer in the web page that causes it to be reloaded at a specified time interval.

Duration

When the 'Auto Refresh Page' option is set to **Yes**, this field specifies the time interval in seconds that the page will be refreshed. It can be set from 1 to 32 seconds.

All of the parameters below appear on all five Input setup pages.

Input Description

The text in this field appears to the left of the input status on the control page. This text also appears in the email status messages when that feature is enabled. This field can be up to 20 characters in length.

Display Input Status

When this option is set to **Yes,** the status of this input will be displayed in the control page. This setting also enables or disables the input status in email alert messages (must be set to **Yes** for this input to appear in email alert messages).

Status ON Color

When 'Display Input Status' is set to **Yes**, this field specifies the color that will be displayed when the input is *on* (voltage applied to input).

Status ON Text

When 'Display Input Status' is set to **Yes**, this field specifies the text that will be displayed when the input is *on* (voltage applied to input). This text also appears in email status messages when the input is on. This field can be up to 15 characters in length.

Status OFF Color

When 'Display Input Status' is set to **Yes**, this field specifies the color that will be displayed when the input is *off* (voltage is not applied to input).

Status OFF Text

When 'Display Input Status' is set to **Yes**, this field specifies the text that will be displayed when the input is *off* (voltage is not applied to input). This text also appears in the email status messages when the input if off. This field can be up to 15 characters in length.

Counter Options

The inputs can be used as counters. This field specifies counter operation. Note that the input voltage must remain on or off for the minimum hold time before counter will be incremented (see specifications in the back of this manual for minimum hold time).

- *counter off*- The counter is deactivated and will not be incremented.
- *increment when input on*- Each time a voltage is applied to the input, the counter will increment.
- *increment when input off*- Each time a voltage is removed from the input, the counter will increment.
- *increment when input changes*- Each time a voltage is applied to or removed from the input, the counter will increment.

Auto-Reset Counter

When this option is set to *Yes,* the counter will reset to 0 as soon as the count reaches the number specified in 'Reset Count' below. When this option is set to *No*, the counter will not reset and will stop when the count reaches its maximum value of 65535.

Reset Count

When 'Automatically Reset Counter' is is set to *Yes,* the counter will reset to 0 as soon as the count reaches the value specified in this field. The counter is reset immediately when it reaches this value so this value will never be returned when the counter is read. For example, if the 'Reset Count' is set to 10, the counter will count from 0 to 9 and return to 0 on the next count. This value can be set from 1 to 65535.

Display Counter

When this option is set to *Yes,* the counter will be displayed on the control page.

Display Counter Reset Button

When this option is set to *Yes,* the counter reset button will be displayed on the control page. This allows users to reset the counter.

Email Options

Simple email messages can be sent when events occur. This parameter is used to specify the events that cause email messages to be sent. Note that email notification will work only if the 'DNS Address', 'Mail Server (SMTP)', and 'Email 1 Address' are correctly set up in the Network setup page.

- *no email*- No email messages will be sent due to state changes on this input.
- *send email when input on*- Each time a voltage is applied to the input, the email status message will be sent to the recipients listed in the Network setup page.
- *send email when input off*- Each time a voltage is removed from the input, the email status message will be sent to the recipients listed in the Network setup page.
- *send email when input changes*- Each time a voltage is applied to or removed from the input, the email status message will be sent to the recipients listed in the Network setup page.
- *send email when counter reaches Email Trigger Count*- When the counter is enabled in the 'Counter Options' and the counter reaches the 'Email Trigger Count' value below, the email status message will be sent to the recipients listed in the Network setup page.

Email Trigger Count

When the counter reaches this value and 'Email Options' is set to '*send email when counter reaches Email Trigger Count*', the status email message will be sent out to the recipients listed in the Network setup page. Note that if 'Automatically Reset Count' is set to **Yes**, this value must be equal to or less than the value of 'Reset Count' or the counter will never reach this value.

Remote Relay Options

Each input can be configured to control the relay contacts of another ControlByWeb™ device (such as WebRelay™) at a remote location. The 'Remote Relay Options' setting is used to specify if and how the input affects the remote relay. The options in the drop down list are described below. Note that in all cases, input changes will only affect the remote relay at the time the input is changed. Once the change has taken place the state of the input has no effect on the state of the remote relay. In other words, if the input causes the remote relay to go on, a user may turn the remote relay off from the web browser, even if the local input is still on.

- *no remote relay control-* The input has no effect on the remote relay.
- *remote command equals input-* When a voltage is applied to the input, a command is sent to the remote device to set the relay state to *on*. When a voltage is removed from the input, a command is sent to the remote device to set the relay state to *off*.
- *remote command opposite of input-* When a voltage is applied to the input, a command is sent to the remote device to set the relay state to *off*. When a voltage is removed from the input, a command is sent to the remote device to set the relay state to *on*.
- *send on command when input on (no off command)-* When a voltage is applied to the input, a command is sent to the remote device to set the relay state to *on*. When a voltage is removed from the input, no commands are sent to the remote device.
- *send on command when input off (no off command)-* When a voltage is removed from the input, a command is sent to the remote device to set the relay state to *on*. When a voltage is applied to the input, no commands are sent to the remote device.
- *send off command when input off (no on command)-* When a voltage is removed from the input, a command is sent to the remote device to set the relay state to *off*. When a voltage is applied to the input, no commands are sent to the remote device.
- *send off command when input on (no on command)-* When a voltage is applied to the input, a command is sent to the remote device to set the relay state to *off*. When a voltage is removed from the input, no commands are sent to the remote device.
- *send pulse command when input on-* When a voltage is applied to the input, a command is sent to the remote device to pulse the relay. When a voltage is removed from the input, no commands are sent.
- *send pulse command when input off-* When a voltage is removed the input, a command is sent to the remote device to pulse the relay. When a voltage is applied to the input, no commands are sent.
- *send pulse command when input changes-* When a voltage is applied to the input or removed from the input, a command is sent to the remote device to pulse the relay.
- *send toggle command when input on-* When a voltage is applied to the input, a command is sent to the remote device to toggle the relay (change the remote relay to the state opposite of its current state). When a voltage is removed from the input, no commands are sent.
- *send toggle command when input off-* When a voltage is removed the input, a command is sent to the remote device to toggle the relay (change the remote relay to the state opposite of its current state). When a voltage is applied to the input, no commands are sent.
- *send toggle command when input changes-* When a voltage is applied to the input or removed from the input, a command is sent to the remote device to toggle the relay (change the remote relay to the state opposite of its current state).
- *remote command equals input (heartbeat mode)* - This is used for a "fail-safe" alarm configuration. This configuration is described as "fail-safe", because an alarm event will sound the alarm, or a network or equipment failure will also sound the alarm. This

configuration is used with a remote WebRelay that controls the alarm. The alarm would be wired to WebRelay using the normally-closed contacts, so as long as the relay is "on", the alarm will remain off. Under normal conditions, the relay stays on because the Five Input Module sends periodic pulse messages that keep the relay turned on. If an alarm condition occurs, the Five Input Module will send a message to the WebRelay unit to turn off the relay and sound the alarm. If there is an equipment failure (for example, the network switch failed), WebRelay will stop receiving the pulse messages. As soon as the pulse timer in WebRelay expires, WebRelay will turn off its relay and the alarm will sound. Note that this can also be used with normally open contacts to ensure that a remote device doesn't remain on in case of a network failure.

When the option "remote command equals input (heartbeat mode)" is selected, the Keep Alive option must also be set to "Yes (TX State)" and the "Keep Alive Period" must be set (50000ms or less is recommended). Set the Keep Alive Period to just under half the pulse time specified in the remote WebRelay. This configuration will cause the Five Input Module to send a message to the remote WebRelay at the interval rate specified by the "Keep Alive Period". When the input is high, it will send pulse commands. When the input is low, it will send off commands. In addition to sending commands at the specified interval, commands will be sent each time the input changes state.

Remote Relay IP Address

When any option in the 'Remote Relay Options' setting is selected other than **no remote relay control**, commands are sent over the IP network to this address as the control voltage input changes.

Remote TCP Port

When any option in the 'Remote Relay Options' setting is selected other than **no remote relay control**, commands are sent over the IP network to this TCP port on the remote device as the control voltage input changes.

Relay

When any option in the 'Remote Relay Options' setting is selected other than **no remote relay control**, commands are sent to the remote device with this relay offset. This option should always be set to 0 if the remote device is a WebRelay™ and should be set to 1, 2, 3, or 4 if the remote device is WebRelay-Quad™. This is used, for example, when the remote device has multiple relays. For example, WebRelay-Quad™ has 4 relays. To send commands to third relay on WebRelay-Quad™, this option would be set to 3. To send commands to the first relay on WebRelay-Quad™, this option would be set to 1. This field may be set from 0 to 255.

For a more technical description of this option, commands sent to remote WebRelay™ units look like this...

```
http://192.168.1.2/state.xml?relayState=1
```

When a 0 is entered into this field, the above format is used which is required for standard the WebRelay™ units.

Commands sent to a remote WebRelay-Quad™ look like this...

```
http://192.168.1.2/state.xml?relay1State=1
http://192.168.1.2/state.xml?relay2State=1
...
http://192.168.1.2/state.xml?relay4State=1
```

In this case, each of the four relays can be addressed as illustrated. The address of the specific relay on the WebRelay quad board is given in this field.

For custom computer applications, the 'Relay #' option may be useful to monitor input changes as they happen. This would work by pointing the 'Remote Relay IP Address' above, to a computer instead of another device. Each time the input changes, a "command" would be sent to the computer indicating the change. The computer could identify the device sending the command by the 'Relay #'. Note that when remote relay commands are sent to a computer instead of a WebRelay™, the computer must appear to this module as a WebRelay™ device which may require some advanced programming.

Password

When any option in the 'Remote Relay Options' setting is selected other than **no remote relay control**, this password is included with commands that are sent to the remote ControlByWeb™ device. If the remote unit has the control password option enabled, the password for that unit must be entered here for the remote commands to have any effect.

Keep Alive

When any option in the 'Remote Relay Options' setting is selected other than **no remote relay control**, the Keep Alive option may be turned on to keep the TCP connection to the remote ControlByWeb™ device alive. If the connection is alive, commands sent to the remote unit will change the state of the remote relay almost instantly (with a good network connection). If the connection is not alive, commands sent to the remote unit will be delayed a few seconds while the connection is being setup. There are three options available in this field.

  - **NO**: When this option is selected, the TCP connection between the two units will be terminated if there is a time gap (more than about 50 seconds) between commands. Once the connection is closed, the two ControlByWeb™ units must re-establish a connection before the next command can be sent. This means that when the input voltage toggles, it may take a few seconds for the remote relay to respond. In many cases, this delay may not be a problem. This option uses the least network bandwidth (and is the most secure) because communications only take place when the input voltage changes.
  - **YES(No TX State)**: When this option is selected, a message is sent to the remote unit every 50 seconds to keep the TCP connection alive. The message does not contain the state of the local input. If power is lost and the control voltage changes while the unit is not powered, the new control voltage status will not be sent to the remote unit when the power is restored. The state will not be updated until the next time the control input changes.
  - **YES(TX State)**: When this option is selected, a message is sent to the remote unit every 50 seconds to keep the TCP connection alive. This message will contain the current state of the input. By sending the state of the unit, changes to the control voltage input will eventually be sent to the remote unit, even if the change occurred during a power loss. Transmit state is only valid for the 'Remote Relay Options' **remote command equals input** and **remote command opposite of input**. If any of the other 'Remote Relay Options' are selected, the state will not be transmitted.

Note: When ControlByWeb™ devices are set up to require a control password, this password must be sent each time the state is updated. When the option is selected to transmit the state of the input each time the keep alive message is sent, the password will be frequently transmitted over the network. This may not be a problem, but the user should be aware that the more often the

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password is sent, the more opportunity hackers would have to capture the password, decode it, and potentially use it to control the remote relay (especially in public networks such as the Internet).

Keep Alive Period

This field is used to specify the time interval that keep alive messages are sent. The default time for this is 50000mS (50 seconds). Note that this field only specifies the time interval between messages sent and does not change the connection timeout period. If the time interval is set longer than 50 seconds, the messages will be sent but the connection timer may expire and close the connection between messages.

Section 3: Operation

Once the input module is set up, operating the units simply consists of reading the input states when necessary. The input states can be read by viewing the control page using a web browser, by sending requests to the XML status/control page, or by using Modbus/TCP.

3.1 Browser Operation

Once the unit is set up, the control page may be accessed by typing the following URL into the web browser: http://192.168.1.2 (Note that if the IP address was changed, replace the default IP address shown with the new address that was assigned. Note also that if any port is used other than port 80, the port must also be included in the request: http://192.168.1.2:8000) A control page with mostly default settings is shown below. In the example control page, none of the text fields have been changed from their default settings. The counter on input 5 has been enabled and is configured to be shown on the control page. Text and colors for the control page can be modified in the setup pages. In the case of the Five Input Module, the control page is really just a page to view the current status of the inputs.
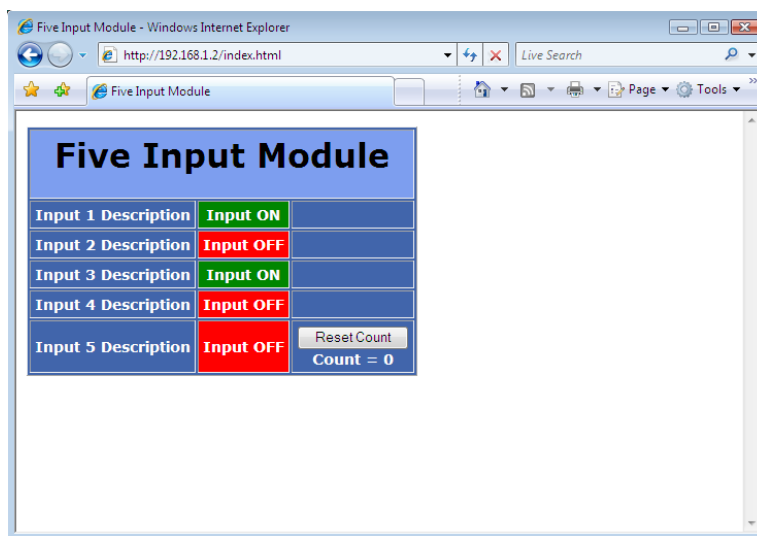
3.2 XML Operation

Custom computer applications can be created to monitor and control the input module without using a web browser. Monitoring the state of the inputs is done by sending a request to port 80 (or port specified in setup) for the XML page. This can be demonstrated by entering commands into the URL line of a web browser.

3.2.1 state.xml

Request the current state: http://192.168.1.2/state.xml

This will return the following XML page.:

```
<?xml version="1.0" encoding="utf-8" ?>
  <datavalues>
      <input1state>1</input1state>
      <input2state>0</input2state>
      <input3state>1</input3state>
      <input4state>0</input4state>
      <input5state>0</input5state>
      <count1>0</count1>
      <count2>0</count2>
      <count3>0</count3>
      <count4>0</count4>
      <count5>0</count5>
      <powerupflag>1</powerupflag>
  </datavalues>
```

The tags <inputXstate> , <countX>, and <powerupflag> indicate the current state of the input module.

Note: 'X' in the case of inputXstate and countX represents the appropriate input number (1-5).

Each tag is described below.

XML Tags	Monitor Values
`<inputXstate>`	0=off (voltage not applied to input) 1=on (voltage applied to input)
`<countX>`	When counters are enabled in the setup pages, this field indicates the current count value.
`<powerupflag>`	This field is used to indicate the loss of power. Whenever the input module is powered, this value is always 1. It can be set to 0 by a user (see command below) and will remain 0 until the module is re-booted. If loss of power is not a concern, this field can be ignored.

Note: The XML reply does not contain headers. To generate an XML reply with headers use the following command:

Command	Description
`stateFull.xml`	Return the XML reply with headers

3.2.2 XML Control

Commands can be sent to the input module to set the counters or to clear the power up flag. Commands are issued by sending http get commands to port 80 (or currently selected port). The two supported commands are `powerUpFlag` and `countX`.

Note: http://192.168.1.2/ would be included on all the following commands.

Example: http://192.168.1.2/state.xml?count1=0

Command	Description
`state.xml?powerUpFlag=0`	Clear the power up flag
`state.xml?count1=0`	Clear counter 1
`state.xml?count1=5&count4=100`	Set counter 1 =5 Set counter 4 = 100

Note: The only values that can be used with `powerUpFlag` is `0`.

When commands are sent to the input module, its current state is returned in the form of an XML page.

Note: The XML reply does not contain headers. To generate an XML reply with headers, use the following command:

Command	Description
`stateFull.xml`	Return the XML reply with headers

The XML commands can also be sent without having the input module return the XML page. This is accomplished by adding the noReply field as follows.

Command	Description
`state.xml?count1=0&noReply=1`	Clear counter 1 without returning state.xml

3.2.3 GET Requests

GET requests can be used by custom applications to monitor and control the input and relay. A few example ET requests are provided below.

No Password Enabled:

GET requests to the device for specific files

Example: Request home.html

```
GET /home.html HTTP/1.1\r\n\r\n
```

Example: Request state.xml

```
GET /state.xml HTTP/1.1\r\n\r\n
```

Password Enabled:

If the control password is enabled in the input module and the XML page is requested through a browser, the browser will prompt the user for the password. If the XML request is sent from another application and not a browser, the html request will need to contain the password encoded using the base 64 encoding scheme. The html request header without the password looks like this:

```
GET /state.xml?noReply=1 HTTP/1.1 (Terminated with two \r\n)
```

The html request header with the password looks like this:

```
GET /state.xml?count1=0&noReply=1 HTTP/1.1 (Terminated with one \r\n)
Authorization: Basic bm9uZTp3ZWJyZWxheQ== (Terminated with two \r\n)
```

where bm9uZTp3ZWJyZWxheQ== is the base 64 encoded version of the username and password none:webrelay

A utility is provided at http://www.ControlByWeb.com/encoder that can be used to encode the password. The utility is used by simply typing the string username:password into the website and pressing encode.

3.3 Modbus Operation

The Five Input Module can be controlled (and read) using Modbus/TCP protocol. This provides a standard means of using the input module in conjunction with devices and software from other manufacturers. This section contains the information necessary to communicate with the input module using Modbus/TCP. This is not a tutorial on Modbus and it is assumed that reader is already familiar with Modbus. Detailed Modbus information can be found at http://www.modbus.org.

It is important to note that when the control password in the input module is enabled, Modbus/TCP communications are disabled. This is because Modbus/TCP does not provide a mechanism for password protection. Make sure the control password is disabled (default) before using Modbus with the input module.

The Five Input Module functions as a Modbus server. Client devices open a connection with the input module on port 502 (unless another modbus port is selected) and send requests or commands to read the state of the inputs, reset the input counter, or clear the power up flag. When the input module receives a command, it will perform the desired function and return a response. The following commands are available:

  - Read Coils (Modbus function 01) - read the status of the power up flag
  - Read Discrete Inputs (Modbus function 02) - read the status of the input
  - Write Single Coil (Modbus function 05) - change the relay state
  - Write Single Register (Modbus function 06) – reset counter
  - Write Multiple Registers (Modbus function 16) – reset multiple counters

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

3.3.1 Read Coils (Modbus Function Code 01 (0x01))

This function returns the state of the power up flag.

Request
  Modbus/TCP:
        Transaction identifier (2 Bytes): 0x0001
        Protocol identifier (2 Bytes): 0x0000
        Length (2 Bytes): 0x0006
        Unit identifier (1 Byte): 0xff

  Modbus:
        Function code (1 Byte): 0x01 (read coils)
        Starting address (2 Bytes): 0x0000
        Quantity of coils (2 Bytes): 0x0001

  Character String Example:
        char read_coils_mb_request[] =
                {0x00, 0x01, 0x00, 0x00, 0x00, 0x06, 0xff, 0x01, 0x00, 0x00, 0x00, 0x01};

Response
  Modbus/TCP:
        Transaction identifier (2 Bytes): 0x0001
        Protocol identifier (2 Bytes): 0x0000
        Length (2 Bytes): 0x0004
        Unit identifier (1 Byte): 0xff
  Modbus:
        Function code (1 Byte): 0x01 (Read coils)
        Byte count (1 Byte): 0x01
        Data(1 Byte): 0x00, 0x01 (bit 0 = power up flag state (1, device has lost power... 0,)

  Modbus Error:
        Function code (1 Byte): 0x81
        Exception code (1 Byte): 0x01 or 0x02

        Exception codes:
        0x01 - Function code not supported
        0x02 - Incorrect starting address / quantity of outputs combination

  Character String Example:
        char read_coils_mb_response[] =
                {0x00, 0x01, 0x00, 0x00, 0x00, 0x04, 0xff, 0x01,0x01, 0x01};

3.3.2 Read Discrete Inputs (Modbus Function Code 02 (0x02))

        This function returns the state of the optically-isolated inputs.

Request
  Modbus/TCP:
        Transaction identifier (2 Bytes): 0x0001
        Protocol identifier (2 Bytes): 0x0000
        Length (2 Bytes): 0x0006
        Unit identifier (1 Byte): 0xff

  Modbus:
        Function code (1 Byte): 0x02 (read inputs)
        Starting address (2 Bytes): 0x0000 to 0x0004
        Quantity of inputs (2 Bytes): 0x0001 to 0x0005

  Character String Example:
        char read_inputs_mb_request[] =
                {0x00, 0x01, 0x00, 0x00, 0x00, 0x06, 0xff, 0x02, 0x00, 0x00, 0x00, 0x05 };

Response
  Modbus/TCP:
        Transaction identifier (2 Bytes): 0x0001
        Protocol identifier (2 Bytes): 0x0000
        Length (2 Bytes): 0x0004
        Unit identifier (1 Byte): 0xff
  Modbus:
        Function code (1 Byte): 0x02 (Read inputs)
        Byte count (1 Byte): 0x01
        Input status: 0x00 – 0x1F (state of inputs, bit0=input 1,,,bit4= input 5)
  Modbus Error:
        Function code (1 Byte): 0x82

Exception code (1 Byte): 0x01 or 0x02
Exception codes:
0x01 - Function code not supported
0x02 - Incorrect starting address / quantity of outputs combination

Character String Example:
    char read_coils_mb_response[] =
        {0x00, 0x01, 0x00, 0x00, 0x00, 0x04, 0xff, 0x02,0x01, 0x1F };

3.3.3 Read Holding Registers (Modbus Function Code 03 (0x03))

Read current counter values

Request:
  Modbus/TCP
    Transaction identifier (2 Bytes): 0x0001
    Protocol identifier (2 Bytes): 0x0000
    Length (2 Bytes): 0x0006
    Unit identifier (1 Byte): 0xff
  Modbus
    Function code (1 Byte): 0x03 (read holding registers)
    Reference number(2 Bytes): 0x0010 to 0x0014
    Register count (2 Bytes): 0x01 to 0x05

  Character String Example:
    char write_registers_mb_request[] =
        {0x00, 0x01, 0x00, 0x00, 0x00, 0x06, 0xff, 0x03,0x00, 0x10, 0x00, 0x05};

Response:
  Modbus/TCP
    Transaction identifier (2 Bytes): 0x0001
    Protocol identifier (2 Bytes): 0x0000
    Length(2 Bytes): 0x0005
    Unit identifier (1 Byte): 0xff
  Modbus
    Function code (1 Byte): 0x03 (read holding registers)
    Byte count(1 Byte): 0x0A
    Register values (2 Bytes): 0xffff -(register count x 2 bytes)
  Modbus Error:
    Function code (1 Byte): 0x83
    Exception code (1 Byte): 0x01 or 0x02

    Exception codes:
    0x01 - Function code not supported
    0x02 - Incorrect starting address / quantity of outputs combination

  Character String Example:
    char read_registers_mb_response[] =
        {0x00, 0x01, 0x00, 0x00, 0x00, 0x05, 0xff, 0x03, 0x02, 0x00, 0x00};

3.3.4 Write Single Register (Modbus Function Code 6 (0x06))

Reset the counter to zero.

Request
    Modbus/TCP:
        Transaction identifier (2 Bytes): 0x0001
        Protocol identifier (2 Bytes): 0x0000
        Length (2 Bytes): 0x0006
        Unit identifier (1 Byte): 0xff

    Modbus:
        Function code (1 Byte): 0x06 (write single register)
        Register address (2 Bytes): 0x0010 to 0x0014
        Register value (2 Bytes): 0x0000   (0x0000 is the only legal value)

    Character String:
        char read_inputs_mb_request[] =
            {0x00, 0x01, 0x00, 0x00, 0x00, 0x06, 0xff, 0x06, 0x00, 0x10, 0x00, 0x00};
Response
    Modbus/TCP:
        Transaction identifier (2 Bytes): 0x0001
        Protocol identifier (2 Bytes): 0x0000
        Length (2 Bytes): 0x0006
        Unit identifier (1 Byte): 0xff
    Modbus:
        Function code (1 Byte): 0x06 (write single register)
        Register address (2 bytes): 0x00010 to 0x0014
        Register value (2 bytes): 0x0000
    Modbus Error:
        Function code (1 Byte): 0x86
        Exception code (1 Byte): 0x01 or 0x02

        Exception codes:
        0x01 - Function code not supported
        0x02 - Incorrect starting address / quantity of outputs combination

    Character String Example:
        char write_registers_mb_request =
            {0x00, 0x01, 0x00, 0x00, 0x00, 0x06, 0xff, 0x06, 0x00, 0x10, 0x00, 0x00};

3.3.5 Write Multiple Registers (Modbus Function Code 16 (0x10))

Reset multiple counters to zero.

Request:
   Modbus/TCP
      Transaction identifier (2 bytes): 0x0001
      Protocol identifier (2 bytes): 0x0000
      Length (2 bytes): 0x0009
      Unit identifier (1 byte): 0xff
   Modbus
      Function code (1 Byte): 0x10 (Write Multiple Registers)
      Starting address (2 Bytes): 0x0010 to 0x0014
      Number of registers (2 Bytes): 0x0001 to 0x0005
      Byte count (1 Byte): 0x02 to 0x0a
      Registers value (2 Bytes per register): 0x0000 (counters can only be set to 0)

   Character String Example:
      char write_registers_mb_request =
         {0x00, 0x01, 0x00, 0x00, 0x00, 0x09, 0xff, 0x10, 0x00, 0x10, 0x00, 0x01, 0x02, 0x00,
     0x00};

Response:
   Modbus/TCP
      Transaction identifier (2 Bytes): 0x0001
      Protocol identifier (2 Bytes): 0x0000
      Length (2 Bytes): 0x0006
      Unit identifier: 0xff
   Modbus
      Function code (1 Byte): 0x10 (Write Multiple Registers)
      Starting address (2 Bytes): 0x0010 to 0x0014
      Number of registers(2 Bytes): 0x0001 to 0x0005
   Modbus Error:
      Function code (1 Byte): 0x90
      Exception code (1 Byte): 0x01 or 2 0x02
      Exception codes:
      0x01 - Function code not supported
      0x02 - Incorrect starting address / byte count combination

   Character String Example:
      char write_registers_mb_response[] =
         { 0x00, 0x01, 0x00, 0x00, 0x00, 0x06, 0xff, 0x10, 0x00, 0x10, 0x00, 0x01 };

3.4 Special Functions

3.4.1 Email Alerts

The Five Input Module can be configured to send an email message to up to three email addresses when inputs change. The email message is basic, but provides the current state of all five inputs and indicates what triggered the message. The header, descriptions, and current state text in the message is taken from the entries in the setup pages.

The message is shown below with default text settings. The text shown in bold indicates that it can be changed by the user.

```
Five Input Module - Email Notification

Email alert triggered by: Input 2 Description

Input 1 Description: Input ON
Input 2 Description: Input ON
Input 3 Description: Input ON
Input 4 Description: Input OFF
Input 5 Description: Input OFF
```

Notice that most of the text in the message above is shown in bold meaning that most of the text can be set by the user. The fields are described below.

   - Five Input Module – This text is set in the 'Main Header Text' field under the Input 1 tab.
   - Input x Description – This text is set in the 'Input Description' for each input.
   - Input ON - This text is set in the 'Status ON Text' for each input.
   - Input OFF - This text is set in the 'Status OFF Text' for each input.

*Note: The email message will only contain the input status for inputs that have the "Display Input Status" set to **Yes** in the Input setup pages.*

Email notification requires that the following fields are set. See Section 2 for description of each field.

> Network Page:
> IP Addressing
> Netmask
> Broadcast
> Gateway
>
> Email Page:
> DNS Address
> Mail Server (SMTP)
> Port
> Domain
> Return Email
> Email 1 Address (Email 2,3 Address are optional)
>
> Input 1, 2, 3, 4, or 5 Pages:
> Email Options
> Use Email Address

Once the email settings are entered, the email functionality can be tested by entering the following command:

```
http://IP address/state.xml?testEmail=1
```

For example, using the default IP address, enter:

```
http://192.168.1.2/state.xml?testEmail=1
```

This will cause an email message to be sent immediately.

3.4.2 Loss of Power Indicator

Some applications (such as security or applications that use counters) could miss or lose important information if the input module loses power. For those applications, it is useful to know when the input module has lost power. The Five Input Module has a flag that keeps track of power loses. Whenever the module is powered, a power-up flag is set. Users can clear this flag after power-up. Once the flag is cleared, it will not be set again until the module looses power. If the flag is set, the user knows that the module has lost power since the last time it was cleared.

The loss of power indicator is included in the XML status page and is read by requesting that page. The flag is cleared by sending a powerUpFlag=0 command. See **Section 3.2** for specific XML command information.

Appendix A: Restoring Factory Default Settings

In the event that the IP address or passwords are forgotten, the input module may be restored to its original factory default settings. To do this, first remove the power from the unit. Next, insert a thin object (such as a toothpick) through the small hole in the bottom of the unit to press the small button that is located inside the unit. When the object is inserted, a tactile feel can be detected as the button is depressed. While holding the button down, apply power and wait for about 10 seconds. After about 10 seconds, release the button.   Now all settings will be back to the original factory defaults.

CAUTION: DO NOT USE METAL OBJECTS FOR THIS FUNCTION.

Reset Button Access Hole
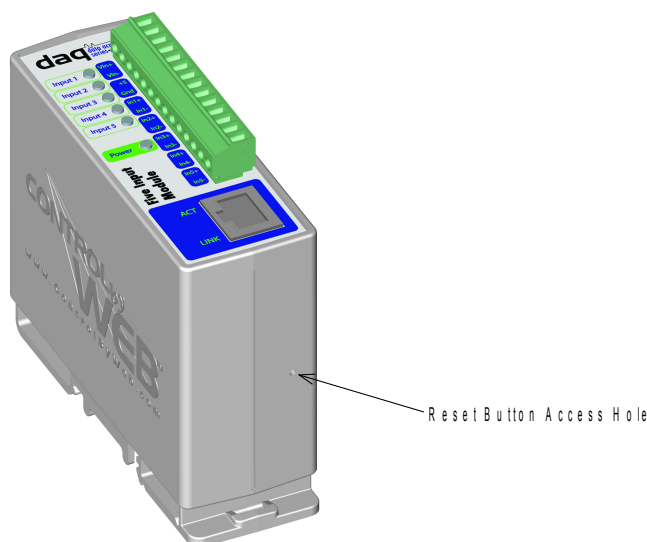
Appendix B: Installing New Firmware

From time to time, updates are made to the Input Module firmware. 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 XP/Vista/7 with the .Net framework installed. The .Net framework is generally installed automatically through Windows update. To install it manually, go to the following address:

http://www.microsoft.com/downloads/details.aspx?FamilyId=333325FD-AE52-4E35-B531-508D977D32A6&displaylang=en

Select the Download button. Once you've downloaded the installation file, double click on the installation file to install the framework.

Setup

1. Download the firmware zip file from the ControlByWeb website. Only an Input Module image can be installed on the Input Module so make sure the correct image is being downloaded.

2. bootloader.exe will connect to the Input Module using default IP address 192.168.1.2, not the address currently assigned to the Input 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 **2.3 Establishing Communications for Setup**.

Note: The IP address of the Input Module will automatically be set to the default 192.168.1.2 during the update process.

Note: A crossover cable cannot be used during the update procedure, an ethernet switch will be necessary to properly update the firmware.
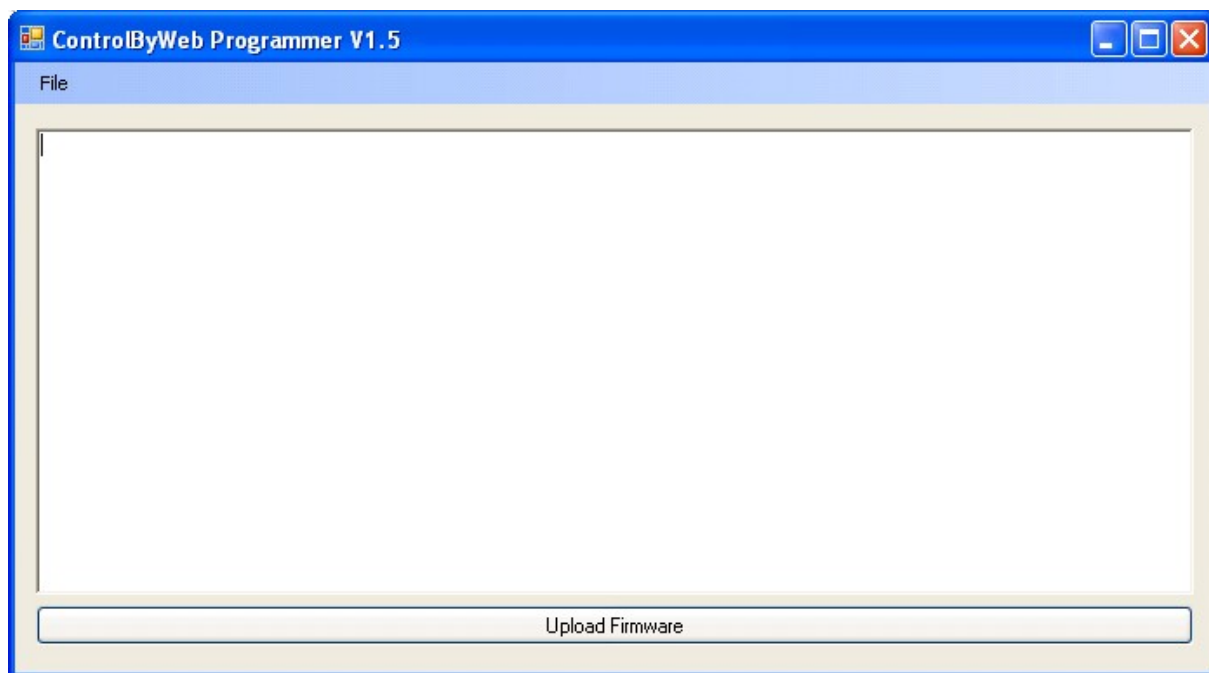

Figure Appendix B.1

3. Open the bootloader.exe utility on the computer by double clicking on the downloaded file (Figure Appendix B.1).

4. 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 Input Module into bootloader mode and perform the upgrade:

1. Remove DC power from the Input Module.

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

3. While holding the reset button, apply power to the Input 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 20-30 seconds, the LINK LED will stop flashing and remain lit. The Input Module will be set to factory defaults with an IP address of 192.168.1.2.

6. Refer to Section **2.3 Establishing Communication for Setup** to reconfigure the Input Module. 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).
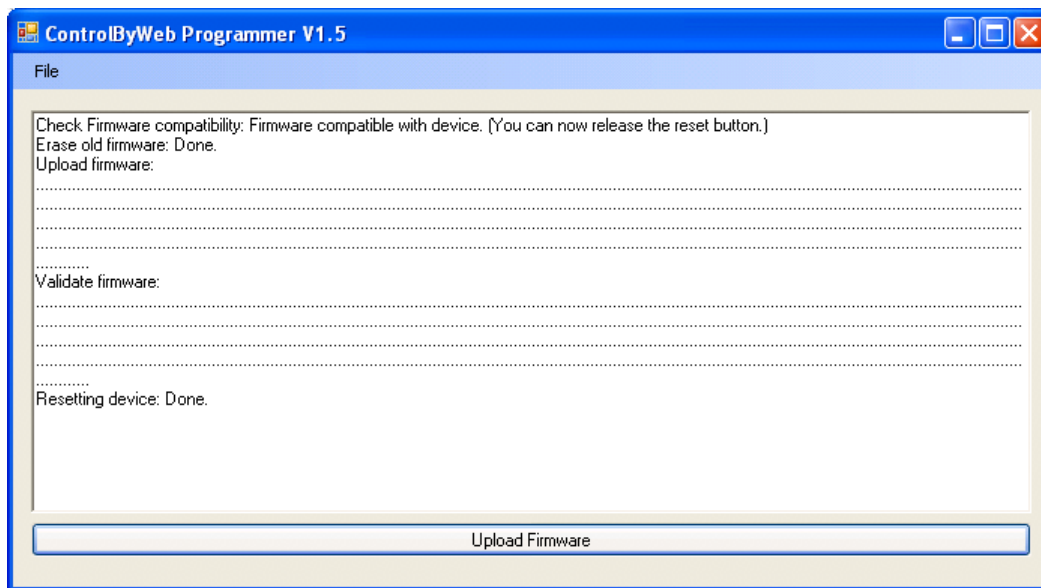

Figure Appendix B.2 - Firmware Update Complete

Appendix C: Specifications

Power Requirements:
Model X-DAQ-5I5-5
Voltage: 5VDC ± 5%

	10Mbps Network	**100Mbps Network**
5 VDC	174 mA	308 mA

Model X-DAQ-5I5-I and X-DAQ-5I24-I
Voltage: 9~28VDC
Current: See table below for typical values

	10Mbps Network	**100Mbps Network**
9 VDC	112 mA	194 mA
12 VDC	88 mA	146 mA
24 VDC	46 mA	76 mA
28 VDC	40 mA	66 mA

Note: If using the internal 5V power supply to power the inputs. Increase current values by 15 mA per Input that is On.

Model X-DAQ-5I5-E
POE Class 1 (0.44Watt to 3.84Watt range). Optionally can be powered with external 5VDC power supply.

I/O: 5 Optically Isolated Inputs

Optically Isolated Inputs:
Input Voltage: 5-12VDC (5V Input models)
Input Current: 4.7mA – 25mA (5V Input models)

Input Voltage: 11-24VDC (24V Input models)
Input Current: 4.9mA – 13.4mA (24V Input models)

Minimum Hold Time on inputs: 62.5mS

Input Functions: Monitor State, Counter, Remote Relay Control

Input to Remote Relay Settings: equal, invert, toggle, latch, pulse, none

Input Isolation: 1500V

Counters:
Number of counters: 5
Counter Triggers: Input transitions - low to high, high to low, or both
Maximum Count: 65535
Counter rollover: can be set to rollover or stop
Maximum count rate: 8Hz

Network: 10/100 Base-T Ethernet
Network Setup: static IP address assignment, TCP port selectable
Connectors:
Power/Input: 14-position, removable terminal strip, 3.81mm terminal spacing
           (Replacement part number, Phoenix Contact 1803691)
Network: 8-pin RJ-45 socket

LED Indicators: 8
 -Voltage applied to inputs 1-5
 -Module powered
 -Network linked
 -Network activity

Physical:
Operating Temperature: -40°C to 65.5°C (-40°F to 150°F)
Size: 1.4in (35.5mm) wide X 3.8in (96.5mm) tall X 3.1 in(78.7mm) deep
Weight: 5oz (142 grams)
Enclosure Material: Lexan 923 (UL94 V0 flame rated)

Password Settings:
Password protection on setup page: Yes
Password protection on control page: Optional
Password Encoding: Base 64
Max password length: 10 characters

Regulatory Compliance:

Electromagnetic Compliance:
IEC CISPR 22, CISPR 24
FCC 47CFR15 (-I and -5 Models class B, POE Model Class A)
EU EN55024, EN55022

Product Safety:
IEC 60950-1 / EN 60950-1

$C\epsilon$ FC

Appendix D: Mechanical Information

3.071

.324
.000
.097

.000

2.040

3.768
3.879

M36 (35mm) DIN RAIL

.000   .481   2.981   3.879

.000

.703

1.406

USE #8 PAN HEAD SCREWS