

NT-RELAY

Basic Application, Setup and Control Manual



Contents

Installation Guidelines (Read Before Installing)

Section 1: Introduction

- 1.1 Features
- 1.2 Connectors & Indicators
- 1.3 Options for Accessing the NT-RELAY
- 1.4 Example Configurations and Applications
 - 1.4.1 Basic Application Example; School Bell/Shift Change Bell Controller
 - 1.4.2 Two Relay Example; Parking Lot Light Controller
 - 1.4.3 Security Example; Control of Electric Locks
 - 1.4.4 Control Example; Timed Control of Electrical Outlets

Section 2: Installation and Setup

- 2.1 Mounting
 - 2.1.1 Wall Mounting
 - 2.1.2 DIN-Rail Mounting
- 2.2 Connection
 - 2.2.1 Power Supply Connection
 - 2.2.2 Network Connection
 - 2.2.3 Relay Connection
 - 2.2.4 Optically-Isolated Input Connection
- 2.3 Establishing Communications for Setup
 - 2.3.1 Assign a temporary IP address to configuration computer
 - 2.3.2 Open Configuration Web Page
- 2.4 NT-RELAY Setup Pages
 - 2.4.1 Main Tab
 - 2.4.2 Network Tab
 - 2.4.3 Advanced Network Tab
 - 2.4.4 Password Tab

Section 3: Operation

- 3.1 Net/X™ Command Center Operation

Appendix A: Restoring Factory Default Settings

Appendix B: Accessing the NT-RELAY Remotely Over the Internet

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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. 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 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 NT-RELAY enclosure. This could damage the unit or cause personal harm and 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.
- This unit must not be used in any way where its function or failure could cause significant loss or property damage.

Notes about security:

By design, NT-RELAY is very secure. It does not support terminal or file transfer programs such as telnet, FTP, SSH, etc. This means it is not possible for someone to 'break in' to NT-RELAY and access other devices on your local network. The simplicity of the NT-RELAY makes it a very secure device. As with any device to be installed on a network, there are some security precautions that should be observed. If NT-RELAY 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 NT-RELAY resides and the client machine (web browser, another, Net/X™ product, etc.).

Final installation note. This Net/X™ 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

NT-RELAY is an Ethernet based, high performance, mini I/O module that has two electro-mechanical relays, two optically-isolated inputs, non-volatile memory for logging, and a real-time clock for full-calendar scheduling. 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 the NT-RELAY using a web browser, or the Net/X™ Command Center PC software. It can also be configured to automatically turn relays on/off at preset times using its advanced scheduler.

NT-RELAY has two optically-isolated inputs that can be used for simple monitoring of discrete (digital) signals such as alarm outputs from a machine, security sensors, switches, etc. The optically-isolated inputs can also be used to control the relays (on/off, pulse, toggle, latch).

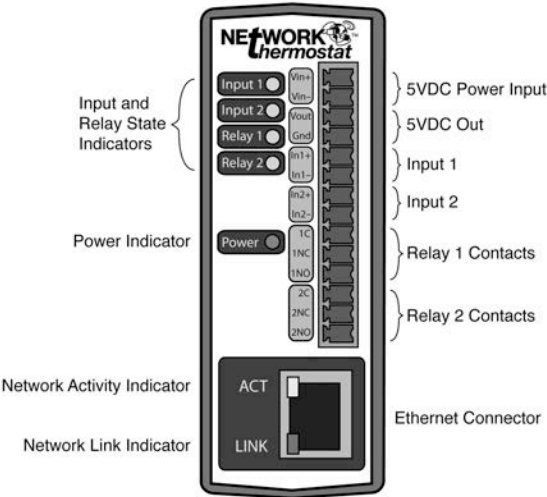
NT-RELAY is the ideal drop-in solution for many applications that require scheduling and Internet control. Example applications include control of circulation pumps, fresh air fans, security and parking lot lights, street signs, school or work shift bells, 1 or 2 zone sprinkler systems, electronic locks, and much more.

1.1 Features

NT-RELAY is very simple but has many features, including:

- No programming required.
- Easy to use as a stand-alone device or as part of a larger control system using the Net/X™ Command Center software.
- Built-in web server provides simple, web based configuration and control.
- Control page can be customized with appropriate text and buttons
- Two 5 Amp / 24 Volt relays.
- Field Re-programmable: users can install firmware updates when available.
- Two optically-isolated inputs can be used for status monitoring, local relay control, or remote relay control.
- Real-time clock with yearly calendar allows relays to be programmed to turn on/off at preset times. Up to 100 one-time or repeated events can be set up.
- Configure manually or with DHCP. (Manual Configuration is highly recommended).
- Modbus/TCP protocol support provides interoperability with devices/software from other manufacturers.
- Password protection.
- Selectable TCP ports.
- On/Off or pulse modes.
- Removable terminal connector (included) simplifies wiring.
- Compact, DIN-Rail mountable enclosure.
- 10/100 Ethernet connectivity.

1.2 Connectors & Indicators



NT-RELAY has a 14-position removable terminal connector and an Ethernet connector. The terminal connector is used to provide power to the module and to provide a connection to the relay contacts and optically-isolated inputs. The Ethernet connector is used to connect the module to the network.

There are seven LED indicators on the NT-RELAY. One LED is labeled Power, which is illuminated (green) whenever the module is powered. Two LEDs are labeled Input 1 and Input 2. These are illuminated (yellow) whenever a voltage is applied to the corresponding input. Two LEDs are labeled Relay 1 and Relay 2. These are illuminated (yellow) whenever the corresponding relay coil is energized. When the relay coil is energized, the NO (Normally Open) contact is closed and the NC (Normally Closed) contact is open. The other two LEDs are located on the Ethernet connector. They are labeled LINK and ACT. LINK is illuminated (green) when the module is properly connected to an Ethernet network. This LED must be illuminated before any communications can take place with the module. The ACT LED flashes when activity is detected on the network.

1.3 Options for Accessing NT-RELAY

NT-RELAY is a flexible, self-contained instrument and requires NO COMPUTER to operate. It can be used as a single stand-alone device or as part of a larger Net/X™ system. It can be accessed directly from a computer using a web browser, or using the Net/X™ Command Center PC software.

1.3.1 Basic Access Using A Web Browser

NT-RELAY has a built-in web server and provides simple web pages that can be accessed using a standard web browser. This allows users to access the unit with NO SPECIAL SOFTWARE installed on their computer. This is ideal for basic 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 set up, simple to use, and can be accessed from any computer without the installation of software. Note that computers that are not on the local network may only access the NT-RELAY if the local network router is setup to allow this.

1.3.2 Accessing NT-RELAY with the Net/X™ Command Center PC Software

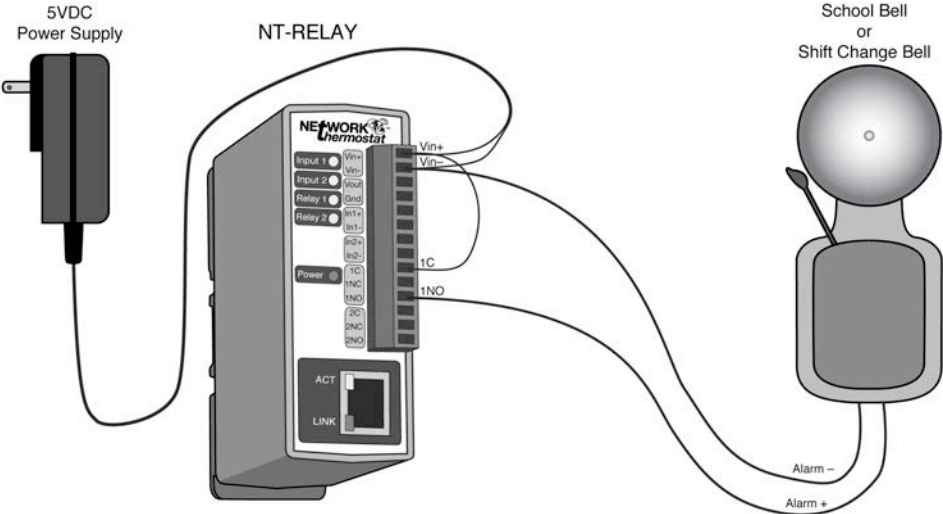
NT-RELAY is included in the Command Center software, starting with version 4.6.0. This software is perfect for controlling multiple NT-RELAY devices with all of the powerful functionality built into the software.

1.4 Example Applications

NT-RELAY is very versatile and can be used in many applications. Some example applications are illustrated in this section to show how it can be used.

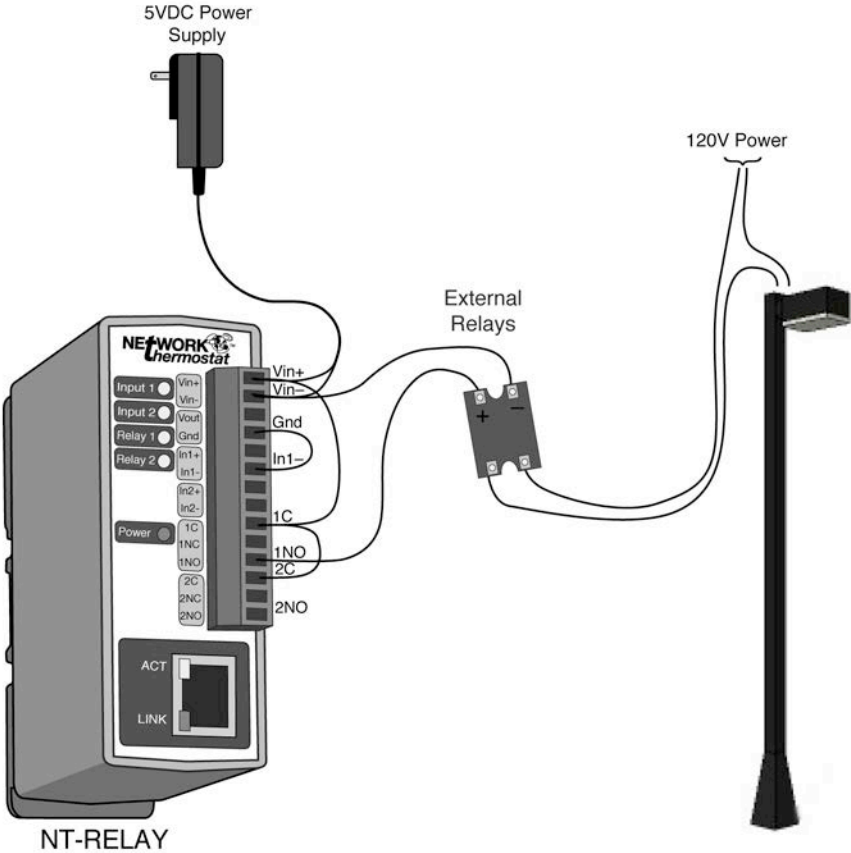
1.4.1 Basic Application Example; School Bell / Shift Change Bell Controller

The illustration below shows a simple example of using the NT-RELAY to control a device over an IP network. In this case, the device being controlled is a bell that is wired in series with the relay contacts. The NT-RELAY can be configured to automatically sound the bell at preset times. Users can also manually control the bell using a web browser.



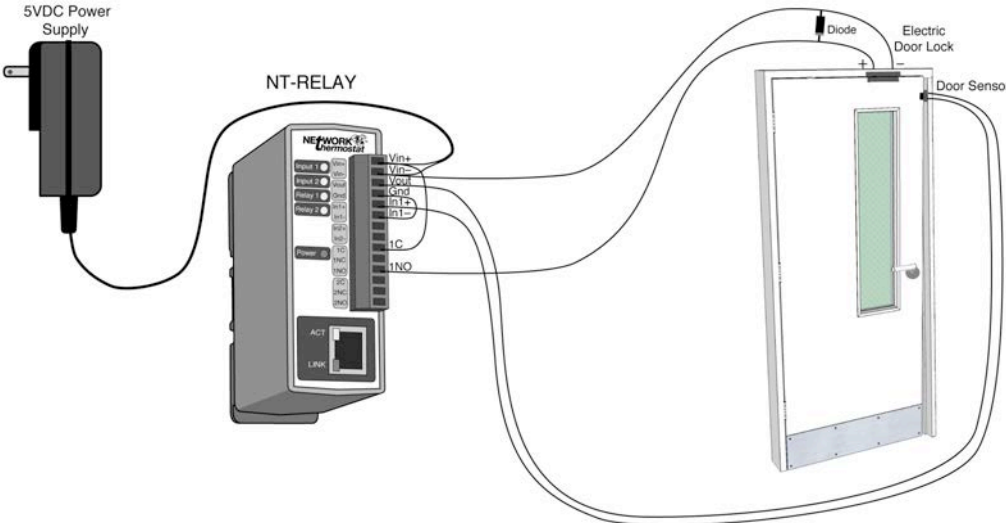
1.4.2 Two Relay Example; Parking Lot Light Controller

This example shows how the NT-RELAY can be used to control a parking lot lights. In this example, the NT-RELAY is configured with an external high-voltage relay to enable the NT-RELAY relay to switch the line voltage load. Both relays on the devices could be configured for parking lot lights, or the second relay in the NT-RELAY could be used for any other independent purpose.



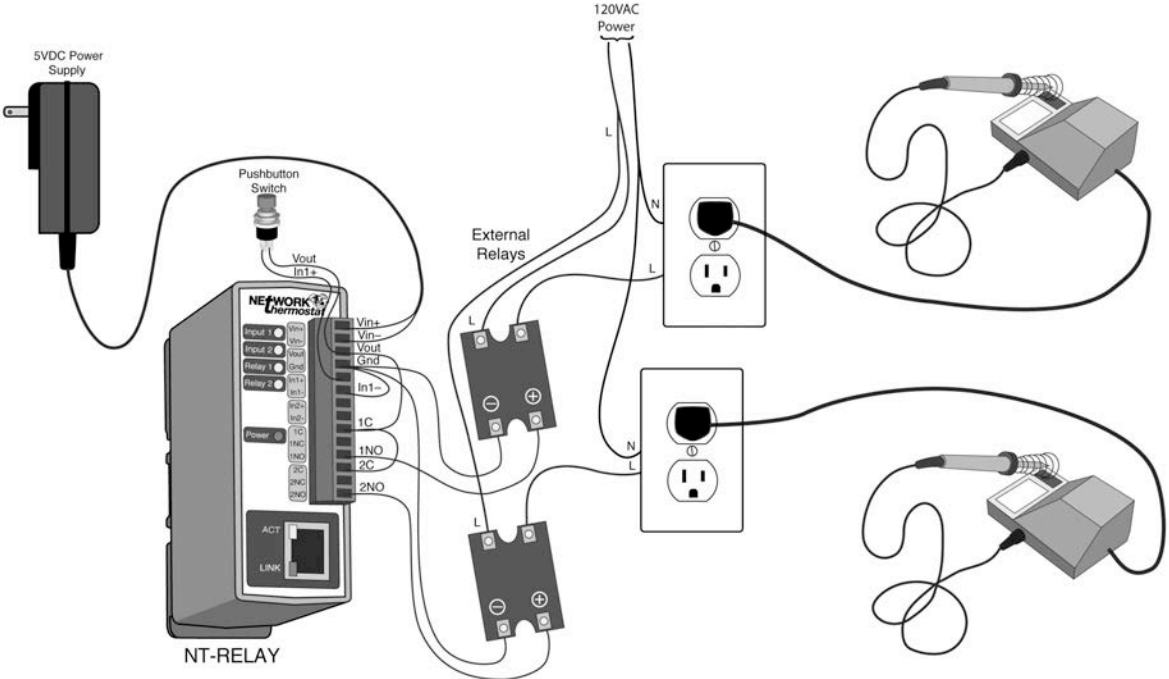
1.4.3 Security Example; Control of Electric Locks

This example shows how the NT-RELAY can be used to control electric locks. In this case, one of the relays in the NT-RELAY is connected to a large magnetic lock. A reverse-bias diode is connected in parallel with the lock to protect the relay contacts from the inductive kickback that will occur when the lock is switched. The example also illustrates how the input can be used to indicate when the door is open or closed.



1.4.4 Control Example; Timed Control of Electrical Outlets

This example shows how the NT-RELAY can be used to control electrical outlets in a building. This is useful to make sure certain equipment gets shut down at night when it is not in use. This is done by wiring the outlets of the building to relays that are controlled by the NT-RELAY. The NT-RELAY is programmed to shut off the outlets when the building is vacant. If the schedule changes, the outlets can be turned on using a web browser, or a pushbutton switch can be tied to an input of the NT-RELAY that will turn on the outlets for a given time period (for example, 3 hour occupancy).



Section 2: Installation and Setup

Installation consists of mounting the NT-RELAY, connecting to an IP network, providing power, configuring via a web browser, and wiring relay contacts to the device that will be controlled. Optionally, control signals may be connected to the optically-isolated inputs.

2.1 Mounting

NT-RELAY can 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.

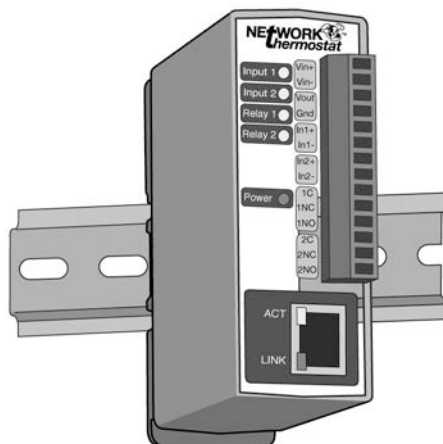
2.1.1 Wall Mounting

Mount the NT-RELAY 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.



2.1.2 DIN-Rail Mounting

The NT-RELAY can be mounted to a standard (35mm by 7.5mm) DIN rail. Attach the NT-RELAY 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 NT-RELAY from the 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!

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

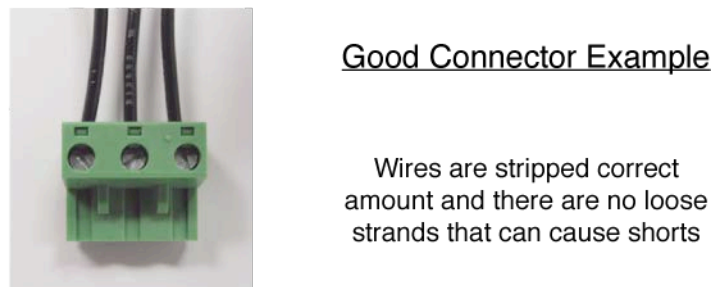
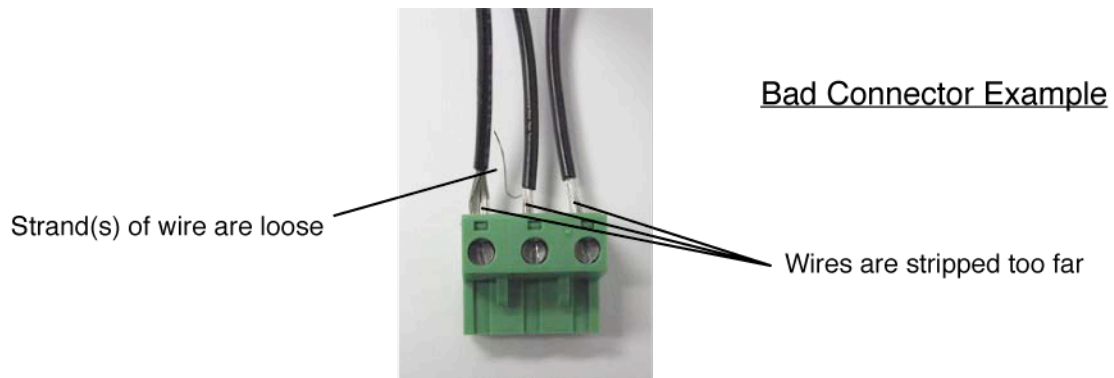
MIS-WIRING OR MIS-CONFIGURATION COULD CAUSE PERMANENT DAMAGE TO THE NT-RELAY AND/OR THE EQUIPMENT TO WHICH IT IS CONNECTED.

A removable terminal connector is provided for simple wiring. The correct wiring procedure is as follows:

1. Make sure power is turned off.
2. Remove the terminal connector from the NT-RELAY and make wiring connections to the terminals.
3. Reconnect terminal connectors.
4. Apply power.

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

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

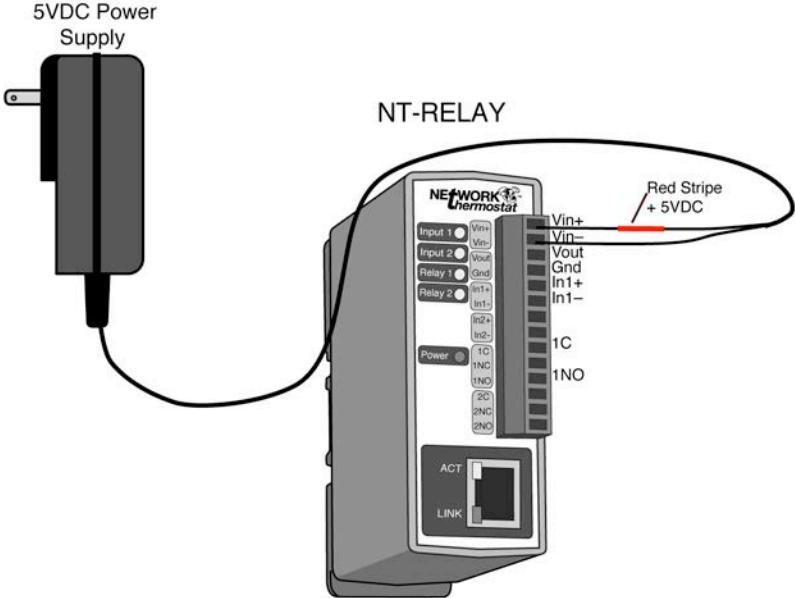


14-pin connector pinout:

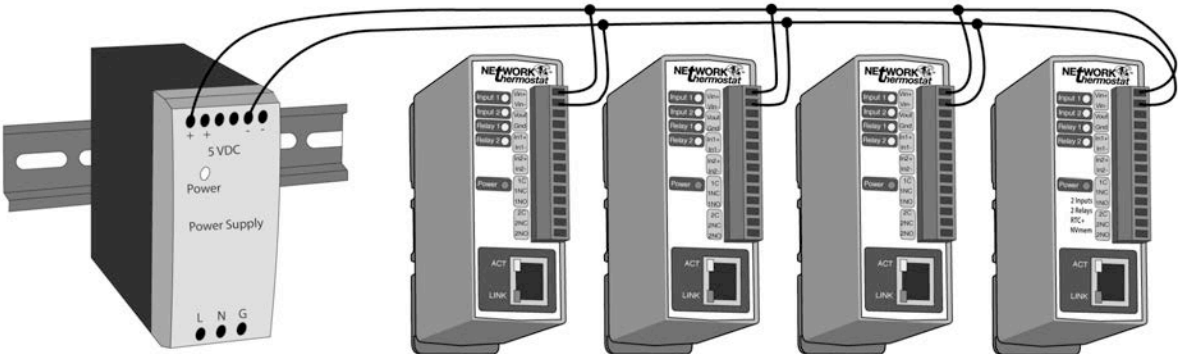
Pin	Description
VIn+	5VDC power supply input. Connect to the positive side of the appropriate power supply. DO NOT EXCEED THE MAXIMUM POWER SUPPLY VOLTAGE.
VIn-	VIn- Negative power supply input.
+5	+5VDC Out. This voltage is provided as a convenient voltage source for the optically-isolated inputs. This 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 the Gnd, and then connecting this terminal to the INPUT+ through a switch. DO NOT USE THIS OUTPUT FOR ANY OTHER PURPOSE.
Gnd	Negative side of the 5VDC output voltage.
In1+	This is the positive side of the optically-isolated input 1.
In1-	This is the negative side of the optically-isolated input 1.
In2+	This is the positive side of the optically-isolated input 2.
In2-	This is the negative side of the optically-isolated input 2.
1C	Relay 1 Common Contact
1NC	Relay 1 Normally Closed Contact
1NO	Relay 1 Normally Open Contact
2C	Relay 2 Common Contact
2NC	Relay 2 Normally Closed Contact
2NO	Relay 2 Normally Open Contact

2.2.1 Power Supply Connection

The NT-RELAY requires power for its internal logic circuits. Connect the included 5VDC power supply to the Vin+ and Vin- terminals.

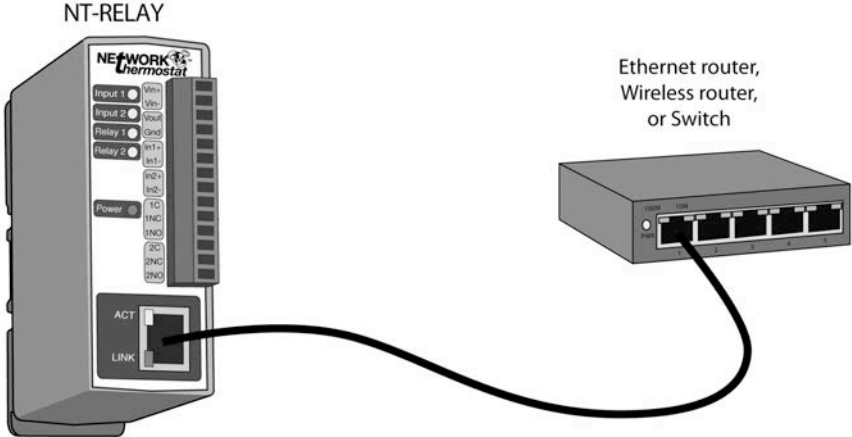


Multiple NT-RELAY units may be connected to a single power supply by connecting the power supply input terminals in parallel. The power supply must have a high enough current rating to power all units connected (a minimum of 0.6A per NT-RELAY). NetX does NOT offer these larger supplies. The drawing below is shown only for reference.

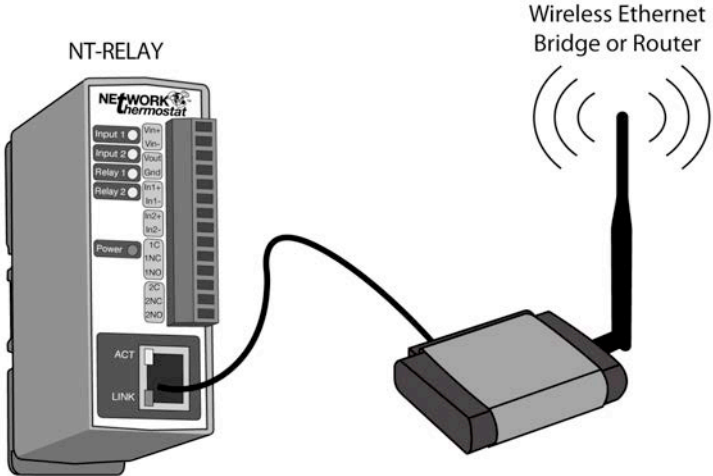


2.2.2 Network Connection

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, NT-RELAY 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.



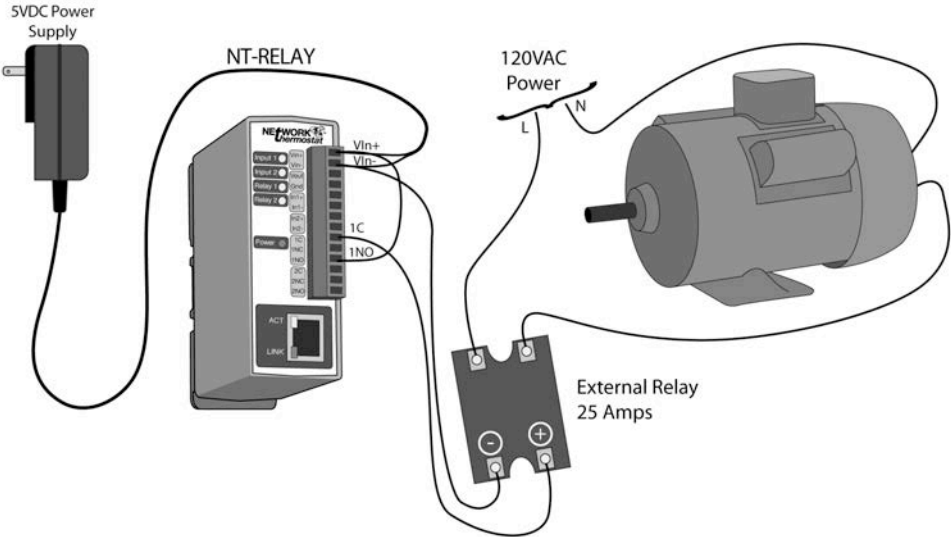
The NT-RELAY can be used indirectly on a wireless network. This is done by using a wireless Ethernet bridge or a wireless router. The network connection of the NT-RELAY is connected to the wireless device and the wireless device makes the connection to the wireless network. Note that the wireless Ethernet bridge or router must be properly set up for the wireless network used. Refer to the installation instructions that came with the wireless device.



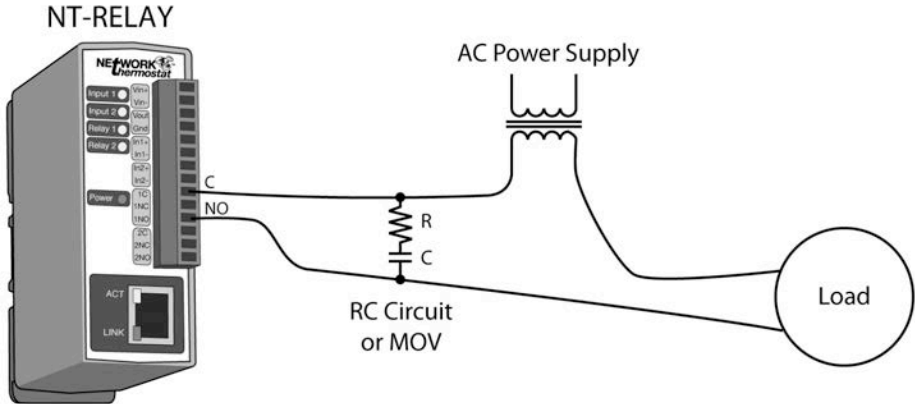
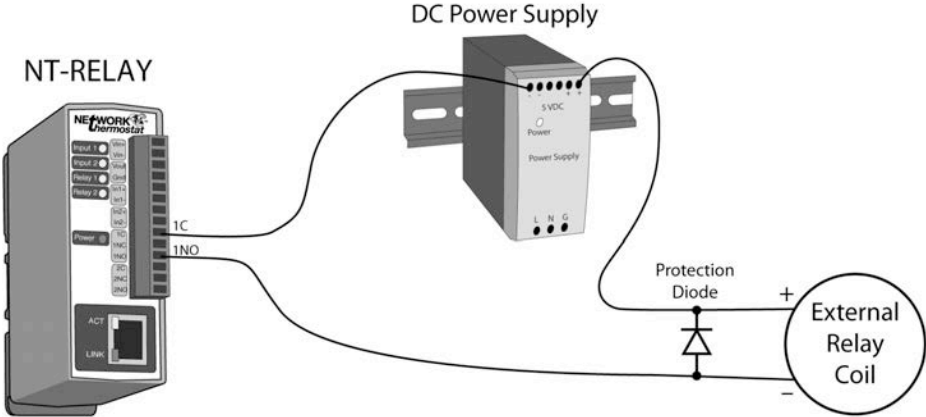
2.2.3 Relay Connection

The relay contacts internally connect directly to the terminal connector. Common, Normally Open, and Normally Closed contacts are provided. The relay contacts may be wired in series with the power source for the load (device to be controlled) as long as the load does not exceed the maximum current and voltage rating of the relay contacts.

For loads greater than 5 Amps, an external relay should be used. The illustration below shows how a 20-Amp motor can be controlled using an external relay. In the example, the NT-RELAY controls the external relay and the external relay controls the load.



When relays switch inductive loads such as motors, transformers, relays, etc., electricity will arc across the internal relay contacts each time the contacts open. Over time, this causes wear on the relay contacts which can shorten their life span. When switching an inductive load, it is recommended that simple relay contact protection devices are used. Note that the NT-RELAY does not provide relay contact protection in order to provide the greatest versatility and because appropriate protection differs for various loads. Below is an example of relay contact protection for a DC circuit and an AC circuit. See the illustrations below. For component values required to provide sufficient contact protection for your application, refer to appropriate references.

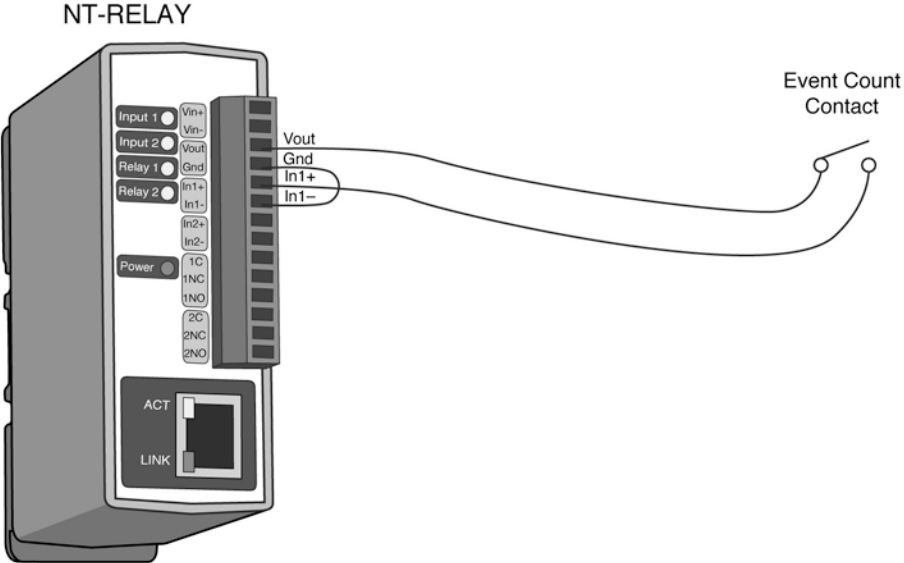


2.2.4 Optically-Isolated Input Connections

The optically-isolated inputs can be used to control the internal relays, control remote relays (over the network), or simply to monitor the state of a discrete device. To use these inputs, connect a small DC control voltage directly to the input and set up the function of the input using the configuration pages. A current limiting resistor is provided internally, so no external resistors are required as long as the maximum input voltage is not exceeded. If an AC signal, or a signal greater than the rated input voltage needs to be detected by the NT-RELAY, use a signal conditioner to convert the signal to a DC signal within the input range. Signal conditioners can be made of discrete components or can be purchased at industrial automation distributors.

Connecting "dry contacts" to the optically-isolated inputs:

The figure below illustrates how dry contacts can be connected to the input (or inputs) of NT-RELAY. One side of the contact is connected to Vout, and the other side is connected to In+. The In- terminal is connected directly to the Gnd terminal. When the dry contact is closed, it closes the circuit and applies 5V to the input terminals.



2.3 Establishing Communications for Setup

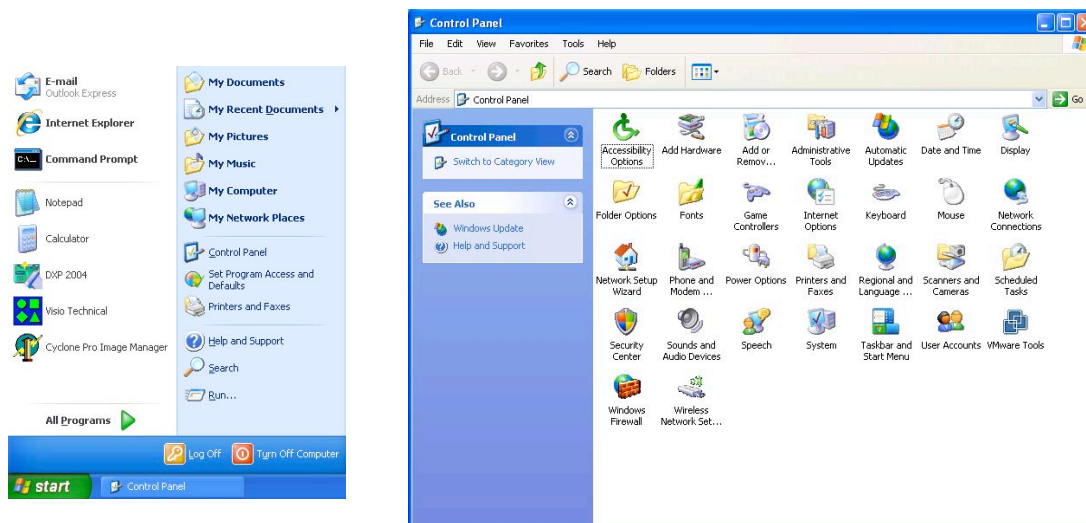
NT-RELAY is set up using a web browser. The first task is to establish communications between a computer and the NT-RELAY device so that the browser-based configuration can begin. To do this, the computer and the NT-RELAY must be physically connected to the same network and both must have IP addresses on the same network.

By default, the NT-RELAY comes from the factory with an IP address of 192.168.1.10. Communications with the NT-RELAY may be established by assigning an IP address to the configuration computer that is on the same network as the NT-RELAY (for example, the configuration computer could be assigned to 192.168.1.50).

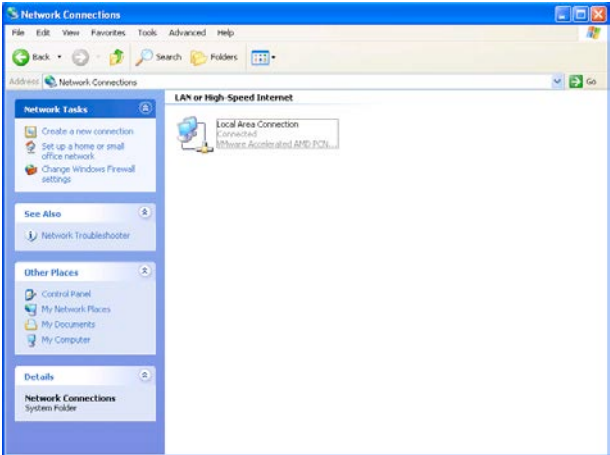
2.3.1 Assigning a temporary IP address to the configuration computer

Instructions for changing the IP address of the computer that will be used for the NT-RELAY configuration are given below. The following example is for those running the Windows operating system. For setup using other operating systems, refer to the appropriate users manual.

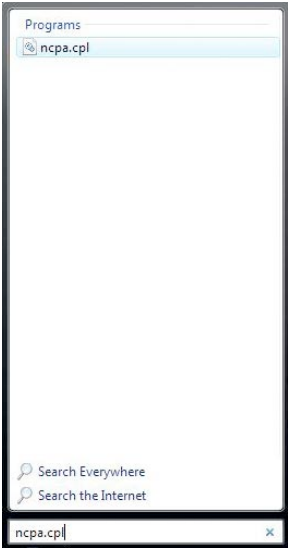
Step 1: Open the control panel by clicking on the start menu and then clicking on Control Panel. (Note that the control panel shown is in “Classic View.” If the control panel is in “Category View,” select the “Classic View” option before proceeding.)



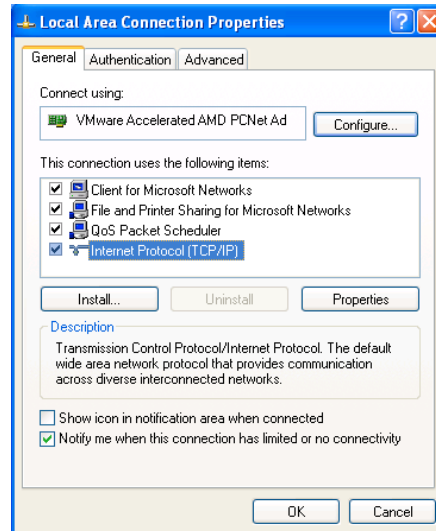
Step 2: Double click on the icon labeled Network Connections. The following window will pop up.



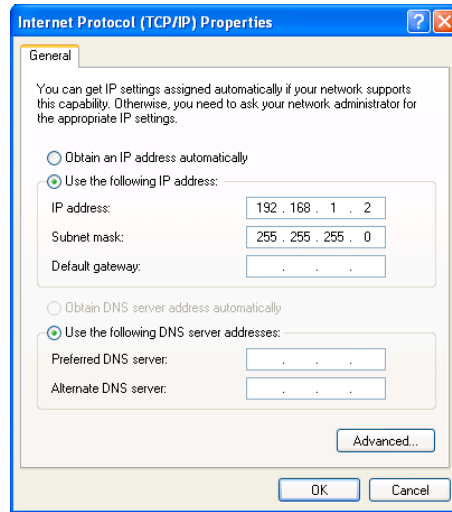
Note: To access the Network Connections folder in Windows Vista, select the Windows Icon (Start Menu) and enter **ncpa.cpl** into the search bar and press Enter.



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."



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



Before making any changes to the network settings as shown above, write down the current settings so that they can be restored once the NT-RELAY is configured.

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. Leave the default gateway field blank. Click OK to accept the new settings.

2.3.2 Open Configuration Web Page

Once the network is set up, open the setup page as described in the section below. If the setup pages are not accessible, verify that the NT-RELAY 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 NT-RELAY (from the command prompt by typing ping {*NT-RELAY IP address*}).

2.4 NT-RELAY Setup Pages

The NT-RELAY is configured using a web browser. To access the setup pages, enter the following URL in the address bar of a web browser:

`http://{ipaddress}/setup.html`

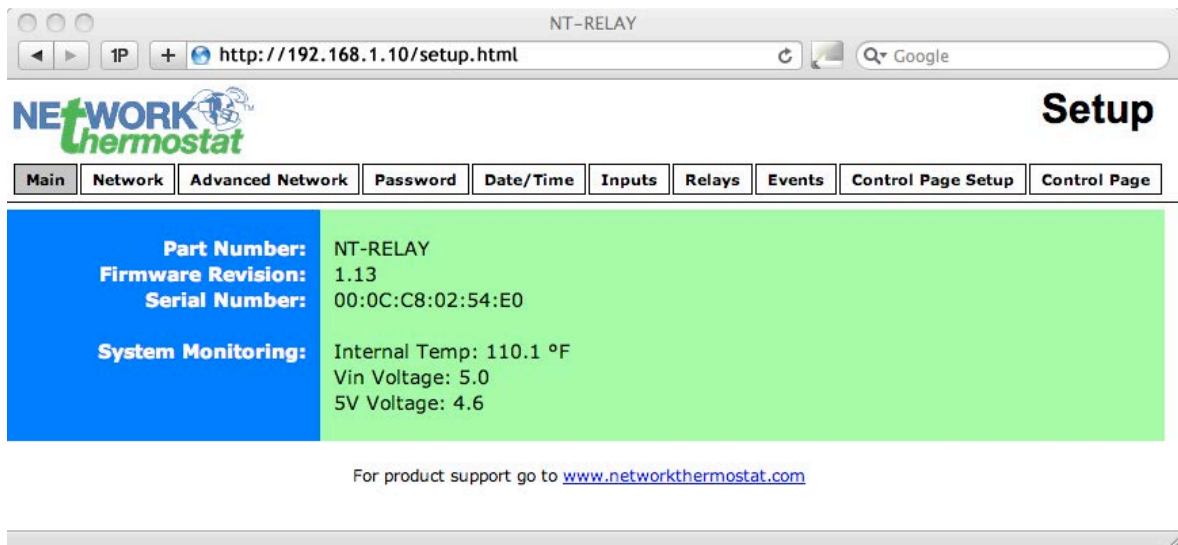
For example, using the default IP address, enter:

`http://192.168.1.10/setup.html`

After the page is requested, a password prompt will appear. Enter the user name and password. Note that the default user name is **admin** and the default password is **netx** (password is case sensitive).

2.4.1 Main Tab

This is the initial page that is displayed when `setup.html` is entered into the address bar of the browser. It displays model and serial number information, and basic diagnostic information about the NT-RELAY unit.



1. Part Number:

This is the full model number of the NT-RELAY.

2. Firmware Revision:

This is the current product revision of the unit's firmware.

3. Serial Number:

This is the serial number of this unit. The serial number is also the MAC address of the unit.

4. System Monitoring:

*****NOTE:** The values in these fields are only updated when the web page is refreshed.

Internal Temp: This displays the current temperature inside the NT-RELAY.

Note that it is normal for this to be significantly higher than room temperature.

Vin Voltage: This is the DC voltage that is applied to the VIn+ and VIn- terminals.

5V Voltage: Internally, the unit operates on a 5V DC power supply. This field is used to view current value.

2.4.2 Network Tab

The network parameters are set on this page. Note that if multiple Net/X™ products are used on the same network, install one at a time and set the IP address of each unit before connecting the next unit to the network. This avoids having multiple devices being installed on the network with the same factory default IP address at the same time.

Note that the NT-RELAY must be power-cycled (power disconnected, then reconnected) before network settings take effect. Only the settings on the **Network** tab and some settings on the **Advanced Network** tab require power-cycling before taking effect.

The screenshot shows a web browser window titled "NT-RELAY" with the address bar displaying "http://192.168.1.10/setup.html". The page features the "NetworkThermostat" logo and a "Setup" header. A navigation menu includes tabs for "Main", "Network", "Advanced Network", "Password", "Date/Time", "Inputs", "Relays", "Events", "Control Page Setup", and "Control Page". The "Network" tab is active, displaying a green background with the following settings:

- Use DHCP:** Yes No
- IP Address:** 192 . 168 . 1 . 10
- Subnet Mask:** 255 . 255 . 255 . 0
- Gateway:** 192 . 168 . 1 . 2
- Preferred DNS Server:** 68 . 238 . 96 . 12
- Alternate DNS Server:** 68 . 238 . 112 . 12
- HTTP Port:** 80
- Speed:** 10 Mbps 100 Mbps
- Mode:** Half Duplex Full Duplex

A note at the top of the settings area states: "*Network parameters require reboot before they take effect." At the bottom of the settings area are "Submit" and "Reset" buttons.

1. Use DHCP:

This option allows DHCP to be enabled or disabled. If this option is set to **Yes**, the NT-RELAY will wait for an IP address from a DHCP server each time it is powered. The default setting is **No** (this is recommended for most installations). If DHCP is set to **Yes**, the **Network** page must be submitted and the NT-RELAY must be rebooted before an IP address will be assigned. Once the NT-RELAY is assigned an IP address by the DHCP, the new IP address can be found through the clients list kept by the DHCP server. For most instances, this is found on the local gateway or router.

Brief notes about DHCP:

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

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

2. IP Address:

Enter the IP address for the NT-RELAY in this field.

The IP address is specific to the network where the NT-RELAY will be installed, and must be obtained from the network administrator. For more information on IP addresses and remotely accessing the NT-RELAY over the Internet, see Appendix B. The default setting for this field is 192.168.1.10.

3. Subnet Mask:

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

4. Gateway:

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

5. Preferred DNS Server:

The IP address of the Primary DNS server is specified here. When DNS services are required, this is the address that will be used. The default setting for this field is 192.168.1.1.

This field is only required when the following options are used:

- Remote Services (when server is specified by name and not IP address).
- Sync time clock with remote NTP server (when server name is specified by name and not IP address).
- Mail Server is used (when server name is specified by name and not IP address).

6. Alternate DNS Server:

This field is used to specify the IP address of a Secondary DNS server. This is used when the NT-RELAY requires DNS services and the preferred DNS server is not available. The default setting for this field is 192.168.1.1.

7. HTTP Port:

The TCP port used for HTTP communications (web browser, xml, get commands) with the NT-RELAY is specified here. It is recommended that the port not be changed without an understanding of TCP/IP and ports. For more information on TCP ports and IP addressing see Appendix B. The default setting for this field is 80, which is the standard HTTP port.

8. Speed:

This option sets the data rate (clock rate) of the Ethernet port. Either **10Mbps** or **100Mbps** can be selected. The 100Mbps option offers faster communications but the amount of data to and from the NT-RELAY is so small that users will not likely notice much (if any) difference. When the NT-RELAY is set to **10Mbps**, it draws less power and runs a little cooler which translates 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**. The default setting for this field is **10Mbps**.

9. 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. The default setting for this field is **Half Duplex**.

Section 3: Operation using Net/X™ Command Center Software

Once the NT-RELAY is configured with a static IP address, it can be easily operated via the Net/X™ Command Center software.

3.1 NetX™ Command Center Operation

Once the NT-RELAY is configured with a static IP address, it can be easily operated via the Net/X™ Command Center software. Version 4.6.0 or higher. Simply start the software, click on the 'Add Relay' icon and follow the setup wizard.

Appendix A : Restoring Factory Default Settings

In the event that the IP address or passwords are forgotten, NT-RELAY may be restored to its original factory default settings. To do this, first remove the power from the unit. Next, carefully 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.**



Appendix B: Accessing NT-RELAY Remotely Over the Internet

NT-RELAY can be monitored and/or controlled from a remote location over the Internet. If access over the Internet is required, the NT-RELAY must be set up properly, and the router on the network where the NT-RELAY is installed must be configured for this. Note that once the NT-RELAY can be accessed on the local network, almost all of the settings required to provide remote access are in the router and not in the NT-RELAY. 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 his/her 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:

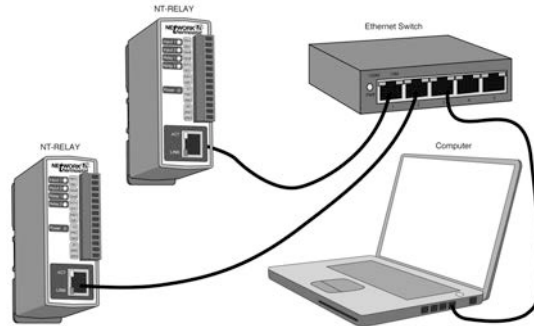
Every device on the Internet is identified by a unique address called an IP (Internet Protocol) address. IP addresses are somewhat similar to mailing addresses in that they identify the precise logical location of the device on the Internet. The IP address identifies the global region down to the network 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 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. Public IP addresses are addresses described in the paragraph above that identify a specific device on the Internet. The NT-RELAY can be assigned a public IP address for direct connection to the Internet. Typically, those who are reading this section of the manual would only assign a public IP address to the NT-RELAY when the NT-RELAY is the only device on the local network. The IP address would be obtained from the Internet Service Provider (ISP).

Due to the limited number of public IP addresses, private networks can be set up with “private” IP addresses. Private IP addresses are blocks of IP addresses that have been set aside for private use by anyone. These addresses have no global designation and 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

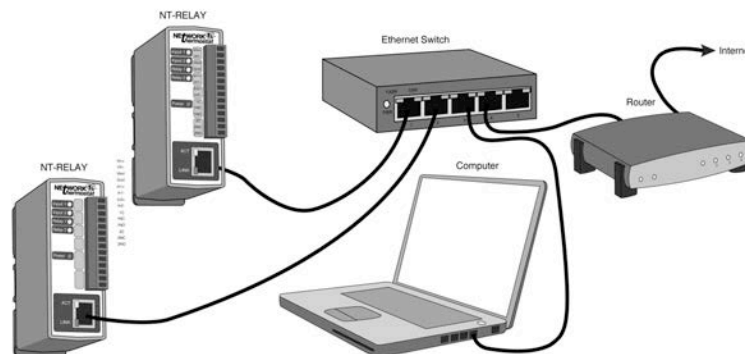
A Simple Local Area Network:

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, and two NT-RELAYs. In this example, the computer is assigned an IP address of 192.168.1.10, the first NT-RELAY has the IP address of 192.168.1.25 and the second has an IP address of 192.168.1.26. A person using the computer can access the first NT-RELAY by entering its IP address in the URL line in the browser (<http://192.168.1.25>). The second NT-RELAY can be accessed by entering its IP address in the URL line in the browser (<http://192.168.1.26>).



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).



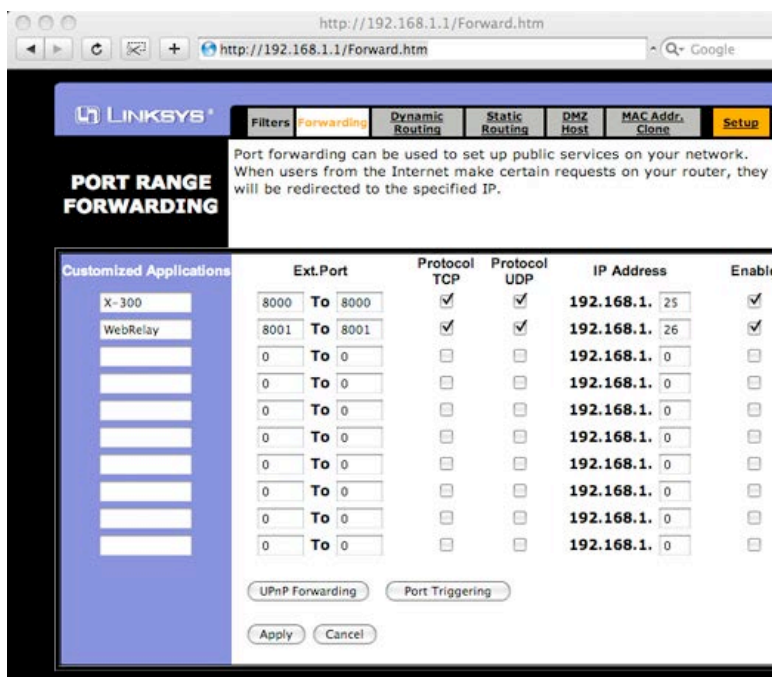
In the example, when a user on the computer needs to access a server on the Internet, the computer sends the request to the router at 192.168.1.1. The router sends the request to the server on the Internet. The server does not send the response directly to the computer on the LAN, but to the router at 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 network can be configured to allow outside access to the NT-RELAYS. All requests to any device on the network use the public IP address (266.70.164.97 in this example). With only a single IP address, TCP ports are used to identify the specific devices the incoming message should be sent to. 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 65235 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 Net/X™ products come from the factory with the HTTP port set to 80 which is the standard port for HTTP. In this example, the NT-RELAY HTTP ports will be changed to port 8000 and 8001. Once the ports are changed in the two Net/X™ devices, the router must be set up for port forwarding. The way this is set up is specific to the router, but many routers use a table. Port forwarding setup associates the IP address of each device with the assigned port. In this example, the address 192.168.1.25 (NT-RELAY #1) would be associated with port 8000. The address 192.168.1.26 (NT-RELAY #2) would be associated with port 8001. By doing this, the NT-RELAY can be accessed from the Internet by entering the public IP address of the router, plus the port number assigned to the NT-RELAY in the URL window of the browser. For example, the user would enter `http://266.70.164.97:8000`. When the router receives this request, it would look in it's port forwarding table to find out what to do with a request for port 8000. It would find that it should forward the request to the local address of 192.168.1.25 and then would forward the request. The second NT-RELAY could be accessed the same way, except it would use port 8001 (`http://266.70.164.97:8001`).

Note that when an HTTP request comes in to the router without the specific port specified (`http://266.70.164.97`) the router will handle this as a port 80 request (default HTTP port). In other words, `http://266.70.164.97` is exactly the same as `http://266.70.164.97:80`.

An example screen shot of a router configuration is given below. This setup allows the two Net/X™ products in the above example to be accessed remotely from the Internet. Note that this screen shot is simply an example of a typical router setup page. Routers will vary. For more information, please download the port forwarding information from the www.networkthermostat.com website. There is an application note for <http://www.portforward.com>.



Accessing Setup Pages:

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

`http://(Local IP Address):(Port Number)/setup.html`

For example, To access the NT-RELAY in the setup page above, the following command would be used:

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

To access the Net/X™ units 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 NT-RELAY:

`http://266.70.164.97:8000/setup.html`