



32 Channel Ethernet Relay Module

User Guide

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Introduction

Numato Lab's 32 Channel Ethernet Relay Module is a versatile product for controlling electrical and electronic devices remotely from a PC over Ethernet link. Ease of use and wider operating system compatibility are the primary goals behind this product's design. This simplicity allows use of off-the-shelf Terminal Emulation programs such as Hyper Terminal and Tera Term for controlling the module with a simple set of human readable commands through Telnet/Web page. For power users, this module can be controlled by writing programs in various programming languages.

Applications

- Home Automation
- Lighting Control
- Garden Equipment Control
- Industrial Automation
- Test Fixtures
- DIY and Hobby

Board Features

- Microcontroller: Microchip PIC18F97J60(1-Mbit Flash Microcontroller with 10Mbps Ethernet communication peripheral)
- Memory: Microchip 25LC1024 serial EEPROM provides 1024 Kbits of storage for both web pages and nonvolatile configuration options
- MAC Address: Separate Serial EEPROM(24AA02E48) with Globally Unique value used as MAC Address
- Reset Jumper: To reset the firmware of board to factory defaults
- Password protected Web console and Telnet communication interface
- LED indication for Power and individual relay status
- Relay: 32 SPDT Relays with individual LEDs for status
- GPIO: 8 GPIOs, each can be configured as analog inputs

How to use the module

The following section describes how to use this module.

Components/Tools required

Along with the module, you may need the items in the list below for easy and fast installation.

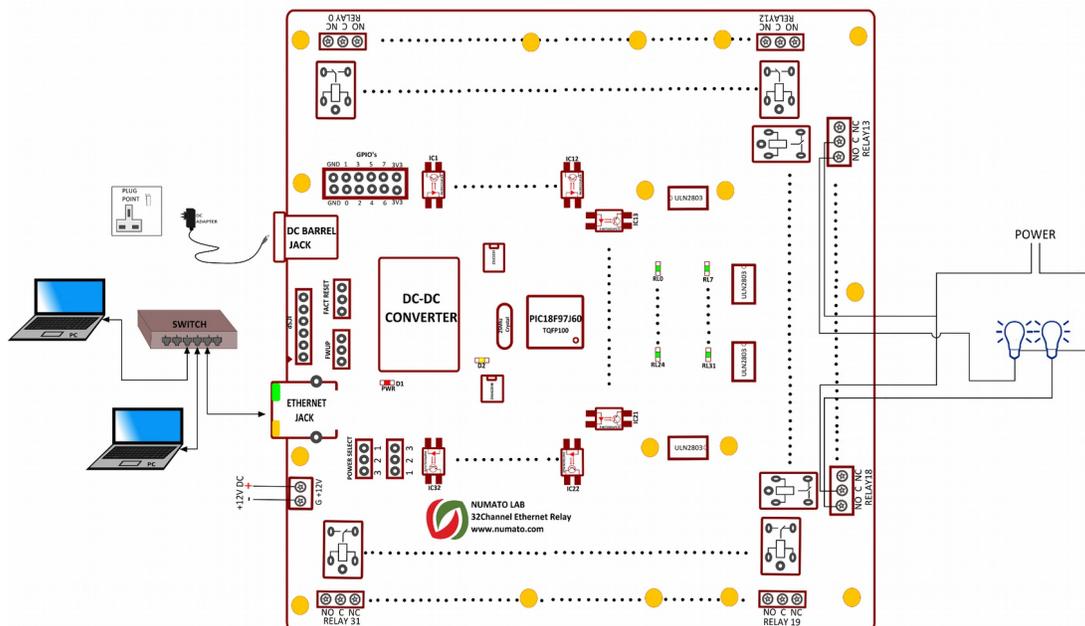
1. CAT 5e Ethernet Cable(Straight through cable)
2. +12V 2 A DC power supply
3. Medium size Philips screw driver

Connection Details



IMPORTANT Please exercise utmost caution while working with electrical mains or other high voltages. Failure to comply with safety regulations may result in injury and or death.

Connection Diagram



Above image shows basic connection diagram that can be used in most of the situations. The

connection diagram is same for both AC and DC loads. Please make sure to use a freewheeling diode or snubber circuit if the load is inductive. More details about using inductive loads is available elsewhere in this document. Use a **Straight Through Ethernet** cable for communication when connecting the board to a switch or router. A **Crossover Ethernet Cable** may be required in some situations if connecting directly to a PC/Laptop port.

It is important to make sure that the wires used to connect loads are sufficiently rated to handle expected load current. Exercise caution while working with high voltages. Short circuits can cause damage to the module and the PC. The following sections identify individual connections in detail.

Ethernet Interface



The on-board Ethernet port supports Ethernet 10 Mbps transmission speed that helps a computer to communicate and control this module easily. There are two basic network configurations for this board/can be used in two ways.

1. Direct connection to Local Area Network(LAN) via common straight through Ethernet cable.
Eg: Connecting the module to a switch in a network.

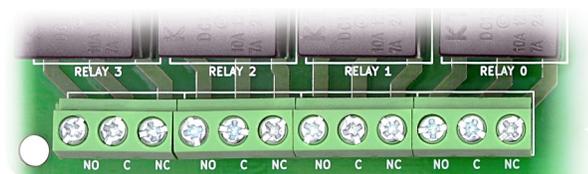
2. Direct connection to a PC through a cross over Ethernet cable.
Eg: Connecting the module directly to the PC. Some PC/Laptops can detect and adapt to the cable type. In such situations, a straight through cable also can be used.



Visit <http://numato.com/cables-accessories> to buy cables and accessories for this product.

Relay Contacts

All contacts on each relay is available externally on screw terminals for easy user access. The relays are rated for AC and DC supply voltages. Please see the electrical parameter table for more details. Each relay has three contacts(C, NO and NC). C is the common terminal and is used in both normally open and normally closed positions. The contacts NC and C will be connected when the relay is turned off and will be disconnected when relay is turned on. And vice versa, the contacts C and NO will be disconnected when relay is turned off and will be connected when the relay is turned on. Table below summarizes possible relay contact positions.



Relay State	Connection between NC and C	Connection between NO and C
OFF	Close	Open
ON	Open	Close

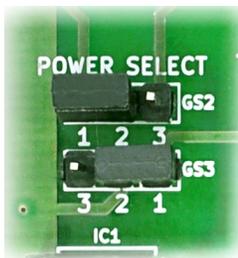
DC Power Supply

This module can be powered in two ways.

1. Use a 12V 2A DC power supply on DC jack(**J1**) on the Board for both logic circuit and relays. Configure the Jumper on **GS2, GS3** in **POWER SELECT** to 1-2 for using this way. Relays and logic circuits are not isolated from each other in this configuration.



2. Use a 7-12V 1A DC power supply for the logic circuit on **J1** and a separate 12V 1A DC power supply for relays on **P5**. Configure the Jumper on **GS2, GS3** in **POWER SELECT** to 2-3 for using this way.



With the first method, the board requires only one DC power supply to be fully functional. But the relay section will not be isolated from the logic section. With the second method, the board requires two power supplies but the relay section will be isolated from logic section as long as the two power supplies are galvanically isolated. Most off the shelf 12V DC power supply can be used for powering this Ethernet Relay Module. Make sure to connect the power supply with correct polarity. Connect the **positive** terminal of the power supply to the **+12** terminal on the module. Connect **negative** terminal of the power supply to **GND** terminal of the module. Connecting power supply incorrectly can cause damage to the module and/or other devices. Please refer to the marking on the board for more details.



Using a product similar to [Numato's DC Barrel Jack Adapter](#) is recommended if the power supply has a Barrel Jack connector (See the image on right).



Connecting power supply incorrectly can cause damage to the module and/or other devices.

Factory Reset

This Jumper is used to reset the settings on board to factory defaults. To execute factory reset, please follow the steps below.

1. Power off the device.
2. Configure the Jumper on **GS5** to 2-3.
3. Power on the device.
4. Wait for 10-15 sec until the **LED D2** on board Blinks.
5. Configure the Jumper on **GS5** back to 1-2.
6. Power off the board and back on

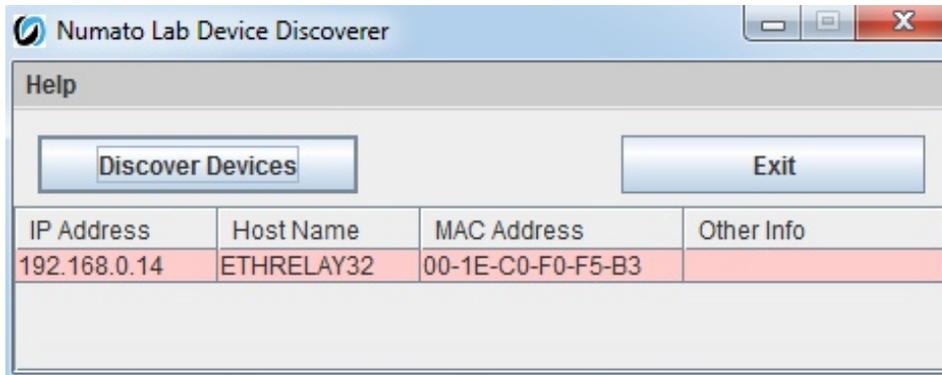
Please use this feature only for recovering the user name / password. This action will reset User Name, Password, Device ID and also other settings as well. After reset the board can be accessed using the default user name and password.

The factory default settings will be as below table.

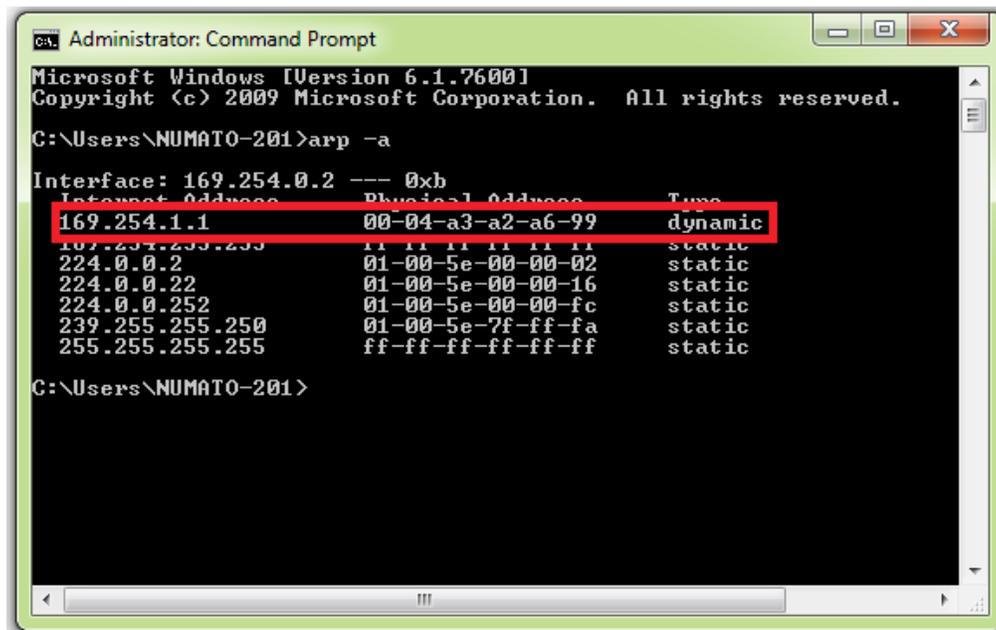
User name	admin
Password	admin
ID	00000000
Host Name	ETHRELAY32
IP Address	DHCP Enabled

Powering Up 32 Channel Ethernet Relay module

Connect a DC power supply and power up the device as mentioned **DC Power Supply** section above. A red LED (D1) will glow which indicates active power. Connect the module to a PC or a Switch/Router as mentioned in **Ethernet Interface** section above. Run **Numato Lab Device Discoverer.jar**, click on **Discover Devices**. The window will displays the IP address, Host Name, MAC Address and Other information.



IP Address and MAC Address can seen in command prompt also, open the command prompt and type the command '**arp -a**'. This will display the available network interfaces and connected devices along with the MAC address and IP address of each device. Look for the IP address that corresponds to your device's MAC address. The MAC address for each Relay Module is printed on a label on the board for your convenience. Use the IP address obtained in order to access the device.



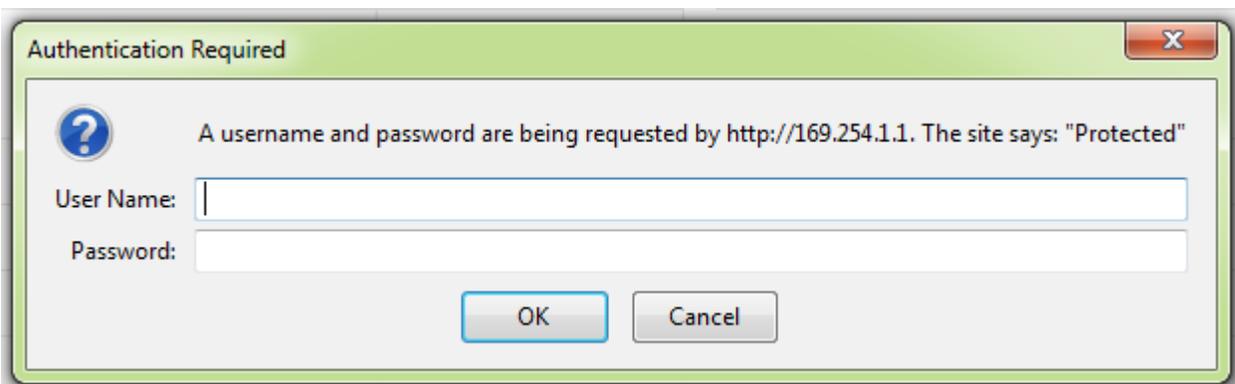
Accessing the module

The module can be controlled by using one of the two interfaces below.

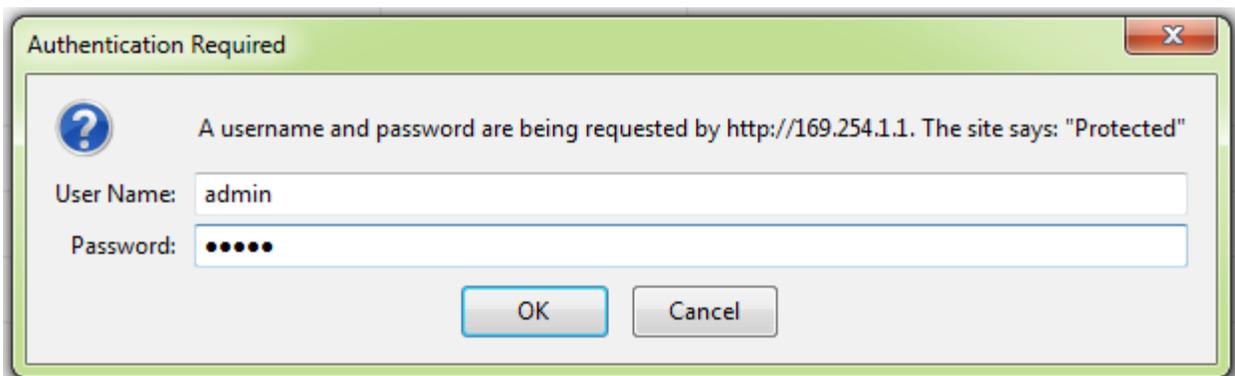
1. Through HTML/Web Page served from the device.
2. Through a Serial terminal Emulator that supports TELNET (Eg: Hyper terminal, Teraterm, PUTTY...).

Accessing the module using web interface

The easiest method for controlling the module is through web page served from the device. To open the administration web page, type in the IP address in to the address bar of any web browser and press enter.



You will prompted to enter user name and password. The default user name and password is '**admin**'. You may change the user name and password once logged in.



Enter the default user name and password then click OK.

You will be presented with the device home page that shows the status of Relays and GPIOs.

Ethernet Relay Module Administration page

NUMATO LAB 32 Channel Ethernet Relay Module

HOME RELAY GPIO/ADC DEVICE SETTINGS

Device Status Summary

Relay Status	
Relay 0	Off
Relay 1	Off
Relay 2	Off
Relay 3	Off
Relay 4	Off
Relay 5	Off
Relay 6	Off
Relay 7	Off
Relay 8	Off
Relay 9	Off
Relay 10	Off
Relay 11	Off
Relay 12	Off
Relay 13	Off
Relay 14	Off
Relay 15	Off

Relay Status	
Relay 16	Off
Relay 17	Off
Relay 18	Off
Relay 19	Off
Relay 20	Off
Relay 21	Off
Relay 22	Off
Relay 23	Off
Relay 24	Off
Relay 25	Off
Relay 26	Off
Relay 27	Off
Relay 28	Off
Relay 29	Off
Relay 30	Off
Relay 31	Off

GPIO Status	
GPIO 0	Digital I/P - Off
GPIO 1	Digital I/P - Off
GPIO 2	Digital I/P - Off
GPIO 3	Digital I/P - Off
GPIO 4	Digital I/P - Off

Relay Status and Control

There are 32 SPDT relays on the board that can be controlled over Ethernet. Click on the “Relay” link on the menu bar to access Relay configuration page. The '**Relay Index**' shows the corresponding relay on board. Relays on the board can be turned on/off by clicking the '**Toggle Relay**' button next to the corresponding relay index. The '**Status**' of the relays change automatically for easy identification.

Ethernet Relay Module Administration page

NUMATO LAB 32 Channel Ethernet Relay Module

HOME RELAY GPIO/ADC DEVICE SETTINGS

Relay Status and Control

Relay Status			Relay Status		
Relay Index	Status	Toggle Relay	Relay Index	Status	Toggle Relay
Relay 0	On	↑↓	Relay 16	Off	↑↓
Relay 1	Off	↑↓	Relay 17	Off	↑↓
Relay 2	On	↑↓	Relay 18	Off	↑↓
Relay 3	Off	↑↓	Relay 19	Off	↑↓
Relay 4	On	↑↓	Relay 20	Off	↑↓
Relay 5	Off	↑↓	Relay 21	Off	↑↓
Relay 6	On	↑↓	Relay 22	Off	↑↓
Relay 7	Off	↑↓	Relay 23	Off	↑↓

In the above image, we can see that Relay 0,2,4 and 6 are in ON position and rest of the relays are in off position. The status of the relay can be viewed on the home page as well.

GPIO Status and Control

This board has 8 general purpose input/output's each multiplexed with analog input. Click on the "GPIO" link on the menu bar to access Relay configuration page. The GPIOs can be turned on/off by clicking on the 'Toggle GPIO' button next to the corresponding GPIO.

Ethernet Relay Module Administration page

NUMATO LAB 32 Channel Ethernet Relay Module

HOME RELAY GPIO/ADC DEVICE SETTINGS

GPIO Status and Control

GPIO Status				
GPIO Index	Current Config	Status	Toggle GPIO	Change Config
GPIO 0	Digital I/P	Low	↑↓	
GPIO 1	Digital I/P	Low	↑↓	
GPIO 2	Digital I/P	Low	↑↓	
GPIO 3	Digital I/P	Low	↑↓	
GPIO 4	Digital I/P	Low	↑↓	
GPIO 5	Digital I/P	Low	↑↓	
GPIO 6	Digital I/P	Low	↑↓	
GPIO 7	Digital I/P	Low	↑↓	

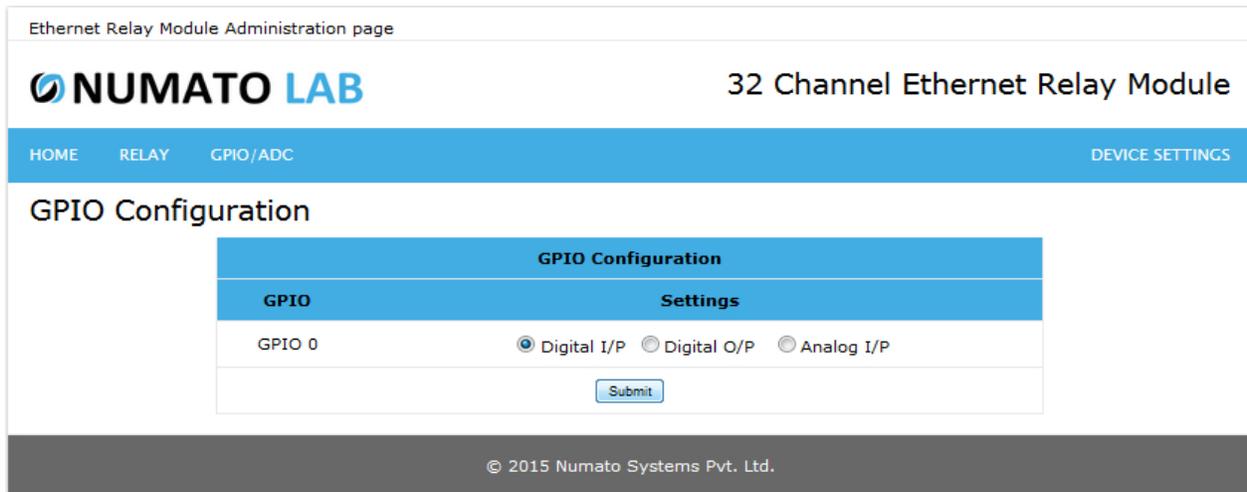
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Individual GPIO can be configured in three modes.

1. Digital Input(I/P)
2. Digital Output(O/P)
3. Analog Input

Digital Input(I/P)

To configure a GPIO as Digital Input, click on corresponding GPIO's '**Change Config**' button. Select “Digital I/P” radio and click the “Submit” button.



Ethernet Relay Module Administration page

NUMATO LAB 32 Channel Ethernet Relay Module

HOME RELAY GPIO/ADC DEVICE SETTINGS

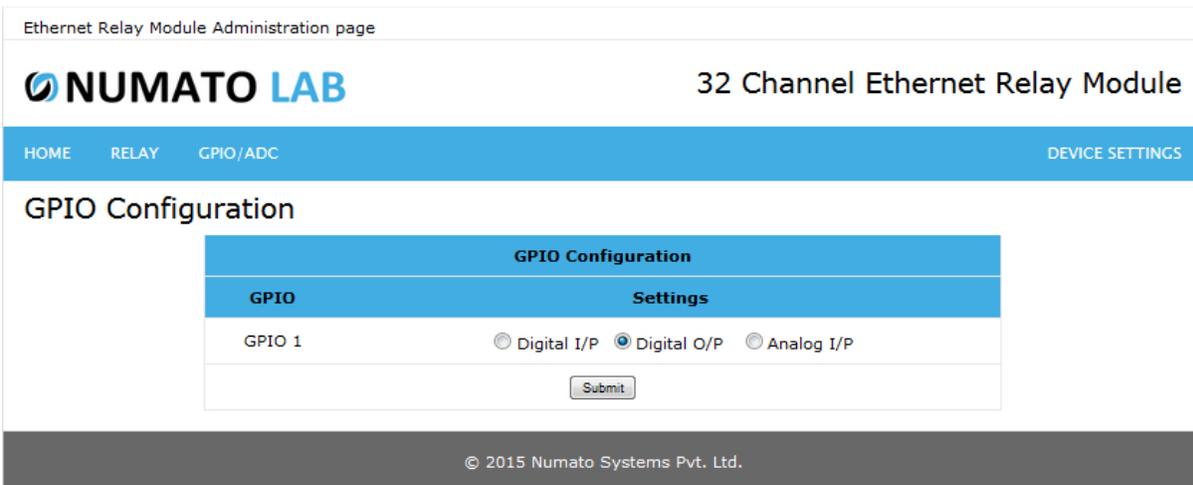
GPIO Configuration

GPIO Configuration	
GPIO	Settings
GPIO 0	<input checked="" type="radio"/> Digital I/P <input type="radio"/> Digital O/P <input type="radio"/> Analog I/P
<input type="button" value="Submit"/>	

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Digital Output(O/P)

To configure a GPIO as Digital Output, click on corresponding GPIO's '**Change Config**' button. Select “Digital O/P” radio and click the “Submit” button.



Ethernet Relay Module Administration page

NUMATO LAB 32 Channel Ethernet Relay Module

HOME RELAY GPIO/ADC DEVICE SETTINGS

GPIO Configuration

GPIO Configuration	
GPIO	Settings
GPIO 1	<input type="radio"/> Digital I/P <input checked="" type="radio"/> Digital O/P <input type="radio"/> Analog I/P
<input type="button" value="Submit"/>	

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Analog Input (I/P)

To configure a GPIO as Analog Input, click on corresponding GPIO's '**Change Config**' button. Select “Analog I/P” radio and click the “Submit” button.

Ethernet Relay Module Administration page

NUMATO LAB 32 Channel Ethernet Relay Module

HOME RELAY GPIO/ADC DEVICE SETTINGS

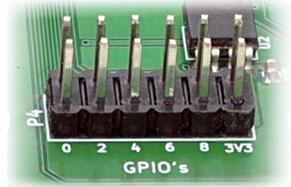
GPIO Configuration

GPIO Configuration	
GPIO	Settings
GPIO 2	<input type="radio"/> Digital I/P <input type="radio"/> Digital O/P <input checked="" type="radio"/> Analog I/P
<input type="button" value="Submit"/>	

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Individual GPIOs on the board can be turned on/off by clicking the '**Toggle GPIO**' button next to the corresponding index. The status change will be displayed on the page immediately for feedback.

All GPIO pins can be used as Analog to Digital Converter inputs as well. The ADC input range is 0 to +3.3V. The ADC can acquire analog signal at the resolution of 10 bits per sample. It is recommended to use a series resistor with the GPIO/ADC pins when interfacing with other circuits. In output mode, GPIOs can source up to 2mA(Refer **Technical Specifications** for more details).



The table below summarizes the GPIO and Analog to Digital Converter input positions on the header.

GPIO	ADC
3V3	3V3
3V3	3V3
I00	ADC0
I01	ADC1
I02	ADC2
I03	ADC3
I04	ADC4
I05	ADC5
I06	ADC6
I07	ADC7
GND	GND
GND	GND

Device Settings

Device Settings page displays the current firmware version, Device ID, Account Settings and Basic Network Settings. A logged in user can change and save the Device ID, User name, password and network settings.

Ethernet Relay Module Administration page

NUMATO LAB 32 Channel Ethernet Relay Module

HOME RELAY GPIO/ADC **DEVICE SETTINGS**

Device Settings

Device Info		
Device ID	<input type="text" value="00000000"/>	
FW version	<input type="text" value="00000008"/>	
Account Settings		
User Name	<input type="text" value="admin"/>	
Password	<input type="text" value="admin"/>	
Basic Network Settings		
MAC Address	<input type="text" value="00:1E:C0:F1:22:D3"/>	
Host Name	<input type="text" value="ETHRELAY32"/>	
Enable DHCP	<input checked="" type="checkbox"/>	
IP Address	<input type="text" value="192.168.0.9"/>	

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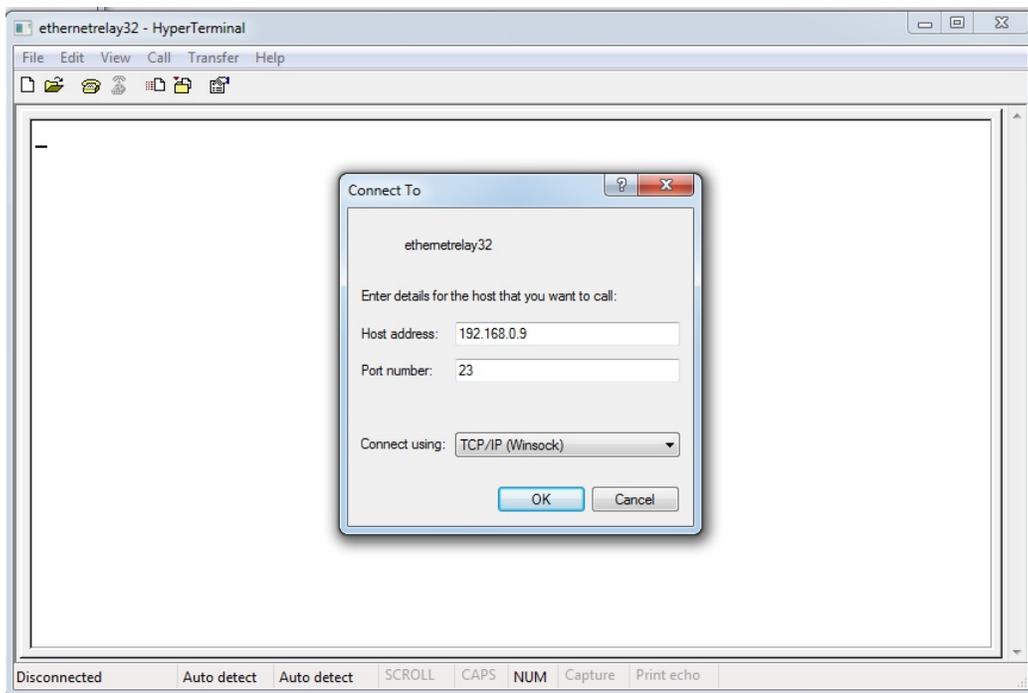
In the above image, firmware version is displayed as 00000008, default device ID 00000000, default user name and password as 'admin'. The user can change and save the Device ID, User name and Password as explained in command set (Page No.19) or changing the appropriate field on this page and clicking on the save button on right side. The user name and password can be reset to factory defaults via Factory Reset explained elsewhere in this document. The Basic Network Settings Shows the Device MAC address, Host Name and IP Address. The default host name and IP Address can also be changed according to the user wish. After saving changes the board will reboot with the new network settings.

Controlling the module through TELNET interface

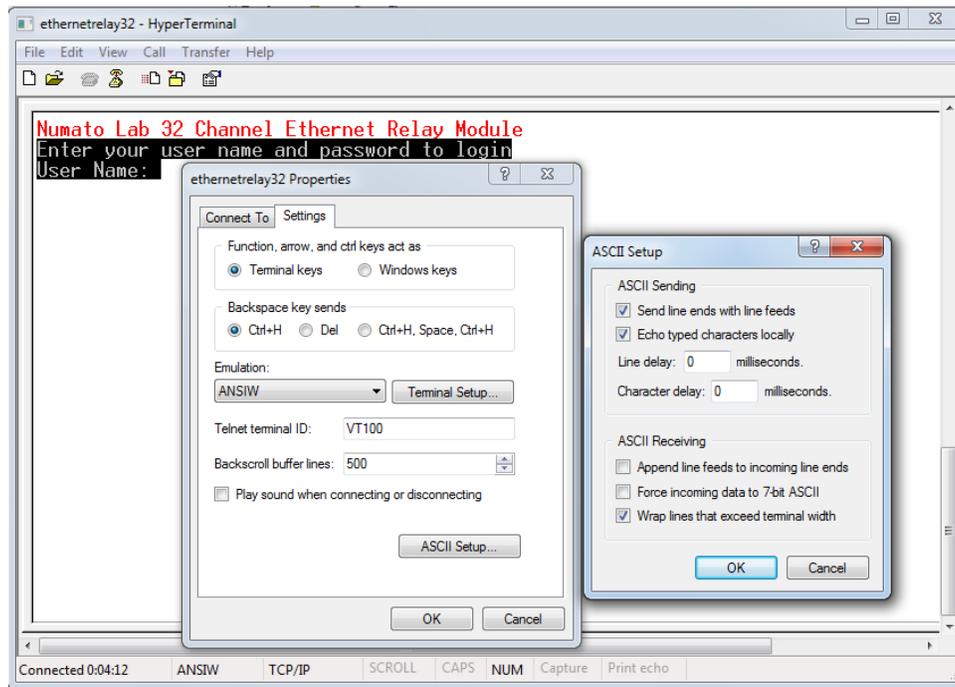
The simple set of ASCII based human readable command set supported by this module makes controlling relays easy via TELNET protocol very easy. The following sections give examples of how to use the module with Hyper Terminal and Tera term.

To use this module with Hyper Terminal, please follow the steps below.

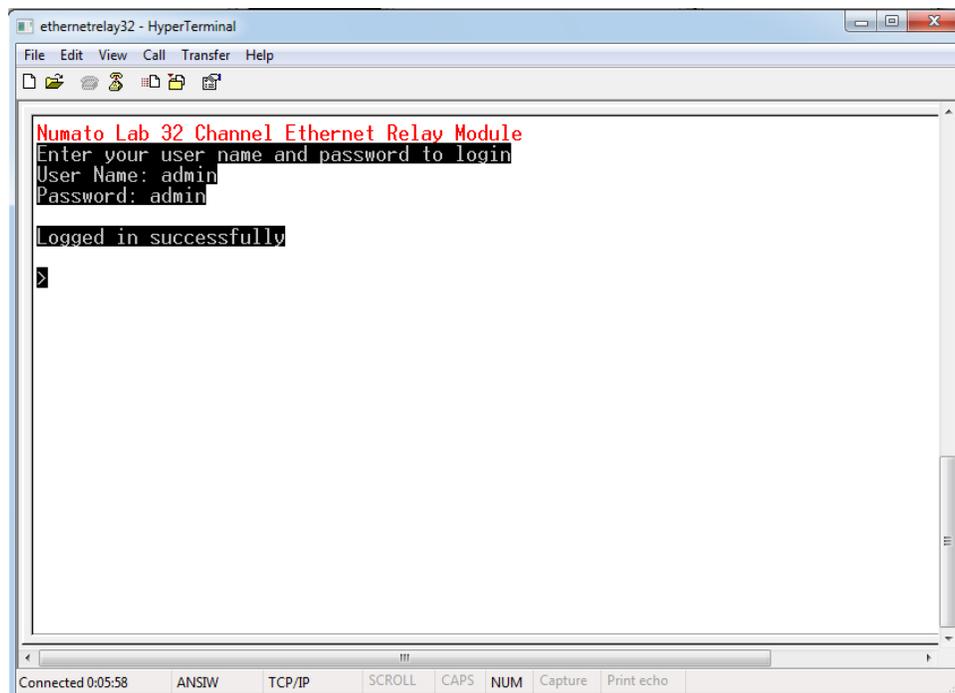
- Connect the module to the PC or LAN.
- Open Hyper Terminal and enter the IP address corresponding to the module, leave the port number as 23.
- Click OK.



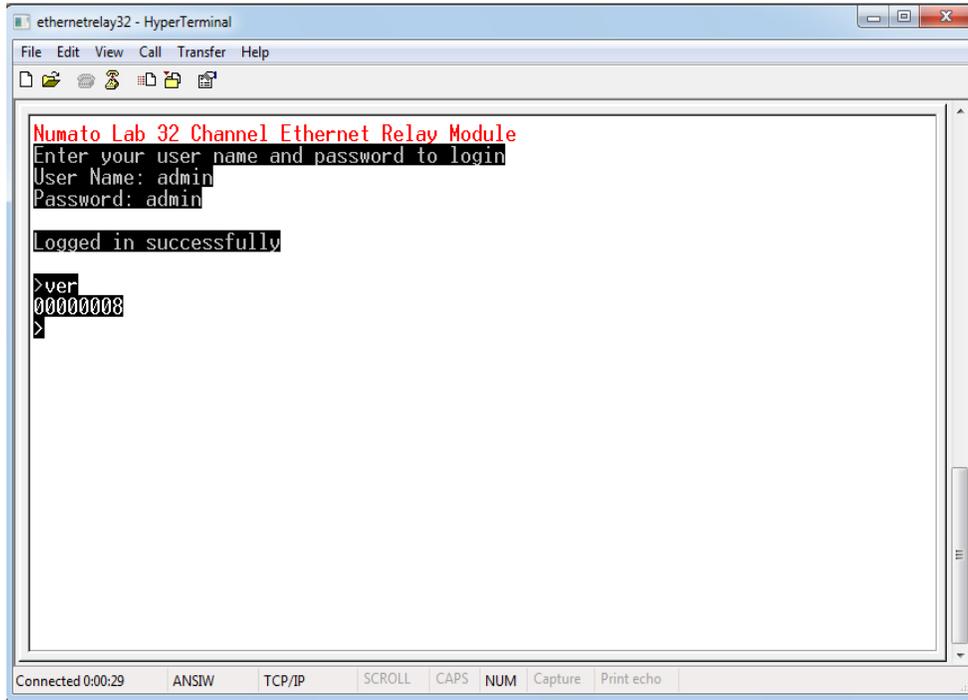
- If everything goes well, you should be presented with a screen as below.
- Select the properties button and do as same as shown below, then press OK.



- Type in the TELNET user name and password when asked and press enter key.



- Press ENTER key again and the command prompt should appear. Commands listed in the table below (please see section “Sending Commands”) can be entered here now. For example, here is the response for “ver” command.

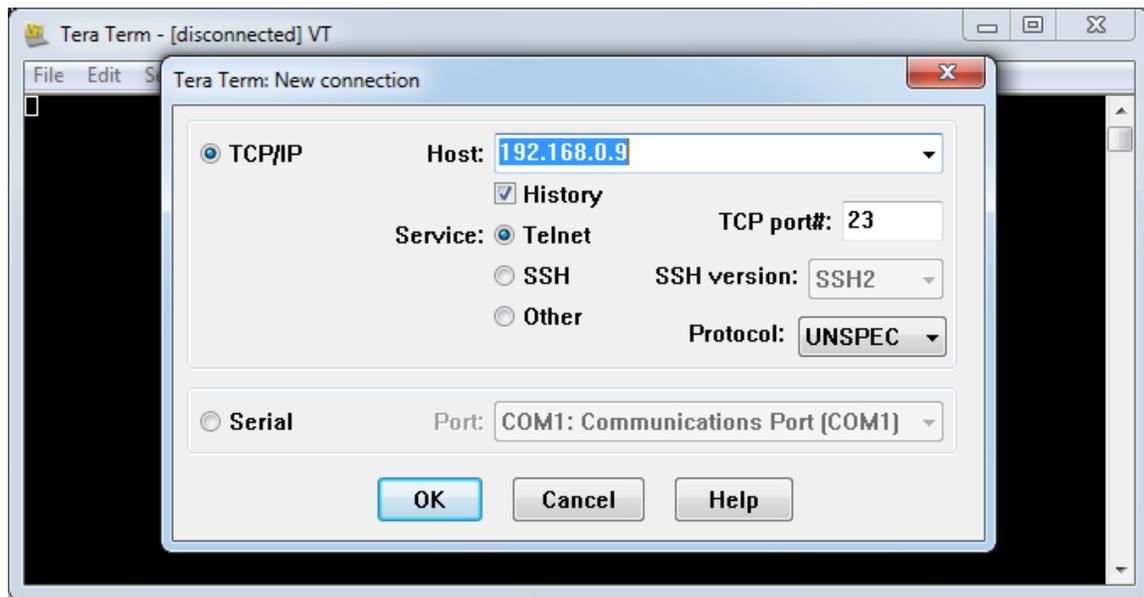


```
ethernetrelay32 - HyperTerminal
File Edit View Call Transfer Help
Numato Lab 32 Channel Ethernet Relay Module
Enter your user name and password to login
User Name: admin
Password: admin
Logged in successfully
>ver
00000008
>
```

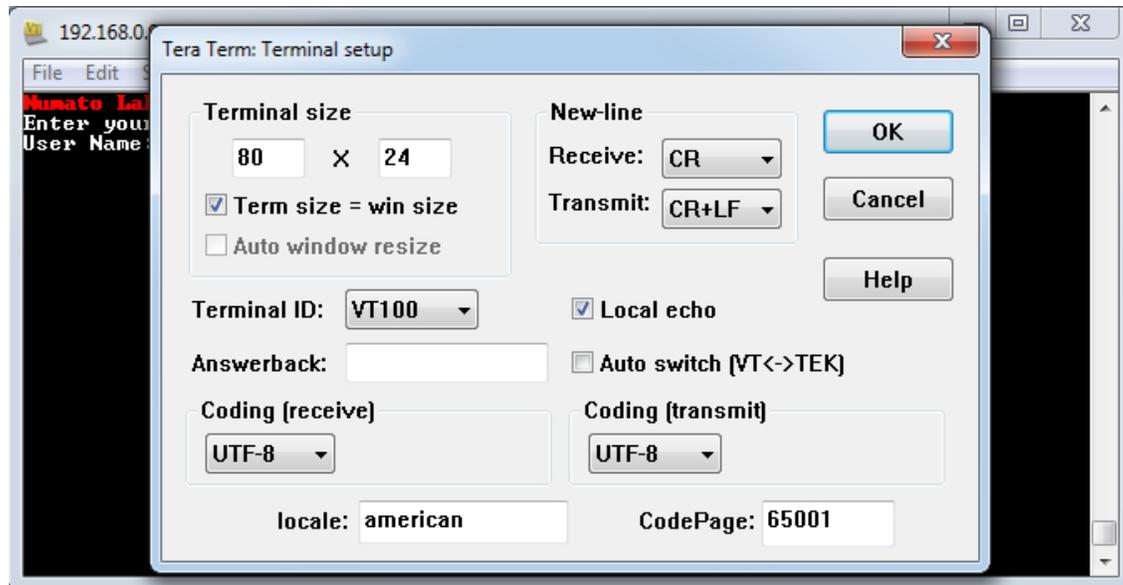
Using the relay module with Tera term is just as easy. Please follow the steps below.

 Tera term is an open source software. A free copy can be downloaded from <http://en.sourceforge.jp/projects/ttssh2/releases/>

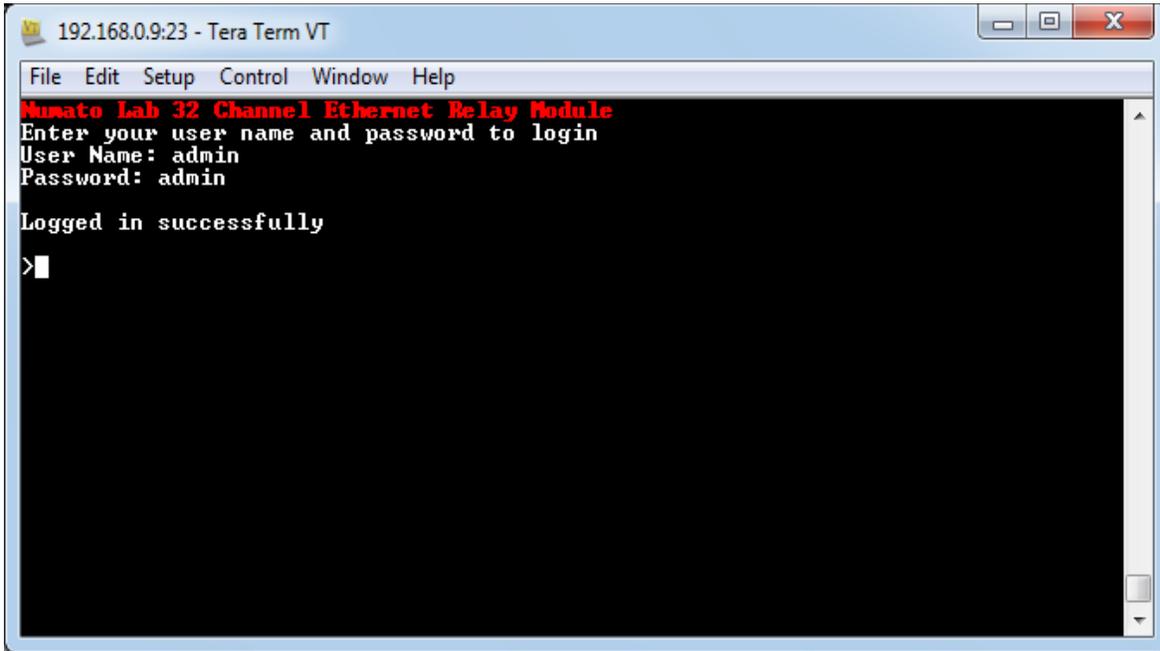
- Run Tera term and type in the IP address corresponding to the module in the “New connection” dialog and click OK.



- Then select the terminal setup from the setup button and make sure the settings are as shown below, and press OK.

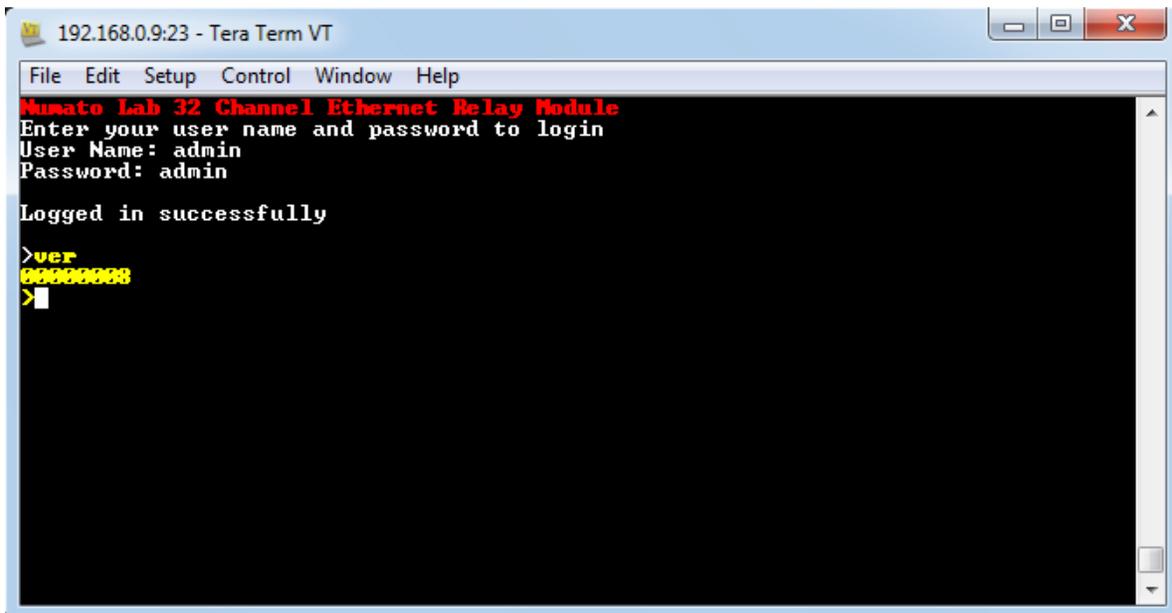


- Type the user name and password when asked.



```
192.168.0.9:23 - Tera Term VT
File Edit Setup Control Window Help
Numato Lab 32 Channel Ethernet Relay Module
Enter your user name and password to login
User Name: admin
Password: admin
Logged in successfully
>|
```

- Press ENTER key and the command prompt should appear. Commands listed in the table below (please see section “Sending Commands”) can be entered here now. For example, here is the response for “ver” command.



```
192.168.0.9:23 - Tera Term VT
File Edit Setup Control Window Help
Numato Lab 32 Channel Ethernet Relay Module
Enter your user name and password to login
User Name: admin
Password: admin
Logged in successfully
>ver
00000000
>|
```

Sending Commands

One of the most powerful features of this module is the simple easy to use command set it supports. This command set allows for a very simple interface to access the features of the module through TELNET protocol. The following sections give details of the command set and how to use the command set.

The command set

This product supports a very simple command set that is designed to be less cryptic and easy to use manually (using terminal emulation programs that support TELNET) or through a program written in one of the many supported languages.

List of currently supported commands.

No.	Command	Parameters	Example	Description
1	ver	None	ver	Returns firmware Version
2	id	get/set xxxxxxxx	id get, id set 12345678	Reads/Sets id of the module
3	usr	get/set xxxxxxxx	usr get, usr set admin	Reads/Sets user name
4	pass	get/set xxxxxxxx	pass get, pass set admin	Reads/Sets password
5	relay	on/off/read, relay number readall/writeall	relay on 0, relay off 0, relay read 0, relay readall, relay writeall ff	Relay control
6	reset	None	reset	Reset relays to default state (all relays turned off)
7	adc	read, channel	adc read 0	Read Analog to Digital Converter input
8	gpio	set/clear/read, gpio number	gpio set 0	Control General Purpose Input/Output

The table below has more detailed information about available commands.

No.	Command	Example	Description
1	ver	ver	Returns current firmware version.
2	id	id get id set xxxxxxxx	Id get reads the module ID. Id set will assign a new ID to the module. "x" stands for alphanumeric characters including

			symbols. The new ID must be exactly 8 characters in length.
3	usr	usr get usr set xxxxxxxx	usr get reads the default user name. usr set will assign a new user name to the module. “x” stands for alphanumeric characters including symbols. The new user name can be 1 – 8 characters length.
4	pass	pass get pass set xxxxxxxx	pass get reads the default password. pass set will assign a new password to the module. “x” stands for alphanumeric characters including symbols. The new password can be 1 – 8 characters length.
5	relay	relay on x	Turns a particular relay on. The parameter “x” stands for the relay number. The relay number starts from zero. See some examples below. <i>relay on 0</i> – Turns on relay 0 <i>relay on 1</i> – Turns on relay 1 This command accepts RELAY number from 0 – 9 and A – V, total 32 values. Eg: “relay on A” writes RELAY 10 as High, “relay read B” reads Relay 11 and so on.
		relay off x	Turns a particular relay off. The parameter “x” stands for the relay number. The relay number starts from zero. See some examples below. <i>relay off 0</i> – Turns off relay 0 <i>relay off 1</i> – Turns off relay 1
		relay read x	Returns the status of a particular relay. The parameter “x” stands for the relay number. The relay number starts from zero. See some examples below. <i>relay read 0</i> – Returns status of relay 0 <i>relay read 1</i> – Returns status of relay 1 The data returned in response to this command will be either “on” or “off” depending on the current status of the relay.
		relay readall	Reads the status of all relays in a single operation. The return value will a hexadecimal number with binary value 1 at bit positions for relays in ON state and 0 for relays in OFF state. Eg: a return value 00000000 (binary 0000 0000 0000 0000 0000 0000 0000 0000) means all relays are OFF. A value FFFFFFFF (binary 1111 1111 1111 1111 1111 1111 1111 1111) means all

			relays are ON. <i>relay readall</i> – Returns status of all relays
		relay xxxxxxxx	writeall Control all relays in a single operation. A hexadecimal value must be specified with desired bit positions set to 0 or 1. A value 0 at a bit position will turn off the corresponding relay. A value 1 at a bit position will turn on the corresponding relay. <i>relay writeall ffffffff</i> – Turns on all relays
6	reset	reset	Resets all relays to off state which is the default state. GPIO's are not by affected by the command.
7	adc	adc read x	Reads the analog voltage present at the ADC input mentioned. "x" stands for the number of ADC input. The response will be a number that ranges from 0 – 1023. Please see examples below. <i>adc read 0</i> – Reads analog input 0 <i>adc read 2</i> – Reads analog input 2
8	gpio	gpio set x	Sets the GPIO output status to high. Here "x" is the number of the GPIO. Please see examples below. <i>gpio set 0</i> – Sets GPIO 0 to high state <i>gpio set 2</i> – Sets GPIO 2 to high state
		gpio clear x	Sets the GPIO output status to low. Here "x" is the number of the GPIO. Please see examples below. <i>gpio clear 0</i> – Sets GPIO 0 to low state <i>gpio clear 2</i> – Sets GPIO 2 to low state
		gpio read x	Reads the digital status present at the input mentioned. Here "x" stands for the number of GPIO. The response will be either "on" or "off" depending on the current digital state of the GPIO. Please see examples below. <i>gpio read 0</i> – Reads GPIO 0 status <i>gpio read 2</i> – Reads GPIO 2 status

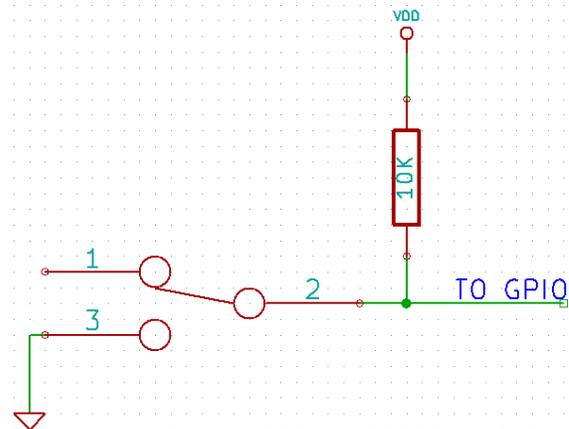
Additional Information

Analog to Digital Converter

Some products do support Analog to Digital Conversion on some of the IO terminals. A list of GPIO's that supports analog function in this product is listed elsewhere in this document. There is no special command is required to execute to switch between analog and digital mode. Executing “adc” command will set the GPIO to analog mode and executing “gpio” command will set the GPIO back to digital mode on the fly. Resolution of the ADC is 10 bits unless otherwise noted. The input voltage range of the ADC is 0 – VDD (this product uses 3.3V power supply, so the range will be 0 – 3.3V). The result will be returned as a number starting at zero and ending at 1023. Zero indicates zero volts at the ADC input and 1023 indicates VDD (3.3V for this product) at ADC input.

Using GPIO's with switches

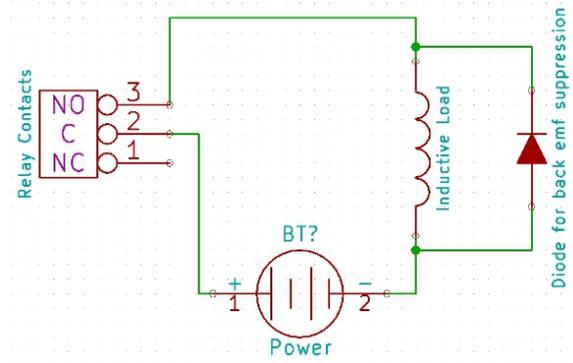
It is possible to read the position of a switch that is connected to a GPIO. A SPST or SPDT switch is recommended to use with GPIO's. Push switches do maintain the contacts closed only for a very short time so using them is discouraged. The fundamental idea of using a switch with GPIO is to have the switch cause a voltage level change at the GPIO pin when pressed. Usually this is achieved by using an external pull-up resistor along with the switch. The pull up resistor is connected between the GPIO and VDD and the switch is connected between the GPIO and ground. When the switch is not pressed, the pull-up resistor will cause the GPIO to stay at VDD voltage level. When the switch is pressed, the GPIO is short circuited to ground and stays at zero voltage. This change in voltage and thus the position of the switch can be read using “gpio read” command. Please see the recommended connection diagram below.



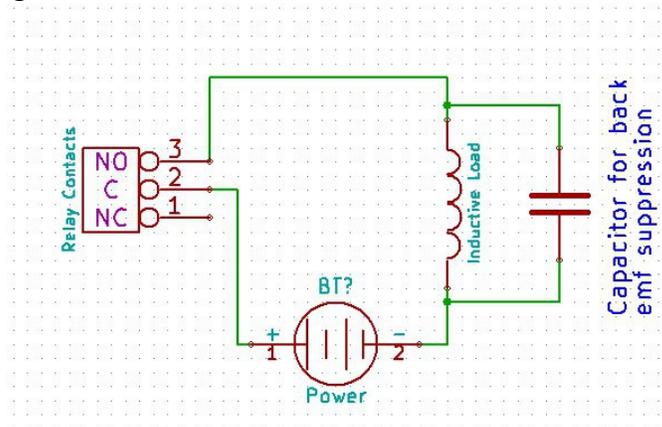
Using relay modules with inductive loads

It is important to take additional care when using relays with inductive loads. An inductive load is pretty much anything that has a coil and works based on magnetic principles like Motors, Solenoids and transformers. Inductive loads produce back emf when the magnitude of the load current changes. The back emf can be in the order of tens or even hundreds of voltage (See this Wikipedia article http://en.wikipedia.org/wiki/Counter-electromotive_force). This effect is most severe when power is disconnected from inductive load because the rate of change of current is maximum at that point. Even though the back emf lives only for a very short time (a few milliseconds) it can cause sparks between the relay contacts and can deteriorate the contact quality over time and reduce the life span for the relays considerably.

So it is important to take countermeasures to suppress the back emf to acceptable levels to protect relay contacts. Usually this requires connecting electronic devices in parallel with the load such that they absorb the high voltage components generated by the load. For solenoids, connecting a diode (fast switching diode is recommended) in parallel to the load (in reverse direction to the load current) is very effective. A diode used for this purpose is usually called a freewheeling diode. Please see the diagram on the right for connection details.



A capacitor with proper rating is recommended for protecting the relay contacts when a motor is used as load. The capacitor should be rated enough to withstand the back emf that is generated by the motor. Please see the diagram below for connection details.



Please note that the relay modules are **NOT** shipped with back emf suppression devices pre-installed. The exact kind of suppression device and the parameters of the selected device can vary depending on the load itself. Some of the parameters that affects the suppression device selection are the inductance of the load, power supply voltage, load current, physical size/structure of the load etc.. It is obvious that it is impossible for us to predict these parameters and design required back emf suppression device and incorporate that on the board. So we believe this is a task best left to the module user. There is an excellent article on designing back emf suppression on Wikipedia at http://en.wikipedia.org/wiki/Flyback_diode

Technical Specifications

Parameter *	Value	Unit
Basic Specifications		
Number of Relays	32	
Number of GPIO's	8	
Number of analog inputs (Multiplexed with GPIO's)	8	
Digital circuit power supply voltage (external)	12	V
Maximum current drawn by digital circuitry	350	mA
Relay Specifications		
Nominal relay coil voltage	12	V
Nominal coil power consumption (per relay)	360	mW
Relay contact material	Silver Alloy	
Contact rating	1A: 10A 240VAC/ 12A 120VAC 1C: 7A 240VAC/ 10A 120VAC	
Maximum switching voltage	250VAC/ 30VDC	
Maximum switching current	15	A
Maximum switching power	2770VA/ 240W	
Contact resistance (initial)	100 Min at 6VDC 1A	mΩ
Life expectancy (Electrical)	100,000	Operations
Life expectancy (Mechanical)	10,000,000	Operations
Nominal insulation resistance	100 Min at 500VDC	MΩ
Maximum switching on response time	10	mS
Maximum switching off response time	5	mS
IO Specifications		
Maximum IO source current	IO0 – IO7	2mA
Maximum IO sink current	IO0 – IO7	2mA
GPIO input low voltage	0.15	V

GPIO input high voltage	3.3	V
GPIO output low voltage	0	V
GPIO output high voltage	3.3	V
ADC Specifications		
Resolution	10	bits
Full scale range	0 – VDD	V
Reference voltage	VDD	V
Recommended Impedance of Analog Voltage Source	2.5	K Ω

* All parameters considered nominal. Numato Systems Pvt. Ltd. reserve the right to modify products without notice.

* <http://kyotarelays.com/datasheets/KT%20603.pdf>

FAQ

Q. What is the connector marked as ICSP on this module?

A. This connector is used to program the on-board microcontroller. This connector is primarily intended for factory use.

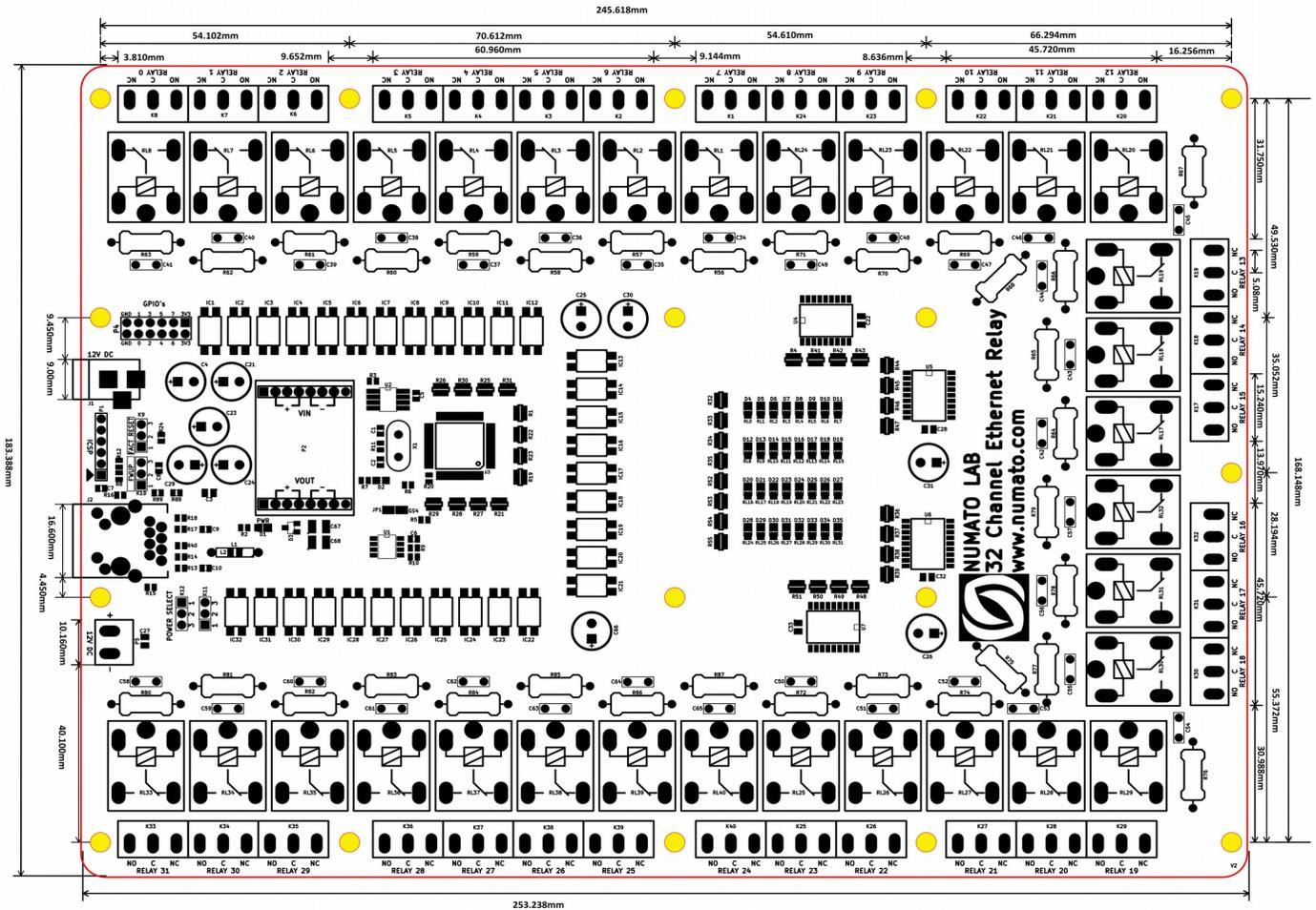
Q. I need a customized version of this product, can Numato do the customization for me?

A. Yes, we can definitely do customization but there may be minimum order requirements depending on the level of customization required. Please write to sales@numato.com for a quote.

Q. Where can I buy this product?

A. All Numato products can be ordered directly from our web store <http://www.numato.com>. We accept major credit cards and Paypal and ship to almost all countries with a few exceptions. We do have distributors in many countries where you can place your order. Please find the current list of distributors at <http://numato.com/distrib>.

Physical Dimensions



L x W x H : 253.238 mm x 183.388 mm x 20 mm
 Mechanical Hole Diameter : 4.0 mm

Schematics

See next page.

