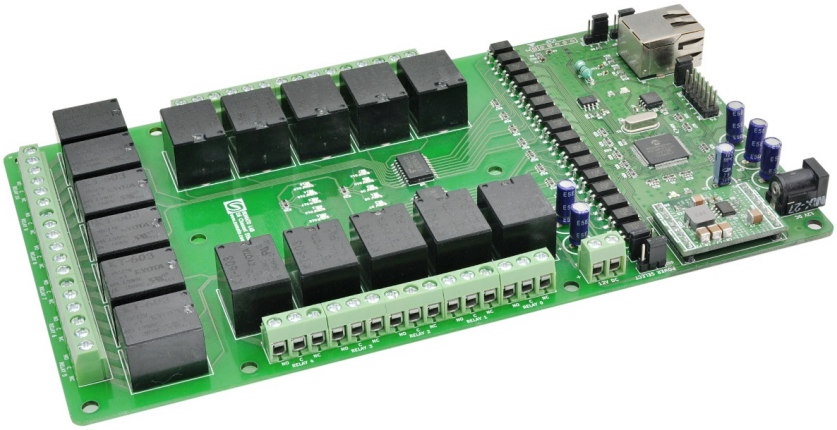

16 Channel Ethernet Relay Module

User Guide

NUMATO LAB

www.numato.com

Rev 9

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Introduction

Numato Lab's 16 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: 16 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

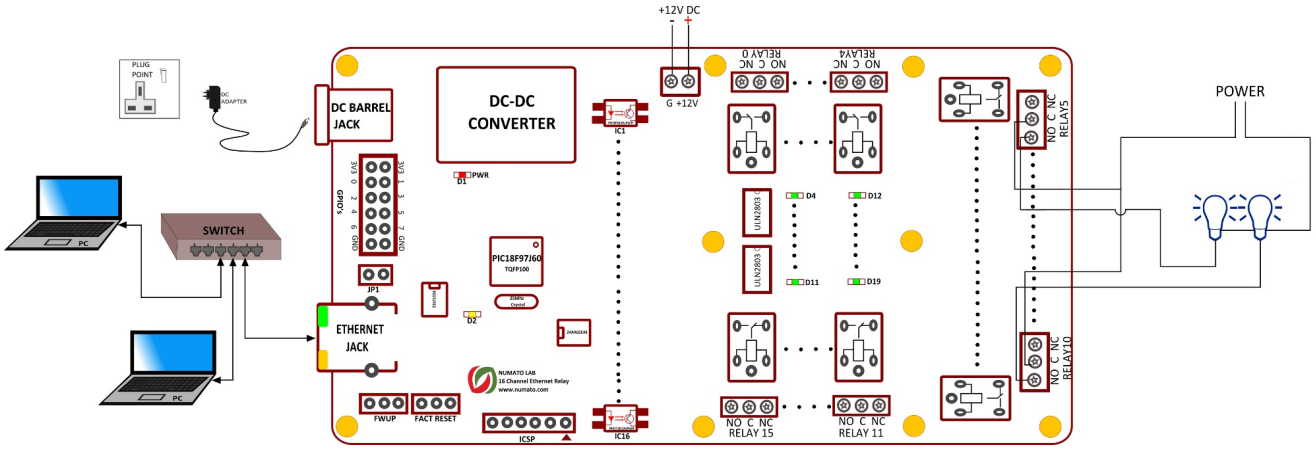
Along with the module, you may need the items in the list below for easy and fast installation.

1. CAT 5e Ethernet Cable(Straight through cable)
2. +12V 1.5 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.

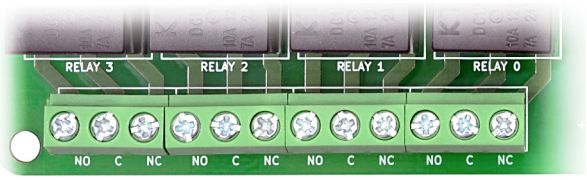
1. Direct connection to Local Area Network(LAN) via common straight through Ethernet cable.
Eg: Connecting the module to a switch in a network.

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.

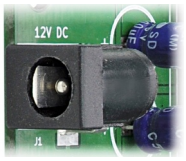


Relay State	Connection between NC and C	Connection between NO and C
OFF	Close	Open
ON	Open	Close

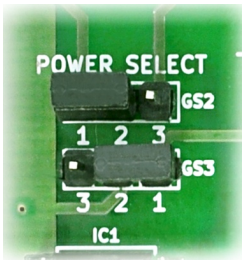
DC Power Supply

This module can be powered in two ways.

1. Use a 12V 1.5A 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 cuircuits are not isolated from each other in this configuration.

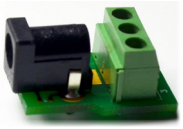


2. Use a 7-12V 1A DC power supply for the logic circuit on **J1** and a separate 12V 1A DC power supply for relays on **P5**. Configure the Jumper on **GS2, GS3** in **POWER SELECT** to 2-3 for using this way.



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.

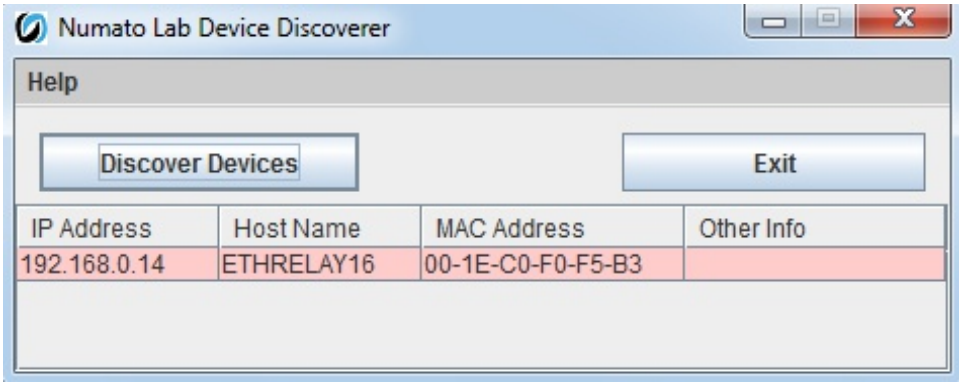
Please use this feature only for recovering the user name / password. This action will reset User Name, Password, Device ID and also other settings as well. After reset the board can be accessed using the default user name and password.

The factory default settings will be as below table.

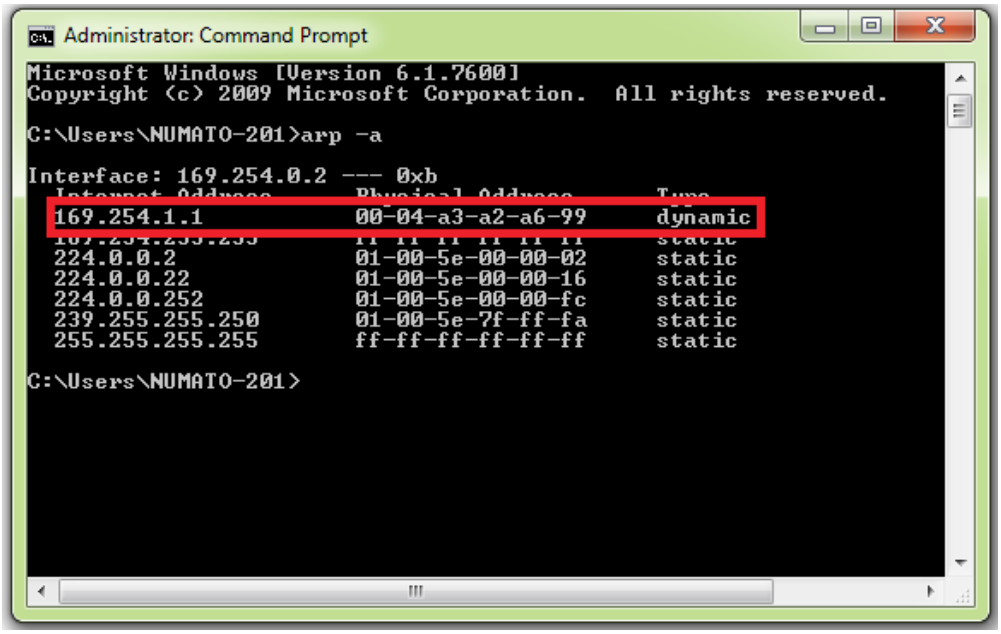
User name	admin
Password	admin
ID	00000000
Host Name	ETHRELAY16
IP Address	DHCP Enabled

Powering Up 16 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.



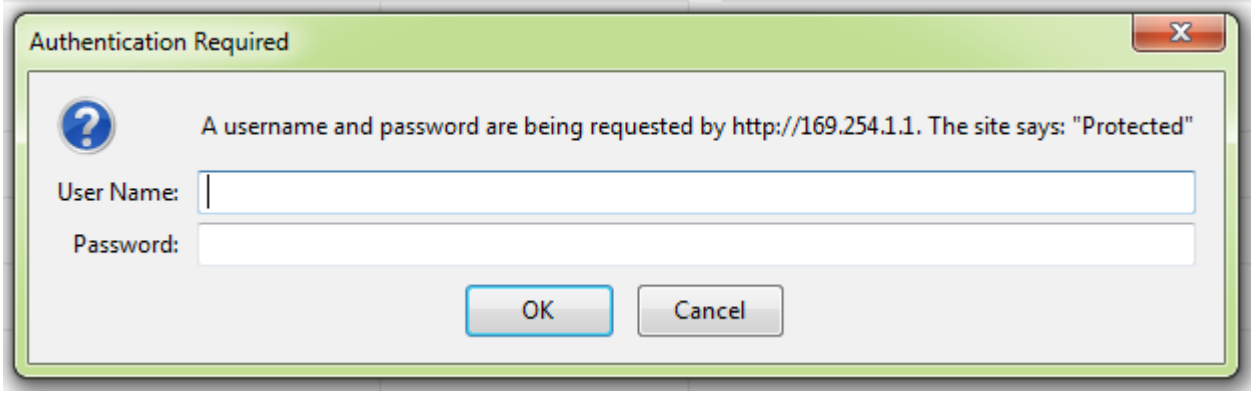
Accessing the module

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

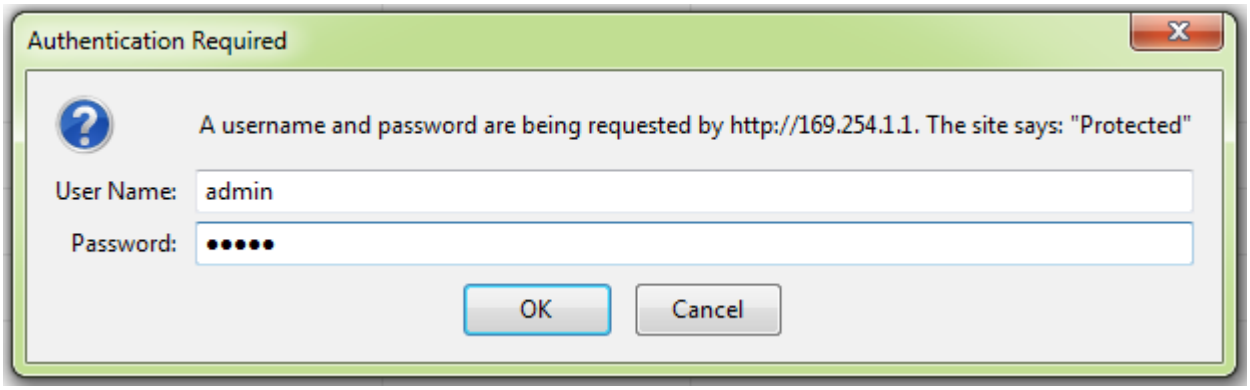
1. Through HTML/Web Page served from the device.
2. Through a Serial terminal Emulator that supports TELNET (Eg: Hyper terminal, Teraterm, PUTTY...).

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.

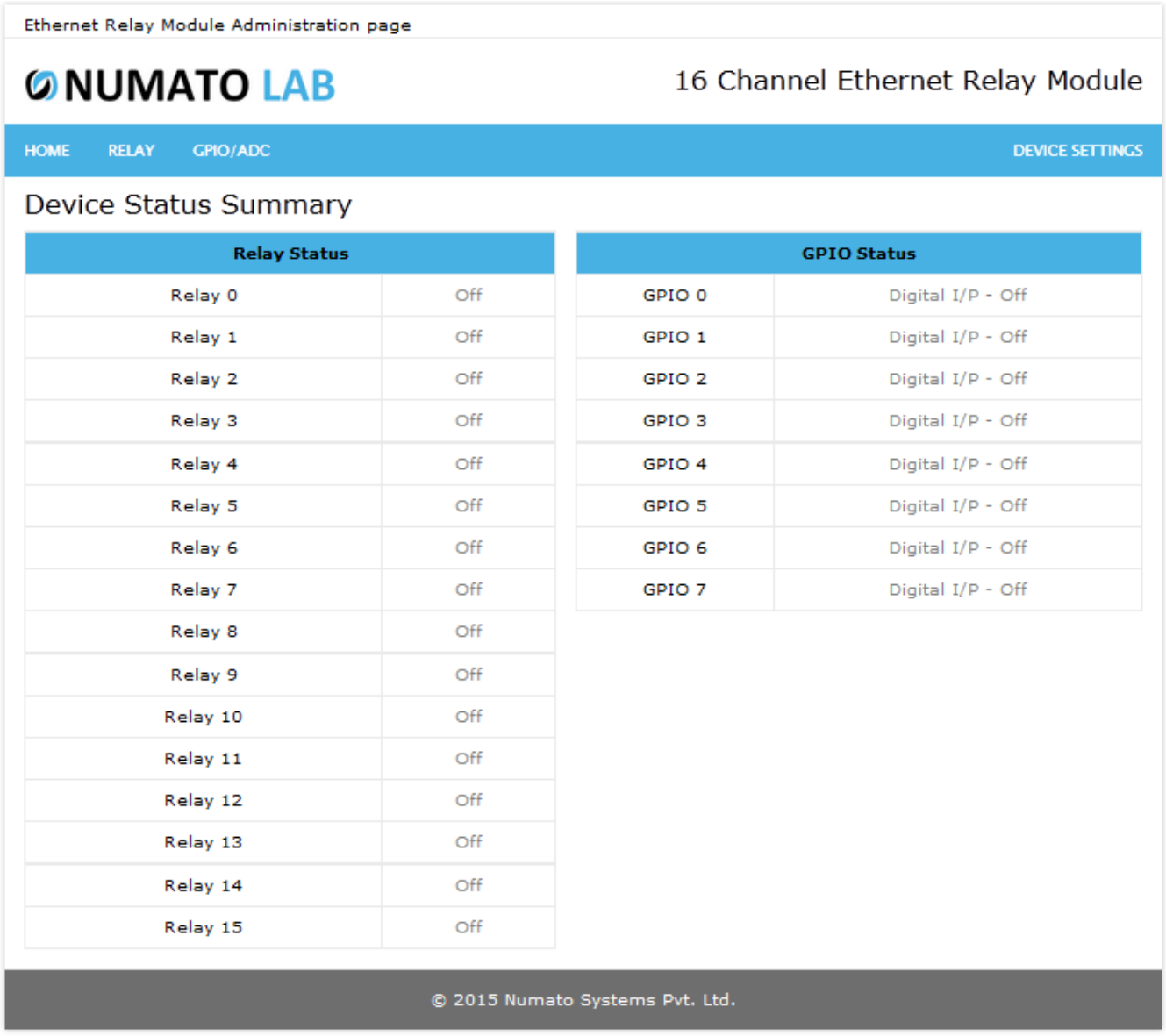


You will prompted to enter user name and password. The default user name and password is '**admin**'. You may change the user name and password once logged in.



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.



Relay Status and Control

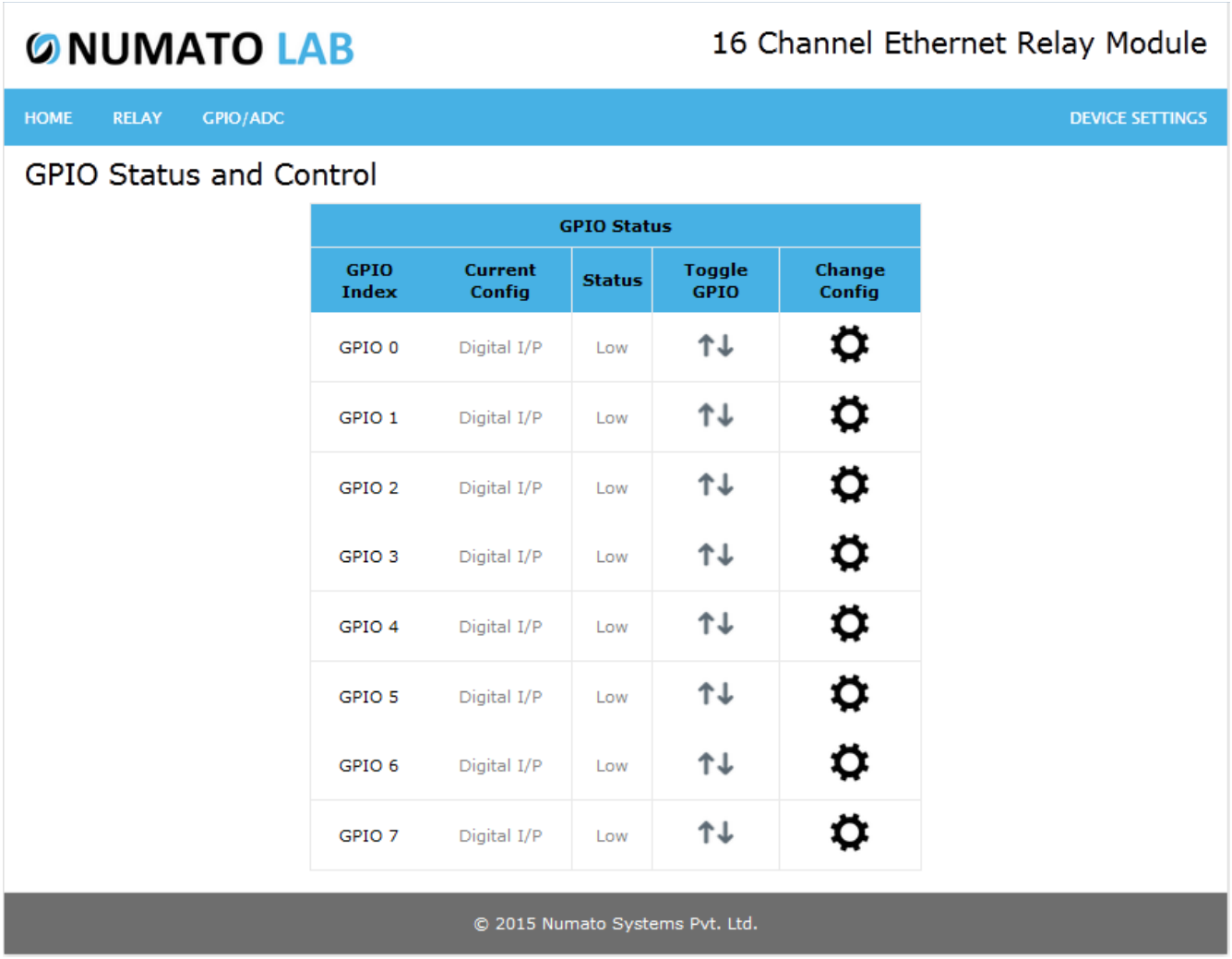
There are 16 SPDT relays on the board that can be controlled over Ethernet. Click on the “Relay” link on the menu bar to access Relay configuration page. The **'Relay Index'** shows the corresponding relay on board. Relays on the board can be turned on/off by clicking the '**Toggle Relay**' button next to the corresponding relay index. The '**Status**' of the relays change automatically for easy identification.

Relay Status		
Relay Index	**Status**	**Toggle Relay**
Relay 0	On	↑↓
Relay 1	Off	↑↓
Relay 2	On	↑↓
Relay 3	Off	↑↓
Relay 4	On	↑↓
Relay 5	Off	↑↓
Relay 6	On	↑↓
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	↑↓

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.

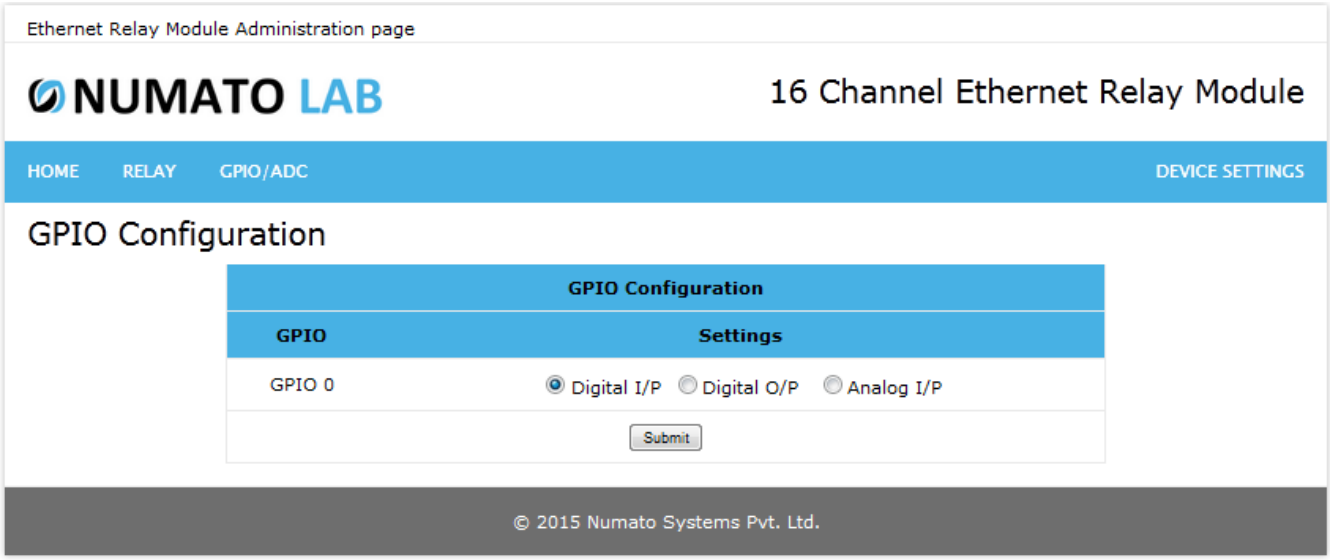


Individual GPIO can be configured in three modes.

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

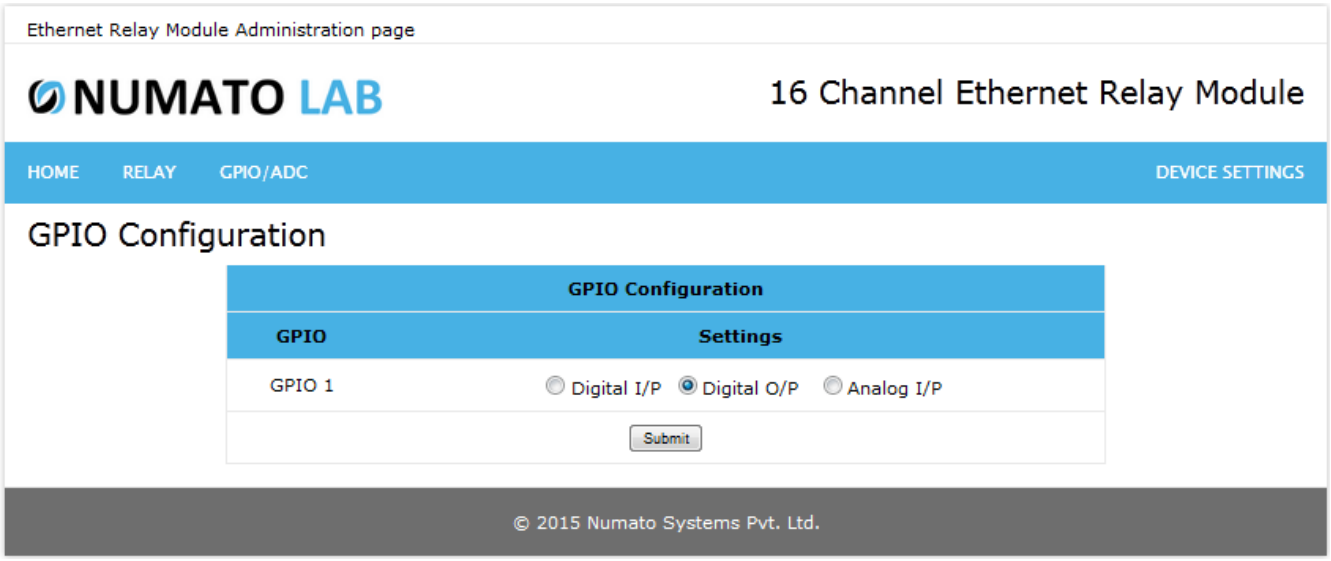
Digital Input(I/P)

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.



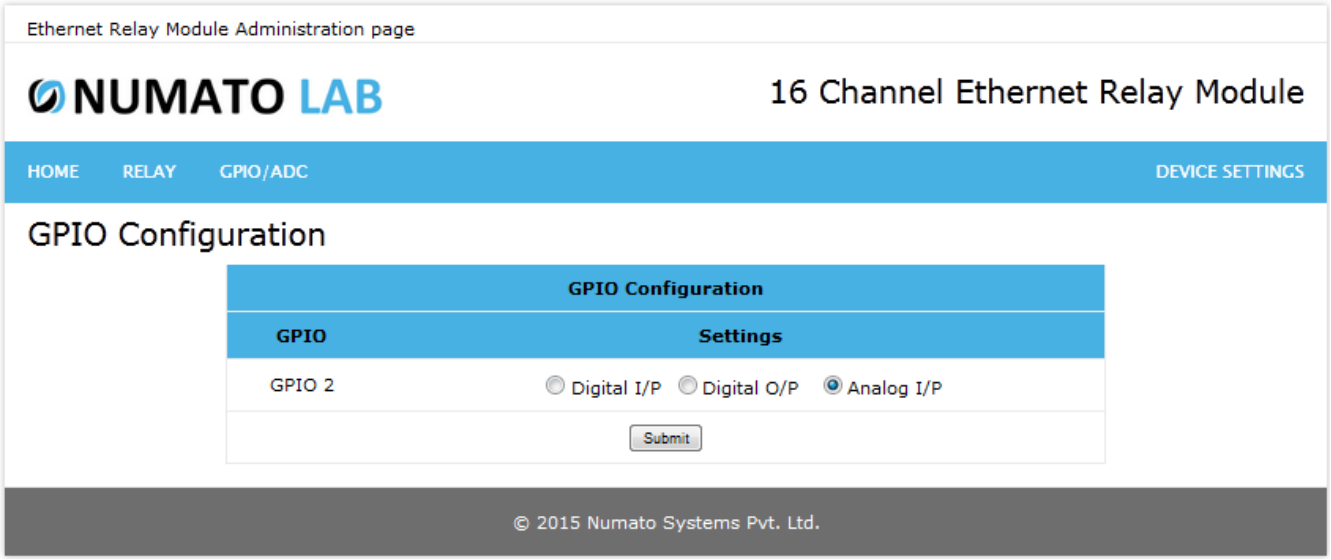
Digital Output(O/P)

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.



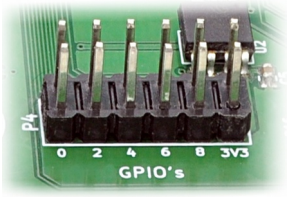
Analog Input (I/P)

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.



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).

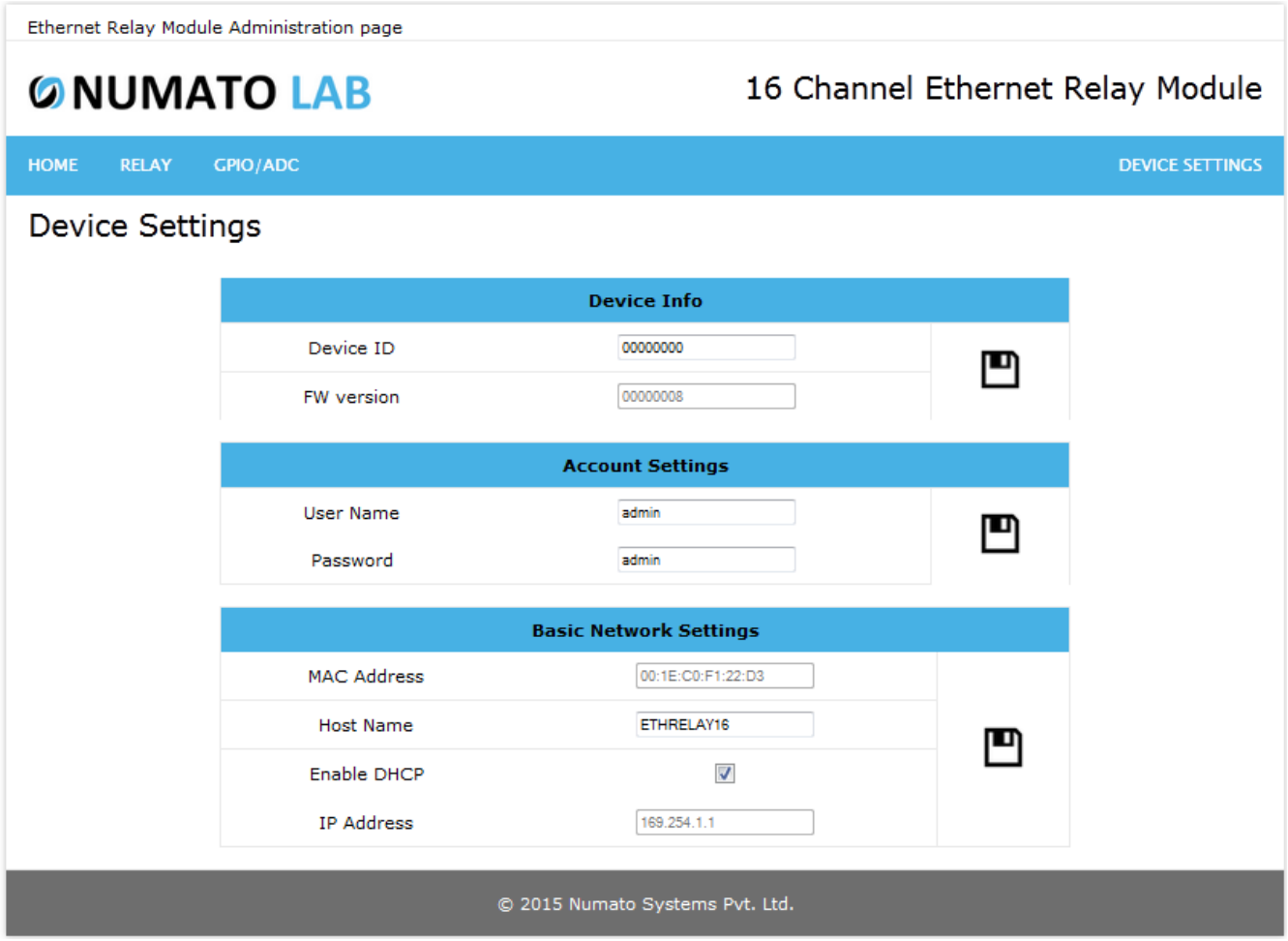


The table below summarizes the GPIO and Analog to Digital Converter input positions on the header.

GPIO	ADC
3V3	3V3
3V3	3V3
IO0	ADC0
IO1	ADC1
IO2	ADC2
IO3	ADC3
IO4	ADC4
IO5	ADC5
IO6	ADC6
IO7	ADC7
GND	GND
GND	GND

Device Settings

Device Settings page displayes 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.



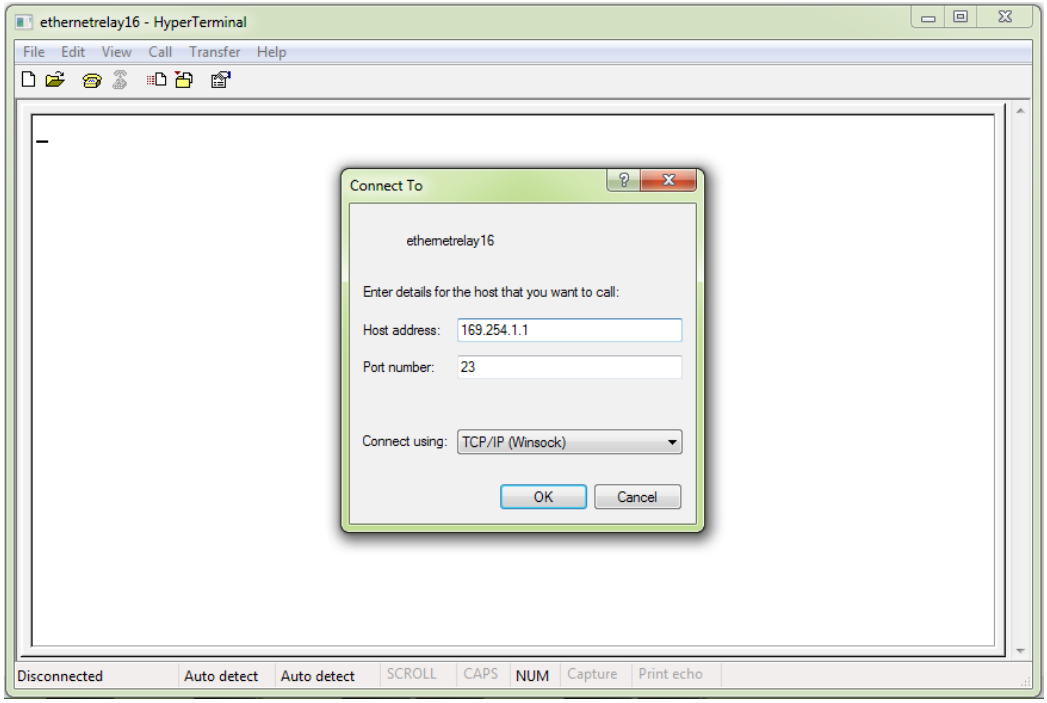
In the above image, firmware version is displayed as 00000008, default device ID 00000000, default user name and password as 'admin'. The user can change and save the Device ID, User name and Password as explained in command set (Page No.22) or changing the appropriate field on this page and clicking 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

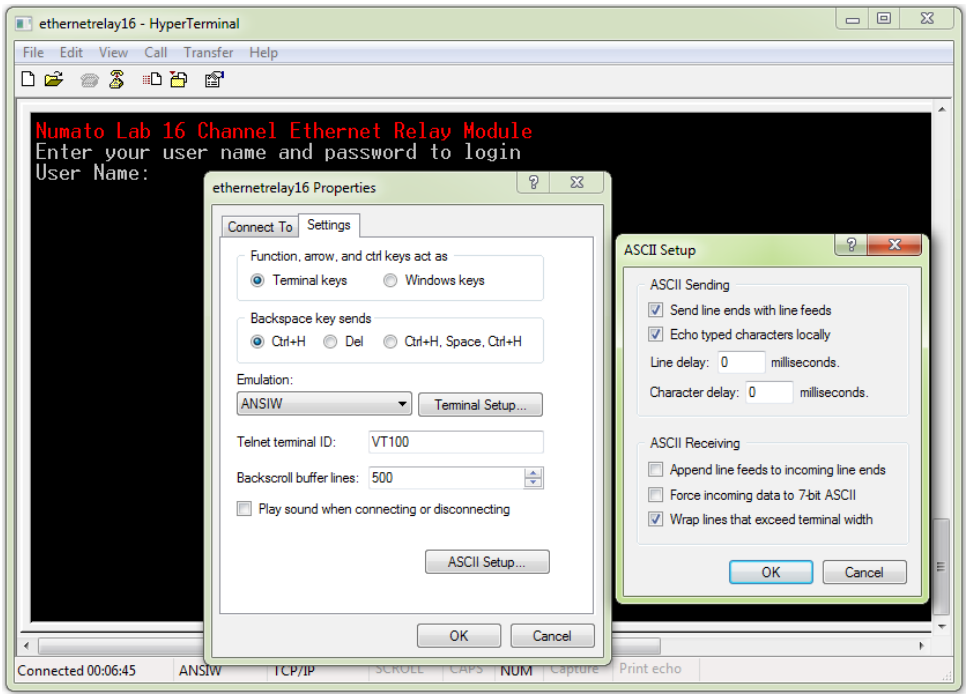
The simple set of ASCII based human readable command set supported by this module makes controlling relays easy via TELNET protocol very easy. The following sections give examples of how to use the module with Hyper Terminal and Tera term.

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

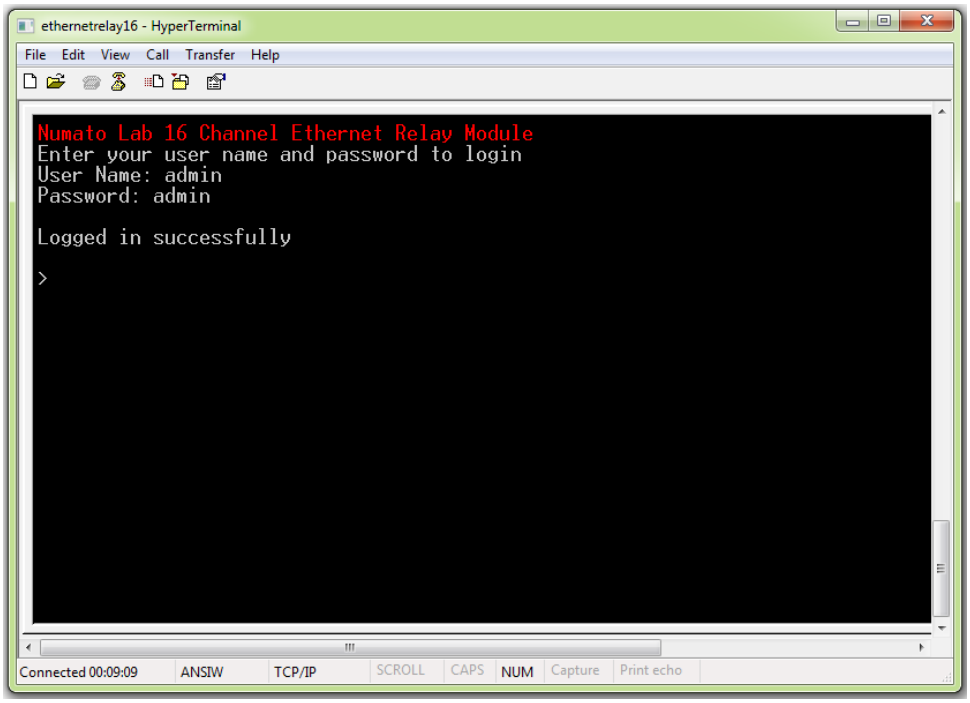
- Connect the module to the PC or LAN.
- Open Hyper Terminal and enter the IP address corresponding to the module, leave the port number as 23.
- Click OK.



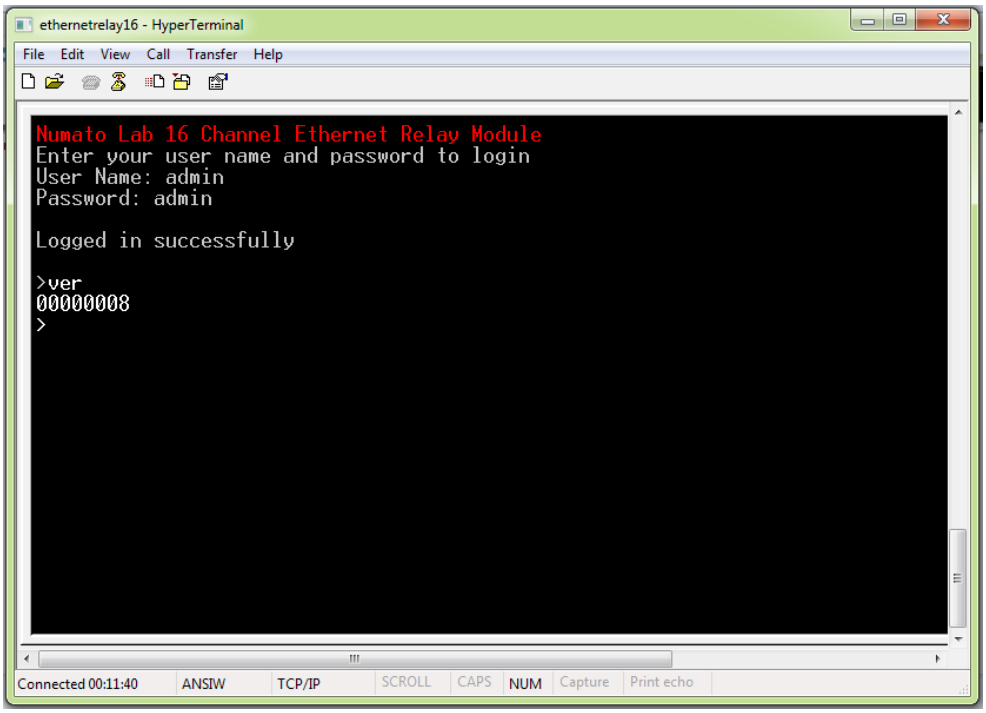
- If everything goes well, you should be presented with a screen as below.
- Select the properties button and do as same as shown below, then press OK.



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



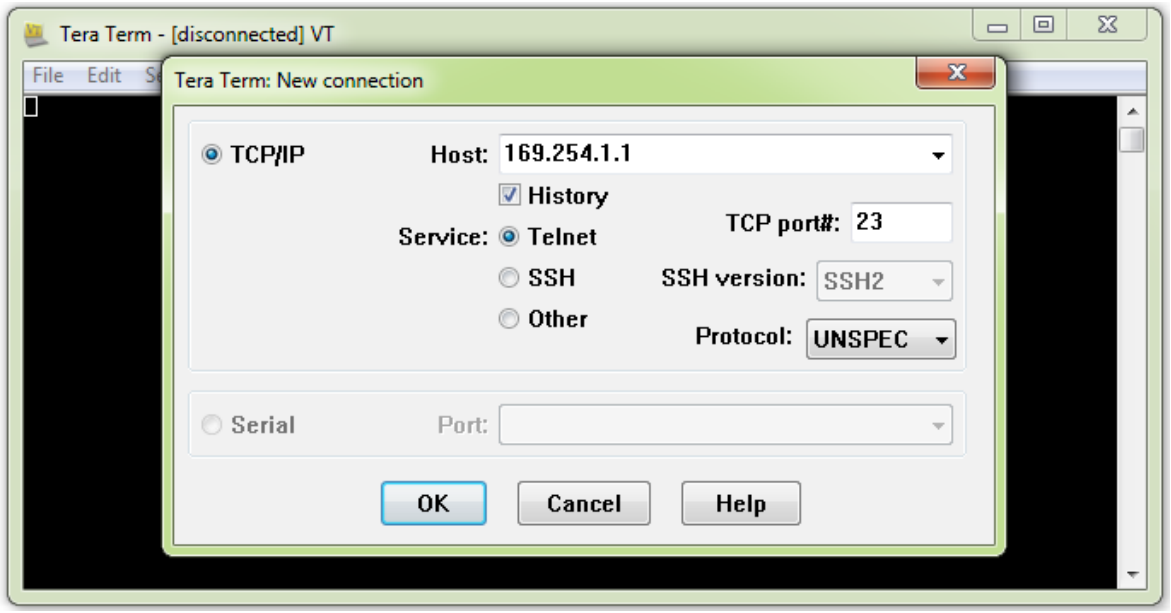
- Press ENTER key again and the command prompt should appear. Commands listed in the table below (please see section “Sending Commands”)can be entered here now. For example, here is the response for “ver” command.



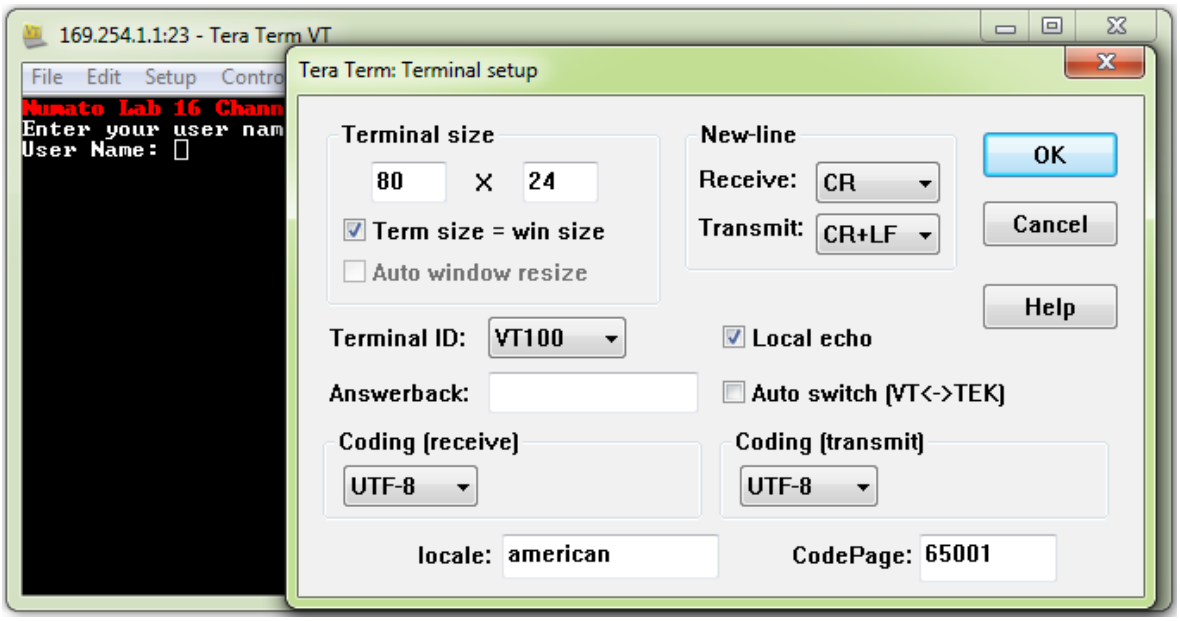
Using the relay module with Tera term is just as easy. Please follow the steps below.

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

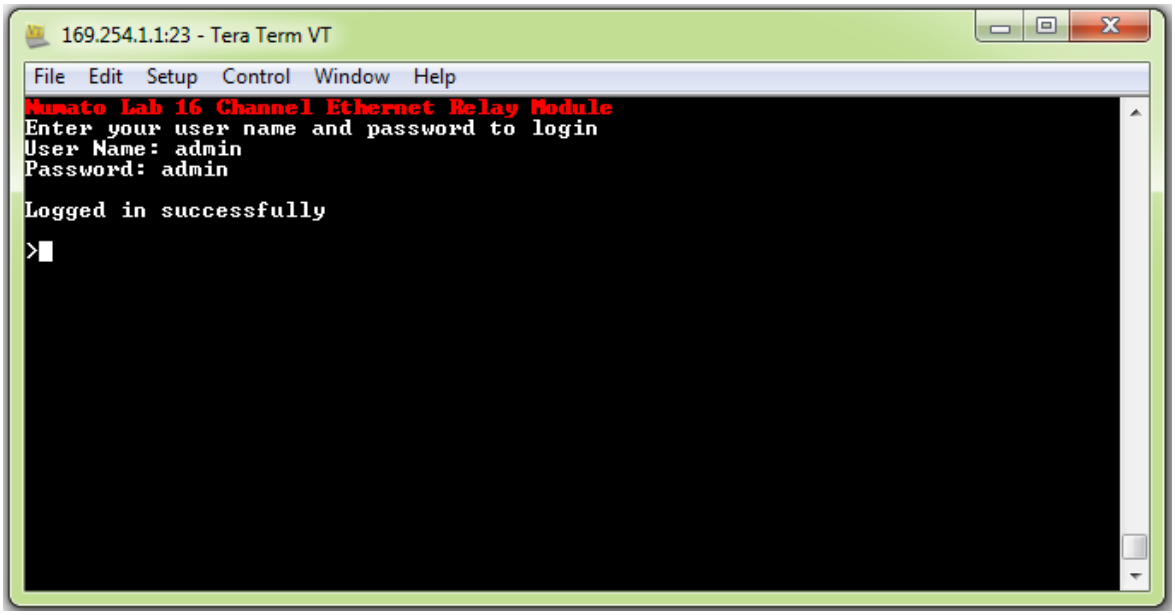
- Run Tera term and type in the IP address corresponding to the module in the “New connection” dialog and click OK.



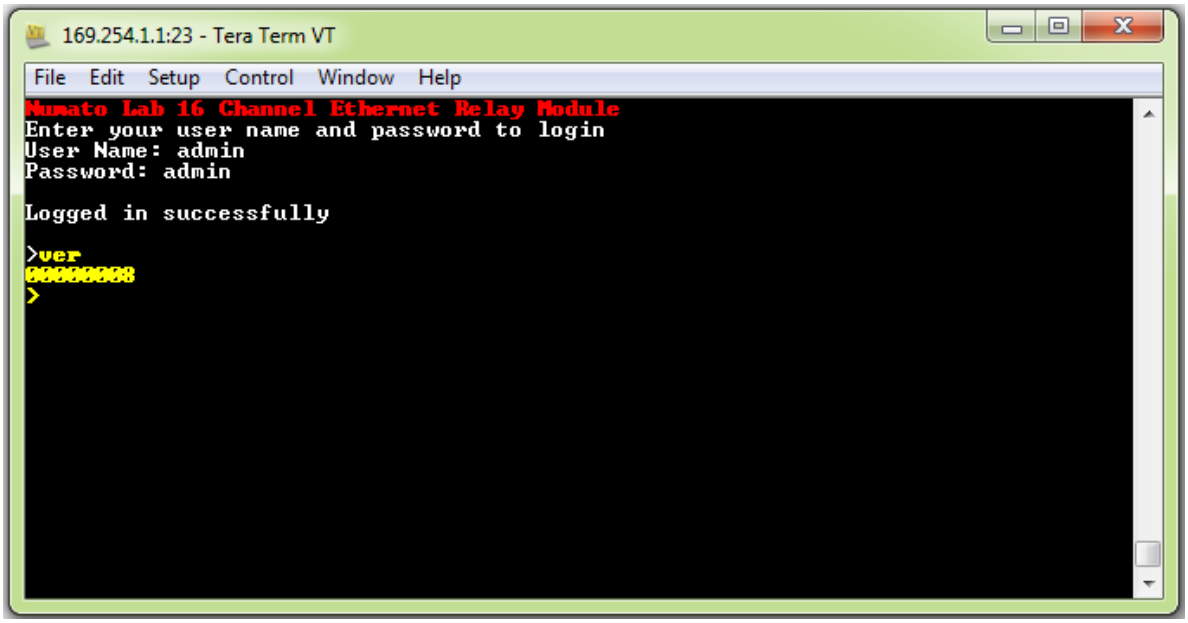
- Then select the terminal setup from the setup button and make sure the settings are as shown below, and press OK.



- Type the user name and password when asked.



- 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.



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 usr 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. This command accepts relay number from 0 - 9 and A – F, total 16 values. See some examples below. *relay on 0* – Turns on relay 0 *relay on A* – Turns on relay 10
		relay off *x*	Turns a particular relay off. The parameter "*x*" stands for the relay number. The relay number starts from zero. This command accepts relay number from 0 - 9 and A – F, total 16 values. See some examples below. *relay off 0* – Turns off relay 0 *relay off A* – Turns off relay 10
		relay read *x*	Returns the status of a particular relay. The parameter "*x*" stands for the relay number. The relay number starts from zero. This command accepts relay number from 0 - 9 and A – F, total 16 values. See some examples below.. *relay read 0* – Returns status of relay 0 *relay read A* – Returns status of relay 10 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 00 (binary 0000 0000 0000 0000) means all relays are OFF. A value FF (binary 1111 1111 1111 1111) means all relays are ON.

			relay readall – Returns status of all relays
		relay writeall xxxx	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. *relay writeall ffff* – 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. *adc read 0* – Reads analog input 0 *adc read 2* – 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. *gpio set 0* – Sets GPIO 0 to high state *gpio set 2* – 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. *gpio clear 0* – Sets GPIO 0 to low state *gpio clear 2* – 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. *gpio read 0* – Reads GPIO 0 status *gpio read 2* – Reads GPIO 2 status

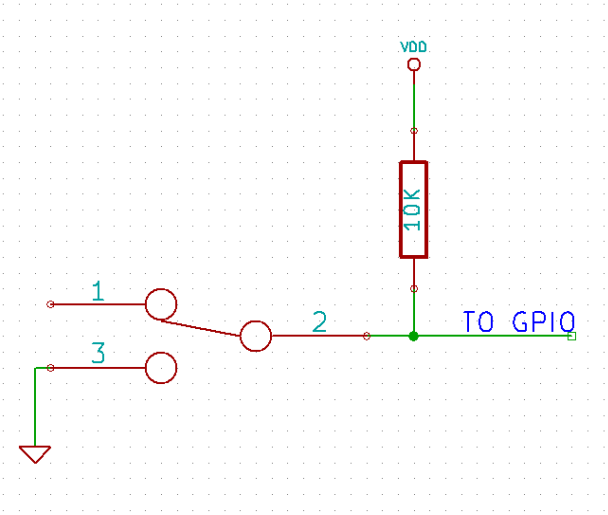
Additional Information

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

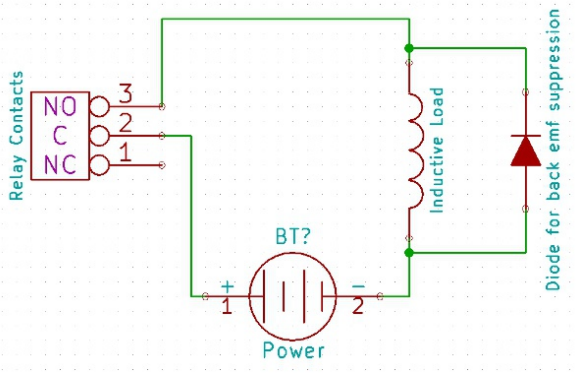
It is possible to read the position of a switch that is connected to a GPIO. A SPST or SPDT switch is recommended to use with GPIO's. Push switches do maintain the contacts closed only for a very short time so using them is discouraged. The fundamental idea of using a switch with GPIO is to have the 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.



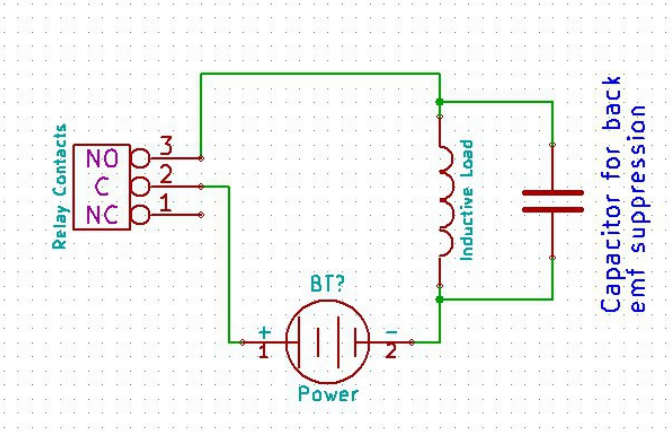
Using relay modules with inductive loads

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	16	
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	600	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 – IO9	2mA
Maximum IO sink current	IO0 – IO9	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	KΩ

* All parameters considered nominal. Numato Systems Pvt. Ltd. reserve the right to modify products without notice.
* http://kyotarelays.com/datasheets/KT%20603.pdf

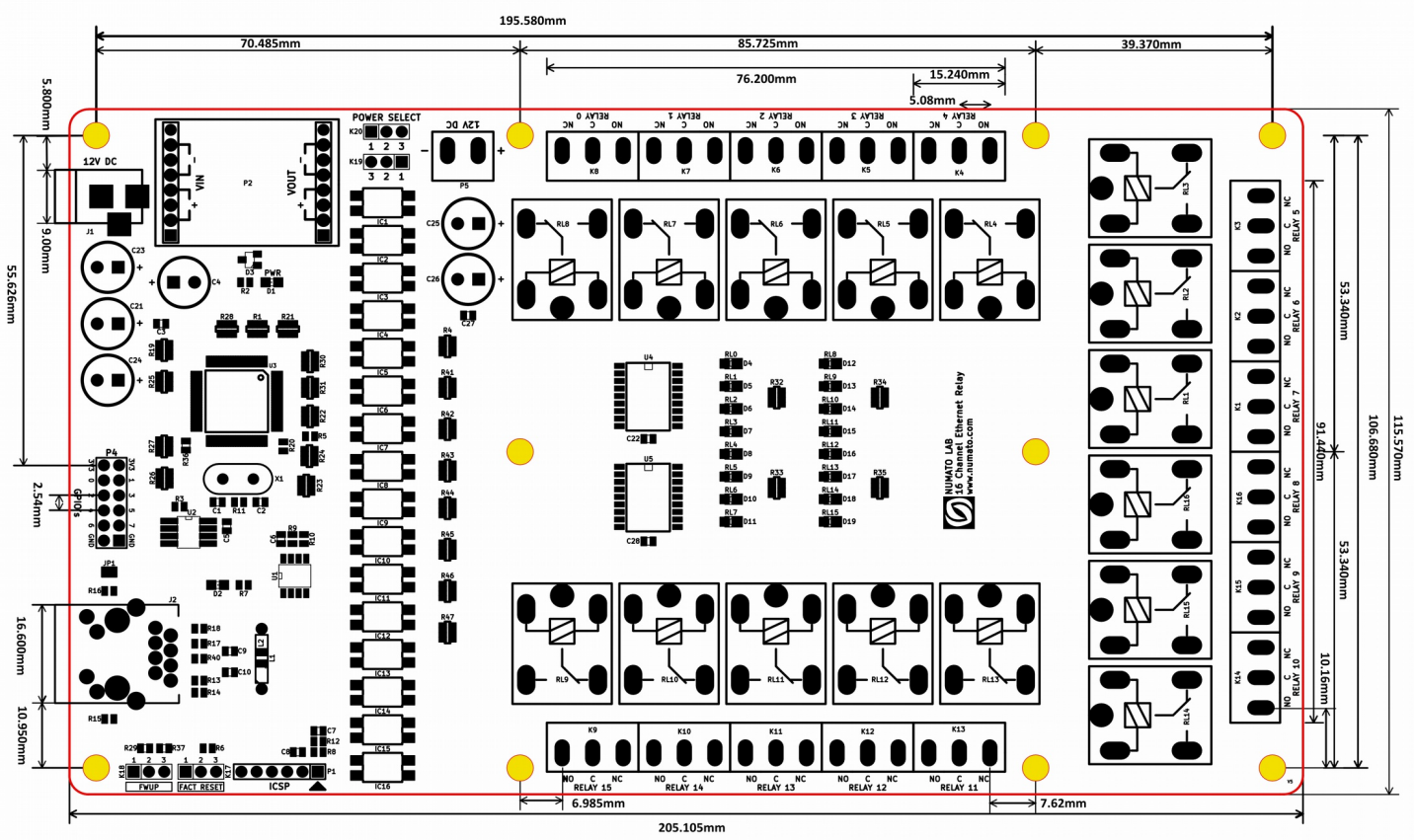
FAQ

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.

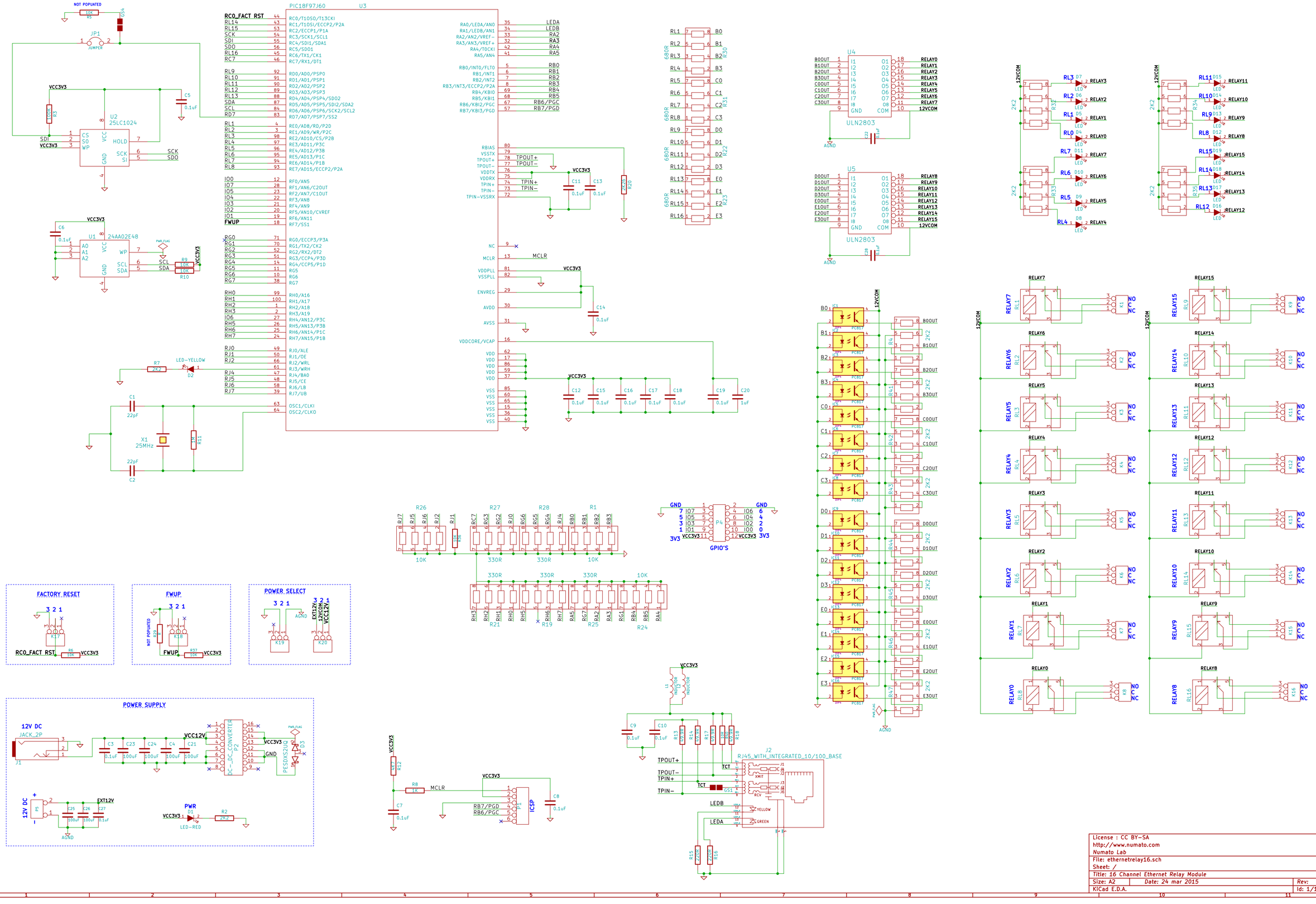
Physical Dimensions



L x W x H : 205.105 mm x 115.570 mm x 20 mm
Mechanical Hole Diameter : 4.0 mm

Schematics

See next page.


NOT POPUATED
10K
R5
JP1
JUMPER
VCC3V3
0.1uF
C5
10K
R3
U2
25LC1024
CS
SO
WP
HOLD
SCK
SI
GND
VCC
SDI
SDO
SCK
SDI
VCC3V3
C6
0.1uF
U1
24AA02E48
A0
A1
A2
WP
SCL
SDA
GND
VCC
PWR_FLAG
R9
10K
R10
VCC3V3
R7
2K2
LED-YELLOW
D2
C1
22pF
X1
25MHz
C2
22pF
1M
R11
PIC18F97J60
U3
RC0_FACT RST
RL14
RL15
SCK
SDI
SDO
RL16
RC7
RL9
RL10
RL11
RL12
RL13
SDA
SCL
RD7
RL1
RL2
RL3
RL4
RL5
RL6
RL7
RL8
IO0
IO7
IO5
IO4
IO3
IO2
IO1
FWUP
RG0
RG1
RG2
RG3
RG4
RG5
RG6
RG7
RH0
RH1
RH2
RH3
IO6
RH5
RH6
RH7
RJ0
RJ1
RJ2
RJ3
RJ4
RJ5
RJ6
RJ7
OSC1/CLKI
OSC2/CLKO
RC0/T1OSO/T13CKI
RC1/T1OSI/ECCP2/P2A
RC2/ECCP1/P1A
RC3/SCK1/SCL1
RC4/SDI1/SDA1
RC5/SDO1
RC6/TX1/CK1
RC7/RX1/DT1
RD0/AD0/PSP0
RD1/AD1/PSP1
RD2/AD2/PSP2
RD3/AD3/PSP3
RD4/AD4/PSP4/SDO2
RD5/AD5/PSP5/SDI2/SDA2
RD6/AD6/PSP6/SCK2/SCL2
RD7/AD7/PSP7/SS2
RE0/AD8/RD/P2D
RE1/AD9/WR/P2C
RE2/AD10/CS/P2B
RE3/AD11/P3C
RE4/AD12/P3B
RE5/AD13/P1C
RE6/AD14/P1B
RE7/AD15/ECCP2/P2A
RF0/AN5
RF1/AN6/C2OUT
RF2/AN7/C1OUT
RF3/AN8
RF4/AN9
RF5/AN10/CVREF
RF6/AN11
RF7/SS1
RG0/ECCP3/P3A
RG1/TX2/CK2
RG2/RX2/DT2
RG3/CCP4/P3D
RG4/CCP5/P1D
RG5
RG6
RG7
RH0/A16
RH1/A17
RH2/A18
RH3/A19
RH4/AN12/P3C
RH5/AN13/P3B
RH6/AN14/P1C
RH7/AN15/P1B
RJ0/ALE
RJ1/OE
RJ2/WRL
RJ3/WRH
RJ4/BA0
RJ5/CE
RJ6/LB
RJ7/UB
RA0/LEDA/AN0
RA1/LEDB/AN1
RA2/AN2/VREF-
RA3/AN3/VREF+
RA4/T0CKI
RA5/AN4
RB0/INT0/FLT0
RB1/INT1
RB2/INT2
RB3/INT3/ECCP2/P2A
RB4/KBI0
RB5/KBI1
RB6/KBI2/PGC
RB7/KBI3/PGD
LEDA
LEDB
RA2
RA3
RA4
RA5
RB0
RB1
RB2
RB3
RB4
RB5
RB6/PGC
RB7/PGD
RBIAS
VSSTX
TPOUT+
TPOUT-
VDDTX
VDDRX
TPIN+
TPIN-
TPIN-VSSRX
TPOUT+
TPOUT-
TPIN+
TPIN-
C11
0.1uF
C13
0.1uF
2K26
R20
NC
MCLR
VDDPLL
VSSPLL
ENVREG
AVDD
AVSS
VDDCORE/VCAP
C14
0.1uF
VDD
VSS
C12
C15
C16
C17
C18
C19
C20
1uF
0.1uF
680R
R30
R31
R22
R23
RL1
RL2
RL3
RL4
RL5
RL6
RL7
RL8
RL9
RL10
RL11
RL12
RL13
RL14
RL15
RL16
B0
B1
B2
B3
C0
C1
C2
C3
D0
D1
D2
D3
E0
E1
E2
E3
U4
U5
ULN2803
B0OUT
B1OUT
B2OUT
B3OUT
C0OUT
C1OUT
C2OUT
C3OUT
D0OUT
D1OUT
D2OUT
D3OUT
E0OUT
E1OUT
E2OUT
E3OUT
RELAY0
RELAY1
RELAY2
RELAY3
RELAY4
RELAY5
RELAY6
RELAY7
RELAY8
RELAY9
RELAY10
RELAY11
RELAY12
RELAY13
RELAY14
RELAY15
12VCOM
AGND
C22
0.1uF
C28
0.1uF
12VCOM
2K2
R32
R33
R34
R35
LED
RL1
RL2
RL3
RL4
RL5
RL6
RL7
RL8
RL9
RL10
RL11
RL12
RL13
RL14
RL15
RL16
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
D19
RELAY0
RELAY1
RELAY2
RELAY3
RELAY4
RELAY5
RELAY6
RELAY7
RELAY8
RELAY9
RELAY10
RELAY11
RELAY12
RELAY13
RELAY14
RELAY15
B0
B1
B2
B3
C0
C1
C2
C3
D0
D1
D2
D3
E0
E1
E2
E3
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
PC817
R4
R42
R43
R44
R45
R46
R47
2K2
B0OUT
B1OUT
B2OUT
B3OUT
C0OUT
C1OUT
C2OUT
C3OUT
D0OUT
D1OUT
D2OUT
D3OUT
E0OUT
E1OUT
E2OUT
E3OUT
PWR_FLAG
AGND
RELAY7
RELAY6
RELAY5
RELAY4
RELAY3
RELAY2
RELAY1
RELAY0
RELAY15
RELAY14
RELAY13
RELAY12
RELAY11
RELAY10
RELAY9
RELAY8
RL1
RL2
RL3
RL4
RL5
RL6
RL7
RL8
RL9
RL10
RL11
RL12
RL13
RL14
RL15
RL16
K1
K2
K3
K4
K5
K6
K7
K8
K9
K10
K11
K12
K13
K14
K15
K16
NO
C
NC
R26
R27
R28
R1
R21
R19
R25
R24
330R
10K
RH7
RH6
RH5
RH4
RH3
RH2
RH1
RH0
RG7
RG6
RG5
RG4
RA3
RA2
RA1
RA0
RB5
RB4
RB3
RB2
RB1
RB0
RA4
P4
GPIO'S
IO7
IO5
IO3
IO1
IO6
IO4
IO2
IO0
VCC3V3
GND
3V3
FACTORY RESET
RC0_FACT RST
R6
10K
K17
FWUP
R37
10K
K18
NOT POPUATED
R29
0
POWER SELECT
EXT12V
12VCOM
VCC12V
K19
K20
POWER SUPPLY
12V DC
JACK_2P
J1
C3
C23
C24
C4
C21
0.1uF
100uF
VCC12V
DC-DC_CONVERTER
P2
GND
PWR_FLAG
D3
PESDS2UQ
P3
EXT12V
C25
C26
C27
100uF
0.1uF
AGND
PWR
D1
LED-RED
R2
2K2
C9
C10
0.1uF
L1
INDUCTOR
R13
R14
R17
R18
4.99R
J2
RJ45_WITH_INTEGRATED_10/100_BASE
TPOUT+
TPOUT-
TPIN+
TPIN-
TCT
XMIT
RCV
LEDB
LEDA
YELLOW
GREEN
R15
R16
220R
R8
1K
MCLR
C7
0.1uF
C8
0.1uF
ICSP
P1
RB7/PGD
RB6/PGC
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http://www.numato.com
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Size: A2
Date: 24 mar 2015
Rev:
KiCad E.D.A.
Id: 1/1