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ETH8020 - 20 Relays at 16A, 8 Analogue Inputs

Technical Documentation



Overview

The ETH8020 provides 20 volt free contact relay outputs with a current rating of up to 16Amp each and 8 analogue inputs. The module is powered from a 12vdc supply which can be regulated or unregulated. The DC input jack is 2.1mm with positive core polarity, DC supplies are required to supply at least 1A at 12vdc. The relays are SPCO (Single Pole Change Over) types. The normally open, normally closed and common pins are all available on the screw terminals.The Relays on the ETH8020 can be controlled from the inputs on the ETH484 or another ETH8020. This offers the opportunity to construct a system where an input can control an output anywhere on the earth provided both locations are connected to the network/internet.

Operating temperature

-40C to +70C

LED indication

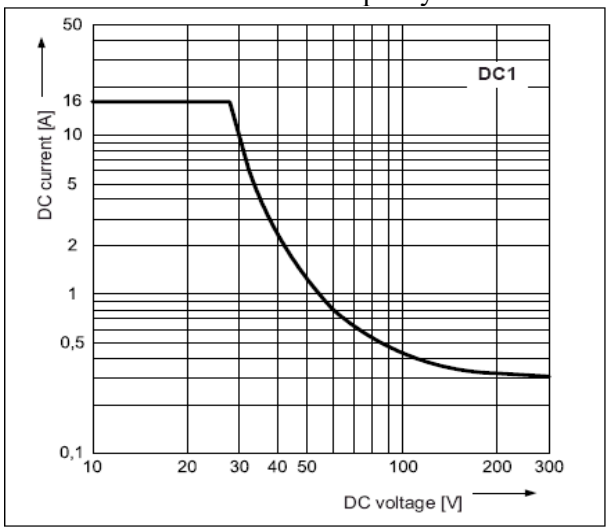
The ETH8020 provides a red LED mounted immediately next to each relay to indicate whether it is in a powered state (LED on), there is also two LED's mounted in the Ethernet connector which will flash with Ethernet traffic. Finally there is a green power LED next to the processor.

Relay power rating

If the contact load voltage and current of the relay are in the region enclosed by the solid and dotted lines in the figure below, the relay can perform stable switching operation. If the relay is used at a voltage or current exceeding this region, the life of the contacts may be significantly shortened.

load type	Typical applications	Rating
AC1	Non inductive or slightly inductive loads	16A @ 250V AC
AC15	Control of electromagnetic load (>72VA)	3A @ 120V AC 1.5A @ 240V AC
AC3	Control of motor	750W
DC1	Non inductive or slightly inductive loads	16A @ 24V DC
DC13	Control of electromagnetic loads	0.22A @ 120V DC 0.1A @ 250V DC

Max DC load capacity

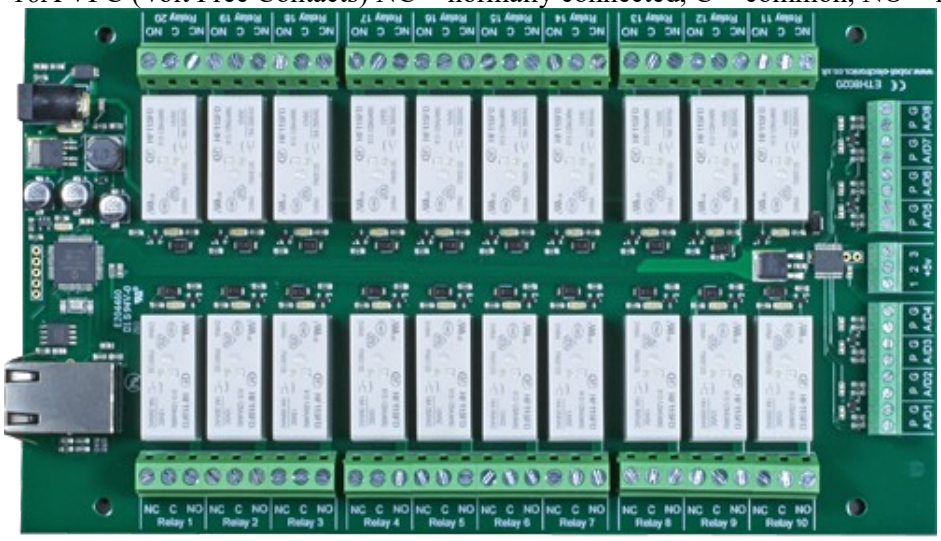


A full datasheet for the relays used on the ETH8020 is here: HF115FD datasheet

Connections

16A VFC (Volt Free Contacts) NC = normally connected, C = common, NO = normally open

12v dc output
Direct from
2.1mm jack



Analogue
inputs
P = Analogue
Input (0-5v)
G = 0v ground

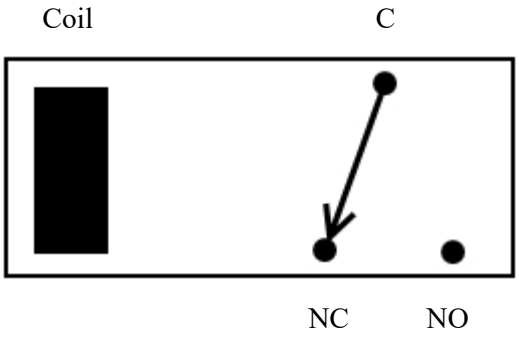
RJ45
Ethernet

16A VFC (Volt Free Contacts) NC = normally connected, C = common, NO = normally open

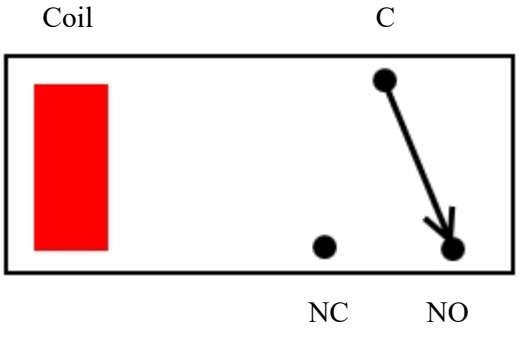
Power relays

Four 16A volt free contact relays are provided for switching a common input between a normally closed output and a normally open output. The relay coil is powered by the 12vdc incoming supply on user command.

Relay in passive state

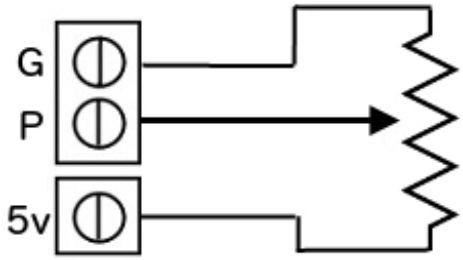
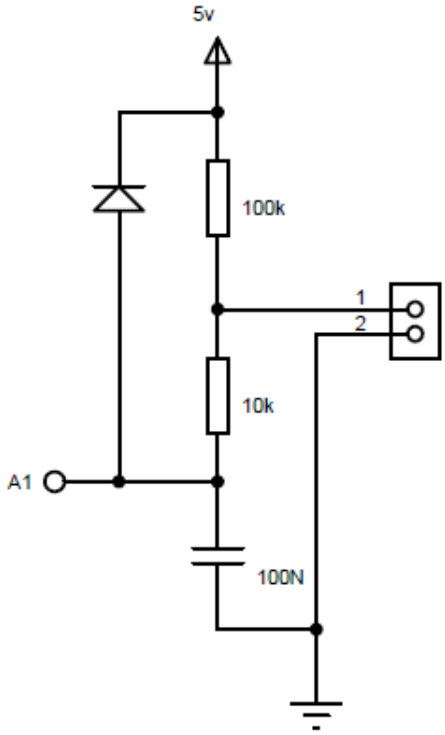


Relay in powered state



Analogue Inputs

Eight (8) analogue inputs of 0v-5V at 10-bit resolution are provided. The conversion is performed when you send the "Get Analogue Voltage" command 0x32 and the channel number. The resulting 16 bit integer will be transmitted back in two bytes (high byte first), combine these for the result. The 10-bit conversion will be in the lower 10 bits of the 16 bit integer with the upper 6 bits being 0. There is a 5v supply available on the 3-pin terminal block between the analogue inputs .

Examples	
Example input - connecting a potentiometer Connecting a potentiometer should be the simplest of tasks, either end of the pot should be wired to the 5v and 0v respectively, the output pin of the pot is then wired into the analogue (A) pin.	
Representative Analogue Schematic	

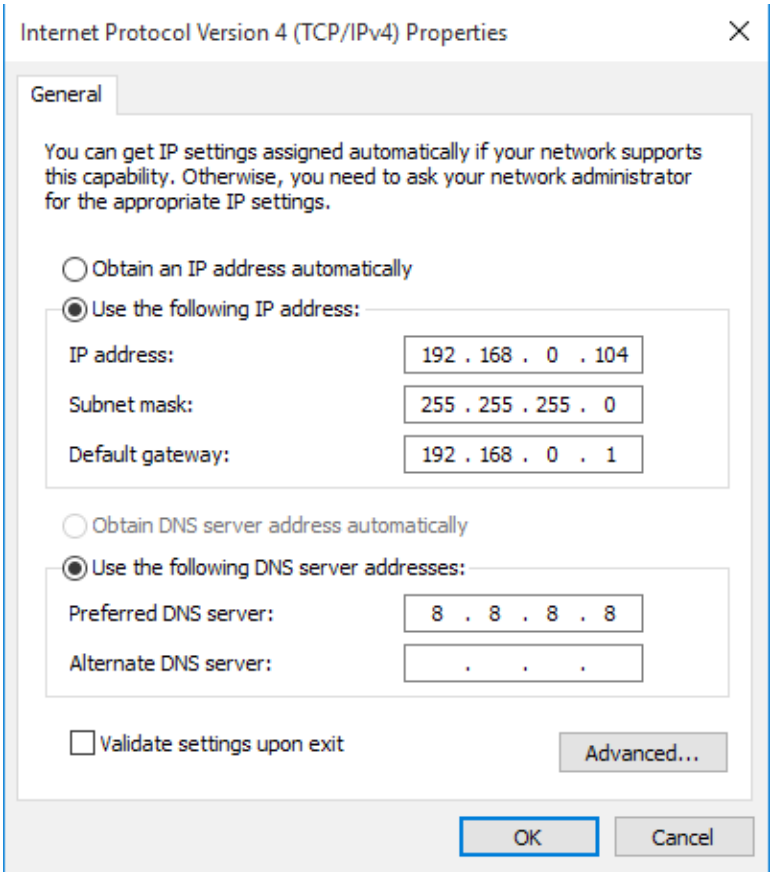
Network connection and Http access

IP Addresses & DHCP Servers

The easiest way to use the ETH8020 is to connect it to a network with a DHCP server. In this case the ETH8020 will have its IP address assigned automatically by the DHCP server.

If there is no DHCP server on the network, then a fixed IP address of 192.168.0.200 is used. To control the ETH8020 using this fixed IP address your computer MUST be on the same subnet.
The next step is to set your computers IP address to 192.168.0.x where x is in the range of 1 to 255 but not 200 (the ETH8020 is there!) or any other used IP addresses on the network.
The subnet mask dictates what IP addresses the PC can communicate with, we set this to 255.255.255.0 so the PC can talk to any module with an IP address of 192.168.0.x

The default gateway is likely to be the IP address that the internet connection is located at and the DNS server can be either your router address or Google provide a DNS service at 8.8.8.8..



This image is for a PC running Windows 10.
To get to the TCP/IP properties screen, go to: Control Panel->Network and Sharing Center->Local Area Connection->Properties.
Select Internet Protocol Version 4(TCP/IPv4) from the scroll box and click Properties.
That gets you to the dialog box shown left.

Accessing the ETH8020 from your browser

Having plugged in your 12vdc power supply and Ethernet connection the board will power up and request an IP address from the DHCP server, if no server is present then the board will default to IP address 192.168.0.200.

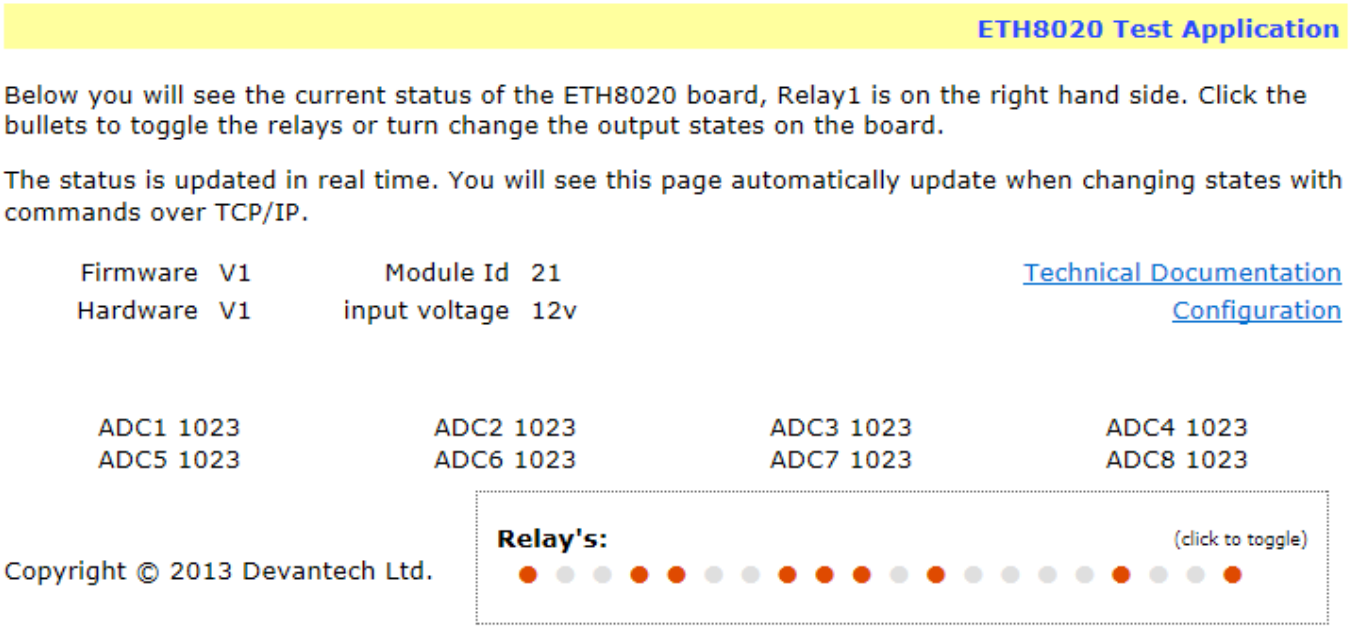
Now please start up your web browser and type http**://ETH8020** into the address bar, please note this only works in windows. You will be prompted for a password as shown below:



The default login is:
Username: admin
Password: password

The ability to change these settings is shown in the configuration section

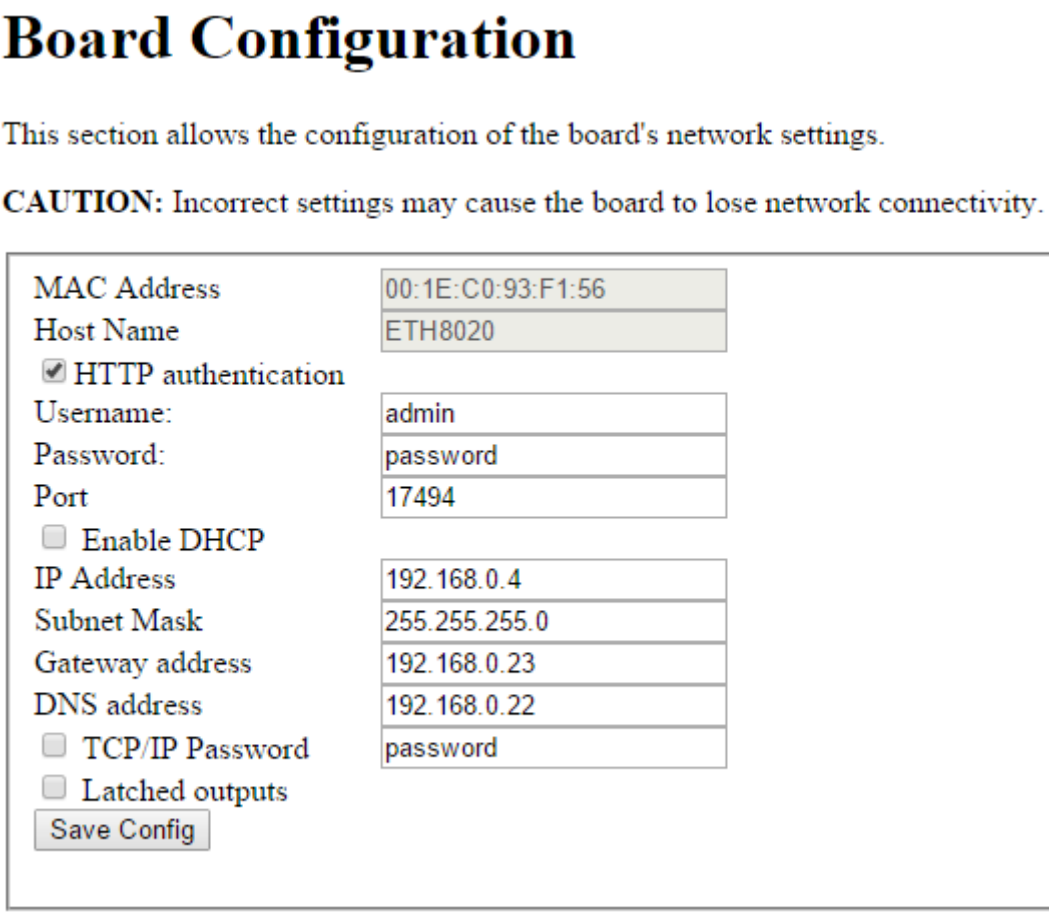
You should now see the following web page:



This web page will allow you to switch the relays on and off by clicking the relay buttons (the red/gray circles). It also contains a links to this technical documentation page, the network configuration and mapped inputs.

Configuration

By clicking the configuration link it's possible to configure the ETH8020 IP address and subnet mask together with the ability to set a password for entry to control screens. Gateway address and DNS address is configurable and is used with mapped inputs which are described in section below. The configuration page also offers the option to set a password that will be required to change any of the relay states or digital outputs using TCP IP commands, this is explained in the TCP/IP password section. All settings are saved to memory so be careful to remember the username and password! Default password settings are shown in the picture below. Version 2 now offers a latched outputs option, this will automatically save any permanent output changes (not pulsed) and restore them following power loss.



Mapped inputs

Digital inputs are able to be configured to remotely control outputs on ETH008,ETH8020 or ETH8020, this offers simple linking and versatile usage. An input in one country can control a output in another, or across a small network. There are eight independent inputs that can be mapped to eight different relays (on the same or different boards). The "Address of target board" field accepts an IP address or hostname (which will be converted to an IP address by the DNS server supplied in the board configuration above). If the module is on the local network then you can use the assigned IP address, if the target is over the internet then you need to supply the gateway in the configuration (internet source IP like your router) and the "Address of target board" is the IP address of the targets internet connection (to point at the router). Accessing the target via a router is dealt with in the section "**Access from the Internet**".

Input mapping configuration

You can map an input to switch a relay over on another board using the configuration below.

Enable Input1		Enable Input5	
Address of target board	192.168.0.1	Address of target board	192.168.0.1
Port	17494	Port	17494
Output number	1	Output number	5
TCP Password: (if required)	password	TCP Password: (if required)	password
Enable Input2		Enable Input6	
Address of target board	192.168.0.1	Address of target board	192.168.0.1
Port	17494	Port	17494
Output number	2	Output number	6
TCP Password: (if required)	password	TCP Password: (if required)	password
Enable Input3		Enable Input7	
Address of target board	192.168.0.1	Address of target board	192.168.0.1
Port	17494	Port	17494
Output number	3	Output number	7
TCP Password: (if required)	password	TCP Password: (if required)	password
Enable Input4		Enable Input8	
Address of target board	192.168.0.1	Address of target board	192.168.0.1
Port	17494	Port	17494
Output number	4	Output number	8
TCP Password: (if required)	password	TCP Password: (if required)	password

Save Config

Mapping inputs to custom devices

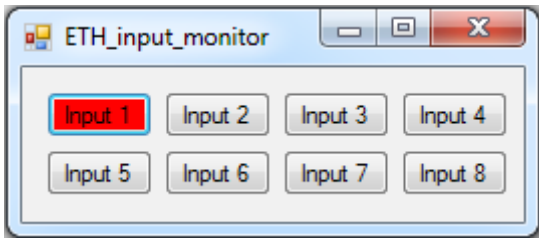
Sometimes it is useful to have a message sent on input change without the need for polling, you can use the input mapping for sending messages to an IP address. The transactions are described below along with an example of the custom device needing a password of “apple” and setting output number 1 active:

- The ETH8020 sends a TCP packet with 0x79 (password entry) in the first byte, then the following bytes will be the password supplied above.
  So it would send 6 bytes: 0x79, 'a','p','p','l','e'
- To acknowledge a password match, respond with 1, else send 2
  You reply with 1 byte 0x01
- The ETH8020 sends then sends digital active (0x20) or digital inactive (0x21) followed by the output number
  So it would send 2 bytes 0x20, 0x01
- Reply with a 0 for success, else send 1
  You reply with 1 byte 0x00

Note that the complete sequence must be followed, even if the password fails. If no password is supplied in the input mapping configuration the sequence will be followed with the absence of ''a','p','p','l','e' bytes.

Input monitoring example and source code

We have an example of mapping the inputs to a PC, it operates on the default port of 17494, the default password of "password" (although both are easily changed in the source code) and requires the ETH8020 input mapping to be pointed at the host PC IP address. As it's having to constantly listen it's a multi thread program



The input monitor program is available as Visual C# express ready built installation files here, or as project with source files here. Visual studio express is provided free from Microsoft: http://www.microsoft.com/exPress/download/

HTML commands DOAx and DOIx (V5+ firmware needed)

A customer requested feature, allowing the digital outputs to be switched by the Http get function such as used in some voice over ip phones (VOIP). You can use the Http get function to write to the io.cgi file with the following syntax:

192.168.0.200/io.cgi?DOA2=10

This would use the default address (192.168.0.200) and make output 2 active for 1 second.
Another example would be to set output 1 inactive for 10 seconds:

192.168.0.200/io.cgi?DOI1=10

You can test these functions by typing them directly into the address bar of most internet browsers. Also be aware that you may need to disable Http authentication in the Http configuration if your control device does not support it.

TCP access and commands

The command set designed to provide consistent expansion and new features, they are sent over TCP/IP on port 17494 (0x4456). This is the default port, it can be changed in the configuration settings.
Five connections are allowed at any one time, these are independently protected but all using the same password as defined in the board configuration.

Command		Action
dec	hex	
16	0x10	Get Module Info - returns 3 bytes. Module Id (21 for ETH8020), Hardware version, Firmware version.
32	0x20	Digital Active - follow with 1-20 to set relay on then a time for pulsed output from 1-255 (100ms resolution) or 0 for permanent. Board will return 0 for success, 1 for failure
33	0x21	Digital Inactive - follow with 1-20 to turn relay off then a time for pulsed output from 1-255 (100ms resolution) or 0 for permanent. Board will return 0 for success, 1 for failure
35	0x23	Digital Set Outputs - follow 3 bytes, first byte will set relays 1-8, All on = 255 (0xFF), All off = 0, 2nd byte for relays 9-16, 3rd byte for relays 17-20, Board will return 0 for success, 1 for failure
36	0x24	Digital Get Outputs - returns 3 bytes, the first corresponds with relays 1-8, 2nd byte for relays 9-16, 3rd byte for relays 17-20
37	0x25	Digital Get Inputs - returns 4 bytes, the first three bytes are always 0, the 4th bytes bits correspond with the 8 digital inputs, a high bit meaning input is active (driven low)
50	0x32	Get Analogue Voltage - follow with 1-8 for channel and ETH8020 will respond with 2 bytes to form an 16-bit integer (high byte first)
58	0x3A	ASCII text commands - allows a text string to switch outputs, see section below
119	0x77	Get Serial Number - Returns the unique 6 byte MAC address of the module.
120	0x78	Get Volts - returns relay supply voltage as byte, 125 being 12.5V DC
121	0x79	Password Entry - see TCP/IP password, board will return 1 for success or 2 for failure
122	0x7A	Get Unlock Time - see section below
123	0x7B	Log Out - immediately re-enables password protection, board will return 0 for success

Digital Active/Inactive Commands

These are 3 byte commands, The first byte is the command, 32 (active means on) or 33 (inactive).
Second byte is the output number, 1-4 for the relays, or 9 - 16 for digital outputs (marked I/O1 to I/O8 on the board).
Third byte is the on time. Set this to zero for non pulsed mode, or 1-255 for a pulse in 100mS intervals (100mS to 25.5 seconds).
For example:

0x20 - turn the relay on command
0x03 - relay 3
0x32 (50) - 5 seconds (50 * 100ms)

Board will return 0 for success, 1 for failure.
Note - All bytes in a command must be sent in one TCP/IP packet . Digital outputs pull the output pin down to 0v when active and pull up to 12v via a 10k resistor when inactive.

Analogue input read

Four analogue inputs of 0v-5v at 10-bit resolution are provided, the conversion is performed when you send the "Get Analogue Voltage" command 0x32 and the channel number. The resulting 16 bit integer will be transmitted back in two bytes (high byte first), combine these for the result. The 10-bit conversion will be in the lower 10 bits of the 16 bit integer with the upper 6 bits being 0.

TCP/IP Password

If this option is enabled in the Http configuration page then a password will be required to be entered before relay states can be changed. In the following example the password was set to "apple":

0x79 - 1st byte in frame sent to ETH8020 to indicate password entry
'a' (0x61) - 2nd byte in frame (ASCII hex equivalent in brackets http://www.asciitable.com/)
'p' (0x70) - 3rd byte in frame
'p' (0x70) - 4th byte in frame
'l' (0x6C) - 5th byte in frame
'e' (0x65) - 6th byte in frame

These 6 bytes are then transmitted in the same transaction to the ETH8020 and if the password is correct then 1 will transmitted back, a failure will send 2.
The board will now accept changes from the device that entered the password. If communication becomes idle for more than 30 seconds then the password protection is re-enabled. There is also a log-out command of 0x7B to enable the protection immediately.

Get Unlock Time

Returns TCP/IP password protection status:
0 - password protection is enabled and password entry is required before changes can be made
1-30 - seconds until TCP/IP password protection is re-enabled. All authorised commands set the timer back to 30 seconds (including this one).
255 - TCP/IP password is not enabled.

ASCII text commands DOA and DOI (V5+ firmware needed)

Following customer request we have added a feature that allows the outputs to be switched using an ASCII string, devices like a Mobotix camera can now switch relays with simple strings.
The string for activating output1 for 5 seconds is formatted using comma separated variables with the following syntax:

":DOA,1,50,password"

To break this down ":" (0x3A) at the start of the string indicates that there is an ASCII message to follow, "DOA" is digital output active, "1" is the output number, then "50" for 5 seconds (50 * 100ms) and finally the TCP password (if applicable). If I wanted to make output 2 inactive for 3 seconds I would use:

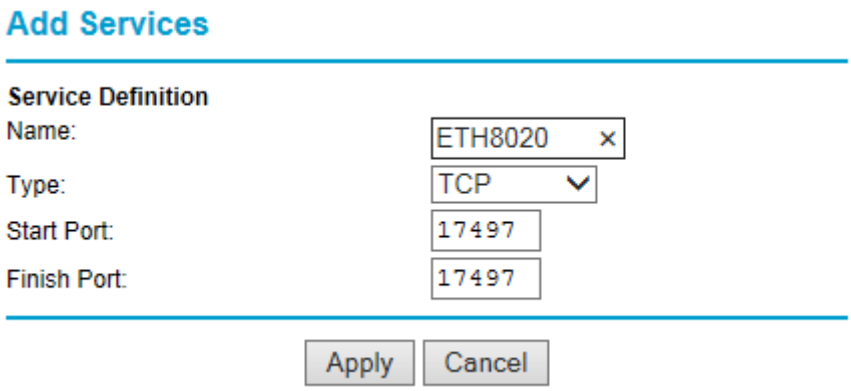
":DOI,2,30,password"

To break this down ":" (0x3A) at the start of the string indicates that there is an ASCII message to follow, "DOI" is digital output inactive, "2" is the output number, then "30" for 3 seconds (30 * 100ms) and finally the TCP password (if applicable). Assuming no password is used the previous command would simply be:

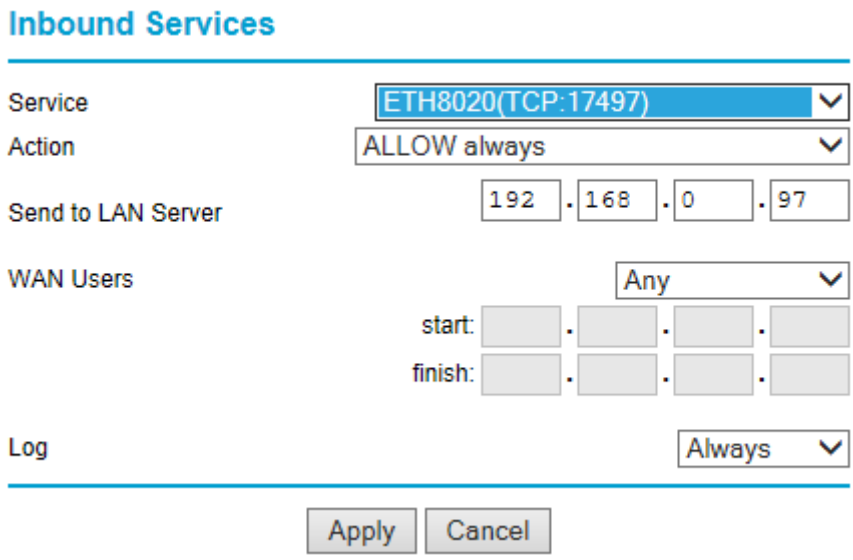
":DOI,2,30 "

Access from the Internet

The ETH8020 can be controlled over the internet almost as easily as on your local network. Your network will most likely be connected to the internet with a broadband router. This will provide NAT (Network Address Translation) and Firewall services. To access the ETH8020 from the internet you will need to open up port 17494 (0x4456) to allow incoming TCP connections. Be careful not to open up any other ports. There are a wide variety of routers and we cannot give details for all of them. If in doubt ask your system administrator for assistance. The following shows how to open up a port on a Netgear DG834 router.



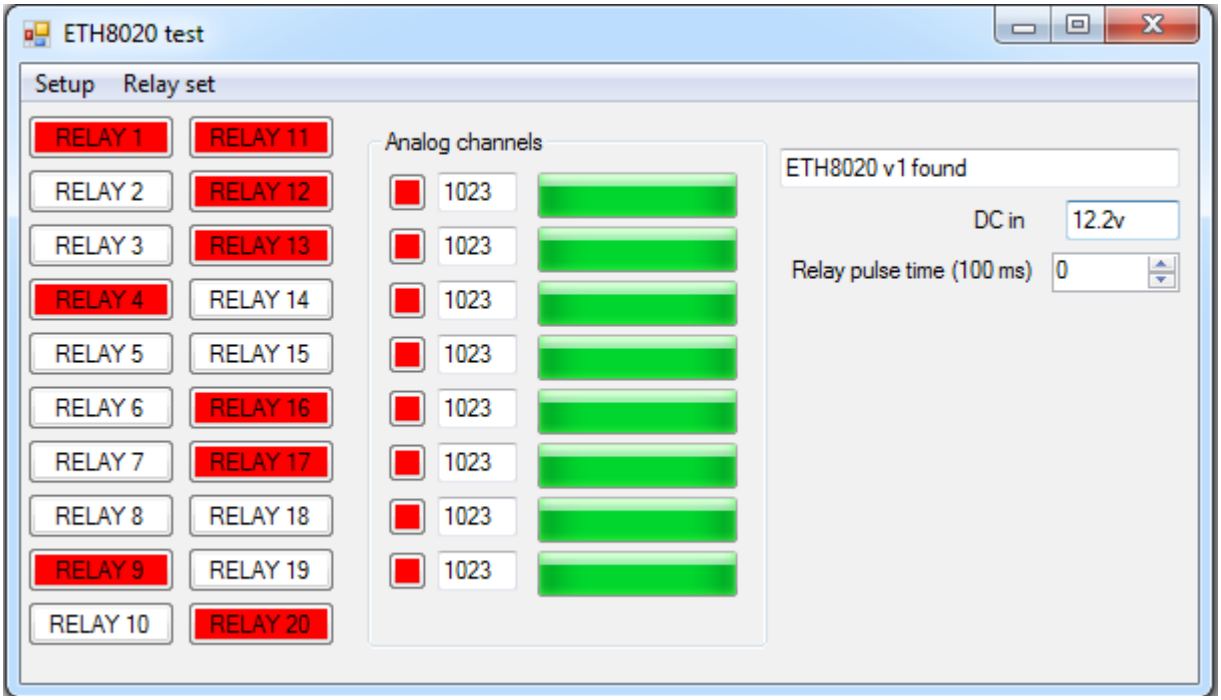
After logging on to your routers setup page, the first thing to do is create a new service. Click on the "Services" menu then "Add Custom Service". Enter a name for the service, select TCP and enter the ETH8020's port address for both the start and finish ports. Click "Apply".



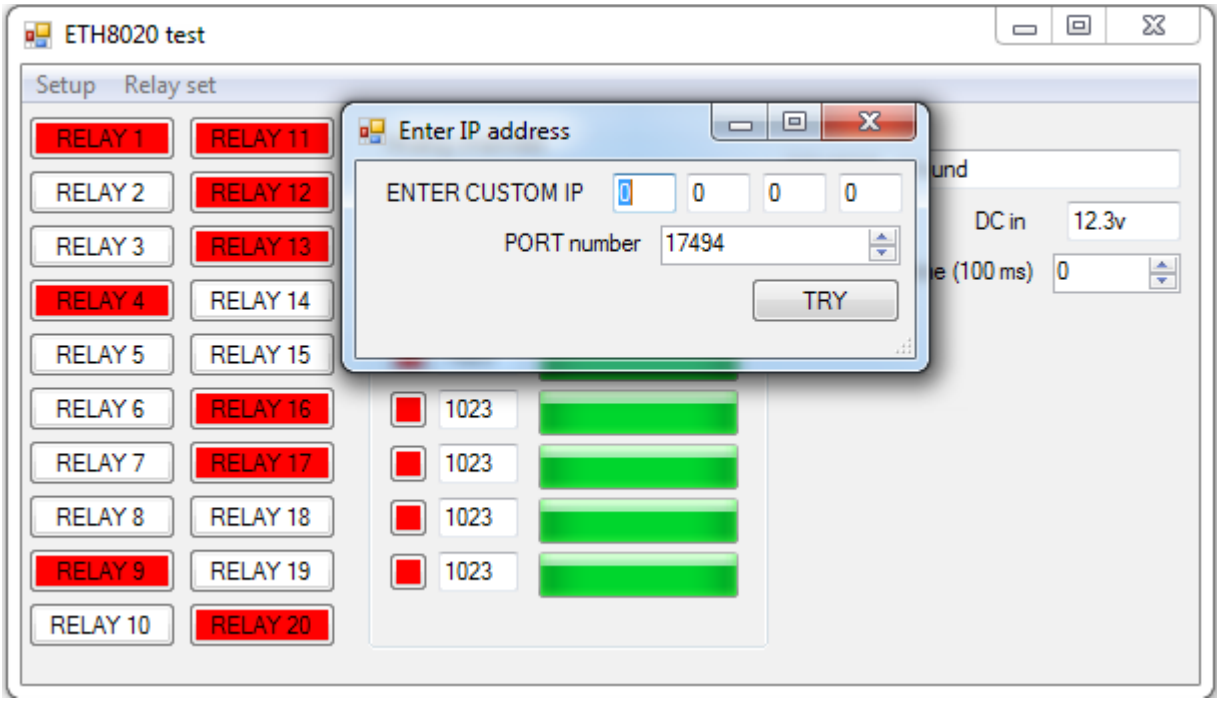
Now go to the "Firewall Rules" menu and click "Add" in the Inbound services section. Select the ETH8020 service and ALLOW always. The "Send to LAN Server" IP address is the ETH8020's IP address, 192.168.0.96 in the example above but check what it is on your network. Click "Apply" and that's it. The ETH8020 is now accessible over the internet. Before you close the routers setup pages, go to the "Router Status" menu and make a note of its ADSL port IP address. This is the routers internet facing IP address.

TCP Test program and example source code

To get the ETH8020 up and running in the minimum amount of time we have put together an example program and also full C# source code for this program. You may examine this code or use it as a starting point for your own application.



Visual studio express is provided free from Microsoft: http://www.microsoft.com/exPress/download/



The test program is able to control an ETH8020 on the local network or over the internet using your router port forwarding, an example of the setup procedure is described on the page above. To point the example program at your router go to menu Setup, Set Comport and click “Custom IP”, then enter the Router IP and desired port.

Android & iPhone Apps

We have a free app IO network available for Android and iPhone to remotely control your relays, download from Google Play or iTunes. Search for "Devantech" and you will find the app.

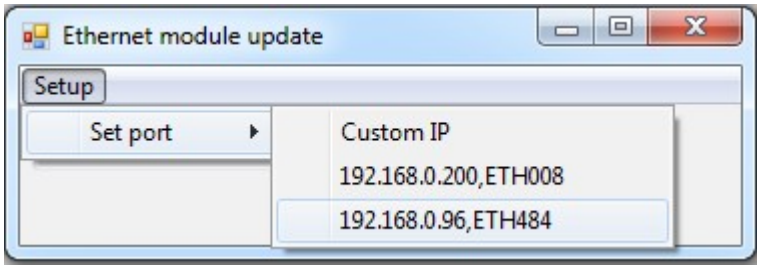
Firmware Updates

The firmware can be fully updated by re-flashing the board using our custom windows program. The updates currently available are:

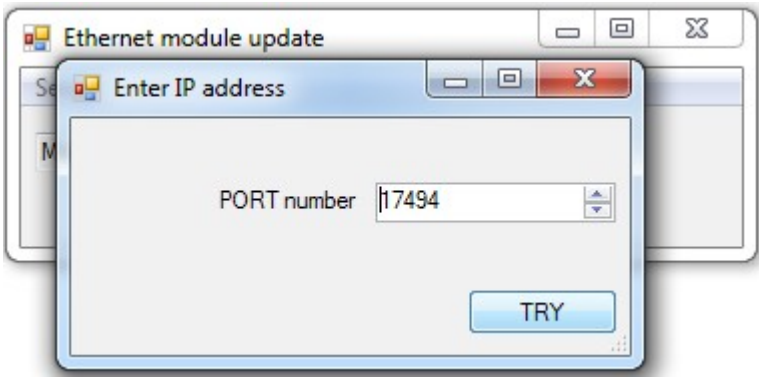
Version	Date of update	Reason for update
V3	04/08/14	DNS and Gateway removed in http config page as they were not required, new latching function added to config and board name now appears correctly on NBNS (WINS) meaning routers display board name.
V4	07/11/14	ASCII messages added in tcp, security now on all http pages, http set output commands added
V5	08/13/14	Fixed ASCII command buffer overruns
V6	02/25/15	Corrected issue with http password length of 12 characters
V7	11/16/15	Digital input mapping functionality added, html commands now respond with board relay and input status
V8	29/11/16	HTML page now has relays numbered for easy identification
V9	03/04/17	Mapped inputs socket closure correction
V10	07/02/19	Support for new flash chip variant added (SST25VF016B), no functionality changes

Using the Ethernet module update:

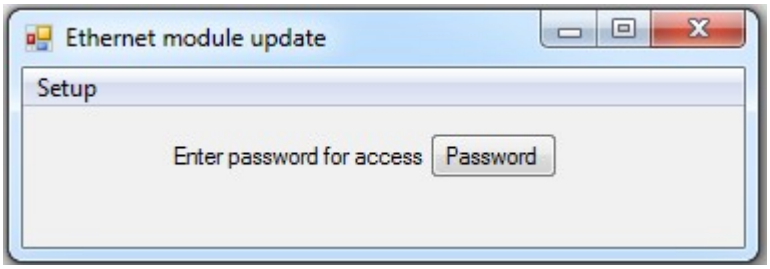
First you need to connect to the board, the program will scan the local network and provide any boards in a list that it can see.



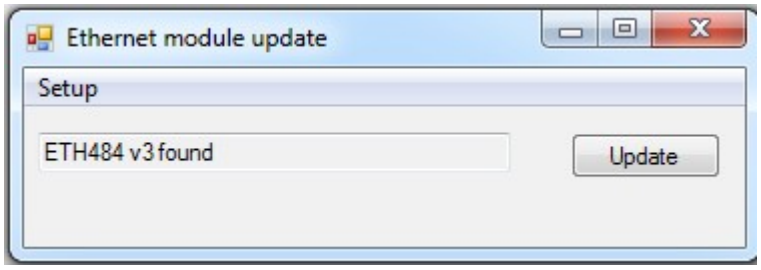
Next you will need to specify what port the board is located on, this will be 17494 unless you have changed it in the settings.

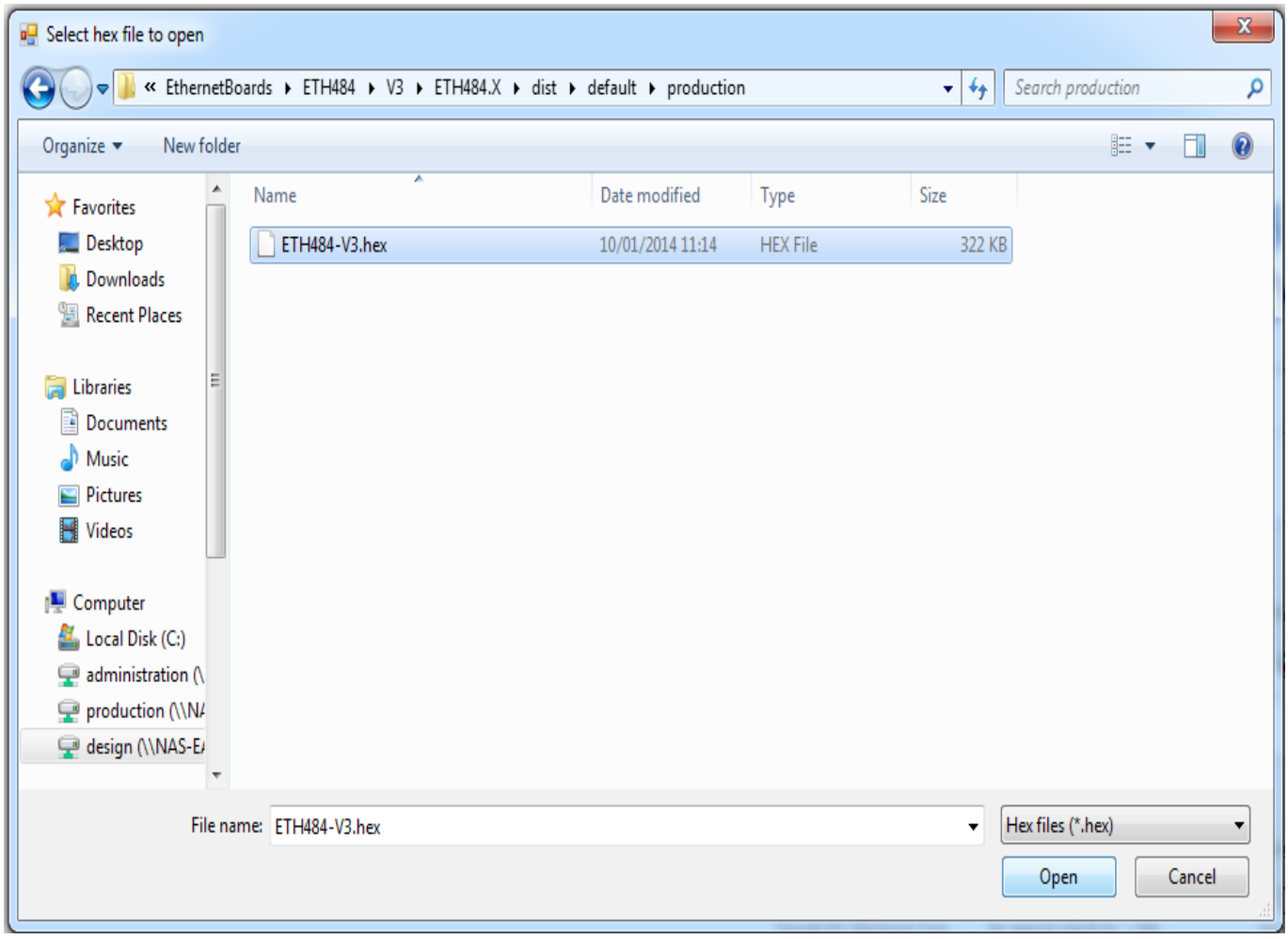


If there is a TCP/IP password the program will require it to be entered by clicking the password button.

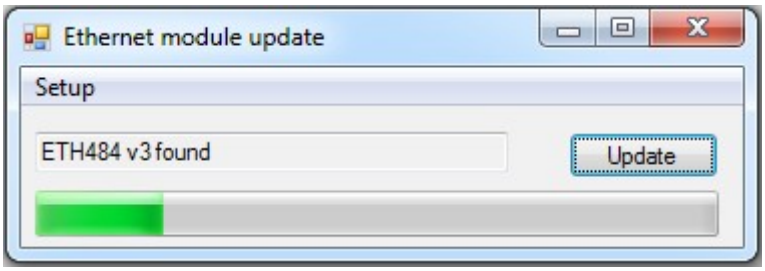


Following a successful connection you will now be able to click the update button to select a file



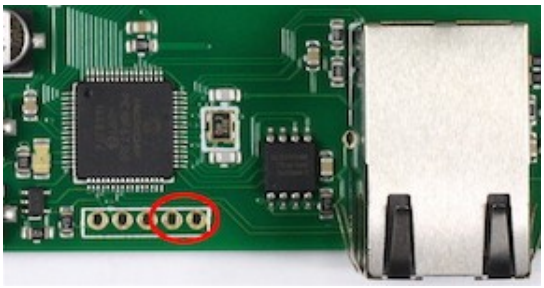

Select hex file to open
« EthernetBoards ▸ ETH484 ▸ V3 ▸ ETH484.X ▸ dist ▸ default ▸ production
Search production
Organize
New folder
Favorites
Desktop
Downloads
Recent Places
Libraries
Documents
Music
Pictures
Videos
Computer
Local Disk (C:)
administration (\
production (\\NA
design (\\NAS-EA
Name
Date modified
Type
Size
ETH484-V3.hex
10/01/2014 11:14
HEX File
322 KB
File name: ETH484-V3.hex
Hex files (*.hex)
Open
Cancel

Once the file has been opened the programming sequence will now begin, it's fairly short and following it's completion the board will reset (automatically) and the LED will flash quickly while the programming sequence completes. Do not turn the power off in this sequence.

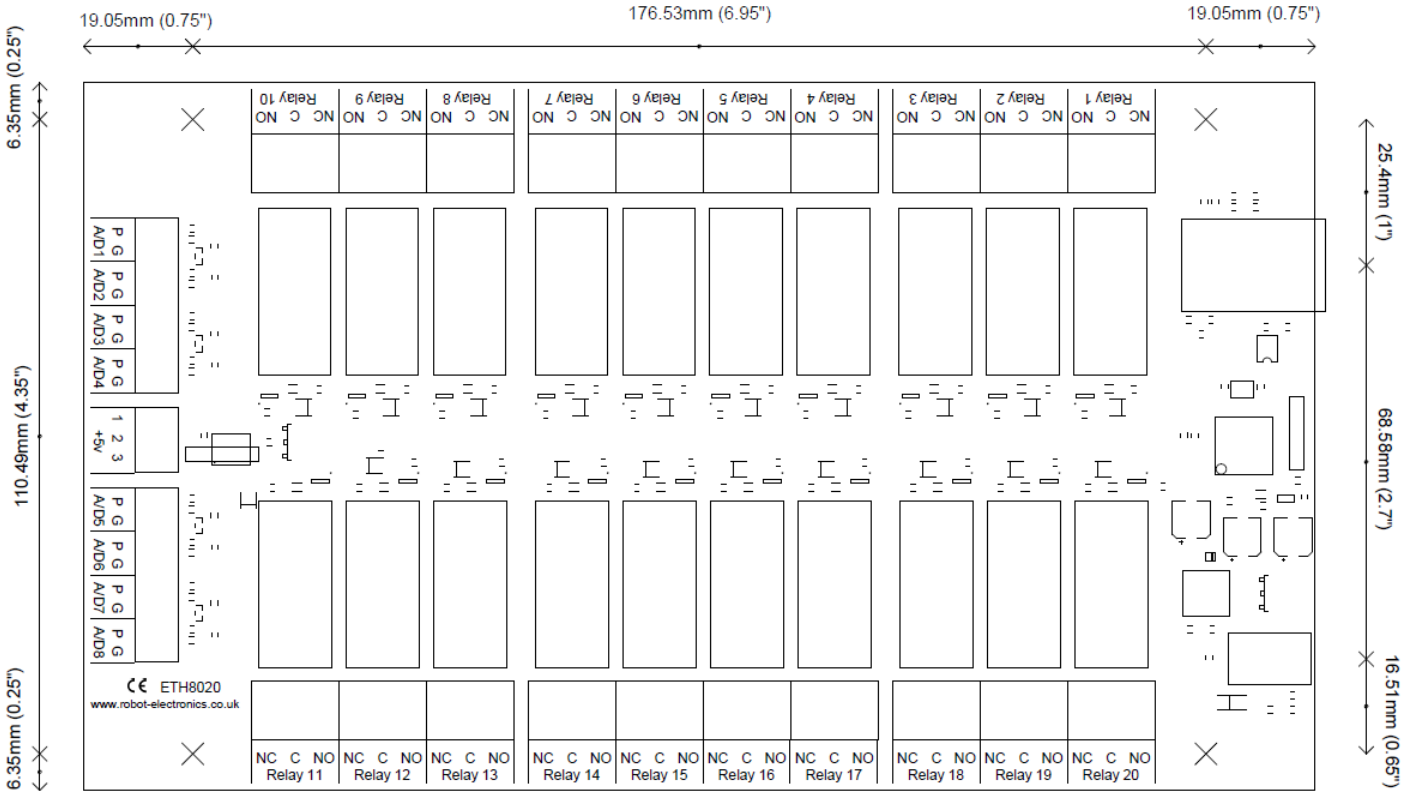


Factory Reset

Should it be necessary to reset the ETH8020 to its shipped condition then the end two contacts of the row of 5 holes near the large chip on the side nearest the Ethernet connection must be shorted together at board power up. Keep the pins shorted until the green power LED starts to flash, this will take up to 5 seconds. The green LED will flash as the settings are reset, please wait until the LED finishes flashing and do not remove power during this period.



Board dimensions



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