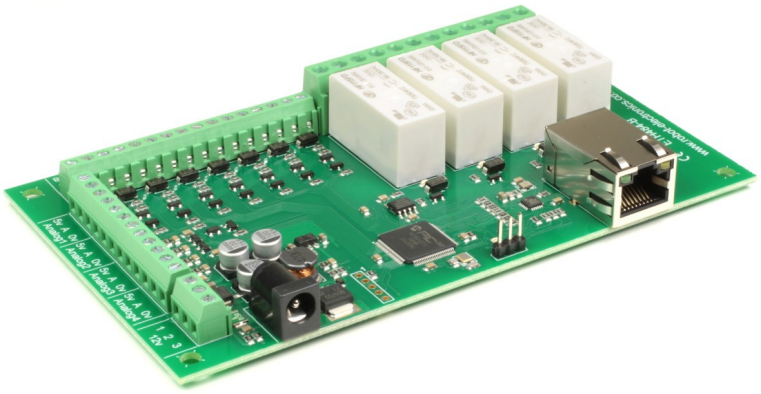
ETH484-B

Technical Documentation



Overview

The ETH484-B is a drop in update of the ETH484 with additional upgrades.

There are four volt free contact relay outputs with a current rating of up to 16Amp each, 8 digital I/O and 4 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 500mA 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.

New features and improvements over the ETH484 are:

- 100mb full duplex Ethernet connection (ETH484 was 10mb half duplex)
- Hostname is now configurable
- MQTT with optional TLS encryption
- Email added with optional TLS encryption
- 12bit analogue converter scaled over 5v, but old commands still return 10 bit results scaled to 3.3v for compatibility

Operating temperature

-40C to +70C

LED indication

The ETH484-B 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 just above the processor.

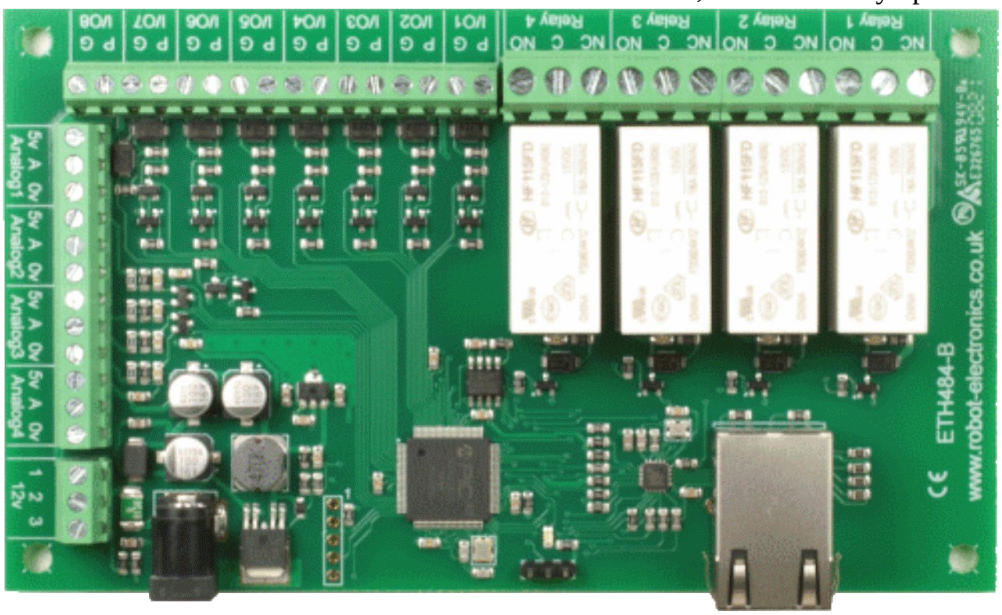
Connections

Digital I/O
P = Pin, G = 0v ground

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

Analogue inputs
5v = 5v dc output
A = Input (0-5v)
0v = 0v ground

12v dc output
Direct from 2.1mm jack



12v dc 2.1mm jack (+ve core)

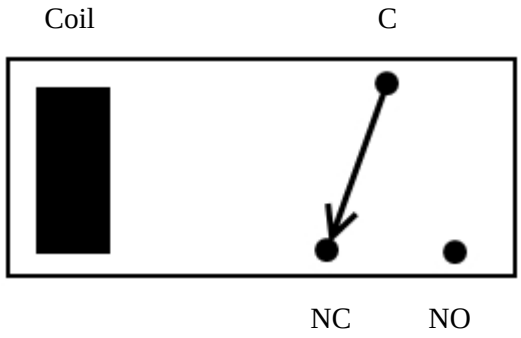
Reset link
Link middle and right
For Factory reset

RJ45 Ethernet

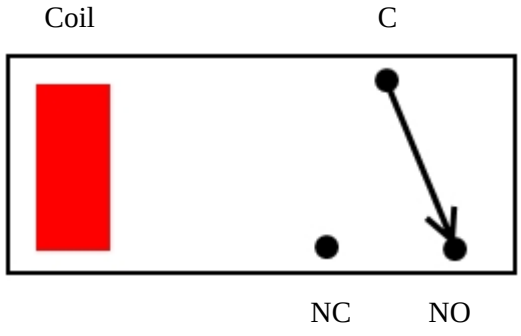
Relays

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

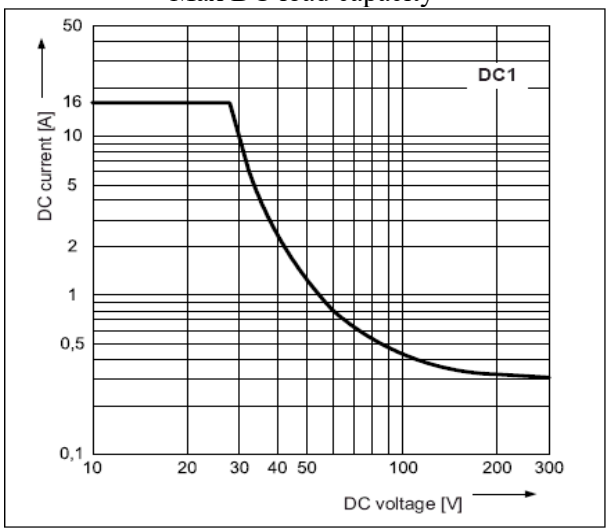


Relay power ratings

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

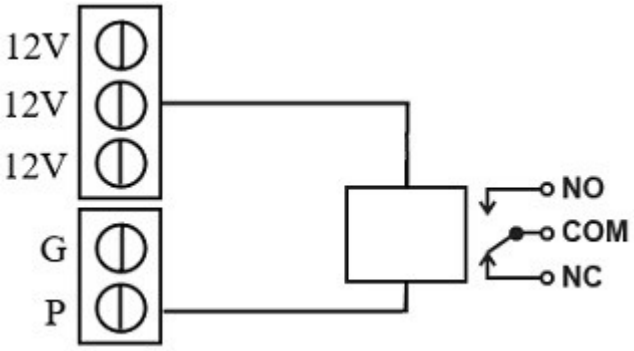


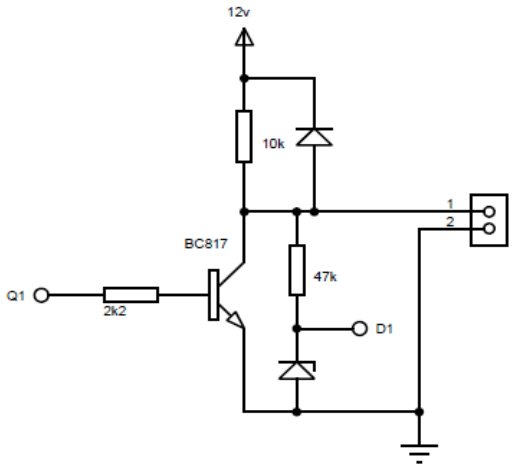
A full datasheet for the relays used on the ETH484-B is here: HF115FD datasheet

Digital IOs

Our Ethernet modules could potentially have many types of outputs. The ETH008 only has one type - Relays. The ETH484-B has both Relay outputs and NPN Open Collector Transistor outputs. Activating a relay means turning the relay on. Likewise activating an output means turning the transistor on. This will cause it to sink current to 0v ground. If you had an LED connected from the output to 12v (via a resistor of course) it would light up. Other modules (not this one) could have PNP Open Collector Transistor outputs. These types will source current from the supply when active. So here's the point: Active does not mean a high voltage comes out. It means that the output has been activated. That could result in the output sinking or sourcing current, depending on its type. The ETH484-B outputs will sink current (up to 100mA) when active.

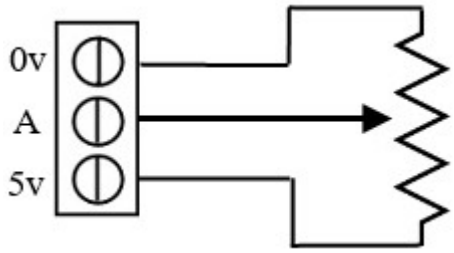
The same principle applies to the ETH484-B's inputs. These are designed to allow you to directly connect a VFC (Volt Free Contact). This could be from other relay contacts, thermostat contacts, alarm contacts etc. When the contacts are closed the input will read as active. In fact anything that pulls the input pin down to 0v will read as active. Do not think of the I/O in terms of a high or low voltage output. Think of it in terms of Active (or on, something is actively driving the I/O), or inactive (or off, nothing is driving the I/O). It's a subtle point but one you need to be clear on.

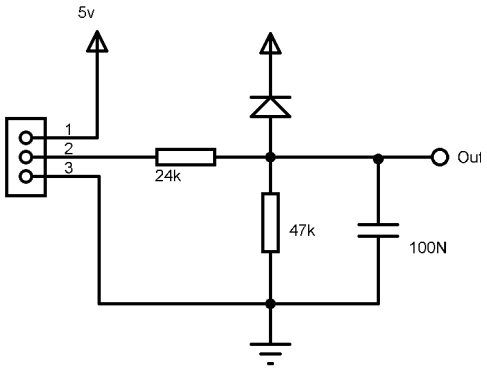
Examples	
Example input - connecting a switch Connecting a simple switch could not be easier, just wire the switch between a pin (P) and ground (G). When the switch closes the input will become active.	
Example output - connect a relay The ETH484-B allows you to connect your own 12V relays (500mA max), the first coil pin of the relay is wired to the 12V supply terminals on the board, the other is wired to the output pin (P). When the output pin becomes active it is driven down to 0V ground, the relay will have 12V across the terminals and switch so COM is connected to NO.	

Representative Digital I/O Schematic	

Analogue Inputs

Four independent analogue input channels are provided for sampling voltages up to 5V. Each channel is also filtered with a resistor and a capacitor to stabalise high frequency jitter, there is also a pull down resistor so the port will read around 0 when nothing is connected. 5V inputs can be used, although for 10 bit results the 3.3V to 5V region will merely read full scale.

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	

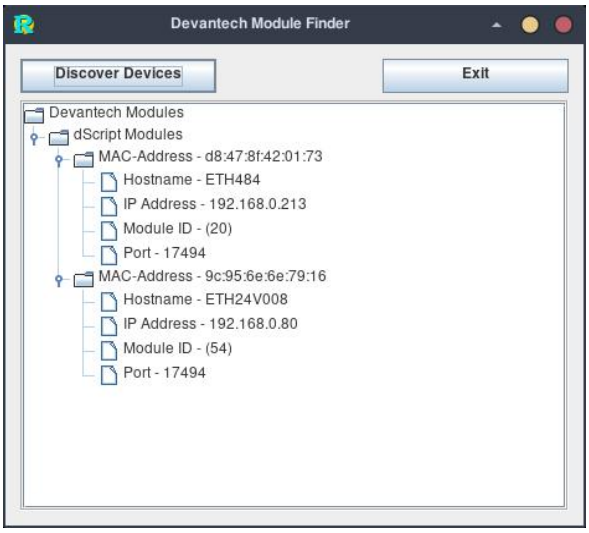
Network connection

Once you have connected the Ethernet cable and turned on the power you will need to obtain your modules IP address.

With a DHCP Server

The easiest way to use the ETH484-B is to connect it to a network with a DHCP server. In this case the ETH484-B will have its IP address assigned automatically by the DHCP server.

To find the IP address of your module you can check in your routers settings for the list of devices connected to your network. Alternatively we also provide a Devantech Module Finder application that will scan your network and report with any modules on your network that your computer can talk to.



Download the Devantech Module Finder

With a Fixed IP

If there is no DHCP server a fixed IP address of 192.168.0.200 is used.

Your computer must be on the same subnet as the module. Set your computers IP address to 192.168.0.X where X is in the range of 1 to 255, but not 200 (the ETH484-B is there!) or any other IP addresses in use on the network.

Set your computers subnet mask to 255.255.255.0 so it can talk to any module with an IP address of 192.168.0.x.

Set your computers default gateway to the IP address that the internet connection is located at. This is most likely the address of your router.

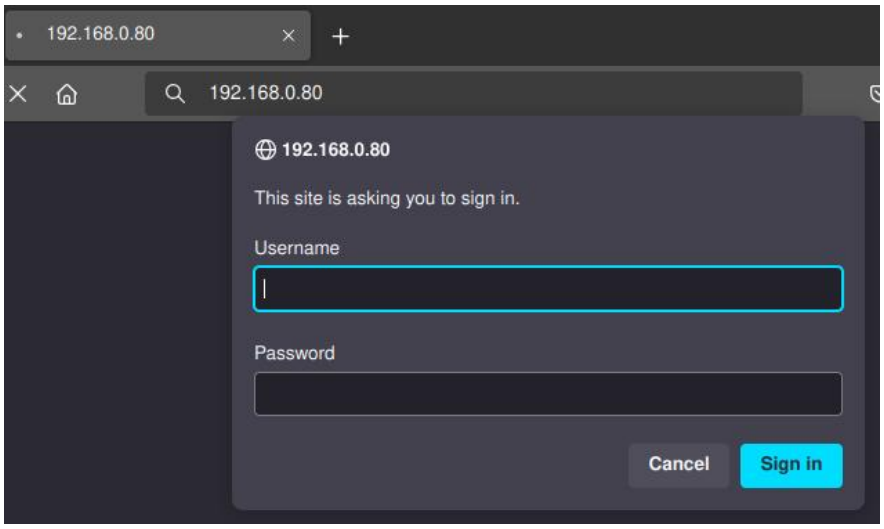
Set your computers DNS server to either your router address, or a free DNS service such as Google DNS at 8.8.8.8 or Cloudflare DNS at 1.1.1.1

Example computer network settings:

IP address:	192.168.0.104
Subnet mask:	255.255.255.0
Gateway:	192.168.0.1
DNS server:	192.168.0.1

Accessing the ETH484-B from your browser

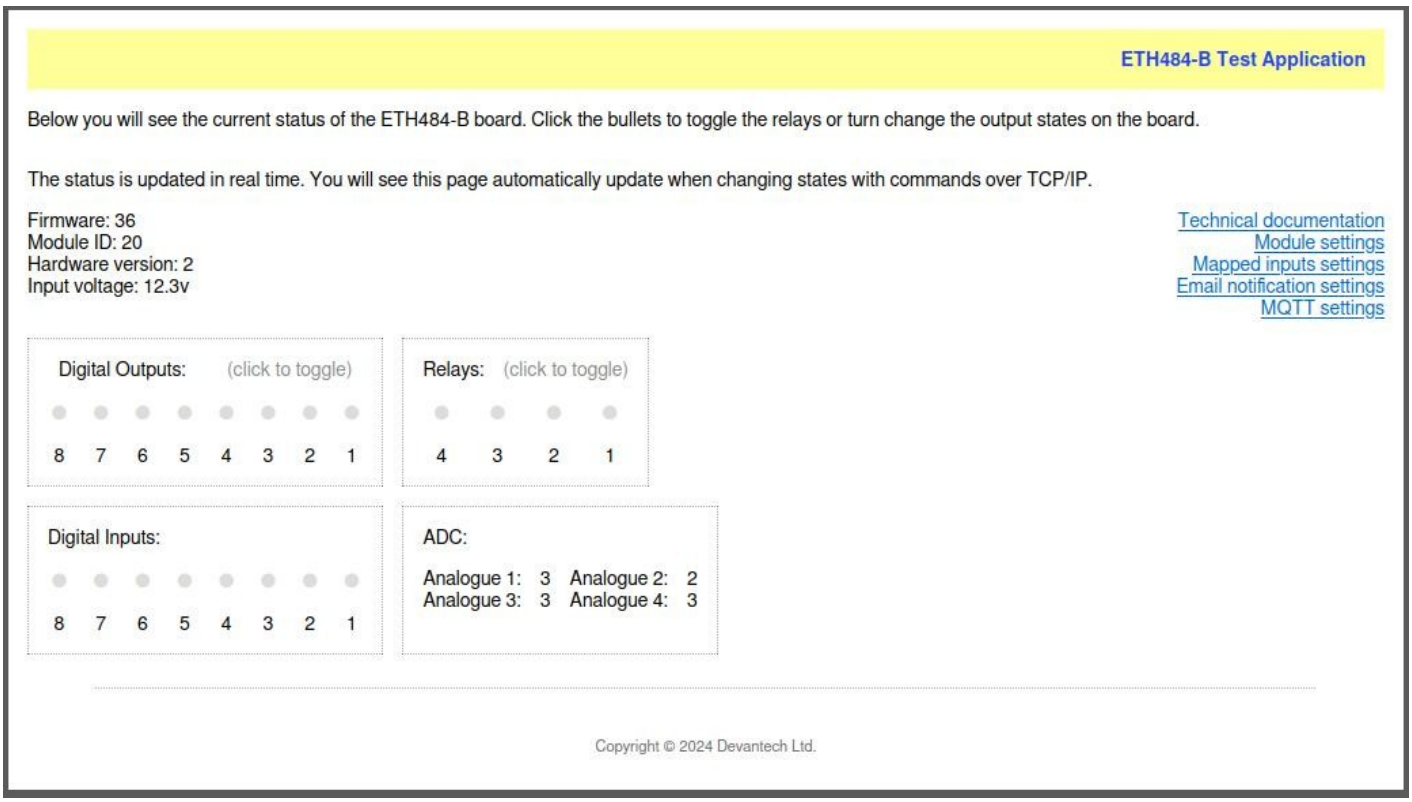
Start up your web browser and type the IP address of your module into the address bar (in this example 192.168.0.80) and you will be prompted for a password, as shown below:



The default login is:
Username: admin
Password: password

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

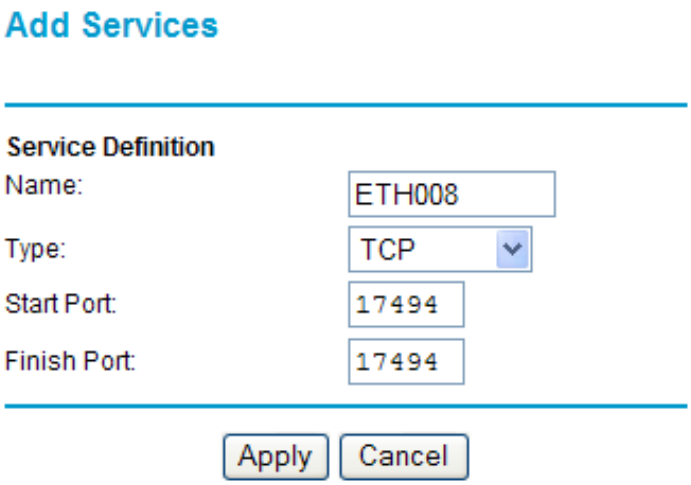
You should now see the following web page:



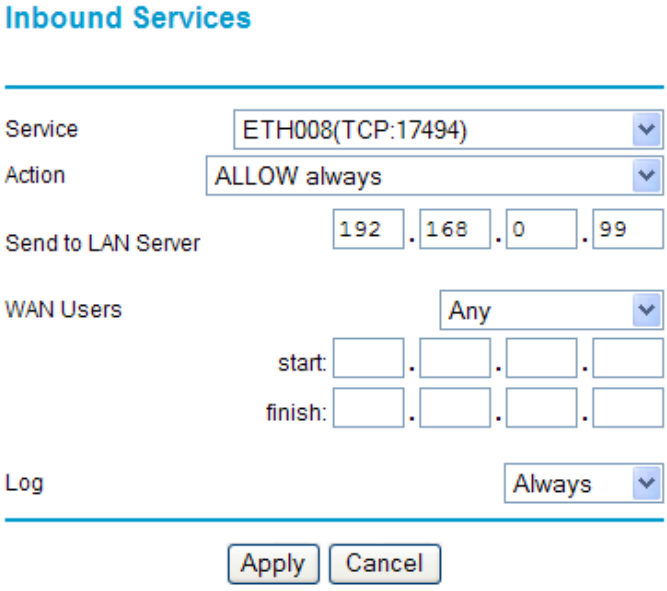
This web page will allow you to switch the outputs on and off by clicking the output buttons (the red/gray circles), and also view the states of the inputs. It also contains a links to this technical documentation and configuration pages.

Access from the Internet

The ETH484-B 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 ETH484-B 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 ETH484-B's port address for both the start and finish ports. Click "Apply".

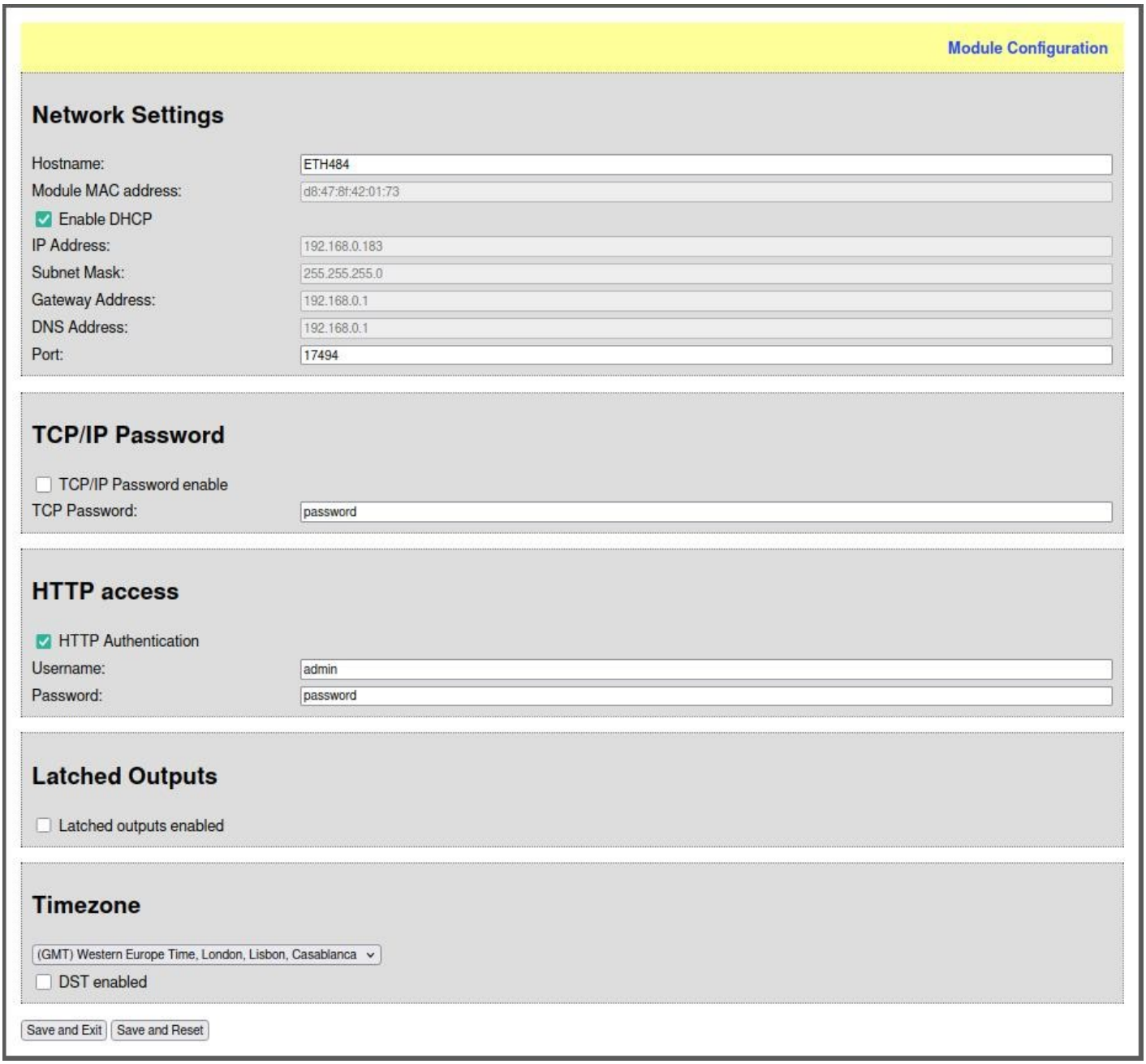


Now go to the "Firewall Rules" menu and click "Add" in the Inbound services section. Select the ETH484-B service and ALLOW always. The "Send to LAN Server" IP address is the ETH484-B's IP address, 192.168.0.96 in the example above but check what it is on your network. Click "Apply" and that's it. The ETH484-B 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.

Configuration

Module Settings

Settings changes in this page will not be applies until a module reset.



MAC Address	The unique identifier of this module.
Host Name	The host name of this module.
Enable DHCP	Enable, or disable, the DHCP address. When this box is checked the module will get its IP address from the DHCP server. If it is unchecked then the module will use the network settings input below.
IP Address	The IP address of the module. Only editable if DHCP is disabled.

Subnet Mask	The subnet mask. Only editable if DHCP is disabled.
Gateway Address	The gateway address. Only editable if DHCP is disabled.
DNS address	The address of the DNS server. Only editable if DHCP is disabled.
Port	The port number that the TCP connection listens on.
TCP/IP Password	Enables, or disables, the TCP/IP password (see TCP/IP commands section). When checked the input password will be required to change any outputs via TCP/IP commands.
HTTP Authentication	Enables, or disables, the HTTP authentication that asks for a username and password to be input for access to the control pages.
Username	The username to be used for HTTP authentication.
Password	The password to be used for HTTP authentication.
Latched Outputs	Sets the outputs to latching mode. This will automatically save any permanent output state changes (not pulsed) and restore them following power loss.
Timezone	The timezone.
Enable DST	Enables, or disables, daylight saving time.

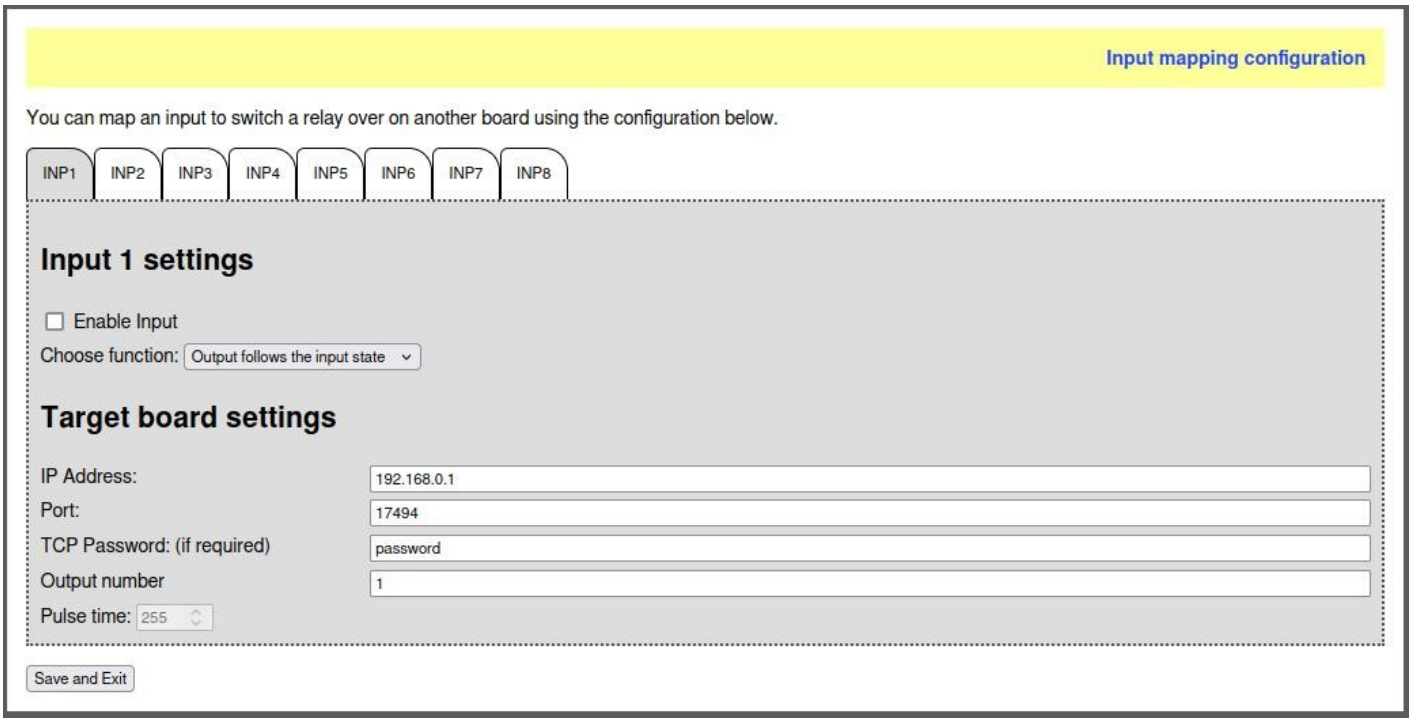
Mapped Inputs Settings

Digital inputs can be configured to remotely control outputs on another ETH series modules, this offers simple linking and versatile usage. An input in one country can control an output in another, or across a small network.

There are eight independent inputs that can be mapped to eight different outputs on the same, or different, boards.

To select which input to map click one of tabs at the top of the screen.

When you are finished save your settings by pressing the save and exit button.



Enable Input	Enable, or diable, the input mapping for this input.
Choose function	Select how the input state will affect the target output.
IP address.	The IP address or hostname of the target module. If the module is on the local network then you can use the assigned IP address, but 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".
Port	The port number the target board is listening on.
TCP Password	The password set on the target module to allow control via TCP/IP commands.
Output Number	The output number to control.
Pulse Time	The time to pulse the output for in 100mS increments, e.g. a value of 10 will pulse the output for 1 second. The minimum pulse value is 1 and the maximum is 255. A value of zero will make the change permenant, not pulsed.

Mapping inputs to custom devices

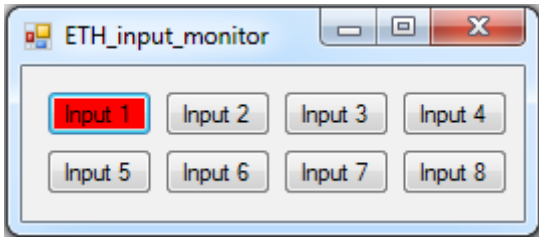
Sometimes it is useful to have a message sent on input change without the need for polling, you can use the input mapping for sending messages to an IP address. The transactions are described below along with an example of the custom device needing a password of “apple” and setting output number 1 active:

- The module 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, or a 2 for failure. You reply with 1 byte 0x01
- The module 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, or a 1 for failure. 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 modules input mapping to be pointed at the host PC IP address. As it's having to constantly listen it's a multi thread program.

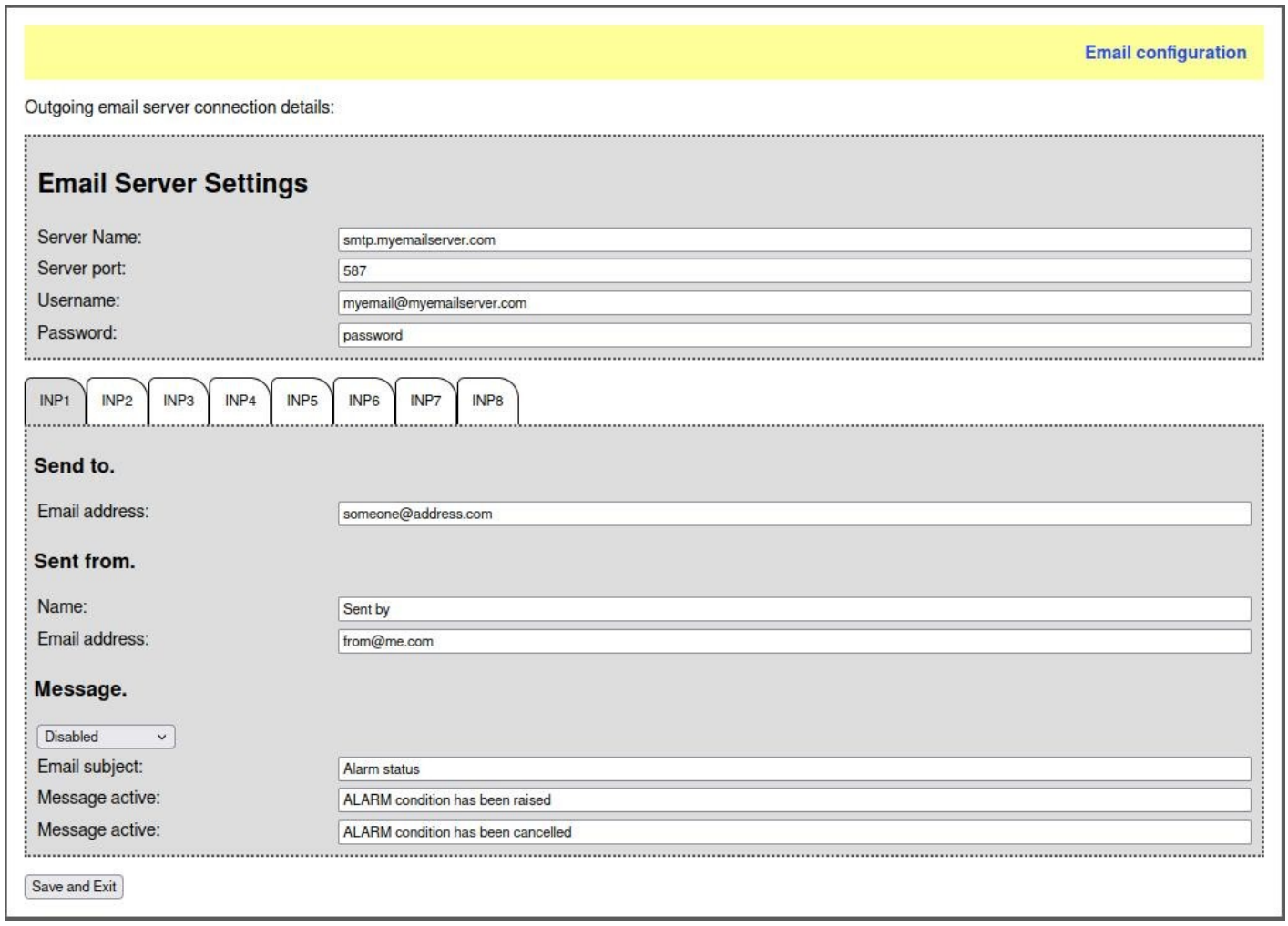


The input monitor program is available as Visual C# express ready built installation files here, or as project with source files here.

Email Settings

The ETH484-B can send email notifications by high transition, low transition or both for any of the 8 inputs available.

To select an input to configure email for click the IO button at the bottom for that input, update the settings, and then when you are finished click the save and exit button.



Server Name	The name of the outgoing mail server.
Port	The port number for the outgoing mail server. TLS or START TLS will be automatically switched on when port 587 or 465 is selected.
Username	The username for logging into the outgoing mail server.
Password	The password for logging into the outgoing mail server.
Email Sending	Enable the email for this input. • Disabled – No email sent. • Send on active – email sent on transition from inactive to active input. • Send on inactive – email sent on transition from active to inactive input. • Send on both – email sent on any state transition of input.
Send Email To Address	The email address to send the email to.
From Name	The name of the sender of the email.

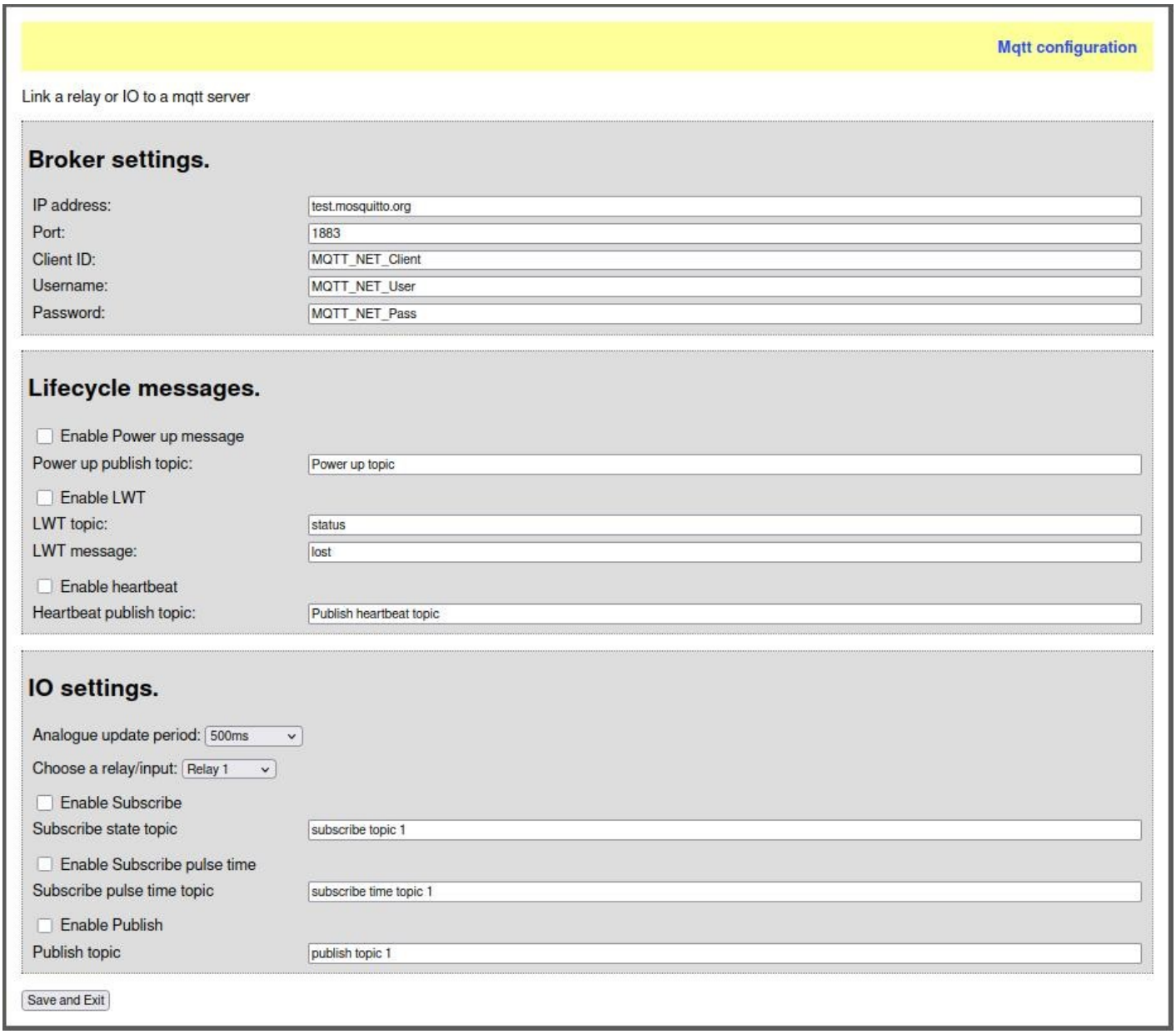
Sent From Address	The address that the email will be sent from.
Subject	The subject line of the email.
Message for active transition	The message to be sent for an active transition.
Message for inactive transition	The message to be sent for an inactive transition.

MQTT Settings

The module can connect to an MQTT broker to publish certain status messages such as a power up message, or a heartbeat. Each IO on the module can also subscribe, or publish, to a topic to control or monitor its state.

To configure the settings for an IO select it from the “Choose an I/O state” drop down box and fill in the required information.

Once finished save your chages by pressing the Save Config button.



IP Address	The IP address of the MQTT broker to connect to.
Port	Should be 1883 for no encryption or port 8883 for a TLS encrypted link (the ETH module will automatically use TLS for port 8883).
Client ID	The client name of your module.
Username	Optional username for connection to the MQTT broker.
Password	Optional password for connection to the MQTT broker.

Enable Power Up Meaasge	Enables, or disables, the publisheing of a message at power up containing the MAC address, IP address, software and hardware versions.
Power Up Publish Topic	The topic that the power up message will be published to.
Enable LWT	Enables, or disables, the last will and testament. The broker will publish the message after no contact for 5 minutes.
LWT Topic	The topic the LWT will be published on.
LWT Message	The message published for the LWT.
Enable Heartbeat	Enable, or disable, the heartbeat, which publishes an incremented count once a minute, giving the up time, count is reset on socket loss.
Heartbeat Publish Topic	The topic that the heartbeat message will be published to.
Enable Subscribe	Enables, or disables, subscribing to a topic that contains a message of “1” or “0” to control the state of the selected output.
Subscribe State Topic	The topic to subscribe to that controls the state of the selected output.
Enable Subscribe Pulse Time	Enables, or disables, subscribing to a topic that contains a message of between “1” and “255” which will pulse the output on for that number of 100mS units.
Subscribe Pulse Time Topic	The topic to subscribe to that pulses the state of the selected output.
Enable publish	Enables, or disables, the publishing of a message containing a “1” or a “0” when the state of the selected IO changes.
Publish Topic	The topic to publish the IO state changes to.

Control Sets

There are three command sets that can be used to control the module: TCP/IP, ASCII and HTTP.

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.

All bytes for any command must be sent in a single transaction.

Command		Action
dec	hex	
16	**0x10**	Get Module Info - returns 3 bytes. Module Id (20 for ETH484-B), Hardware version, Firmware version.
32	**0x20**	Digital Active – A three byte command. Follow with the output number, and then a time for pulsed output from 1-255 (100ms resolution) or 0 for permanent. Board will return 0 for success, 1 for failure Example: 0x20 – Digital Active 0x02 – Output 2 0x32 – (50) - 5 seconds (50 * 100ms) Board will return 0 for success, 1 for failure.
33	**0x21**	Digital Inactive – A three byte command. Follow with the output number, and then a time for pulsed output from 1-255 (100ms resolution) or 0 for permanent. Board will return 0 for success, 1 for failure Example: 0x21 – Digital Inactive 0x02 – Output 2 0x32 – (50) - 5 seconds (50 * 100ms)
35	**0x23**	Digital Set Outputs – Follow with two bytes. The first byte will set all relays states, All on = 255 (xxxx1111) All off = 0, 2nd byte sets digital outputs. Board will return 0 for success, 1 for failure
36	**0x24**	Digital Get Outputs - returns 2 bytes, the first corresponds with relays being powered and the 2nd corresponds with active digital outputs.
37	**0x25**	Digital Get Inputs - returns 2 bytes, the 1st is always 0 as the relays are not inputs, the 2nd bytes bits correspond with the digital io, a high bit meaning input is active (driven low)
50	**0x32**	Get Analogue Voltage (10 bit result scaled to 3.3v for ETH484 compatibility) - follow with 1-4 for channel and ETH484-B will respond with 2 bytes to form an integer. The resulting 16 bit integer will be transmitted back in two bytes (high byte first). Combine these for the result. The conversion will be in the lower 10 bits of the 16 bit integer with the remaining upper bits being 0.
51	**0x33**	Get Analogue Voltage (12 bit result scaled to 5v) - follow with 1-4 for channel and ETH484-B will respond with 2 bytes to form an integer. The resulting 16 bit integer will be transmitted back in two bytes (high byte first). Combine these for the result. The conversion will be in the lower 12 bits of the 16 bit integer with the remaining upper bits being 0.
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 1 byte representing the 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 - Returns 1 byte indicating the 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 authorized commands set the timer back to 30 seconds (including this one). ***255*** - TCP/IP password is not enabled.
123	**0x7B**	Log Out - immediately re-enables TCP/IP password protection, board will return 0 for success

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 ETH484-B 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 module, and if the password is correct then a 1 will transmitted back, a failure will send a 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.

ASCII text commands DOA and DOI

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 you wanted to make output 2 inactive for 3 seconds you would send:

":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 "

HTTP Commands DOAx and DOIx

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

If you wish to pass a username and password with the request you can do so like this (example uses default credentials):

admin:password@192.168.0.200/io.cgi?DOA1=10

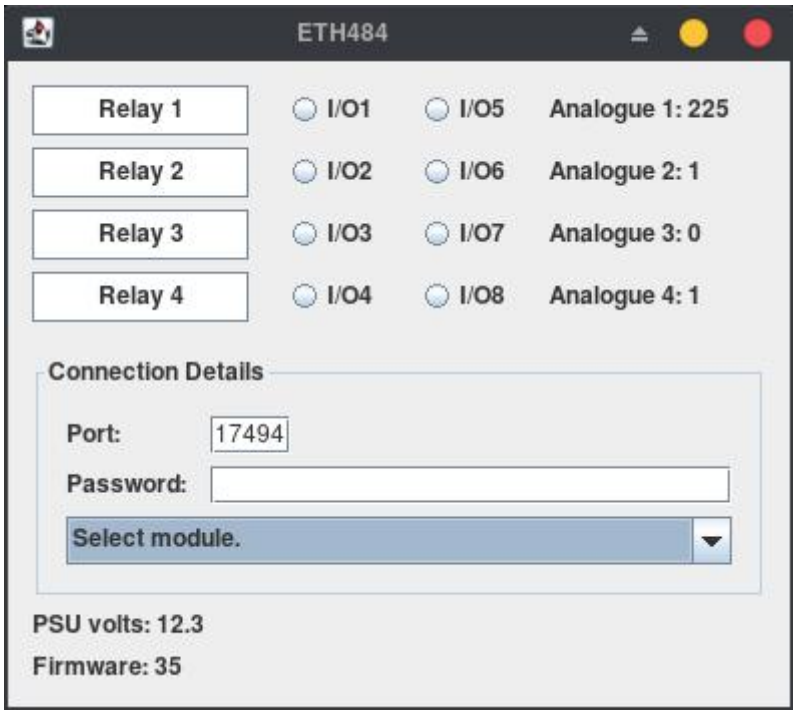
To set the relay with no timer (it will remain in state you can just pass a 0 value for the timer:

192.168.0.200/io.cgi?DOA1=0

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 Test program and example source code

To get the ETH484-B up and running in the minimum amount of time we have put together an example java program, and also full source code for this program. You may examine this code or use it as a starting point for your own application.

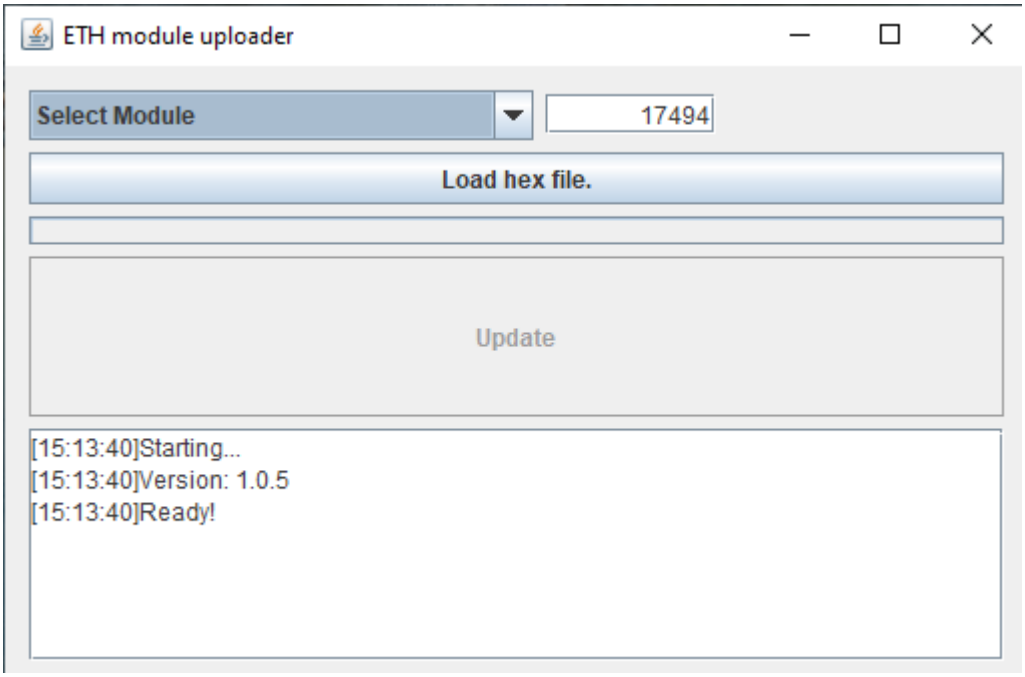


Android & iPhone Apps

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.

Software updates

With our software update tool you can upgrade the firmware to get the latest features



Latest firmware.

V38 Update highlights

- Fixed memory leak
- Fixed MQTT reconnect

Board dimensions