IO-204 Monitor and Control Module

[User Guide]

1. Introduction

The IO-204 Monitor & Control Module helps bridge the gap between the physical world and the World Wide Web. The IO-204 module and online tools at www.ioBridge.com allow you to easily get your projects on the web. There is no need to run a home web server or track ever changing dynamic IP addresses. The IO-204 module takes care of the internet connectivity and the user customizable widgets on the ioBridge website remove the need for complex programming. Just plug in your IO-204 module, register on the ioBridge website and within minutes, you'll be interacting with lights, switches, servos and sensors. Keep your widgets private on your secure ioBridge dashboard or publish them on your website for the entire world to enjoy!

2. Hardware Features

- 4 I/O channels, with separate digital input, analog input and digital output

- Pulse Out and Serial Out functions available on all 4 digital outputs

- Attach up to 4 Smart Boards for more complex functions

- Time interval based or event based data delivery

- Works on any 10/100/1000Base-T auto-negotiated network

- Works on Dynamic IP based networks, through firewall and proxy servers

- Highly secure encryption based communication

- Configurable MAC address and DHCP host name

- Network status indicator

- Non-volatile memory keeps your settings during power down

- Configurable network disconnect failsafe settings

- Upgradeable firmware

3. Requirements

3.1 Network

The IO-204 module requires a 10/100Base-T auto-negotiated Ethernet connection. In addition, the module requires a DHCP server to be running on the network. Almost any home networking router meets these simple requirements. Because of the special way the IO-204 module communicates with the internet, no additional ports need to be opened on the firewall or router.

However, if the network uses MAC address filtering, the module's MAC address will need to be added to the router's "allow" table.

3.2 Electrical

The IO-204 module requires a regulated electrical supply of 5V at 200mA. The wall adapter supplied with the module is rated for approximately 1 Amp. This extra current allows external circuits and devices to be powered direct from I/O channel connectors.

4. The IO-204 Module

4.1 Module Diagram
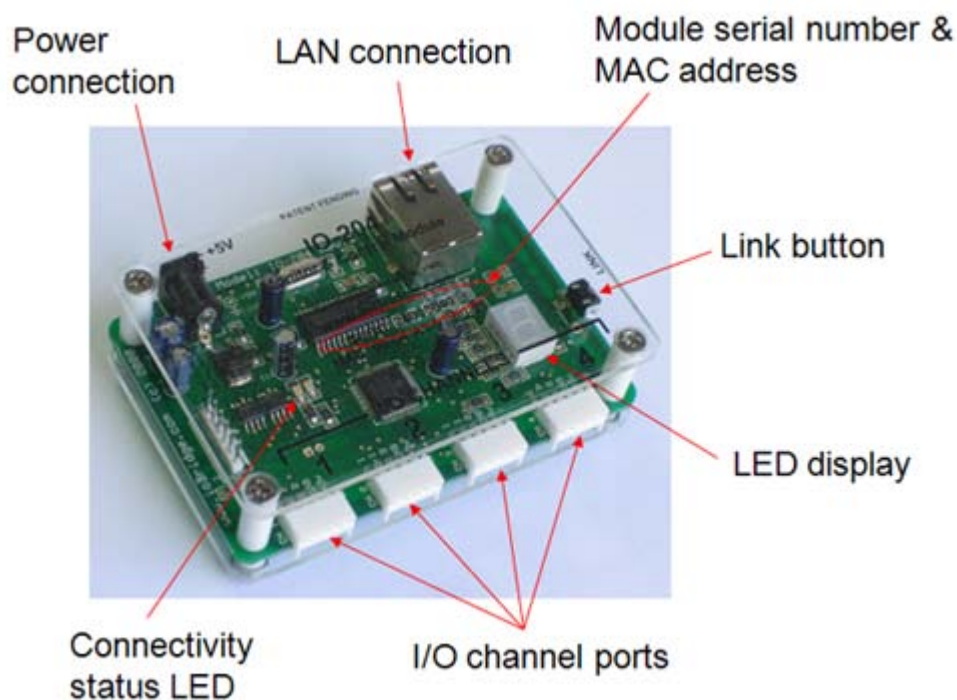
4.2 Connectivity Status LED

The Connectivity Status LED is red when the module is offline and green when the module is online. During a reset both the red and green LED will flash rapidly for about a second

4.3 LED Display

The LED display is used to convey information for a variety of reasons. The following sections help explain what the various messages mean.

4.3.1 LED Display during startup (Connectivity Status LED is red)

The module goes through a series of steps to get internet connectivity. Normally the entire process takes just a few seconds. The current step is shown on the LED display during startup. If the module fails to get online, knowing the step that fails may be helpful for troubleshooting network problems.

0 - Module has booted successfully, looking for network connection

1 - Network connection has been established

2 - Successful DHCP transaction, the module now has an IP address

3 - Checking DNS 4 - DNS is ok

5 - Looking for an internet connection

6 - Internet connection found

7 - Opening communication channel

8 - Channel open, securing channel

9 - Everything is ok, begin normal operation

4.3.2 LED Display during normal operation (Connectivity Status LED is green)

The LED display will be blank until an operation is performed on an I/O channel. When this happens, the channel number will be shown for about one second before it goes blank again.

4.3.3 LED Display during a hard reset (see section 5.7)

As power is applier to the module with the LINK button pressed, the LED display with show a rotating pattern for a few seconds.

4.3.4 LED Display while linking a module to am ioBridge user account

The LED display will show a flashing hyphen and numbers will be shown. These numbers are to be entered back into the website when prompted.

4.3.5 LED Display during a firmware upgrade

A rotating pattern is shown on the LED display as the new firmware is being downloaded. The download is finished when an "F" is shown. The process is completed by pressing the LINK button. When the display begins flashing a hyphen, follow the online prompts to complete the upgrade process.

4.4 I/O Channels

An "I/O channel" is a 5 pin port with the following pins.

1. Analog input -function pin

2. Digital input -function pin

3. Digital output -function pin

4. Ground -power pin

5. +5V -power pin
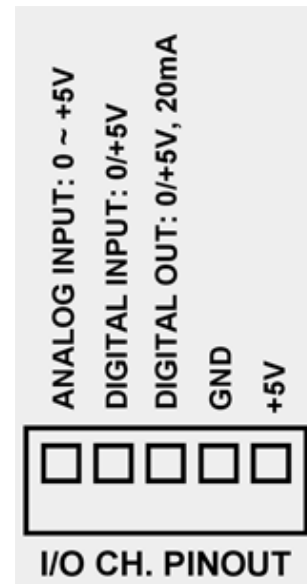
The IO-204 module has 4 for these ports on the front edge labeled "I/O CHANNELS". All of the channels can be controlled independent from one another. Furthermore, all of the function pins within a single channel can be controlled individually. The only property that is shared among all the function pins on a particular channel is the "method of data push" (see section 5.3.3)

The I/O channel connector will interface with 0.1 inch pitch header pins. Alternately, 22AWG solid strand wire with approximately 0.3 inches of insulation removed will slide nicely into a socket connector hole.

Pins 4 and 5 on each I/O channel attach to the main power lines of the module. These lines can be used to power small circuits that are attached to the channel. The power adapter supplied with the module is rated at 1 Amp. The module requires about 200mA during normal operation. If more than 800mA of current is drawn through the I/O channels, the module may malfunction or reset.

4.4.1 Analog input

Each I/O channel's analog input pin is connected to a 10-bit analog-to-digital converter. The voltage input range is 0V to +5V. An input above +5V or below 0V could damage the module and should be avoided.

4.4.2 Digital input

Each I/O channel's digital input pin is capable of accepting a digital signal of 0/+5v. A voltage outside this range could damage the module and should be avoided.

4.4.3 Digital output

Each I/O channel's digital output pin is capable of supplying a voltage level of 0v or +5v. Care should be taken not to exceed a current draw of 20mA per digital output as this may damage the module.

4.4.4 Digital output failsafe settings

Normally, while online, the digital outputs are controlled through either the ioBridge website or widgets in other websites. In the event that the module loses internet connectivity, each digital output pin is controlled by a pre-configured failsafe setting. The three failsafe settings are 'no change', 'pin high' and 'pin low'. Using the 'no change' option, the pin maintains its digital state when the module is offline. The 'pin high' and 'pin low' options will cause the module to automatically change the pin's digital out to the respective state if the module goes offline. However, when the module comes back online, the digital output will return to its original state (the digital state before it was knocked offline).

5. Using the IO-204 Module

5.1 Power up

The module doesn't have a power switch. It's a piece of networking equipment that is meant to be on all the time. To power it up, just plug in a network cable and the power cord. Assuming the basic network requirements are met, the module will get online by itself. Digits, increasing from 0 to 9, will be shown on the LED display and the Connectivity Status LED will turn green. The module may restart itself and start the process over again if a connection attempt fails.

5.2 Linking the module

In order to configure the IO-204 module, it must be linked to an ioBridge user account. Linking a module provides a means of authentication for a particular user to configure a module.

- Here are the steps for creating a user account link:

- Plug in the power cord and network cable.

- Wait for the connectivity indicator LED to turn green (may take a   minute).

- Go to www.iobridge.com and create a user account.

- Navigate to the "Modules" page and clink "Link Module".

- Follow the prompts on the website to finish the process.

The website will ask for the module's serial number found on the top label. Also, when prompted, press and hold down the LINK button until the LED display begins to flash a hyphen. A series a numbers will be shown on the LED display. These numbers need to be entered into the website during the module linking process. After a successful link is created, the LED display will go blank.

5.3 Getting data from your module

Getting data from the module can happen in two ways. Either the data is requested from the module by a web widget (polling) or the module pushes data to the web on its own.

5.3.1 Polling Data

A widget can be created which will request a given value from a module and display the results. This can occur automatically at a predetermined interval (every 30 seconds for instance). The widget can also be configured to request the data on a mouse click or when the widget loads up in a web page.

5.3.2 Pushing Data

Pushed data is transferred from the module to the internet without any request for it. Pushed data messages are controlled by either an adjustable periodic timer or by an input trigger. Pushed data is used to control user configured "actions", such as sending a text message to a mobile phone or sends a command to another module.

5.3.3 Methods of Pushing Data

Auto Message Analog Input: The module automatically sends the analog input reading for this channel at a set interval. The interval can be set from a range of 10 seconds to 18 hours.

Auto Message Digital Input: The module automatically sends the digital input state for this channel at a set interval. The interval can be set from a range of 10 seconds to 18 hours.

Send Message on Digital State Change: The module will automatically send the value of the digital input on this channel when the digital input state changes.

Send Message on Analog Trigger: For this method of pushing data, a trigger and reset value are set for the I/O channel's analog input. When the analog input reading reaches the trigger value, the analog data will be pushed from the module. After the data is pushed, no more analog data will be sent until the reset value is reached.

Note: The analog trigger value can be set lower than the reset if a negative going data push is needed.

An I/O channel set to push data can only be set to a single method at a time. Meaning, while all three function pins (analog input, digital input and digital output) of an I/O channel can be read and controlled simultaneously, only one push method can be set for the entire channel. For example, an I/O channel cannot be set to send analog inputs at periodic interval as well as push digital inputs values on a state change.

Note: Selecting a method for pushing data will only control when messages are sent from the module. In order to act upon this data (sending email alerts, controlling other module, etc), an "action" will need to be created.

5.5 Sending Commands

Sending commands to the module allows users to control the digital state of pins as well as carry out more complex tasks through the use of Smart Boards (see section 5.6). Commands are sent to the module via user defined web widgets. These widgets are easily created through the widget wizard on the ioBridge.com website.

5.6 Smart Boards

An I/O channel can also be configured to interface with a Smart Board. A Smart Board is a small circuit board that performs a function more complex than basic I/O channel inputs and outputs. For example, a Smart Board may control multiple servos or control X10 home automation devices. An I/O channel is set for smart mode under the module configuration page on the ioBridge website. After the Smart Board is plugged in an I/O channel and the channel is set for the proper mode from the drop down menu, the module will be reset remotely to initialize the Smart Board.

Note: While an I/O channel is in smart mode, all of the normal channel input/output functions will be disabled.

5.7 Hard Reset

The module contains non-volatile memory, meaning settings are stored even when the device is not powered. In the event that the module's memory needs to be reset to the factory default settings, a hard reset is required.

To perform a hard reset:

- Unplug the power cord.

- While holding down the LINK button, plug the power cord in.

- The LED display will show a rotating pattern for a second or two while it is re-writing the memory.

- Release the LINK button.

5.8 Changing the MAC address

The default MAC address is printed on the module's top label. Although, if needed, the MAC address can be changed. Once the module is online and linked to a user account, navigate to the "Module, Advanced Settings" page and find the entry showing the module's MAC address. Click the MAC address and change it to a new valid 12 digit MAC address. Upon clicking "save", the module will reset and go through a start up process, eventually connecting again with the new MAC address.

Warning: If MAC address filtering is used on the network, the module may not reconnect after resetting with the new address. If this happens, either add the new MAC address to the router's filter table or perform a hard reset (see section 5.7).

5.9 Changing the DHCP name

A DHCP name is the title that is listed in the DHCP server table (normally in the router's settings page)

The module's default DHCP name is "io" followed by the 8 digit serial number. If needed, the DHCP name can be changed. Once the module is online and linked to a user account, navigate to the "Module, Advanced Settings" page and find the entry showing the module's DHCP name. Click the "DHCP Name" and change it to a new valid 12 character alpha-numeric name. Upon clicking "save", the module will reset and go through a start up process, eventually connecting again with the new DHCP name.

5.10 Updating the module's firmware

Occasionally, module firmware updates will become available on the ioBridge website. It is recommended that all of the external connections be detached from the I/O channels. To start the update process, go to the module configuration page, click on the "Upgrade" link and follow the prompts. During an upgrade, the module will download new firmware and reprogram itself. The actual moment when the module is reprogramming itself, both the red and green Connectivity Status LEDs will be lit. Avoid, disrupting the power when the module is in this state. The entire update process takes only a few minutes.

6. Frequently Asked Questions

Q1: What kind of home network do I need?

A1: You'll need a 10/100Base-T network configured for auto-detection. A DHCP service running on the network is also required for the IO-204 to obtain an IP address automatically. Most home networking routers take care of DHCP by default.

Q2: How do I get around MAC filtering?

A2: The easiest solution is to add the IO-204 module's MAC address to the "allowed" table in your router. If you don't have access to the router settings then, you will need to first attach your module to a network connection that isn't MAC filtered. After linking your module to your ioBridge account, you'll be able to change the MAC address to whatever you want and then return it to the original, MAC filtered network.

Q3: Do I have to open any ports on my firewall?

A4: No, you shouldn't need to open up any ports on your firewall. If you can access the web from inside your network, then the IO-204 module will work without any modifications.

Q5: Can I control a motor from an I/O channel?

A5: Not directly. The digital output on an I/O channel is only capable of 5v, 20mA. To control the high current demanded by motors, you will need either our relay adapter board or a third party motor controller board. Motor controller boards a fairly common and a simple web search will yield plenty of hits.

Q6: What are the specs of the analog input?

A6: Each I/O channel has a 10-bit analog to digital converter with a range of 0 to 5 volts. Anything over 5 volts may permanently damage the IO-204 module.

Q7: Ok, I plugged it in and the light turned green. Now what?

A7: Sign up for an account at ioBridge.com and follow the steps to link your IO204 module to your account. Once a link is established, you'll be able to control and monitor your module as well as set up widgets for placing on your own webpage.

Q8: How about security?

A8: Although nothing online can be 100% secure, we have gone to great lengths to ensure that you are the only one who can access your module (useless you chose to share control of course). Data transfer with the module is encrypted using an algorithm similar to SSL, which is the standard method for secure web transactions.

Q9: Is there a wireless version?

A9: Not at the present time, but the IO-204 module will work with wireless bridge devices such as the "Linksys WGA54G Wireless Bridge".

Q10: Where can I go for help?

A10: Visit the ioBridge online forum at http://www.iobridge.com/forum. ioBridge developers monitor forum posts and offer advice on using your module.

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