

HiCON OEM – pn7752

**Ethernet Motion Controller
Data Acquisition System
Logic Controller**

User Guide

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Atlanta, USA**

For more information please visit the product web page:

<https://www.vitalsystem.com/hicon>

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License Agreement

Before using the HiCON and accompanying software tools, please take a moment to go thru this License agreement. Any use of this hardware and software indicate your acceptance to this agreement.

It is the nature of all machine tools that they are dangerous devices. In order to be permitted to use HiCON on any machine you must agree to the following license:

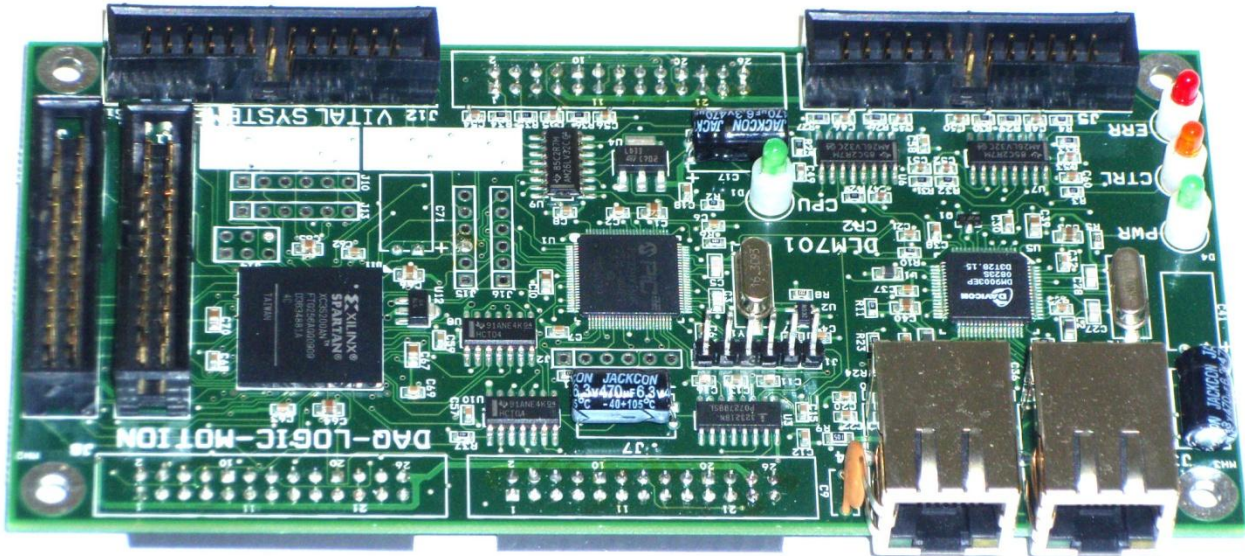
I agree that no-one other than the owner of this machine, will, under any circumstances be responsible, for the operation, safety, and use of this machine. I agree there is no situation under which I would consider Vital Systems, or any of its distributors to be responsible for any losses, damages, or other misfortunes suffered through the use of the HiCON board and its software. I understand that the HiCON board is very complex, and though the engineers make every effort to achieve a bug free environment, that I will hold no-one other than myself responsible for mistakes, errors, material loss, personal damages, secondary damages, faults or errors of any kind, caused by any circumstance, any bugs, or any undesired response by the board and its software while running my machine or device.

I fully accept all responsibility for the operation of this machine while under the control of HiCON, and for its operation by others who may use the machine. It is my responsibility to warn any others who may operate any device under the control of HiCON board of the limitations so imposed.

I fully accept the above statements, and I will comply at all times with standard operating procedures and safety requirements pertinent to my area or country, and will endeavor to ensure the safety of all operators, as well as anyone near or in the area of my machine.

WARNING: Machines in motion can be extremely dangerous!
It is the responsibility of the user to design effective error handling and safety protection as part of the system. VITAL Systems shall not be liable or responsible for any incidental or consequential damages. By using the HiCON motion controller, you agree to the license agreement.

1. Overview



The HiCON is an Ethernet based controller for motion control, data acquisition, and general PID control system applications. Utilizing the latest Microchip technology, the HiCON offers a comprehensive set of features for your demanding applications.

HiCON controller can be applied in a variety of applications involving PC based Motion Control, Storage and Retrieval Systems and CNC Milling / Lathe Machines. Equipped with a rich set of hardware interfaces, it can also be used for wide variety of applications involving PID control, e.g., speed, oven temperature control and so on.

Key Features:

- **9 Differential Quadrature Encoder Inputs. 32-Bit Resolution**
- **4 Mhz Max Encoder frequency. Encoder resolution multiplied by 4 thru Hardware.**
- **6 Step and Direction Channels. Up to 2MHz Step Frequencies**
- **2 Channel Analog Inputs, Range 0-3.3VVolts, 12-bit Resolution**
- **72 Digital I/O (48 Inputs & 24 Outputs)**
- **Ethernet 100Mb connectivity using TCP/IP interface.**
- **Simple UDP Socket Programming Interface.**
- **Visual Studio 2010 .Net Managed Library for C#, C++, and VB.Net Software Developers.**
- **Standalone Operation by programming the unit with BASIC programming language.**

Software Tool Set:

- **HiCON Firmware Upgrade** – A GUI based software tool to re-flash (burn) the firmware stored on the HiCON board. New versions of this program and firmware can be obtained from the factory.
- **Mach4/MachPro Plugin** – Plugin Software for Mach.
- **Windows .Net Library** – Software Library for custom PC software development.



Extremely Important Reminder

Extreme precautions must be observed when operating machinery. Machines are known to have enormous power even with a small motor. Never come within a machine's path while powered.

Failure to observe caution while operating machines can result in severe injuries or even death.



2. Software setup

2.1 HiCON Mach4/MachPro Plugin Setup

To use the HiCON plugin for Mach4 or MachPro, download the [ZIP file](#) and extract or copy its contents into the **Plugins** folder of your Mach4/MachPro installation directory. When you launch Mach4 or MachPro, the software will detect multiple available plugins and display a prompt that includes the HiCON plugin in the list. For detailed step-by-step instructions, refer to the link below:

- [HiCON Mach Software Integration](#)

2.2 VSI Device Manager

In order to change or update the firmware installed on the HiCON, or activate features, you will have to install the VSI Device Manager application. For instructions on using the program, see the provided [manual](#).

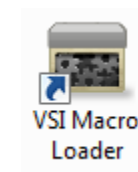


Extended Features:

- Extended I/O – Unlocks J7 and J8 for an additional 32 Inputs and 16 Outputs. Default number of I/O is 23 inputs, 8 outputs, and 5 relay outputs.
- Basic Macro – Unlocks the use of HiCON Basic Programs for standalone operation.
- Analog Input – Unlocks the user of Analog Inputs (0 – 3.3V).

2.3 VSI Macro Loader

VSI Macro Loader is an application that is used to install and debug the HiCON Basic Program on the HiCON controller. The user can select the HiCON Basic file (.bas file) and download it to the controller. After launching the HiCON Basic program, the user can see the print statement outputs on the output window.



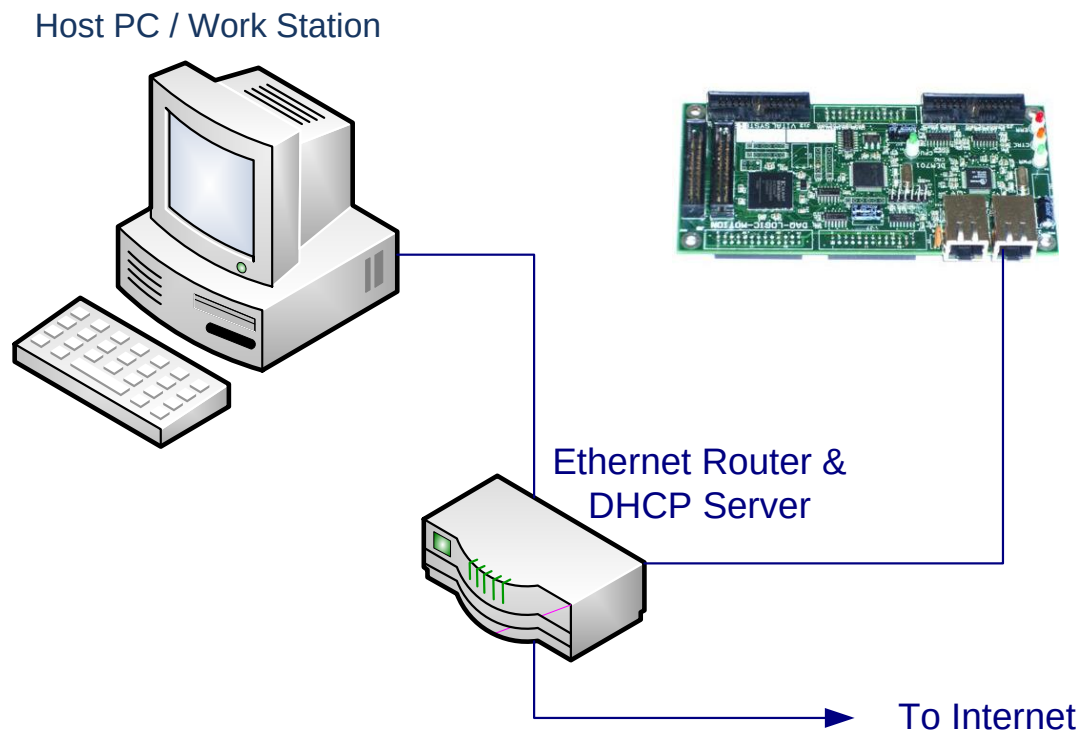
2.4 Custom Software Application with HiCON

Custom Windows applications can be created using the HiCON CLR library. The Library is an API designed to allow communication (via Ethernet) using commands to arm/disarm, control and read I/O, and command motion among others. A demo C# application containing the HiCON CLR library can be downloaded from the [vitalsystem website](#).

3. Network Connection Setup

You can connect the HiCON directly to your PC or connect via an Ethernet switch. The HiCON board can use the DHCP server on the network or a fixed IP address (firmware pre-assigned IP address is 192.168.0.35). The default IP address of the device can be manually changed via the VSI Device Manager Software.

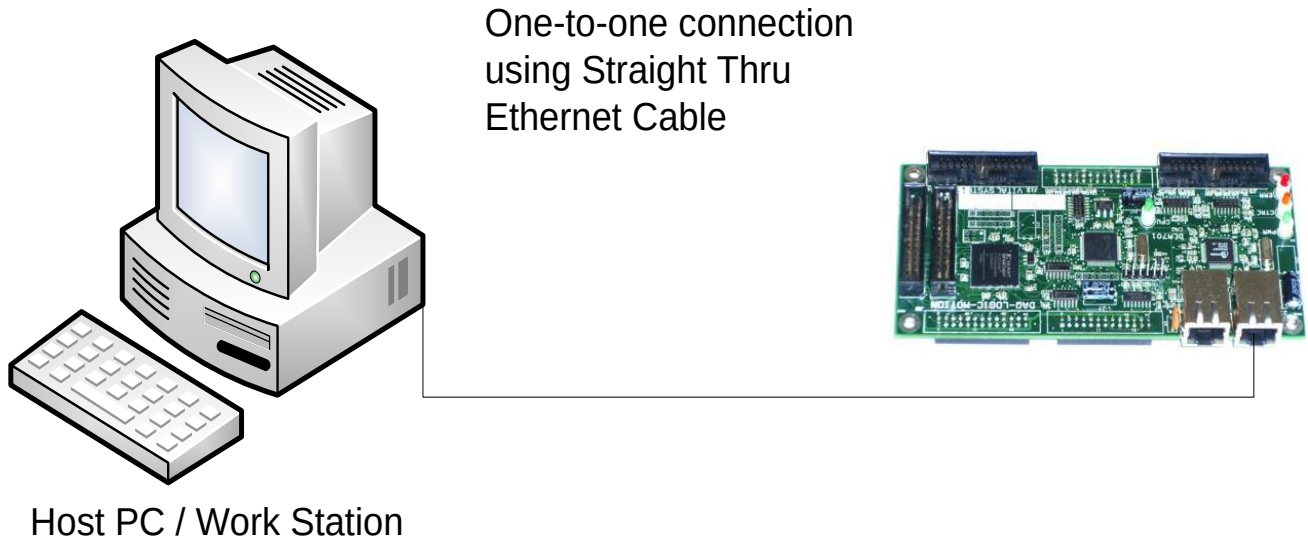
3.1 Setup IP address using a Router with DHCP Server



The figure above shows a basic setup using a router on your network. Connect the Ethernet cable from the J3 or J4 Ethernet port of the HiCON to the DHCP server/Router. Connect another Ethernet cable from the DHCP Server/Router to the PC. The DHCP server dynamically assigns IP address both to the PC as well as to the HiCON, and therefore completes the network setup without requiring any intervention from the user.

3.2 Direct Connection to the PC

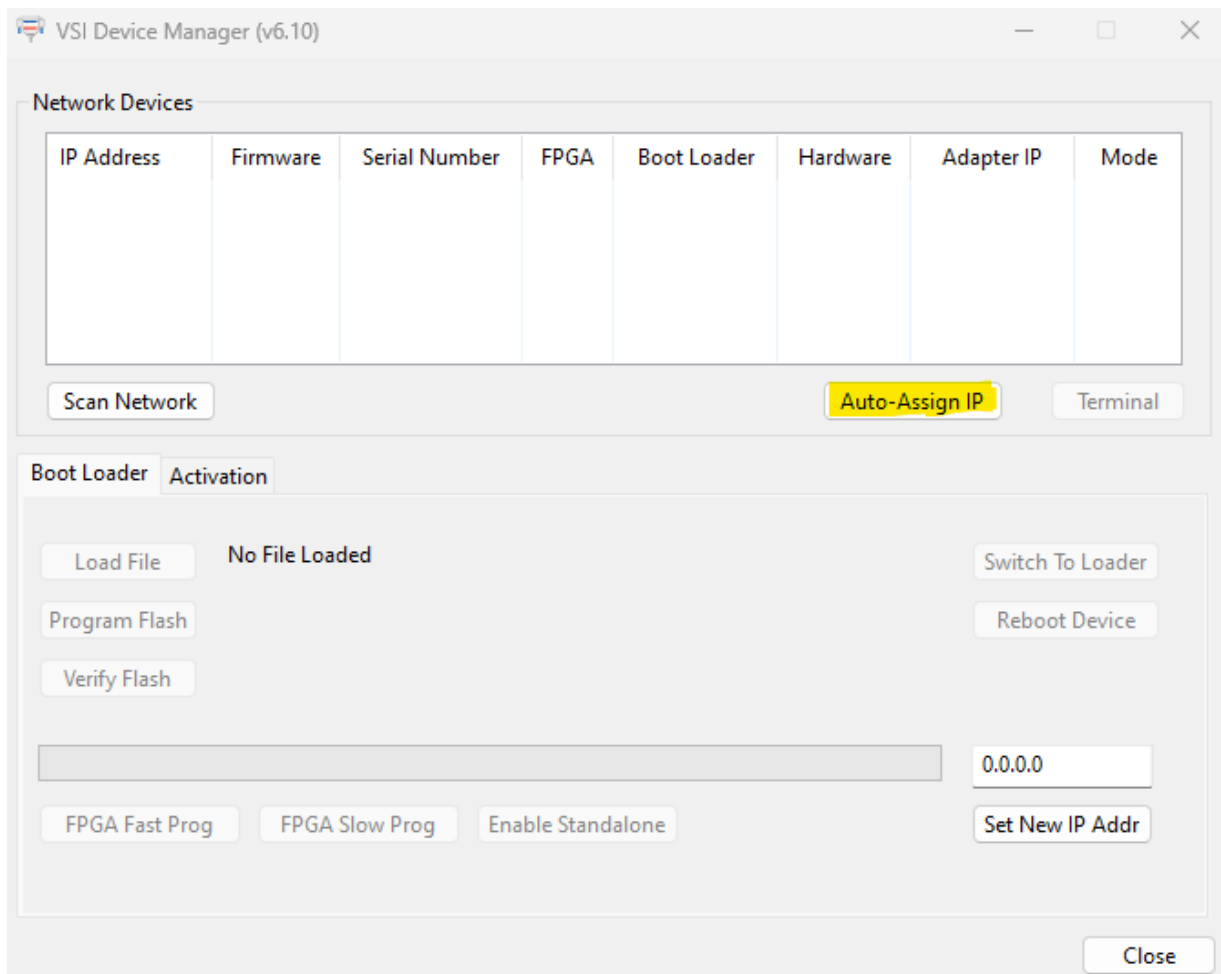
The Ethernet cable is connected from the J3 or J4 Ethernet port of the HiCON board to the PC as shown below:



When this configuration is used, the network address of the HiCON board must match that of the PC's ethernet adapter. The default IP address of the HiCON board is 192.168.0.35. This means that we must change the PC's adapter IP to a static IP with the form 192.168.0.xxx. The following two methods will demonstrate how to accomplish this.

Primary Method:

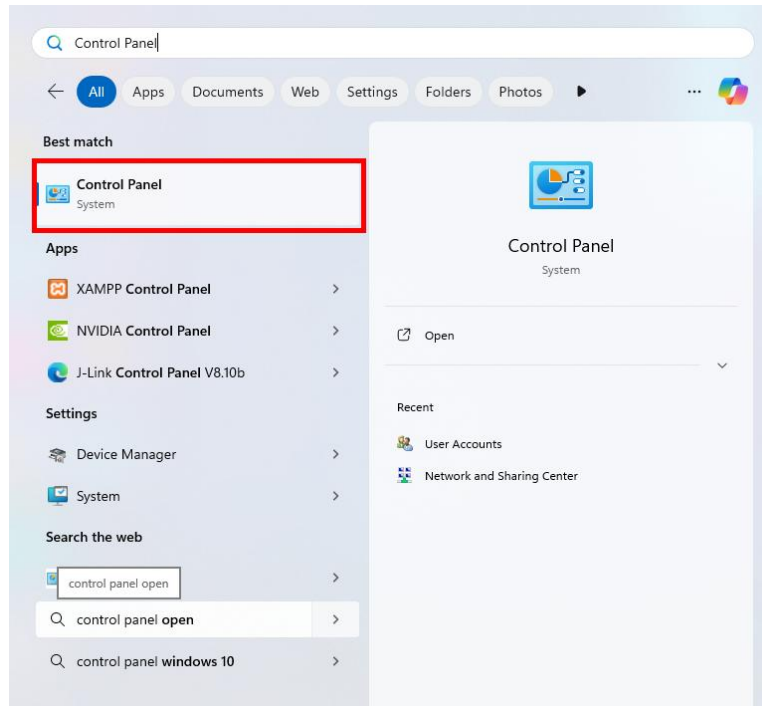
To connect your PC directly to the HiCON, begin by clicking on the "Scan Network" option. The HiCON board should appear in the Network Devices list. If the device does not appear, click the "Auto-Assign IP" button. Afterward, cycle the power of the HiCON board to ensure the new IP address takes effect. This method will automatically assign an IP address to the HiCON board, facilitating a seamless connection.



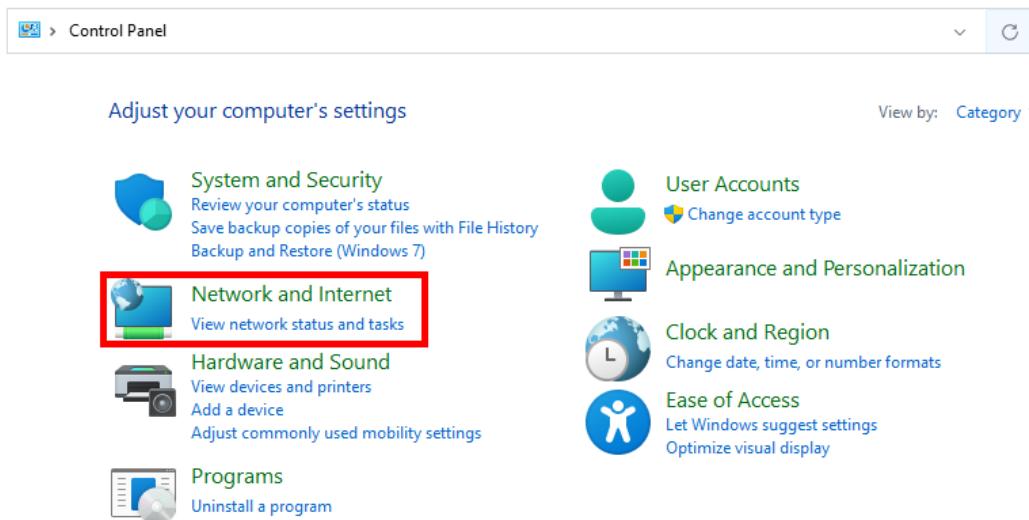
When connecting the PC directly to the HiCON, you may need to manually assign IP address 192.168.0.10 in Windows XP, 7 or newer in case Auto-Assign IP does not take effect. The HiCON board will use its firmware default IP address, i.e., 192.168.0.35. Do not use VSI Device Manager Software to change the HiCON IP address, unless you know exactly what you doing. If not sure, please email VSI for more information (support@vitalsystem.com). Network setup is a pretty simple task, but wrong settings can get you stuck for many hours.

Secondary Method:

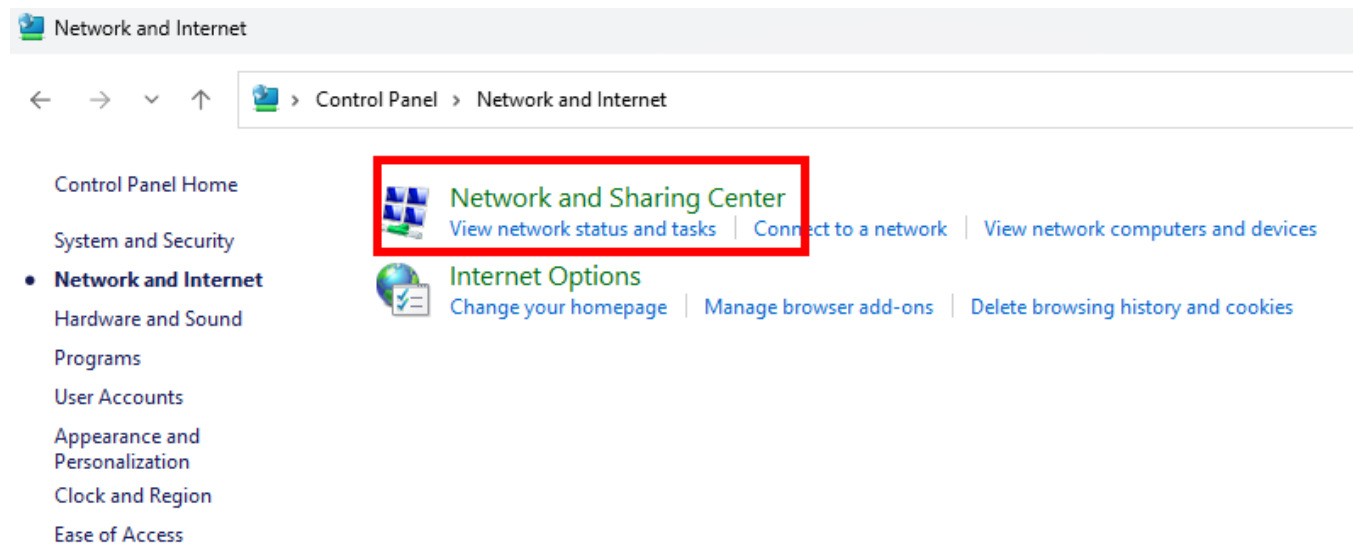
Click the **Start** menu. Next, click on the **Control Panel** option.



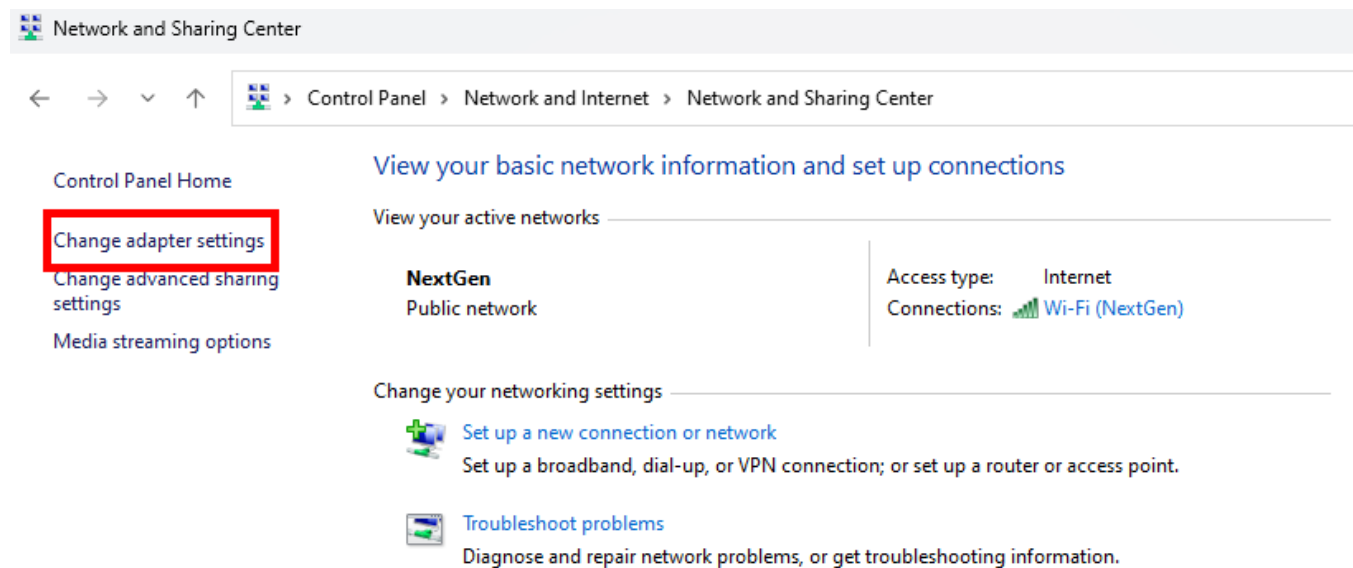
Click on the **Network and Internet** option.



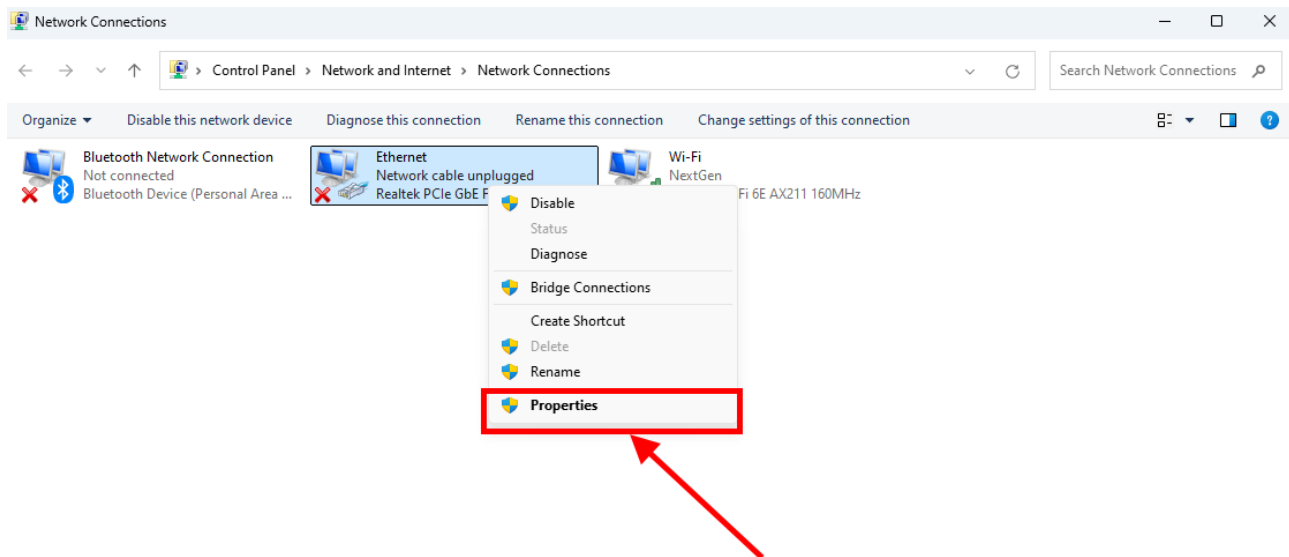
Click on the **Network and Sharing Center** option.



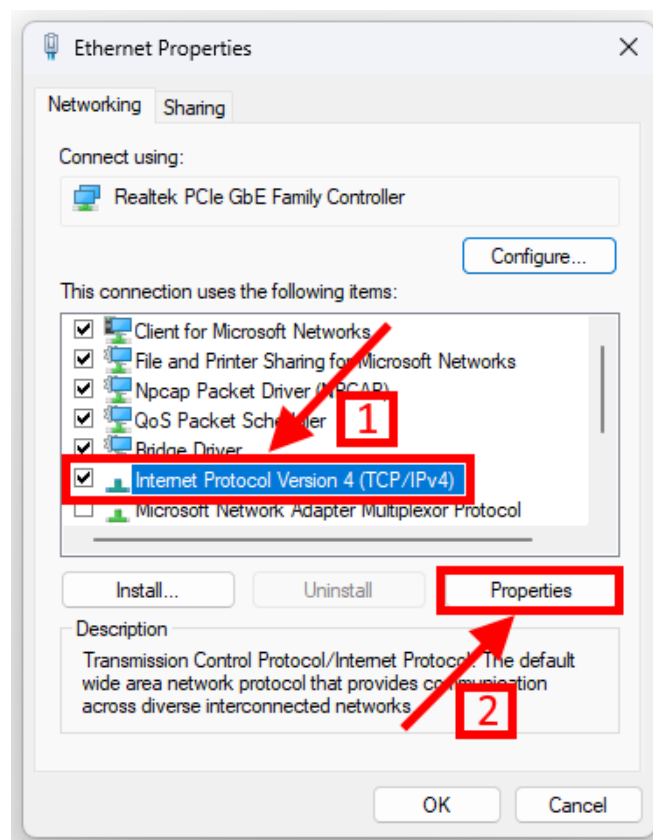
Click on **Change adapter settings** from the left side menu.



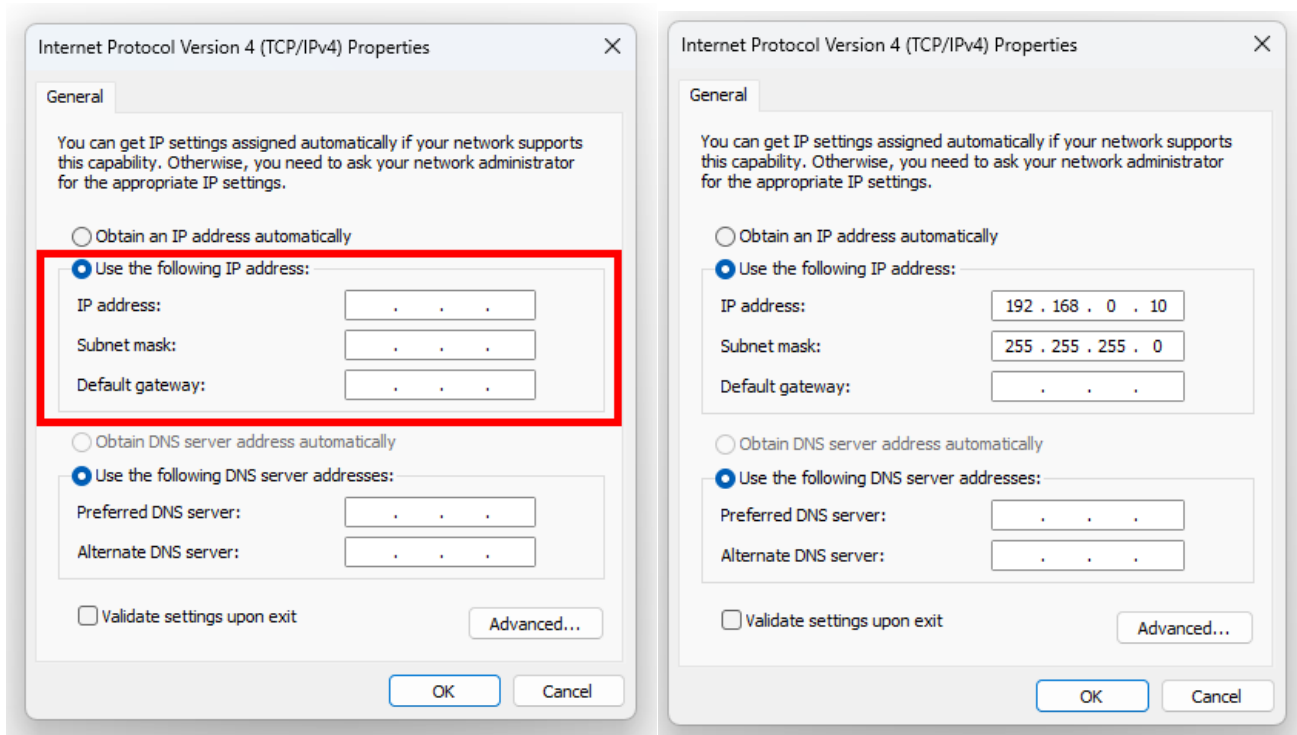
Right-click on the **Ethernet** icon, then select **Properties**.



In the window that opens, click on the **Internet Protocol Version 4 (TCP/IPv4)** (you may need to scroll down to find it). Next, click on the **Properties** button.



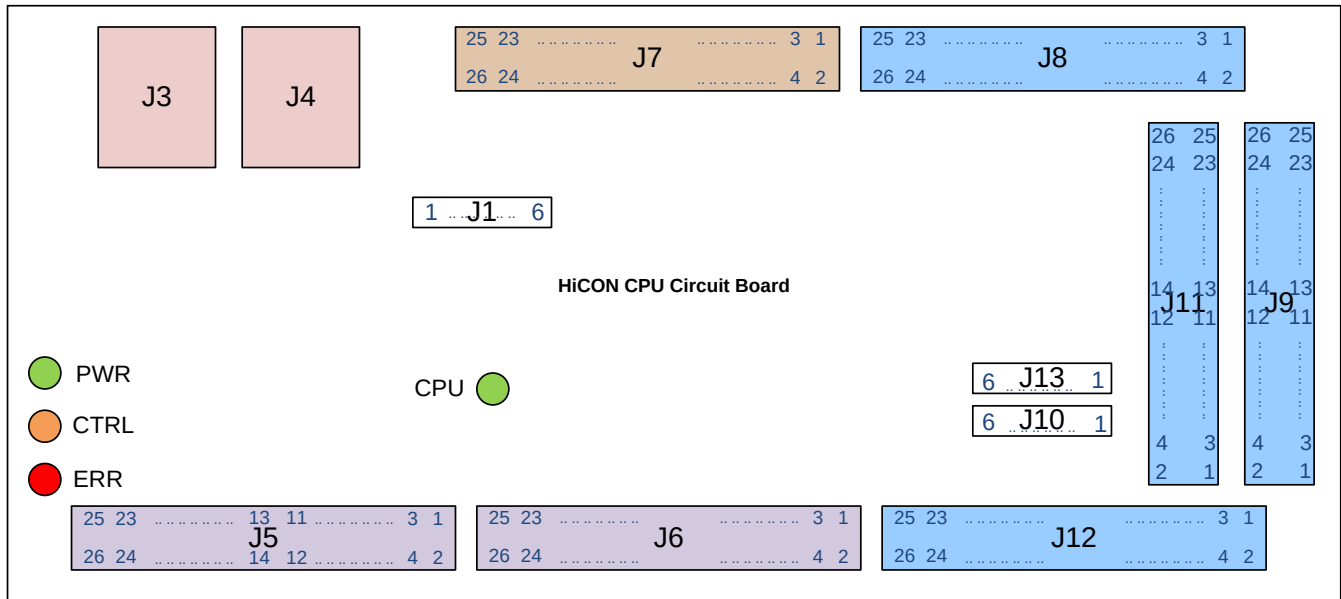
In the window that opens, click the Use the following IP address: radio button. In the **IP address:**, type **192.168.0.10**, **Subnet mask:** **255.255.255.0**, and **Default gateway:** leave blank. For the DNS server settings, leave both of them blank.



Click OK to save the setting. After a few seconds, you should be able to connect HiCON from Mach software.

4. HiCON CPU Hardware Interface

The HiCON CPU board has several interface ports and indicator LEDs. The figure below shows a top view of the HiCON CPU board with interface ports and other components:



- J3, J4 – Ethernet connection
- J5 – Differential Encoder inputs (Index 0, 1 and 2).
- J6 – Differential Encoder inputs (Index 3), Single-ended Encoder inputs (4 – 7), Digital I/Os
- J7 – Stepper Motor outputs, PWM Output, Digital I/Os, Serial RX and TX, Analog Outputs
- J8 – Port 11 digital I/Os, provide 16 inputs (0 – 15) and 8 outputs (0 – 7)
- J9 – Port 12 digital I/Os, provide 16 inputs (16 - 31) and 8 outputs (8 – 15)
- J10 – Single-ended Encoder input 8
- J11 – Port 13 digital I/Os, provide 16 inputs (32 - 47) and 8 outputs (16 – 23)
- J12 – Port 14 digital I/Os, provide 16 inputs (48 – 63) and 8 outputs (24 – 31)
- J13 – Digital Outputs 24 – 29

- PWR LED – Green colored LED for Power indication; it glows steadily when Power is on
- CTRL LED – Orange colored LED for PIDs in-control; it glows steadily when PID is armed
- ERR LED – Red colored LED for error indication.
- CPU LED – Green colored LED for Power indication; it blinks steadily when Power is on and running normally. It blinks rapidly if it is on download mode.

4.1 Ethernet Port – J3, J4

The HiCON controller has a built-in Ethernet switch that allows the user to connect up to two Ethernet cables (e.g. for daisy chain). Connect to PC directly or via an Ethernet Hub or switch. The HiCON board supports both 10 MBit and 100 Mbit network speeds. TCP/IP network protocol in UDP mode is used for PC communications.

4.2 Digital I/O Ports – J8, J9, J11, J12, J13

The Digital inputs and outputs on HiCON (J8, J9, J11, J12, and J13) use the 3.3volts standard. The user should make sure that these I/O signals do not connect to a 5volts source. However, 5volts through a 4.7K or higher value resistor can be connected to any input or output pin. A direct connection of these pins to 5volts (without a resistor) will damage the unit.

The Vital Systems [Opto-Isolated I/O boards 7535](#), and OPTO22 style modules e.g. G4ODC5 and G4IDC5, are compatible with HiCON Digital I/O Ports.

J8 Pin Assignments:

Pin#	Function	Pin#	Function
1	Ground	2	Digital Output Port 11, Pin 0
3	Digital Output Port 11, Pin 1	4	Digital Output Port 11, Pin 2
5	Digital Output Port 11, Pin 3	6	Digital Output Port 11, Pin 4
7	Digital Output Port 11, Pin 5	8	Digital Output Port 11, Pin 6
9	Digital Output Port 11, Pin 7	10	Digital Input Port 11, Pin 0
11	Digital Input Port 11, Pin 1	12	Digital Input Port 11, Pin 2
13	Digital Input Port 11, Pin 3	14	Digital Input Port 11, Pin 4
15	Digital Input Port 11, Pin 5	16	Digital Input Port 11, Pin 6
17	Digital Input Port 11, Pin 7	18	Digital Input Port 11, Pin 8
19	Digital Input Port 11, Pin 9	20	Digital Input Port 11, Pin 10
21	Digital Input Port 11, Pin 11	22	Digital Input Port 11, Pin 12
23	Digital Input Port 11, Pin 13	24	Digital Input Port 11, Pin 14
25	Digital Input Port 11, Pin 15	26	+5V

J9 Pin Assignments:

Pin#	Function	Pin#	Function
1	Ground	2	Digital Output Port 12, Pin 0
3	Digital Output Port 12, Pin 1	4	Digital Output Port 12, Pin 2
5	Digital Output Port 12, Pin 3	6	Digital Output Port 12, Pin 4
7	Digital Output Port 12, Pin 5	8	Digital Output Port 12, Pin 6
9	Digital Output Port 12, Pin 7	10	Digital Input Port 12, Pin 0
11	Digital Input Port 12, Pin 1	12	Digital Input Port 12, Pin 2
13	Digital Input Port 12, Pin 3	14	Digital Input Port 12, Pin 4
15	Digital Input Port 12, Pin 5	16	Digital Input Port 12, Pin 6
17	Digital Input Port 12, Pin 7	18	Digital Input Port 12, Pin 8
19	Digital Input Port 12, Pin 9	20	Digital Input Port 12, Pin 10
21	Digital Input Port 12, Pin 11	22	Digital Input Port 12, Pin 12
23	Digital Input Port 12, Pin 13	24	Digital Input Port 12, Pin 14
25	Digital Input Port 12, Pin 15	26	+5V

J11 Pin Assignments:

Pin#	Function	Pin#	Function
1	Ground	2	Digital Output Port 13, Pin 0
3	Digital Output Port 13, Pin 1	4	Digital Output Port 13, Pin 2
5	Digital Output Port 13, Pin 3	6	Digital Output Port 13, Pin 4
7	Digital Output Port 13, Pin 5	8	Digital Output Port 13, Pin 6
9	Digital Output Port 13, Pin 7	10	Digital Input Port 13, Pin 0
11	Digital Input Port 13, Pin 1	12	Digital Input Port 13, Pin 2
13	Digital Input Port 13, Pin 3	14	Digital Input Port 13, Pin 4
15	Digital Input Port 13, Pin 5	16	Digital Input Port 13, Pin 6
17	Digital Input Port 13, Pin 7	18	Digital Input Port 13, Pin 8
19	Digital Input Port 13, Pin 9	20	Digital Input Port 13, Pin 10
21	Digital Input Port 13, Pin 11	22	Digital Input Port 13, Pin 12
23	Digital Input Port 13, Pin 13	24	Digital Input Port 13, Pin 14
25	Digital Input Port 13, Pin 15	26	+5V

J12 Pin Assignments:

Pin#	Function	Pin#	Function
1	Ground	2	Digital Output Port 14, Pin 0
3	Digital Output Port 14, Pin 1	4	Digital Output Port 14, Pin 2
5	Digital Output Port 14, Pin 3	6	Digital Output Port 14, Pin 4
7	Digital Output Port 14, Pin 5	8	Digital Output Port 14, Pin 6
9	Digital Output Port 14, Pin 7	10	Digital Input Port 14, Pin 0
11	Digital Input Port 14, Pin 1	12	Digital Input Port 14, Pin 2
13	Digital Input Port 14, Pin 3	14	Digital Input Port 14, Pin 4
15	Digital Input Port 14, Pin 5	16	Digital Input Port 14, Pin 6
17	Digital Input Port 14, Pin 7	18	Digital Input Port 14, Pin 8
19	Digital Input Port 14, Pin 9	20	Digital Input Port 14, Pin 10
21	Digital Input Port 14, Pin 11	22	Digital Input Port 14, Pin 12
23	Digital Input Port 14, Pin 13	24	Digital Input Port 14, Pin 14
25	Digital Input Port 14, Pin 15	26	+5V

J13 Pin Assignments:

Pin#	Function
1	Digital Output Port 14, Pin 0
2	Digital Output Port 14, Pin 1
3	Digital Output Port 14, Pin 2
4	Digital Output Port 14, Pin 3
5	Digital Output Port 14, Pin 4
6	Digital Output Port 14, Pin 5

4.3 Stepper and Miscellaneous Signals**J7 Pin Assignments:**

Pin #	Function	Pin#	Function
1	Step 4	2	Step 5
3	Step 2	4	Step 3
5	Step 0	6	Step 1
7	Direction 4	8	Direction 5
9	Direction 2	10	Direction 3
11	Direction 0	12	Direction 1
13	PWM0 Output	14	Digital Input Port 14, Pin 0
15	Digital Input Port 14, Pin 1	16	Digital Input Port 14, Pin 2
17	UART_TX	18	UART_RX
19	Analog Input 0	20	Analog Input 1
21	Digital Input Port 14, Pin 3	22	Digital Input Port 14, Pin 4
23	+3.3V	24	+5V
25	Ground	26	Ground

4.4 Encoders on J5, J6 and J10

J5 Pin Assignments:

Pin #	Function	Pin#	Function
1	Differential Encoder Ch 0 A+	2	Differential Encoder Ch 0 A-
3	Differential Encoder Ch 0 B+	4	Differential Encoder Ch 0 B-
5	Differential Encoder Ch 0 Z+	6	Differential Encoder Ch 0 Z-
7	+5V	8	Ground
9	Differential Encoder Ch 1 A+	10	Differential Encoder Ch 1 A-
11	Differential Encoder Ch 1 B+	12	Differential Encoder Ch 1 B-
13	Differential Encoder Ch 1 Z+	14	Differential Encoder Ch 1 Z-
15	+5V	16	Ground
17	Differential Encoder Ch 2 A+	18	Differential Encoder Ch 2 A-
19	Differential Encoder Ch 2 B+	20	Differential Encoder Ch 2 B-
21	Differential Encoder Ch 2 Z+	22	Differential Encoder Ch 2 Z-
23	+5V	24	Ground
25	+5V	26	Ground

J6 Pin Assignments:

Pin #	Function	Pin#	Function
1	Differential Encoder Ch 3 A+	2	Differential Encoder Ch 3 A-
3	Differential Encoder Ch 3 B+	4	Differential Encoder Ch 3 B-
5	Differential Encoder Ch 3 Z+	6	Differential Encoder Ch 3 Z-
7	+5V	8	Ground
9	Single-ended Encoder Ch 4 A	10	Single-ended Encoder Ch 4 B
11	Single-ended Encoder Ch 4 Z	12	Single-ended Encoder Ch 5 A
13	Single-ended Encoder Ch 5 B	14	Single-ended Encoder Ch 5 Z
15	Single-ended Encoder Ch 6 A	16	Single-ended Encoder Ch 6 B
17	Single-ended Encoder Ch 6 Z	18	Single-ended Encoder Ch 7 A
19	Single-ended Encoder Ch 7 B	20	Single-ended Encoder Ch 7 Z
21	+5V	22	Ground
23	Digital Input Port 14, Pin 5	24	Digital Input Port 14, Pin 6
25	Digital Output Port 14, Pin 6	26	Digital Output Port 14, Pin 7

J10 Pin Assignments:

Pin #	Function
1	Single-ended Encoder Ch 8 A
2	Single-ended Encoder Ch 8 B
3	Single-ended Encoder Ch 8 Z
4	Reserved
5	Reserved
6	Reserved

Further Reading

1. [HiCON Mach Software Integration](#)
2. [HiCON Basic User Guide](#)
3. [VSI Device Manager Software](#)