

Port Hopper Lite User's Guide



Embedded Internet Solutions

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1. Contact Capitol Automation to obtain a Return Material Authorization (RMA) number.
2. Clearly print the RMA number on the outside of the package bearing the product being returned. Include your return address and a telephone or email contact.
3. Send the package to the following address:

Repair Department
Capitol Automation, Inc.
500 Main Street
Clinton, MA 01510

Tel/Fax: 800-550-9672

Or, if email is your preferred method of communication:

support@capitolautomation.com

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Product Updates

To help our customers make the most of our products, we are continually making additional and updated resources available on the Capitol Automation web site. These include manuals, application notes, programming examples, and updated software and firmware.

Check in periodically at www.capitolautomation.com to see what's new!

When we are prioritizing work on these updated resources, feedback from customers (and prospective customers) is the number one priority. If you have questions, comments, or concerns about your Port Hopper Lite product, ***please let us know***.

FCC COMPLIANCE AND ADVISORY

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CANADIAN DOC STATEMENT

DOC Class Compliance – This Class A digital apparatus complies with Canadian ICES-003.

Observation des normes – Class A – Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

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Introduction

The Port Hopper Lite is a low cost Serial to Ethernet converter designed for low cost control and monitoring of endpoints on the Internet or an Intranet. The Port Hopper Lite is housed in a rugged metal enclosure.

Features

- ? Low Cost.
- ? 1 10BASE-T port with RJ-45 connector wired as hub port.
- ? 1 full duplex serial port. RTS/CTS signals are supported. DB-9 male wired DTE.
- ? 8-16 VDC (9VDC @ 300mA typical) DC input jack.
- ? Link and traffic indicator LED.
- ? Operating temp 0-70C.

The Port Hopper can be configured in Client or Server mode.

Quickstart Instructions

Remove the unit, power supply, ethernet and serial cables from the packing container. Check all components and report any missing or damaged components to Capitol Automation.

Connect the AC end of the power supply to any suitable AC wall outlet. Connect the DC female end to the DC input jack.

Connect the serial cable female end into the serial port input and the other end into the legacy device. You may need to use a gender changer, 25 to 9 pin adapter (not included) or null modem connector to accomplish this. This is solely dependent on the legacy device configuration.

Connect one end of the crossover ethernet cable into the ethernet port. Connect the other end into your hub or switch port. Alternatively, you may direct connect to a peer computer using the straight through cable provided.

Configuration of the Port Hopper Lite serial to ethernet parameters can be displayed and changed using a web browser.

The default IP address is 192.168.1.5. Make sure no other devices on your network (such as a DSL or cable router) have the same address. If you have such a configuration, either remove the other device or connect the Port Hopper directly to a peer computer and install a new default IP address compatible with your network using the built in setup pages illustrated below (config.html).

Attempt to *ping* the device from another computer on the network (e.g. ping 192.168.1.5). The Port Hopper Lite should respond to the ping with a reply. You will see the green LED blink upon reception of a ping packet and transmission of a reply packet. If this is not happening, then check your cabling, power supply and whether you're network is configured for 10BASE-T operation.

If you are successful with ping, open a browser window and type:

[HTTP://<ipaddr>/index.html](http://<ipaddr>/index.html) (where <ipaddr> is your IP address, e.g. 192.168.1.5)

This page displays the current configuration:

“Capitol Automation Port Hopper Lite”

MAC: 00-00-E8-EE-09-F5 IP: 192.168.1.5 MASK: 255.255.255.0 GW: 192.168.1.250
COM: 38400,N, 8,1 Flow Control: XON/XOFF **off** RTS/CTS **on** PEER IP: 0.0.0.0

[HTTP://<ipaddr>/config.html](http://<ipaddr>/config.html)

This page allows the user to modify the configuration. The default password is "1234".

	Password
Protocol: ☐ None ☒ Xon/Xoff ☒ RTS/CTS	
19200 Bd	Port speed
192.168.1.5	IP Address
255.255.255.0	IP Mask
192.168.1.250	IP Gateway
0.0.0.0	Peer Connection IP (0.0.0.0 - PASSIVE)
Send	

[HTTP://<ipaddr>/setup.html](http://<ipaddr>/setup.html)

This page allows the user to save the modified configuration in the EEPROM or revert to a default configuration. The default password is "1234".

MY MAC: 00-00-E8-EE-09-F5

Current config:

IP: 192.168.1.5 MASK: 255.255.255.0 GW: 192.168.1.250 POINT: 0.0.0.0
COM: 38400,N,8,1 Flow Control: XON/XOFF **off** RTS/CTS **on**

New config:

IP: 192.168.1.5 MASK: 255.255.255.0 GW: 192.168.1.250 POINT: 0.0.0.0
COM: 38400,N,8,1 Flow Control: XON/XOFF **off** RTS/CTS **on**

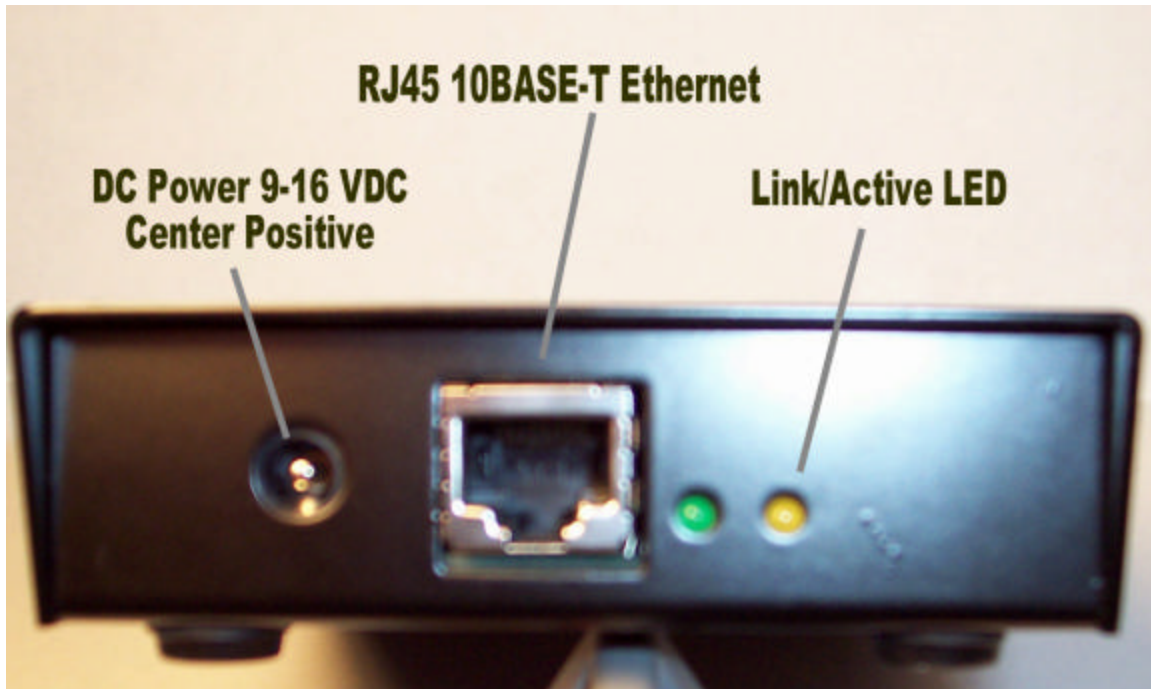
Default config:

IP: 192.168.1.5 MASK: 255.255.255.0 GW: 192.168.1.250 POINT: 0.0.0.0
COM: 38400,N,8,1 Flow Control: XON/XOFF **off** RTS/CTS **on**

Entry Password for change:

[Exit](#)

Connector Pinouts



RJ45 Ethernet connector – Hub Pinout

Signal	Pin
TX+	1
TX-	2
RX+	3
No Connect	4
No Connect	5
RX-	6
No Connect	7
No Connect	8

Note: Link LED is rightmost LED. Color can be green or yellow.

DB-9 Male DTE Serial Connector



Signal	Pin
No Connect	1
RXD Input	2
TXD Output	3
No Connect	4
Signal Common	5
No Connect	6
RTS Output	7
CTS Input	8
No Connect	9

IP Address Recovery

The Port Hopper Lite does not have a default mechanism to restore to a known IP address. If you encounter such a situation, we would be happy to reset the unit to defaults for you. Simply email or call us for arrangements.

For skilled Windows network users, the Port Hopper will respond to ARP requests. If you know the subnet of your network, a simple method of finding the IP address of the Port Hopper Lite is to use a DOS batch file to automatically increment and ping through the range of IP addresses the subnet.

Create a simple local network by connecting the LAN port of your computer to the LAN port of the Port Hopper Lite using a straight through Ethernet cable. Make sure that you have set the IP address of the computer's LAN port to the proper subnet (e.g. 192.168.1.x – x is computer's IP address). Make sure that both of the batch files (pingsub.bat, add.bat) are in the same subdirectory. Open a "cmd" window, change to the directory that the batch files are located in and execute pingsub.bat. The display will print all of the attached devices on that subnet.

pingsub.bat

```
@echo off
:START
call add.bat
ping 192.168.1.%H%%T%%D% | find "Reply" > nul
if not errorlevel 1 echo %H%%T%%D%
if %H%%T%%D%==254 goto DONE
goto START
:DONE
```

add.bat

```
@echo off
if [%H%]==[] set H=0
if [%T%]==[] set T=0
if [%D%]==[] set D=0
:DIGITS
if %D%==9 goto TENS
if %D%==8 set D=9
if %D%==7 set D=8
if %D%==6 set D=7
if %D%==5 set D=6
if %D%==4 set D=5
if %D%==3 set D=4
if %D%==2 set D=3
if %D%==1 set D=2
if %D%==0 set D=1
goto DONE
:TENS
set D=0
if %T%==9 goto HUNDREDS
if %T%==8 set T=9
if %T%==7 set T=8
if %T%==6 set T=7
if %T%==5 set T=6
if %T%==4 set T=5
if %T%==3 set T=4
if %T%==2 set T=3
if %T%==1 set T=2
if %T%==0 set T=1
goto DONE
:HUNDREDS
set T=0
if %H%==9 set H=0
if %H%==8 set H=9
if %H%==7 set H=8
if %H%==6 set H=7
if %H%==5 set H=6
if %H%==4 set H=5
if %H%==3 set H=4
if %H%==2 set H=3
if %H%==1 set H=2
if %H%==0 set H=1
goto DONE
:DONE
```

Specifications

LAN	1 10Base-T (10 Mbps) RJ45
Serial	1 RS-232 Female DB-9 DTE
Signals	RS-232: TxD, RxD, RTS, CTS and Signal Common
Speed	600 BPS – 38,400 BPS
Parity	None
Data bits	8
Stop bits	1
Flow Control	NONE, XON, XOFF, RTS/CTS
Operation Modes	TCP Server, TCP Client (Port 23)
Management	HTTP (Port 80)
Power requirements	DC 8V to 16V, 300mA at 9V typical
Operating temp.	0 - 55°C
Operating Humidity	5 - 95%RH
Storage Temp.	-20 - 85°C
Surge protection	+/-15KV ESD protection for serial port
Magnetic isolation	1.5KV Ethernet
Mechanical	Length 5.25 inches (133 cm) Width 3.5 inches (89 cm) Height 1 inches (25 cm) Weight 1 lb (.45 kg)

Designed to meet the following Certification Requirements, Regulatory Approvals and Standards

Safety: UL 60950 third edition, CSA C22.2 No. 60-950-00,CB Scheme

Emissions/Immunity: FCC Part 15 Class A, Canadian DOC Class A

EU EN61000-4-2, 3, 5, 6

Serial to Ethernet Primer

A serial device server connects legacy serial devices to an Ethernet LAN/WAN, providing a plethora of options for device management/control and data acquisition. A second consideration would be to extend the life of legacy equipment by making it "internet or intranet enabled".

Examples of legacy devices include:

- ? Medical Equipment (e.g. blood gas analyzers, air quality monitors)
- ? Point Of Sales systems (e.g. gas pumps, cash registers)
- ? Security systems (e.g. card readers, cameras)

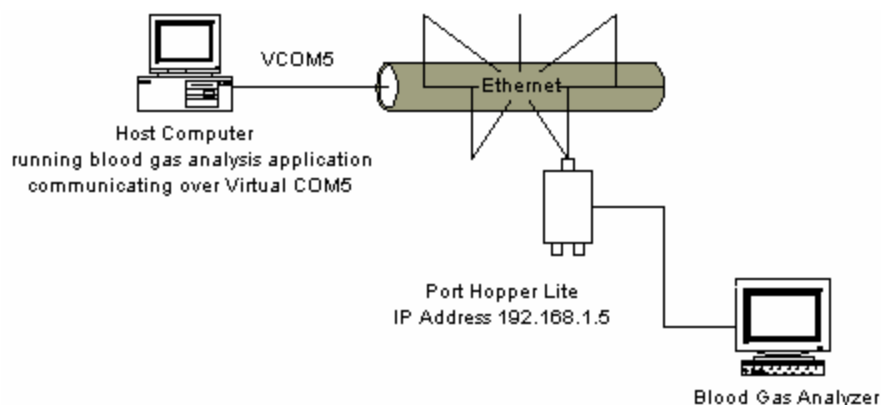
There are several methods of getting these devices "on a net":

Virtual COM Host Drivers

Some serial device server manufacturers provide native "COM" drivers that work with Windows 9x/2000/ME and NT. operating systems. Some also supply fixed tty and real tty drivers for the Linux and Unix operating systems. The driver establishes a connection between host and serial device by creating a virtual "COMn" or "/dev/tty" port on the host computer for each of the serial device server's serial ports. This driver is also known as a "port redirector" since it reroutes the data intended for the serial port to the Ethernet interface device.

Driver modes can be classified as "Single host" or "Multi-host"

Single-host mode describes a topology where only one legacy device is connected to a single host's virtual COM port through the LAN using a Port Hopper Lite connected to the physical serial port of the legacy device.



In the above illustration, an older blood gas analyzer with RS-232 port is attached to a Port Hopper Lite configured with IP address 192.168.1.5. The Port Hopper Lite ethernet port is attached to a LAN, generally by using a crossover Ethernet cable to connect to a hub or switch. A host computer with IP address set to 192.168.1.2 is connected to the same LAN.

Data are passed from the analyzer, out onto the LAN, through the host computer and then up to the user's application. The Port Hopper Lite automatically encapsulates the serial data for transport across the Ethernet. The Port Hopper Lite firmware contains the full TCP/IP protocol stack, allowing the serial data to be appropriately packed into a TCP packet, formed into an

Ethernet frame, and then sent to the host's Ethernet card. The host computer passes the packet up through its own TCP/ IP protocol stack, with the serial data safely delivered to the blood gas analyzer application through the virtual COM port.

Multi-host mode describes a topology in which one or more computers can access multiple serial legacy devices, and includes the option of providing access over the Internet. In this topology, the host computers and Port Hopper Lite's can be located on different LANs. The Port Hopper Lite can be configured so that transmitted data are allowed to pass through one or more routers through a "gateway".

Some applications require that the topology allow only one host to access a legacy device for security reasons or that multiple hosts access the same legacy device simultaneously. We treat these respective cases as "*asynchronous*" or "*synchronous*" port sharing. The Port Hopper Lite currently supports only the "*asynchronous*" mode.

Asynchronous port sharing is simply a situation where only one host can have access to a legacy device at any one time. Any subsequent host requiring access to the legacy device must wait until the previous host has terminated the TCP/IP connection.

Synchronous port sharing allows multiple hosts to simultaneously connect to the same legacy device. Currently, the Port Hopper Lite is limited to a single TCP/IP port so synchronous port sharing is not available.

TCP/IP Sockets

TCP/IP sockets refer to APIs (Application Programming Interfaces) used to communicate with devices over a TCP/IP network. Two Socket API standards are in general use. The original standard was developed for the Unix/BSD/Linux environment. This standard is generally referred to as "TCP sockets". The second standard is used with the Windows operating system, and is more commonly known as "WinSock". There are differences between the two APIs, but the source code for each is generally transportable between operating systems.

There are two transport protocols typically used by socket programming: **TCP (Transmission Control Protocol)** and **UDP (User Datagram Protocol)**, both of which rely on the **IP (Internet Protocol)** layer to communicate over a TCP/IP network. TCP is a connection-oriented service. Before a network initiator can transfer data, it must first establish a "connection" with the receiving device. This is analogous to making a telephone call or ham radio contact. In both cases you **MUST** establish contact with the other end prior to beginning conversation. TCP provides two mechanisms to ensure reliable data transmission. First, the receiving end computes and compares a "checksum" against that provided by the sender. If the receiver finds the checksum valid, it will issue an acknowledgment (**ACK**) to the sender. Otherwise a no-acknowledgment (**NAK**) is issued. This **ACK/NAK** mechanism allows TCP to detect transmission errors, requesting that specific packets be retransmitted as required. Secondly, TCP automatically re-assembles packets based on the packet's "connection sequence number". These features make TCP the preferred method for handling communications over unreliable physical infrastructure. Conversely, TCP may not be an inherently fast protocol. In some cases, you may have to wait a significant amount of time while attempting to establish a connection with another network node. TCP will also attempt to re-establish broken connections, but it could take a significant amount of time for TCP to declare that a connection has failed. Software timers that are embedded in the TCP software perform these retry mechanisms.

UDP is better for transmitting small amounts of data with a fast overall transmission speed. UDP does not require establishing a connection before sending a UDP datagram packet, and the datagram recipient does not issue an acknowledgment. Because a UDP datagram does not have a complicated header structure containing sequence numbers and such, the results are improved

response time and data transmission efficiency. UDP has a “multi-point” capability as well. This is well suited when you must broadcast small messages to numerous endpoint devices on a network.

How does one access a Port Hopper Lite and it's connected legacy device over a TCP/IP network? TCP and UDP both provide an “*IP address + Port Number*” scheme to establish connections. You can use Telnet to access a legacy device attached to the Port Hopper Lite's serial port. Issuing:

telnet 192.168.1.5

from the host computer allows the user to establish contact with the legacy serial device through the Port Hopper Lite's configured for IP address 192.168.1.5, TCP port 23 (the well known TCP port).

The concept of TCP “*client*” and “*server*” should also be addressed.

As a TCP *server*, the Port Hopper Lite acts as a network proxy for the legacy serial device. This model is best described as the host computer initiating a TCP/IP connection to the Port Hopper Lite connected to the legacy device. In *client* mode, the Port Hopper Lite establishes the connection to the host computer.

The Port Hopper Lite has a built in HTTP web server. This firmware can be modified to provide legacy serial devices with Web data presentation capabilities. One option available to the end user is to implement a set of HTTP protocol commands that read the serial data from the legacy device and format them into HTML based messages. Connecting the legacy serial device up to the serial port of the Port Hopper Lite allows it to as a Web Gateway, with the Port Hopper Lite handling the HTTP/TCP/ IP connection over the LAN. In this way, the legacy serial device can become web manageable through standard web browser software.

Peer Connection Mode

Peer Connection Mode involves using two or more Port Hopper Lite devices attached to legacy devices operating as a “tunnel” connection. The serial tunnel operates by encapsulating the legacy device's serial data payload in a TCP/IP packet, which is then transported over the LAN. The major benefit of *Peer Connection Mode* is that it can co-exist with any type of proprietary higher layer protocol such as DeviceNet. The Port Hopper Lite on the receiving end strips away the TCP/IP protocol encapsulation and then presents the original data payload to the connected serial legacy device.

Notes:

Important!

Should you change the default IP settings of the unit, please record these settings.

MAC Address: _____

IP Address: _____

Gateway: _____

Session Peer: _____