

10/24/03
JK

User's Manual

Hub444

Motion Control Network Hub



Applied Motion Products, Inc.

404 Westridge Drive Watsonville, CA 95076

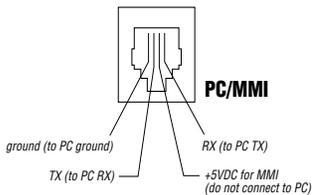
Tel (831) 761-6555 (800) 525-1609 Fax (831) 761-6544



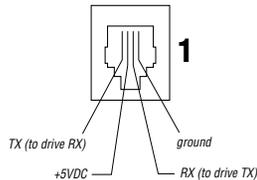
Technical Specifications

- Power** Runs on 5 VDC, 60 mA. Power is provided by Si™ indexer-drive on Port 1. Also provides up to 40 mA for MMI via PC/MMI port.
- Communication** Ports 1 - 4: RS232, 9600-19200 bps, 8 data bits, one stop bit, no parity.
MMI: same.
PC: same.
Max cable length, any port: 50 feet.
- Connectors** I/O: European style screw terminal blocks. Wire size: AWG 12 - 28.
Drives & PC/MMI: RJ11
- Physical** Printed circuit board, 4.2 x 2.85 inches (107 x 72 mm). Weighs 2.7 ounces (75 grams). Two red LEDs. Operating temperature range: 0 - 70° C. Optional DIN rail mounting kit (DMK-1).
- Inputs** Optically isolated, differential 5-24V logic. 2200 ohms internal resistance. 1.5 mA minimum “on” current.
- Outputs** Optically isolated, darlington photo transistors. 30V, 100 mA max.

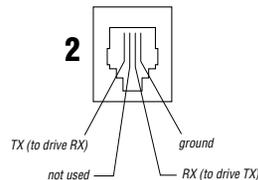
Pin Assignments



PC/MMI Port



Port 1



Ports 2 - 4

Contents

Introduction	4
Features	4
Getting Started	5
Connecting the Hub	7
Programming - Router Mode	8
Programming - Stored Program Mode	9
About the MMI	9
Cable Routing	9
Programmable Inputs	10
Schematic Diagram of Programmable Input Circuit	10
Sinking Circuits (NPN)	10
Sourcing circuits (PNP)	10
Connecting an Si™ Drive	11
Connecting an NPN Type Proximity Sensor	11
Connecting a PNP Type Proximity Sensor	11
Programmable Outputs	12
Schematic Diagram of Output Circuit	12
Sinking Output	12
Sourcing Output	12
Driving a Relay	13
Mechanical Outline	13
Technical Specifications	14
Pin Assignments	14

Introduction

Thank you for selecting an Applied Motion Products motion control device. We hope our dedication to performance, quality and economy will make your motion control project successful. If there's anything we can do to improve our products or help you use them better, please call or fax. We'd like to hear from you. Our phone number is (800) 525-1609 or you can reach us by fax at (831) 761-6544.

Features

- Can be programmed to control an entire multi-axis motion control system using *SiNet Hub Programmer™* software (included).
- Can also act as a router, allowing a host computer or PLC to control one to four drives and the on-board I/O using *Si™ Command Language (SCL)*
- Four built-in programmable inputs, optically isolated, 5-24 VDC
- Four built-in programmable outputs, optically isolated, 24V 100mA max load
- Hub programs and host computers also have access to the I/O in each drive, typically 8 inputs and 3 outputs per drive.
- Screw terminal connectors make I/O wiring easy.
- RJ11 "telephone-style" connectors for drives & PC for easy, reliable connections.
- Hub444 is powered by drive #1. No external power supply required.
- Can control and power optional MMI (operator terminal).
- Optional DIN rail mounting kit makes installation easy.

Compatible Indexers & Drives

All units have 8 programmable inputs and 3 programmable outputs or more

Si5580: runs on 120/240VAC, 80V bus, 5.5A/phase, 2000 - 50800 steps/rev

Si3540: runs on 120/240VAC, 40V bus, 3.5A/phase, 2000 - 50800 steps/rev

7080i: runs on 24 - 80 VDC, 7A/phase, 2000 - 50800 steps/rev

3540i: runs on 12 - 42 VDC, 3.5A/phase, 2000 - 50800 steps/rev

1240i: runs on 12 - 42 VDC, 1.2A/phase, 2000 - 50800 steps/rev

Si-100: indexer only, runs on 120/240VAC, provides industry standard step and direction signals to a wide range of step motor and servo motor drives

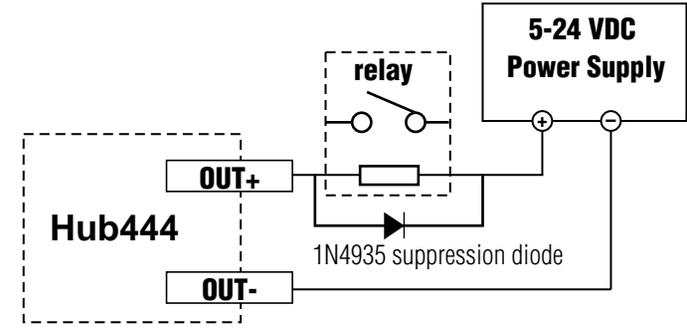
BL7080i: open frame servo drive, 24 - 80 VDC, 7 amps continuous, 14 peak

BLSi7080: 120/240 VAC servo drive, 7 amps continuous, 14 peak

BLU100-S, BLU100-Si: 24 - 48 VDC servo drives, 100 watts

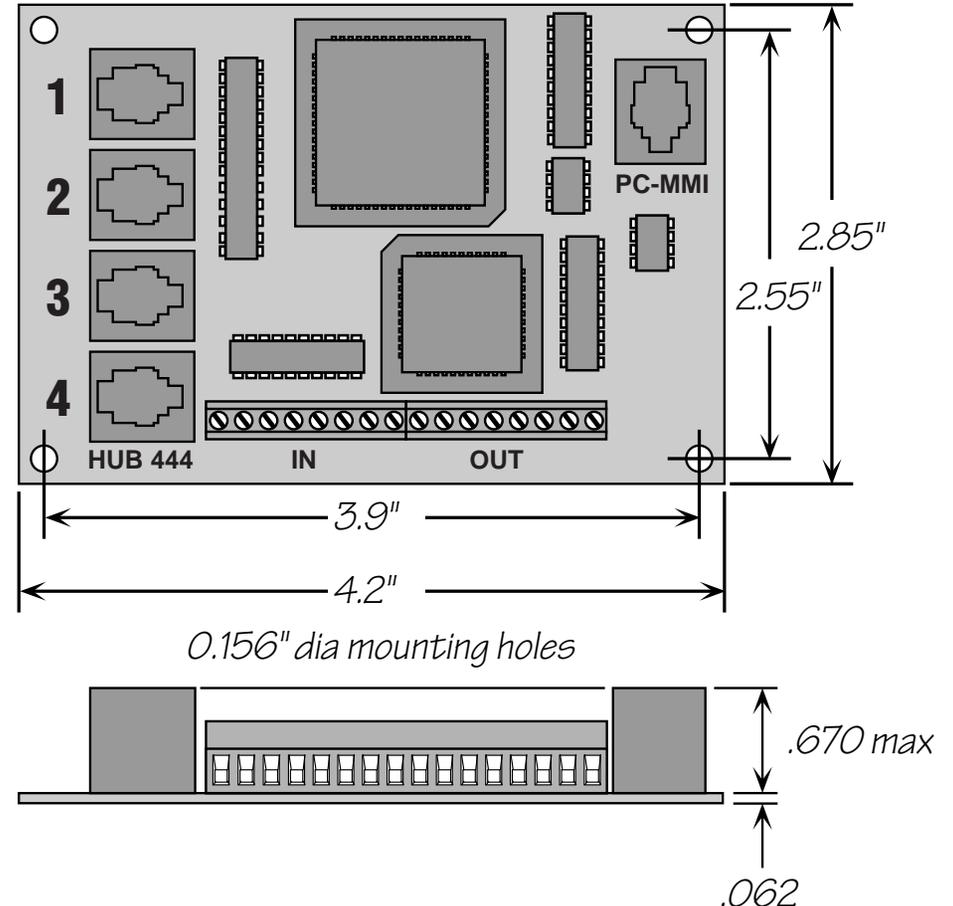
BLU200-S, BLU200-Si: 24 - 48 VDC servo drives, 200 watts

BLU1000-S, BLU1000-Si: 120/240 VAC servo drives, 1000 watts



Driving a Relay

Mechanical Outline

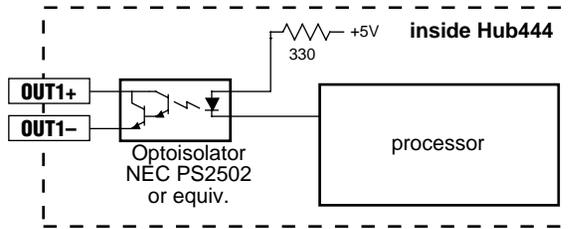


Programmable Outputs

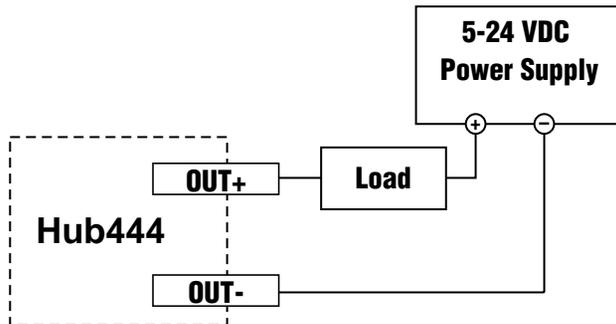
The Hub444 provides four programmable outputs that can be used to drive LEDs, relays and the inputs of other electronic devices like PLCs and counters. The “+” (collector) and “-” (emitter) terminals of each transistor are available at the connector. This allows you to configure each output for current sourcing or sinking. Diagrams of each type of connection are shown below.

Do not connect the outputs to more than 30VDC.

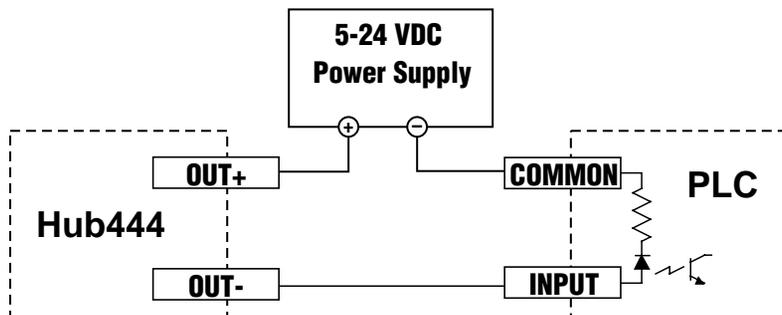
The current through each output terminal must not exceed 100 mA.



Schematic Diagram of Output Circuit



Sinking Output



Sourcing Output

Getting Started

The SiNet™ Hub444 can be used two different ways. You must choose based on your application.

Stored Program Mode is easy. Just install our *SiNet Hub Programmer™* software on your PC, and point and click your way to a completed program. Once you're done preparing and testing your program, it stays inside the hub and runs without the PC. Your program not only controls up to 4 motion control axes, it can also interact with an operator using our Man Machine Interface (MMI). The MMI lets the operator make decisions, choose operations from a menu, visually position your load, and enter part counts, move distances and speeds.

The *SiNet Hub Programmer™* software not only saves you time because it's easy to learn and easy to use, it also eliminates most of the things that can go wrong during the set up and programming of a system.

We highly recommend that you try the *SiNet Hub Programmer™* software before considering Router Mode.

To use your SiNet™ Hub in Stored Program Mode, you will need:

- ✓ at least one *Si™* step motor or servo motor drive
- ✓ a motor for each drive
- ✓ a small flat blade screwdriver for tightening the connectors - an Applied Motion Products screwdriver suitable for this purpose is included with your drive.
- ✓ a 5-24 volt DC power supply may be required to use the isolated I/O
- ✓ a Pentium or better PC running Windows 95, 98, 2000, ME, XP or NT with an unused 9 pin serial port. The *SiNet Hub Programmer™* software does not run with Windows 3.1.
- ✓ a PC serial interface cable (it comes with your *Si™* indexer/drive)
- ✓ a modular telephone line cord for each indexer/drive (the hub comes with one 7 foot cable, and each drive includes a 7 foot cord. You can get longer cords anywhere telephone cords are sold, such as your local supermarket, discount store or Radio Shack)

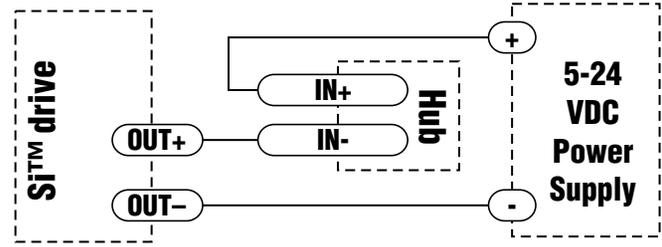
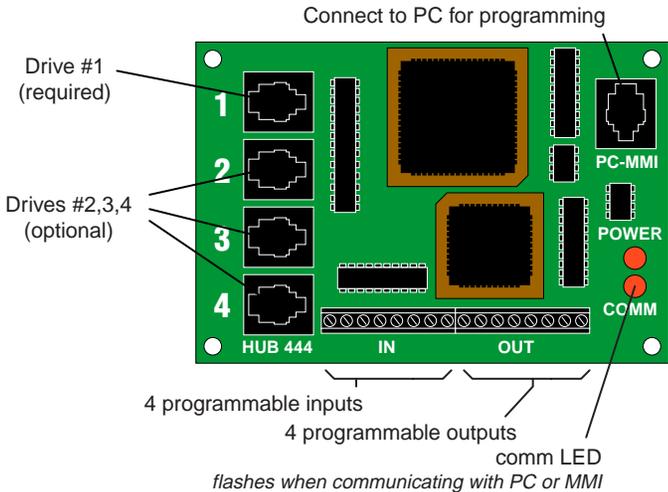
Router Mode is for systems where you will be using your own software to control multiple indexer-drives. The Hub routes commands to individual drives based on address characters that your software sends along with the commands. It also

routes messages from the drives back to the host PC or PLC. In Router Mode, the indexer-drives are commanded and queried using SiNet Command Language (SCL). *Router Mode is the most versatile way to use the hub, but also the most difficult because you'll need a highly skilled programmer to write your host software.*

To use your SiNet™ Hub in Router Mode, you will need:

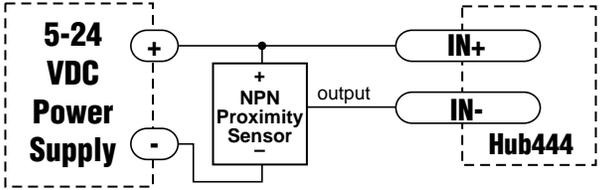
- ✓ at least one Si™ step motor or servo motor drive
- ✓ a motor for each drive
- ✓ a small flat blade screwdriver for tightening the connectors - an Applied Motion Products screwdriver suitable for this purpose is included with your drive.
- ✓ a 5-24 volt DC power supply may be required to use the isolated I/O
- ✓ a PC running Windows 95, 98, 2000, ME, NT or XP with an unused 9 pin serial port.
- ✓ a PC serial interface cable (it comes with your Si™ indexer/drive)
- ✓ a modular telephone line cord for each indexer/drive (the hub comes with one 7 foot cable, and each drive includes a 7 foot cord. You can get longer cords anywhere telephone cords are sold, such as your local supermarket, discount store or Radio Shack)
- ✓ your own custom software to command and query the indexer/drives using Si™ Command Language (SCL). This means you need a highly skilled computer programmer working with a language system like C, Visual Basic or Labview.

The sketch below identifies some of the features of the SiNet™ Hub. Please examine it now.



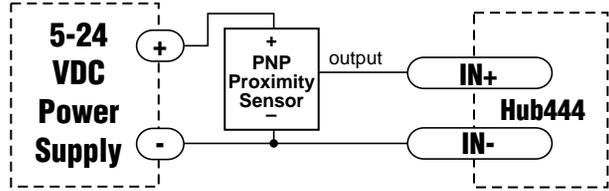
Connecting an Si™ Drive

When drive output closes, Hub input goes low (closed).



Connecting an NPN Type Proximity Sensor

When prox sensor activates, input goes low (closed).



Connecting a PNP Type Proximity Sensor

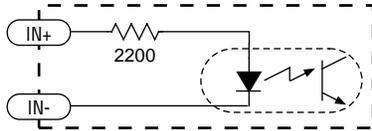
When prox sensor activates, input goes low (closed).

Programmable Inputs

The Hub444 provides four digital inputs for external equipment such as sensors, switches and other electronics. These inputs are optically isolated, and allow a wide range of input voltages to be used. Each input gives you the option of using sinking or sourcing signals.

A schematic diagram of the input circuit is shown below.

You must supply 5-24 volts DC to supply current to the LEDs on the input side of the optoisolators. Most CMOS and open collector TTL devices are directly compatible with this drive, as are typical PLC and proximity sensor outputs.



Schematic Diagram of Programmable Input Circuit

Sinking Circuits (NPN)

If your output devices prefer to sink current, then connect the “+” terminals to your positive power supply, and the “-” terminals to your signals. If you are using a TTL circuit to drive the hub inputs, connect the “+” terminals to your 5 volt bus. No ground connection is needed. If you are using a PLC or proximity sensor, you’ll need a power supply.

Sourcing circuits (PNP)

If your output devices can only source current (some PLC outputs are this way), connect the “-” terminals to the ground of the DC power supply that powers your output circuits. Then connect your signals to the “+” terminals.

Note: We refer to an input as being ON or CLOSED when current is flowing through the input. A signal is OFF or OPEN when no current is flowing. An input is OPEN when the “+” and “-” input terminals are at the same voltage, or when the input is left unconnected.

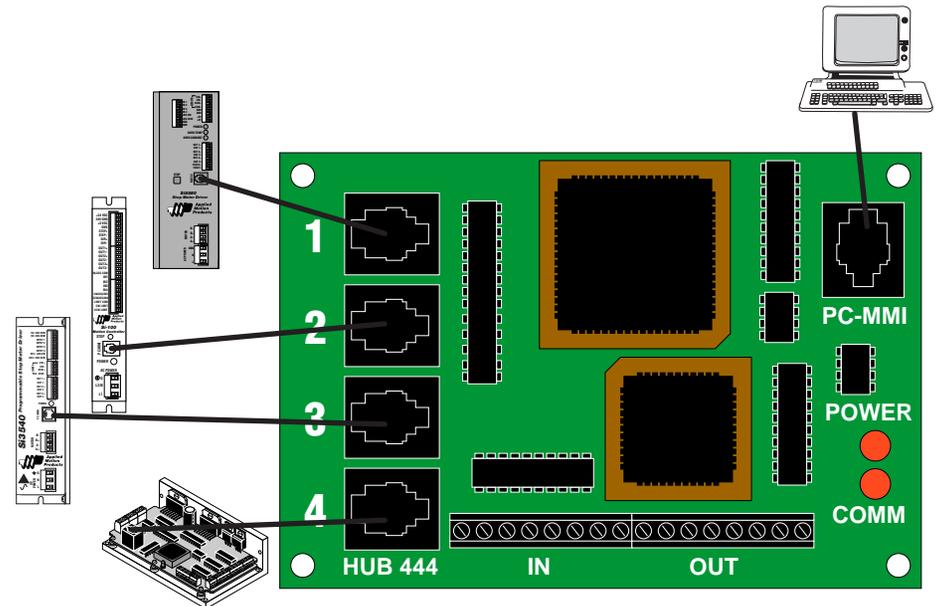
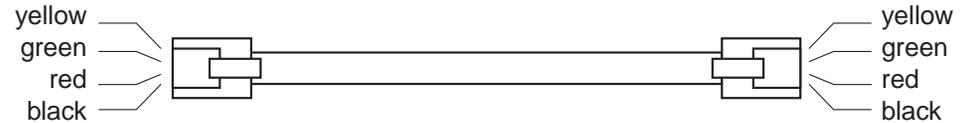
Connecting the Hub

All connections between the PC, the hub and the Si™ drives are made using four wire cables with RJ11 connectors. These are the same cords used to connect a telephone or modem to the wall jack. You’ll also need a small black “modular adaptor” that allows the RJ11 cable to connect to the serial port on your PC. A modular adaptor is included with each Si™ drive.

You can use longer cables, up to 50 feet. Telephone line cords are easily available at your local supermarket, discount or electronics store.

Note: never connect the SiNet hub to a telephone outlet or to the modem port of your PC.

Note: if you decide to make your own cables, make sure that the ends are terminated just like a telephone cord, as shown below. If you mess this up, you could seriously damage the hub, your drives or your PC. If in doubt, don’t make your own cables.



Programming - Router Mode

When operated in router mode, the Hub444 is a motion control network router. It transfers commands from your PC's serial port to individual Si™ drives (up to 4) , and processes responses from the drives.

In router mode, the drives and hub are commanded using Si Command Language (SCL). The *Si Command Language* is explained in the latest copy of the *SCL Manual*, which is included on the CD that ships with the hub. You can also get it from our web site at www.applied-motion.com.

You can use one of the cables that comes with the drives to connect the Hub to your PC. Ordinary telephone cables are used to connect the hub to the drives. The hub operates at 9600 baud, 8 data bits, one stop bit, no parity. There is no hardware handshaking. The BR (bit rate) command can be used to increase the communication speed.

The Hub444 requires no power supply. It gets the power it needs from drive #1, so **make sure you have a drive connected to port #1**. You can apply power to all the drives at the same time. However, you may want to power up the drives "sequentially" to balance the load on your power circuit. **If you do not power up all the drives together, make sure you apply power to drive #1 first. The remaining drives must receive power within 1/2 second.**

The Hub has two status LEDs marked COMM and POWER. If you have a drive connected to port #1 and that drive has power, then the POWER LED on the Hub should light up.

The COMM LED will flash each time a command is sent from the PC to the Hub. You can use our *SCL Setup Utility* to test the Hub, and to get familiar with SCL commands. The *SCL Setup Utility* is shipped with the hub. **To use the hub in router mode, you'll need to set the "power up mode" to "router only."** The *SCL Setup Utility* allows you to control the power up mode. Simply connect the hub to your PC, open the *SCL Setup Utility*, then apply power to the hub. A "Hub Power Up Mode..." button will appear. Click on it.

The addressing scheme is simple. If you want to send a Feed to Length command to the drive connected to port #1, send the hub the ascii string "1FL" followed by a carriage return (ascii 13). If you omit the address character, the command is "global" and will be sent to all drives. That is useful if you want to send the same parameter (accel rate, for example) to all the drives.

If you ask a drive for status information, the hub will append an address character to the drive's response. For example, sending "4RS" to the hub will result in the hub sending the host "4R" (assuming the drive is "ready." If it's moving, you'll see the response "4M".) This is helpful if you send a global status request, since all drives will respond at the same time.

Programming - Stored Program Mode

In this mode, a multi-axis motion control program is stored inside the hub, and the hub then operates without the PC. The PC is used to develop and test your program with the aid of our *SiNet Hub Programmer™* software.

Please refer to the *SiNet Hub Programmer™ Software Manual* when installing the software and developing programs.

About the MMI

In the event that you want to create a system where a machine operator can interact with a display and keypad you may be interested in one of our "Man Machine Interfaces" (MMI). The *Hub Programmer* software supports the MMI-01 and the new, backlit MMI-02.

The MMI connects to the same port as the PC that you use to develop and test your program. At this point you may be thinking "Does that mean I have to swap cables between the PC and MMI while I'm testing my program?" Fear not, we have included an "MMI Emulator" in the *Hub Programmer* software. Anytime you are in running your program from the PC and an MMI related instruction executes, a "virtual MMI" will appear on your computer screen. This not only relieves you of having to swap cables, it also allows you to try out the MMI features before you actually purchase one.

Cable Routing

The Hub444 makes it easy to create multi-axis distributed systems which require both sensitive network communication cables and high power cables for each remote axis. These two classes of cables should not be run together in a common conduit or raceway.