STP-10 Hardware Manual

STP-10-E
STP-10-EIP
STP-10-2
STP-10-5
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Introduction

Thank you for selecting a Bimba DC stepper motor control. 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) 44-BIMBA, or you can reach us by fax at (708) 235-2014. You can also email support@bimba.com.

Features

• Programmable, microstepping digital step motor driver in compact package
• STP-10 operates from a 24 to 80 volt DC power supply
• Operates in velocity or position mode
• Accepts analog signals, digital signals and RS-232 serial commands
• Optional RS-422/485 communication
• Optional encoder feedback
• Optional 100 Mbit Ethernet communication using SCL and IQ Programming
• Optional Ethernet/IP protocol communication
• STP-10 provides motor current up to 10 amps/phase (peak of sine)
• Eight optically isolated digital inputs
• Four optically isolated digital outputs
• Two ±10 volt analog inputs for speed and position control. Can also be configured for 0 to 10V, ±5V or 0 to 5V signal ranges.
Getting Started

This manual describes the use of six different drive models. What you need to know and what you must have depends on the drive model. For all models, you’ll need the following:

- A 24-48 volt DC power supply. Please read the section entitled Choosing a Power Supply for help in choosing the right power supply.
- A compatible Bimba stepper motor. See section on Recommended Motors.
- A small flat blade screwdriver for tightening the connectors (included).
- A personal computer running Microsoft Windows 98, 2000, NT, Me, XP, Vista or 7.
- A Bimba programming cable (included with non-Ethernet drives).
- For Ethernet drives, you will need a CAT5 cable (not included).
- Relevant software applications, as outlined below. All software is available as a free download from www.bimba.com.

If you’ve never used a STP drive before, you’ll need to get familiar with the drive and the set up software before you try to deploy the system in your application. We strongly recommend the following:

1. For -S drives, -Q drives, and -EIP drives, install the IQ® Stepper software application. Bimba IQ® stepper contains a link to the IQ® Programmer software applications.
2. Launch the software by clicking Start...Programs...Bimba...
3. Connect the drive to your PC using the programming cable. For RS-232 drives, select the correct COM port. For Ethernet drives, ensure that the IP address is correct. See page 7 of this manual for more information on “Connecting the Drive to Your PC using Ethernet.”
4. Connect the drive to the power supply.
5. Connect the drive to the motor.
6. Apply power to the drive.
7. The software will recognize your drive, display the model and firmware version and be ready for action.

The connectors and other points of interest are illustrated below. Depending on your drive model and application, you’ll need to make connections to various parts of the drive. These are detailed later in the manual.
Connecting to the PC using RS-232

- Locate your computer within 8 feet of the drive.
- If you have an Ethernet drive, this port is not used. All communication uses the RJ45 Ethernet connector.
- RS-232 drives are shipped with a communication cable. Plug the large end into the serial port of your PC and the small end into the PC/MMI jack on your drive. Secure the cable to the PC with the screws on the sides.

Never connect a drive to a telephone circuit. It uses the same connectors and cords as telephones and modems, but the voltages are not compatible.

If your PC does not have a serial port, you should purchase a “USB Serial Converter”. We have had good results with the USB-COM-CBL from byterunner.com. If you wish to use a different converter, it is recommended to use one that makes use of the FTDI chipset to perform the actual conversion.
Connecting the Drive to Your PC using Ethernet

This process requires three steps

- Physically connect the drive to your network (or directly to the PC)
- Set the drive’s IP address
- Set the appropriate networking properties on your PC.

Addresses, Subnets, and Ports

Every device on an Ethernet network must have a unique IP address. In order for two devices to communicate with each other, they must both be connected to the network and they must have IP addresses that are on the same subnet. A subnet is a logical division of a larger network. Members of one subnet are generally not able to communicate with members of another unless they are connected through special network equipment (e.g. router). Subnets are defined by the choices of IP addresses and subnet masks.

If you want to know the IP address and subnet mask of your PC, select Start…All Programs…Accessories…Command Prompt. Then type “ipconfig” and press Enter. You should see something like this:

If your PC’s subnet mask is set to 255.255.255.0, a common setting known as a Class C subnet mask, then your machine can only talk to another network device whose IP address matches yours in the first three octets. (The numbers between the dots in an IP address are called octets.) For example, if your PC is on a Class C subnet and has an IP address of 192.168.0.20, it can talk to a device at 192.168.0.40, but not one at 192.168.1.40. If you change your subnet mask to 255.255.0.0 (Class B) you can talk to any device whose first two octets match yours. Be sure to ask your system administrator before doing this. You network may be segmented for a reason.

Your drive includes a 16 position rotary switch for setting its IP address. The factory default address for each switch setting is shown in the table on the next page.
Settings 1 through E can be changed using the Bimba IQ® Stepper software (use Bimba IQ® Servo for servo drives). Setting 0 is always “10.10.10.10”, the universal recovery address. If someone were to change the other settings and not write it down or tell anyone, then you will not be able to communicate with your drive. The only way to “recover” it is to use the universal recovery address.

Setting F is “DHCP”, which commands the drive to get an IP address from a DHCP server on the network. The IP address automatically assigned by the DHCP server may be “dynamic” or “static” depending on how the administrator has configured DHCP. The DHCP setting is reserved for advanced users.

Your PC, or any other device that you use to communicate with the drive, will also have a unique address.

On the drive, switch settings 1 through E use the standard class B subnet mask (i.e. “255.255.0.0”). The mask for the universal recovery address is the standard class A (i.e. “255.0.0.0”).

One of the great features of Ethernet is the ability for many applications to share the network at the same time. Ports are used to direct traffic to the right application once it gets to the right IP address. The UDP eSCL port in our drives is 7775. To send and receive commands using TCP, use port number 7776. You’ll need to know this when you begin to write your own application.

You will also need to choose an open (unused) port number for your application. Our drive doesn’t care what that is; when the first command is sent to the drive, the drive will make note of the IP address and port number from which it originated and direct any responses there. The drive will also refuse any traffic from other IP addresses that is headed for the eSCL port. The first application to talk to a drive “owns” the drive. This lock is only reset when the drive powers down.

If you need help choosing a port number for your application, you can find a list of commonly used port numbers at www.iana.org/assignments/port-numbers.

One final note: Ethernet communication can use one or both of two “transport protocols”: UDP and TCP. eSCL commands can be sent and received using either protocol. UDP is simpler and more efficient than TCP, but TCP is more reliable on large or very busy networks where UDP packets might occasionally be dropped.
Option 1: Connect a Drive to Your Local Area Network

If you have a spare port on a switch or router and if you are able to set your drive to an IP address that is compatible with your network, and not used by anything else, this is a simple way to get connected. This technique also allows you to connect multiple drives to your PC. If you are on a corporate network, please check with your system administrator before connecting anything new to the network. He or she should be able assign you a suitable address and help you get going.

If you are not sure which addresses are already used on your network, you can find out using “Angry IP scanner”, which can be downloaded free from www.angryip/w/Download. But be careful: an address might appear to be unused because a computer or other device is currently turned off. And many networks use dynamic addressing where a DHCP server assigns addresses “on demand”. The address you choose for your drive might get assigned to something else by the DHCP server at another time.

Once you’ve chosen an appropriate IP address for your drive, set the rotary switch according the address table above. If none of the default addresses are acceptable for your network, you can enter a new table of IP addresses using Configurator. If your network uses addresses starting with 192.168.0, the most common subnet, you will want to choose an address from switch settings 4 through E. Another common subnet is 192.168.1. If your network uses addresses in this range, the compatible default selections are 1, 2 and 3.

If your PC address is not in one of the above private subnets, you will have to change your subnet mask to 255.255.0.0 in order to talk to your drive. To change your subnet mask:

1. On Windows XP, right click on “My Network Places” and select properties. On Windows 7, click Computer. Scroll down the left pane until you see “Network”. Right click and select properties. Select “Change adapter settings”
2. You should see an icon for your network interface card (NIC). Right click and select properties.
3. Scroll down until you see “Internet Properties (TCP/IP)”. Select this item and click the Properties button. On Windows 7 and Vista, look for “(TCP/IPv4)”.

4. If the option “Obtain an IP address automatically” is selected, your PC is getting an IP address and a subnet mask from the DHCP server. Please cancel this dialog and proceed to the next section of this manual: “Using DHCP”.

5. If the option “Use the following IP address” is selected, life is good. Change the subnet mask to “255.255.0.0” and click OK.

Using DHCP

If you want to use your drive on a network that where all or most of the devices use dynamic IP addresses supplied by a DHCP server, set the rotary switch to “F”. When the drive is connected to the network and powered on, it will obtain an IP address and a subnet mask from the server that is compatible with your PC. The only catch is that you won’t know what address the server assigns to your drive. Bimba IQ® Stepper can find your drive using the Drive Discovery feature, as long as your network isn’t too large. With the drive connected to the network and powered on, select Drive Discovery from the Drive menu.

You will see a dialog such as this:

Normally, Drive Discovery will only detect one network interface card (NIC), and will select it automatically. If you are using a laptop and have both wireless and wired network connections, a second NIC may appear. Please select the NIC that you use to connect to the network to which you’ve connected your drive. Then click OK. Drive Discovery will notify you as soon as it has detected a drive.

If you think this is the correct drive, click Yes. If you’re not sure, click Not Sure and Drive Discovery will look for additional drives on your network. Once you’ve told Drive Discovery which drive is yours, it will automatically enter that drive’s IP address in the IP address text box so that you are ready to communicate.
Option 2: Connect a Drive Directly to Your PC

This is the simplest option:

1. Connect one end of a CAT5 Ethernet cable into the LAN card (NIC) on your PC and the other into the drive. You don’t need a special “crossover cable”; the drive will automatically detect the direct connection and make the necessary physical layer changes.

2. Set the IP address on the drive to “10.10.10.10” by setting the rotary switch at “0”.

3. To set the IP address of your PC:
   a. On Windows XP, right click on “My Network Places” and select properties.
   b. On Windows 7, click Computer. Scroll down the left pane until you see “Network”. Right click and select properties. Select “Change adapter settings”

4. You should see an icon for your network interface card (NIC). Right click and select properties.
   a. Scroll down until you see “Internet Properties (TCP/IP)”. Select this item and click the Properties button.
   b. On Windows 7 and Vista, look for “(TCP/IPv4)”
5. Select the option “Use the following IP address”. Then enter the address “10.10.10.11”. This will give your PC an IP address that is on the same subnet as the drive. Windows will know to direct any traffic intended for the drive’s IP address to this interface card.

6. Next, enter the subnet mask as “255.255.255.0”.

7. Be sure to leave “Default gateway” blank. This will prevent your PC from looking for a router on this subnet.

8. Because you are connected directly to the drive, anytime the drive is not powered on your PC will annoy you with a small message bubble in the corner of your screen saying “The network cable is unplugged.”

**Option 3: Use Two Network Interface Cards (NICs)**

This technique allows you to keep your PC connected to your LAN, but keeps the drive off the LAN, preventing possible IP conflicts or excessive traffic.

1. If you use a desktop PC and have a spare card slot, install a second NIC and connect it directly to the drive using a CAT5 cable. You don’t need a special “crossover cable”; the drive will automatically detect the direct connection and make the necessary physical layer changes.

2. If you use a laptop and only connect to your LAN using wireless networking, you can use the built-in RJ45 Ethernet connection as your second NIC.

3. Set the IP address on the drive to “10.10.10.10” by setting the rotary switch at “0”.
4. To set the IP address of the second NIC:
   a. On Windows XP, right click on “My Network Places” and select properties.
   b. On Windows 7, click Computer. Scroll down the left pane until you see “Network”. Right click and select properties. Select “Change adapter settings”

5. You should see an icon for your newly instated NIC. Right click again and select properties.
   a. Scroll down until you see “Internet Properties (TCP/IP)”. Select this item and click the Properties button.
   b. On Windows 7 and Vista, look for “TCP/IPv4”

6. Select the option “Use the following IP address”. Then enter the address “10.10.10.11”. This will give your PC an IP address that is on the same subnet as the drive. Windows will know to direct any traffic intended for the drive’s IP address to this interface card.

7. Next, enter the subnet mask as “255.255.255.0”. Be sure to leave “Default gateway” blank. This will prevent your PC from looking for a router on this subnet.

8. Because you are connected directly to the drive, anytime the drive is not powered on your PC will annoy you with a small message bubble in the corner of your screen saying “The network cable is unplugged.”

**Connecting to a Host using RS-485 Option Card**

RS-485 allows you to connect more than one drive to a single host PC, PLC, HMI or other computer. It also allows the communication cable to be long (more than 1000 feet). But the device to which you connect must have an RS-485 port.

Pin diagram is shown to the right. Wiring diagrams can be found on the next page. We recommend the use of Category 5 cable. It is widely used for computer networks, it is inexpensive, easy to get and certified for quality and data integrity.

The STP-10 drives can be used with either two wire or four wire RS-485 implementations. The connection can be point to point (i.e. one drive and one host) or a multi-drop network (one host and up to 32 drives).

Four Wire Systems utilize separate transmit and receive wires. One pair of wires must connect the host computer’s transmit signals to each drive’s RX+ and RX- terminals. Another pair connects the TX+ and TX- drive terminals to the host computer’s receive signals. A logic ground terminal is provided on each drive and can be used to keep all drives at the same ground potential. This terminal connects internally to the DC power supply return (V-), so if all the drives on the RS-485 network are powered from the same supply it is not necessary to connect the logic grounds. **You should still connect one drive’s GND terminal to the host computer ground.**

Four wire systems are better than two wire types because the host can send and receive data at the same time, increasing system throughput. Furthermore, the host never needs to disable its transmitter, which simplifies your software.
Two Wire Systems transmit and receive on the same pair of wires, which can lead to trouble. The host must not only disable its transmitter before it can receive data, it must do so quickly, before a drive begins to answer a query. The STP-10 drives include a “transmit delay” parameter that can be adjusted to compensate for a host that is slow to disable its transmitter. This adjustment can be made over the network using the TD command, or it can be set using the IQ® Stepper software. It is not necessary to set the transmit delay in a four wire system.

**RS-232 to RS-485 2-wire Converter**

Model 485-25E from Integrity Instruments (800-450-2001) works well for converting your PC’s RS-232 port to RS-485. It comes with everything you need. Connect the adaptor’s “B” pin to the STP-10 drive’s TX+ and RX+ terminals. Connect “A” to the drive’s TX- and RX- terminals.

### RS-485 Two Wire System

**Converting USB to RS-485**

The USB-COMi-M from www.byterunner.com is an excellent choice for USB to RS-485 conversion. Set SW1 to ON and SW2-4 to OFF. On the USB-COMi-M screw terminal connector: pin 1 goes to RX- and TX-. Connect pin 2 to RX+ and TX+. Pin 6 is ground. The DB-9 is not used.

### Assigning Multi-Drop Addresses

Before wiring all of the drives in a multi-drop network, you’ll need to connect each drive individually to the host computer so that a unique address can be assigned to each drive. Use the programming cable and the IQ® Stepper software that came with your drive for this purpose.

Connect the drive to your PC, then launch the IQ® Stepper software. Finally, apply power to your drive. If you have already configured your drive, then you should click the Upload button so that the IQ® Stepper settings match those of your drive. Click on the Motion button, then select the “SCL” operating mode. If you have an IQ® drive, you may want to select “IQ® Programmer”. Either way, you’ll see the RS-485 Address panel appear. Just click on the address character of your choice. You can use the numerals 0..9 or the special characters ! # $ % & ’ ( ) * + , - . / : ; < = > ? @. Just make sure that each drive on your network has a unique address. If you are using a 2 wire network, you may need to set the Transmit Delay, too. 10 milliseconds works on the adapters we’ve tried. Once you’ve made your choices, click Download to save the settings to your drive.
Connecting the Power Supply

If you need information about choosing a power supply, please read *Choosing a Power Supply* located on page 27 in this manual.

Connect the motor power supply “+” terminal to the drive terminal labeled “V+”. Connect power supply “-” to the drive terminal labeled “V-”. Use 18 or 20 gauge wire. The STP drives contain an internal fuse that connects to the power supply + terminal. This fuse is not user replaceable. If you want to install a user servicable fuse in your system install a fast acting fuse in line with the + power supply lead. Use 7 amps for the STP-10.

The green ground screw on the corner of the chassis should be connected to earth ground.

*Be careful not to reverse the wires. Reverse connection will destroy your driver and void your warranty.*

If you plan to use a regulated power supply, you may encounter a problem with regeneration. If you rapidly decelerate a load from a high speed, much of the kinetic energy of that load is transferred back to the power supply. This can trip the overvoltage protection of a switching power supply, causing it to shut down. We offer the RGC-050 “regeneration clamp” to solve this problem. If in doubt, buy an RGC-050 for your first installation. If the “regen” LED on the RGC-050 never flashes, you don’t need the clamp.

RGC-050 Regen Clamp
Connecting the Motor

*Never connect or disconnect the motor while the power is on.*

Four lead motors can only be connected one way. Please follow the sketch at the right.

Six lead motors can be connected in series or center tap. In series mode, motors produce more torque at low speeds, but cannot run as fast as in the center tap configuration. In series operation, the motor should be operated at 30% less than the rated current to prevent overheating. Winding diagrams for both connection methods are shown below. NC means not connected.

Eight lead motors can also be connected in two ways: series and parallel. As with six lead motors, series operation gives you less torque at high speeds, but may result in lower motor losses and less heating. In series operation, the motor should be operated at 30% less than the unipolar rated current. The motors recommended in this manual should be connected in parallel. The wiring diagrams for eight lead motors are shown below.
Connecting an Encoder (Requires the Optional Encoder Feedback Card)

The encoder connections use a HD-15 connector, which you must connect to your encoder as shown below. See back page for mating connector information.

If your encoder is single ended, connect the encoder outputs to the A+, B+ and Z+ inputs. Leave A-, B- and Z- unconnected. (Z is the encoder index signal and is optional.)
Connecting Input Signals

The STP drives have three types of inputs:

- High speed digital inputs for step & direction commands or encoder following, 5 volt logic
- Digital inputs for other signals, 12 - 24 volt logic
- Analog inputs for analog speed and positioning modes

All drives include eight digital inputs and two analog inputs.

- CW & CCW Limit: can be used to inhibit motion in a given direction, forcing the motor and load to travel within mechanical limits. Can be configured for active closed, active open or not used.
- IN1/STEP & IN2/DIR: digital signals for commanding position. Quadrature signals from encoders can also be used. These inputs can also be connected to sensors, switches and other devices for use with Q commands such as Wait Input, Seek Home, Feed to Sensor, If Input and others.
- IN3,4,5,6: software programmable inputs can be used for motor enable, alarm reset or jogging. These inputs can also be connected to sensors, switches and other devices for use with Q Wait Input, Seek Home, Feed to Sensor, If Input and other commands.
- Analog In: analog velocity or position command signal. Can be configured for 0-10V, 0-5V, ±10V or ±5V, with or without offset.

Connector Pin Diagram

High Speed Digital Inputs

The STP Series drives include two high speed inputs called STEP and DIR. They accept 5 volt single-ended or differential signals, up to 2 MHz. Normally these inputs connect to an external controller that provides step & direction command signals. You can also connect a master encoder to the high speed inputs for following applications. Or you can use these inputs with Wait Input, If Input, Feed to Sensor, Seek Home and other such commands.
Connecting to indexer with Sourcing Outputs

Connecting to Indexer with Sinking Outputs

Connecting to Indexer with Differential Outputs

(Many High Speed Indexers have Differential Outputs)

Wiring for Encoder Following

Connection diagrams follow.
Using High Speed Inputs with 12-24 Volt Signals

Most PLCs don’t use 5 volt logic. You can connect signal levels as high as 24 volts to the STEP and DIR inputs if you add external dropping resistors, as shown below.

- For 12 volt logic, add 820 ohm, 1/4 watt resistors
- For 24 volt logic, use 2200 ohm, 1/4 watt resistors

The maximum voltage that can be applied to an input terminal is 24 volts DC. Never apply AC voltage to an input terminal.

Connecting to PLC with Sourcing (PNP) Outputs

(Most PLC’s use 24 volt logic)

Connecting to PLC with Sinking (NPN) Outputs

(Most PLC’s use 24 volt logic)

Using Mechanical Switches at 24 Volts
Other Digital Inputs

As we mentioned in the previous section, the high speed STEP and DIR inputs are configured for five volt logic. All other digital inputs are designed for operation between 12 and 24 volts DC.

Single Ended Inputs

The STP drives include four single ended, optically isolated input circuits that can be used with sourcing or sinking signals, 12 to 24 volts. This allows connection to PLCs, sensors, relays and mechanical switches. Because the input circuits are isolated, they require a source of power. If you are connecting to a PLC, you should be able to get power from the PLC power supply. If you are using relays or mechanical switches, you will need a 12-24 V power supply.

What is COM?

“Common” is an electronics term for an electrical connection to a common voltage. Sometimes “common” means the same thing as “ground”, but not always. In the case of the STP drives, if you are using sourcing (PNP) input signals, then you will want to connect COM to ground (power supply -). If you are using sinking (NPN) signals, then COM must connect to power supply +.

Note: If current is flowing into or out of an input, the logic state of that input is low or closed. If no current is flowing, or the input is not connected, the logic state is high or open.

The diagrams below and on the following page show how to connect the inputs to various commonly used devices.
Connecting an NPN Type Proximity Sensor to an input
(When prox sensor activates, input goes low).

Connecting a PNP Type Proximity Sensor to an input
(When prox sensor activates, input goes low).
Connecting Limit Switches

The CWLIMIT and CCWLIMIT inputs are used for connecting end of travel sensors. These inputs are differential, which allows you to use signals that are sinking (NPN), sourcing (PNP) or differential (line driver). By connecting switches or sensors that are triggered by the motion of the motor or load, you can force the motor to operate within certain limits. This is useful if a program or operator error could cause damage to your system by traveling too far.

The limit inputs are optically isolated. This allows you to choose a voltage for your limit circuits of 12 to 24 volts DC. This also allows you to have long wires on limit sensors that may be far from the drive with less risk of introducing noise to the drive electronics. The schematic diagram of the limit switch input circuit is shown below.

Wiring a Mechanical Limit Switch

You can use normally open or normally closed limit switches. Either way, wire them as shown here. Be sure to set the polarity using the IQ® Stepper software for the STP-10-Q.

Wiring a Limit Sensor

Some systems use active limit sensors that produce a voltage output rather than a switch or relay closure. These devices must be wired differently than switches.

If your sensor has an open collector output or a sinking output, wire it like this:
If the sensor output goes low at the limit, select the option "closed" (in the software). If the output is open, or high voltage, choose "open".

Other sensors have sourcing outputs. That means that current can flow out of the sensor output, but not into it. In that case, wire the sensor this way:

**Analog Inputs**

The STP drives feature two analog inputs. Each input can accept a signal range of 0 to 5 VDC, ±5 VDC, 0 to 10 VDC or ±10 VDC. The drive can be configured to operate at a speed or position that is proportional to the analog signal.

*A shielded cable is recommended for electrically noisy environments.*

Use the IQ® Stepper software to set the signal range, offset, deadband and filter frequency.

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**Connecting a Potentiometer to Analog Input 1**
Programmable Outputs

The STP drives feature four digital outputs. These outputs can be set to automatically control a motor brake, to signal a fault condition, to indicate when the motor is moving or to provide an output frequency proportional to motor speed (tach signal). Or the outputs can be turned on and off by program instructions like Set Output.

The outputs can be used to drive LEDs, relays and the inputs of other electronic devices like PLCs and counters. For Y4, the “+” (collector) and “-” (emitter) terminals of each transistor are available at the connector. This allows you to configure this output for current sourcing or sinking. The Y1-3 outputs can only sink current. The Y COM terminal must be tied to power supply (-).

Diagrams of each type of connection follow.

Do not connect the outputs to more than 30VDC. The current through each output terminal must not exceed 100 mA.
Driving a Relay
Using Y1, Y2, Y3

Driving a Relay
Using Y4
Choosing a Power Supply

When choosing a power supply, there are many things to consider. If you are manufacturing equipment that will be sold to others, you probably want a supply with all the safety agency approvals. If size and weight are an issue use a switching supply.

You must also decide what size of power supply (in terms of voltage and current) is needed for your application.

Voltage

PWM drives work by switching the voltage to the motor terminals on and off while monitoring current to achieve a precise level of phase current. To do this efficiently and silently, you’ll want to have a power supply with a voltage rating at least five times that of the motor. Depending on how fast you want to run the motor, you may need even more voltage than that.

If you choose an unregulated power supply, make sure the no load voltage of the supply does not exceed the drive’s maximum input voltage specification.

Current

The maximum supply current you could ever need is the sum of the two phase currents. However, you will generally need a lot less than that, depending on the motor type, voltage, speed and load conditions. That’s because the STP drives use switching amplifiers, converting a high voltage and low current into lower voltage and higher current. The more the power supply voltage exceeds the motor voltage, the less current you’ll need from the power supply. A motor running from a 48 volt supply can be expected to draw only half the supply current that it would with a 24 volt supply.

We recommend the following selection procedure:

1. If you plan to use only a few drives, get a power supply with at least twice the rated phase current of the motor.

2. If you are designing for mass production and must minimize cost, get one power supply with more than twice the rated current of the motor. Install the motor in the application and monitor the current coming out of the power supply and into the drive at various motor loads. This will tell you how much current you really need so you can design in a lower cost power supply.
## Recommended Motors

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Holding Torque</th>
<th>Drive Current Setting</th>
<th>Resistance</th>
<th>Inductance</th>
<th>Rotor Inertia</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTR-DC17T-275-F</td>
<td>62.8 oz-in</td>
<td>4.52 kg-cm</td>
<td>2.0 amps</td>
<td>1.7 ohms</td>
<td>3.0 mH</td>
</tr>
<tr>
<td>MTR-DC23T-598-F</td>
<td>177 oz-in</td>
<td>12.7 kg-cm</td>
<td>5.0 amps</td>
<td>0.4 ohms</td>
<td>1.2 mH</td>
</tr>
<tr>
<td>MTR-DC23T-598D-F</td>
<td>177 oz-in</td>
<td>12.7 kg-cm</td>
<td>5.0 amps</td>
<td>0.4 ohms</td>
<td>1.2 mH</td>
</tr>
<tr>
<td>MTR-DC23T-598-S</td>
<td>177 oz-in</td>
<td>12.7 kg-cm</td>
<td>5.0 amps</td>
<td>0.4 ohms</td>
<td>1.2 mH</td>
</tr>
<tr>
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<td>1.2 mH</td>
</tr>
<tr>
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<td>177 oz-in</td>
<td>12.7 kg-cm</td>
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<td>0.4 ohms</td>
<td>1.2 mH</td>
</tr>
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<td>MTR-DC23W-598D-S</td>
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</tr>
<tr>
<td>MTR-DC23T-601-F</td>
<td>264 oz-in</td>
<td>19.0 kg-cm</td>
<td>5.0 amps</td>
<td>0.5 ohms</td>
<td>1.6 mH</td>
</tr>
<tr>
<td>MTR-DC23T-601D-F</td>
<td>264 oz-in</td>
<td>19.0 kg-cm</td>
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</tr>
<tr>
<td>MTR-DC34T-506-F</td>
<td>1260 oz-in</td>
<td>90.7 kg-cm</td>
<td>5.6 amps</td>
<td>0.48 ohms</td>
<td>5.4 mH</td>
</tr>
<tr>
<td>MTR-DC34T-506D-F</td>
<td>1260 oz-in</td>
<td>90.7 kg-cm</td>
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</tbody>
</table>

*Note: The “Drive Current Setting” shown here differs from the rated current of each motor because the rated current is RMS and the drive current setting is peak sine. If you are using a motor not listed here, for best results set the drive current at the motor’s rated current x 1.2.*
Specifications and Sizing

Speed/Thrust Performance, Vertical Orientation, Pounds and Inches/Second Maximum Continuous

![Graph of OLE-75 with MTR-DC17-275 at 48VDC](image)

![Graph of OLE-75 with MTR-DC23-601 at 48 VDC](image)
OLE-075 with MTR-DC23-598 at 24 VDC

Speed (in/s) vs. Thrust (Lbs)

- 0.125
- 0.500
- 0.750

OLE-075 with MTR-DC23-598 at 48 VDC

Speed (in/s) vs. Thrust (Lbs)

- 0.125
- 0.500
- 0.750
Motor Heating

Step motors convert electrical power from the driver into mechanical power to move a load. Because step motors are not perfectly efficient, some of the electrical power turns into heat on its way through the motor. This heating is not so much dependent on the load being driven but rather the motor speed and power supply voltage. There are certain combinations of speed and voltage at which a motor cannot be continuously operated without damage.

We have characterized the recommended motors in our lab and provided curves showing the maximum thrust versus speed for each motor at commonly used power supply voltages. Please refer to these curves which demonstrate 100% duty cycle when planning your application.

Please also keep in mind that a step motor typically reaches maximum temperature after 30 to 45 minutes of operation. If you run the motor for one minute then let it sit idle for one minute, that is a 50% duty cycle. Five minutes on and five minutes off is also 50% duty. However, one hour on and one hour off has the effect of 100% duty because during the first hour the motor will reach full (and possibly excessive) temperature.

The actual temperature of the motor depends on how much heat is conducted, convected or radiated out of it. Our measurements were made in a 40°C (104°F) environment with the motor mounted to an aluminum plate sized to provide a surface area consistent with the motor power dissipation. Your results may vary.
Motor Dimensions

OLE-75, -150; No Encoder

<table>
<thead>
<tr>
<th>Code</th>
<th>DC Motor</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>P6</td>
<td>MTR-DC23T-598-S</td>
<td>0.79</td>
<td>0.25</td>
<td>0.23</td>
<td>0.59</td>
<td>1.498/1.502</td>
<td>0.06</td>
</tr>
<tr>
<td>P7</td>
<td>MTR-DC23W-598-S</td>
<td>0.79</td>
<td>0.25</td>
<td>0.23</td>
<td>0.59</td>
<td>1.498/1.502</td>
<td>0.06</td>
</tr>
<tr>
<td>P8</td>
<td>MTR-DC23T-601-S</td>
<td>0.79</td>
<td>0.25</td>
<td>0.23</td>
<td>0.59</td>
<td>1.498/1.502</td>
<td>0.06</td>
</tr>
<tr>
<td>P9</td>
<td>MTR-DC23W-601-S</td>
<td>0.79</td>
<td>0.25</td>
<td>0.23</td>
<td>0.59</td>
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OLE-75, -150; Encoder Version

<table>
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<tr>
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<th>A</th>
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## OLE-350; No Encoder

![Diagram of OLE-350; No Encoder](image)

<table>
<thead>
<tr>
<th>Code</th>
<th>DC Motor</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>P10</td>
<td>MTR-DC34T-506-S</td>
<td>1.46</td>
<td>0.50</td>
<td>0.45</td>
<td>1.00</td>
<td>2.873/2.877</td>
<td>0.08</td>
</tr>
<tr>
<td>P11</td>
<td>MTR-DC34W-506-S</td>
<td>1.46</td>
<td>0.50</td>
<td>0.45</td>
<td>1.00</td>
<td>2.873/2.877</td>
<td>0.08</td>
</tr>
</tbody>
</table>

## OLE-350; Encoder Version

![Diagram of OLE-350; Encoder Version](image)

<table>
<thead>
<tr>
<th>Code</th>
<th>DC Motor</th>
<th>A</th>
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</tr>
</tbody>
</table>
Mounting the Drive

You can mount your drive on the wide or the narrow side of the chassis using #6 screws. If possible, the drive should be securely fastened to a smooth, flat metal surface that will help conduct heat away from the chassis. If this is not possible, then forced airflow from a fan may be required to prevent the drive from overheating.

- *Never use your drive in a space where there is no air flow or where other devices cause the surrounding air to be more than 40°C.*
- *Never put the drive where it can get wet or where metal or other electrically conductive particles can get on the circuitry.*
- *Always provide air flow around the drive. When mounting multiple STP drives near each other, maintain at least one half inch of space between drives.*

Mechanical Outline
Technical Specifications

**Amplifier**
Digital MOSFET. 20 kHz PWM.
ST5: 24 - 48 VDC, motor current: 0.5 to 5.0 amps/phase peak of sine
STP-10: 24 - 48 VDC, motor current: 0.5 to 10 amps/phase peak of sine

**Digital Inputs**
Step & Direction: differential, optically isolated, 5V logic. 330 ohms internal resistance.
0.5 µsec minimum pulse width. 2 µsec minimum set up time for direction signal.
All other digital inputs: optically isolated, 12 - 24V logic. 2200 ohms. Maximum current: 10 mA.

**Analog Inputs**
±10VDC, 12 bit ADC, 100k ohms internal impedance.

**Outputs**
Photodarlington, 100 mA, 30 VDC max. Voltage drop: 1.2V max at 100 mA.

**Physical**
1.775 x 3 x 5 inches overall. 10 oz (280 g)
Ambient temperature range: 0°C to 40°C.
Mating Connectors and Accessories

Mating Connectors
Motor/power supply: PCD P/N ELV06100, included with drive.

Accessories
Breakout Box for DB-25 Connector
   BOB-1, includes cable

Screw Terminal Connectors that mate directly to the DB-25 connector on the front panel of the drive:
   Phoenix Contact P/N 2761622.
   *This connector is not available from Bimba. You must purchase it from a Phoenix distributor.*

Mating Cable for IN/OUT connector with “flying leads”
   Black Box P/N: BC00702
   *This cable is not available from Bimba. You must purchase it from Black Box.*
Useful for wired applications. This shielded cable has a DB-25 connector on each end. You can cut off the female end to create a 6 foot “DB-25 to flying lead cable”.
   It’ll be easier to wire if you get the cable color chart from Black Box’s web site.

Regeneration Clamp:
   Bimba BIM-RGC-050

Power supplies:
   Bimba PWR-320A48 (48 VDC, 6.7A)
   Bimba PWR-150A24 (24 VDC, 6.3A)
Alarm Codes

In the event of an error, the red and green LEDs on the main board will flash in alternating red-green patterns as shown below. The pattern repeats until the alarm is cleared.

<table>
<thead>
<tr>
<th>Code</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>solid green</td>
<td>no alarm, motor disabled</td>
</tr>
<tr>
<td>flashing green</td>
<td>no alarm, motor enabled</td>
</tr>
<tr>
<td>1 red, 1 green</td>
<td>motor stall (optional encoder only)</td>
</tr>
<tr>
<td>1 red, 2 green</td>
<td>move attempted while drive disabled</td>
</tr>
<tr>
<td>2 red, 1 green</td>
<td>ccw limit</td>
</tr>
<tr>
<td>2 red, 2 green</td>
<td>cw limit</td>
</tr>
<tr>
<td>3 red, 1 green</td>
<td>drive over heating</td>
</tr>
<tr>
<td>3 red, 2 green</td>
<td>internal voltage out of range</td>
</tr>
<tr>
<td>3 red, 3 green</td>
<td>blank Q segment</td>
</tr>
<tr>
<td>4 red, 1 green</td>
<td>power supply overvoltage</td>
</tr>
<tr>
<td>4 red, 2 green</td>
<td>power supply undervoltage</td>
</tr>
<tr>
<td>4 red, 3 green</td>
<td>bad instruction in Si program</td>
</tr>
<tr>
<td>5 red, 1 green</td>
<td>over current/short circuit</td>
</tr>
<tr>
<td>5 red, 2 green</td>
<td>motor resistance out of range</td>
</tr>
<tr>
<td>6 red, 1 green</td>
<td>open motor winding</td>
</tr>
<tr>
<td>6 red, 2 green</td>
<td>bad encoder signal (optional encoder only)</td>
</tr>
<tr>
<td>7 red, 1 green</td>
<td>serial communication error</td>
</tr>
<tr>
<td>7 red, 2 green</td>
<td>flash memory error</td>
</tr>
<tr>
<td>8 red, 1 green</td>
<td>internal voltage out of range</td>
</tr>
</tbody>
</table>

Connector Diagrams

DB-25 I/O Connector

HD-15 Encoder Connector