# ST

# Hardware Manual

• ST5-S • ST10-S

*920-0027 Rev. D*
*2/7/2014*

Applied Motion Products

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## Introduction

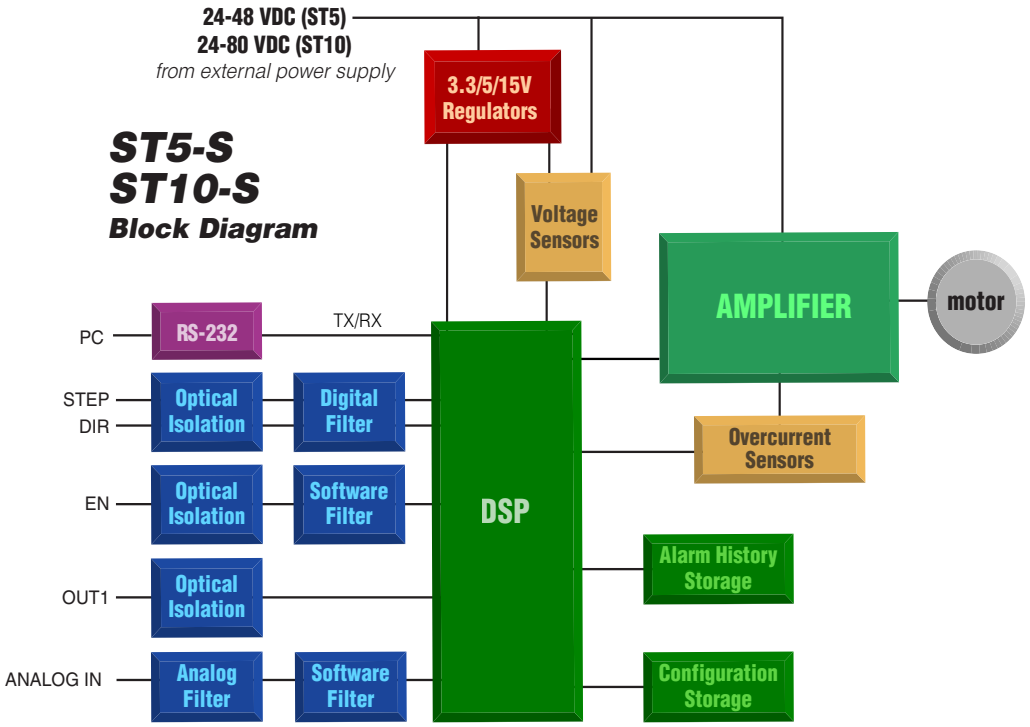
Thank you for selecting an Applied Motion Products motor control. We hope our dedication to performance, quality and economy will make your motion control project successful.

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) 525-1609, or you can reach us by fax at (831) 761-6544. You can also email support@applied-motion.com.

## Features

- Microstepping digital step motor driver in compact package
- ST5 operates from a 24 to 48 volt DC power supply
- ST10 operates from a 24 to 80 volt DC power supply
- Accepts analog signals, digital signals and RS-232 serial commands
- ST5 provides motor current up to 5 amps/phase (peak of sine)
- ST10 provides motor current up to 10 amps/phase (peak of sine)
- Three digital inputs
- One digital output
- One analog input

## Block Diagrams




ST5-S and ST10-S

## *Getting Started*

This manual describes the use of two different drive models, ST5-S & ST10-S. To get started, you'll need the following:

- A 24-48 volt DC power supply. (24 - 80VDC for ST10 model). Please read the section entitled Choosing a Power Supply for help in choosing the right power supply.
- A compatible step 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 Windows 7.
- Relevant software applications, as outlined below. All software is available as a free download from http://www.applied-motion.com/products/software.
- An Applied Motion programming cable (included)

If you've never used an ST 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. Launch the ST Configurator™ software by clicking Start...Programs...Applied Motion...
2. Connect the drive to your PC using the programming cable.
3. Connect the drive to the power supply.
4. Connect the drive to the motor.
5. Apply power to the drive.
6. The software will recognize your drive, display the model and firmware version and be ready for action.

## *Connecting to the PC using RS-232*

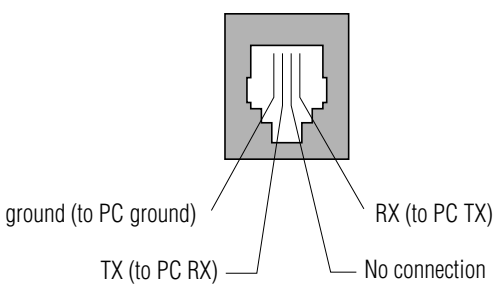
• Locate your computer within 8 feet of the drive.

• Your drive was shipped with a communication cable. Plug the large end into the serial port of your PC and the small end into the 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 Port Authority "USB Serial DB9" Adapter from CablesToGo.com and with the SW1301 from SewellDirect.com. For 64 bit XP and Vista systems, the recommended USB serial adapter is USB-COM-CBL from byterunner.com. This adapter also works for 32 bit Windows systems.

For laptops, a PCMCIA converter card is a good choice. Our applications engineers use the SSP-100 from Sewell Direct.




Pin Assignments of the PC/MMI Port
(RJ11 connector)

## *Connecting the Power Supply*

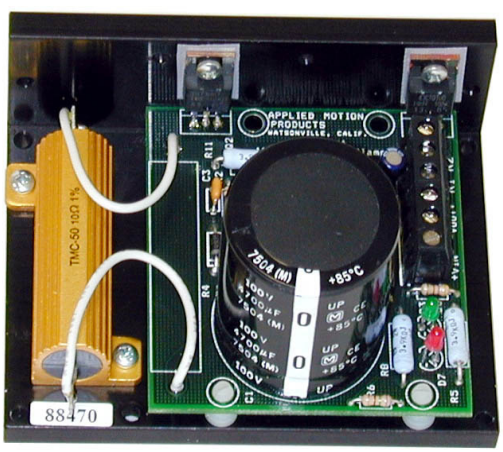
If you need information about choosing a power supply, please read **Choosing a Power Supply** located elsewhere in this manual.

Connect the motor power supply "+" terminal to the drive terminal labeled "VDC". Connect power supply "-" to the drive terminal labeled "GND". Use 18 or 20 gauge wire. The ST 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 a 4 amp fuse for the ST5 drives and 7 amps for the ST10.

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

**Be careful not to reverse the power supply wires. Reverse connection will destroy your driver, void your warranty and generally wreck your day.**

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 RC050 "regeneration clamp" to solve this problem. If in doubt, buy an RC050 for your first installation. If the "regen" LED on the RC050 never flashes, you don't need the clamp.




RC050 Regen Clamp

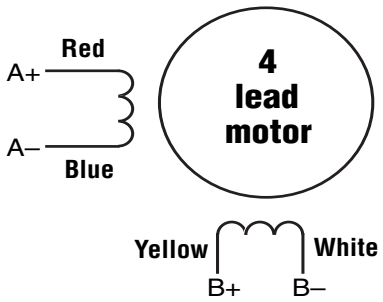
## *Connecting the Motor*

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

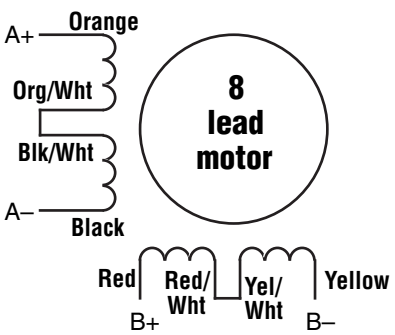
If you are using a non-Applied Motion Products motor, do not connect it until you have configured the drive for that motor.

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

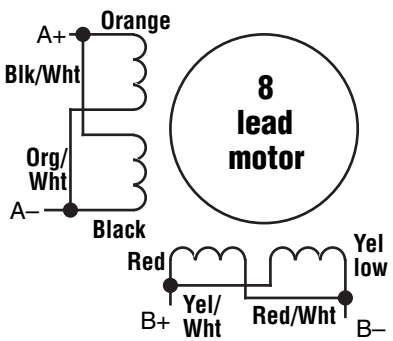
Six lead motors can be connected in series or center tap. In series operation, motors produce more torque at low speeds, but cannot run as fast as in the center tap configuration. In series operation, the motor should be operated at 30% less than the rated current to prevent overheating. Winding diagrams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




**4 Leads**

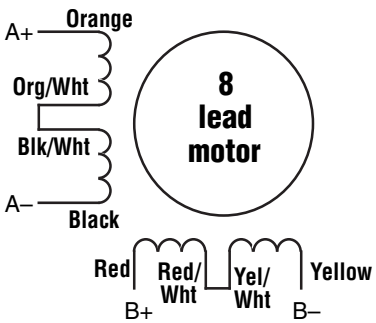



**8 Leads Series Connected**

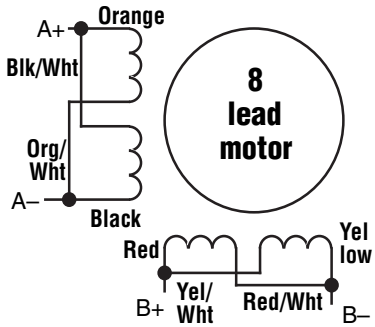



**8 Leads Parallel Connected**

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 on the following page.




**8 Leads Series Connected**




**8 Leads Parallel Connected**

## *Connecting Input Signals*

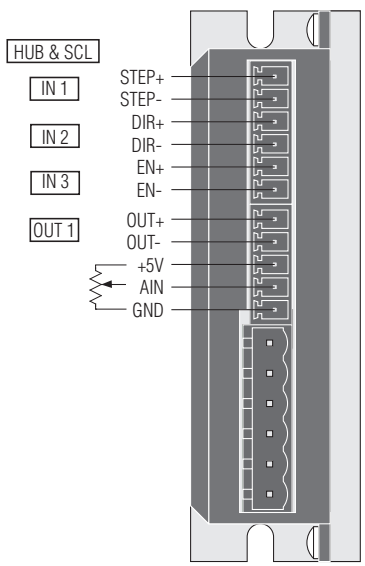
The ST drives have three types of inputs:

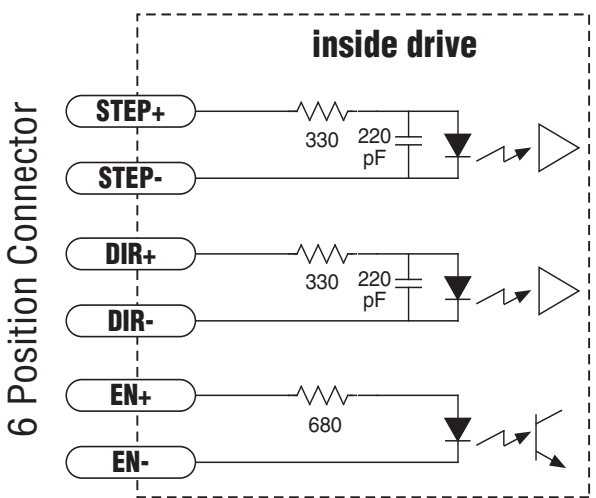
• High speed digital inputs -STEP & DIR- for step & direction commands, encoder following, run/stop & direction, or general purpose, 5 volt logic.
• Quadrature signals from encoders can also be used.
• Digital input for other signals, 5 -12 volt logic, including an enable (EN) . Digital signal for enabling the drive.
• Analog input for analog speed adjustment - analog velocity 0-5V

All drives include three digital inputs and one analog input. See page 35 for a list of all functions.

• STEP & DIR: digital signals for commanding position. Quadrature signals from encoders can also be used.
• EN - enable . Digital signal for enabling the drive, speed change, or general purpose..
• Analog In: analog velocity 0-5V.

Connector Pin Diagram



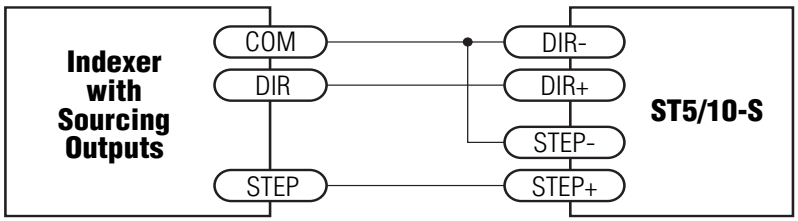
## *High Speed Digital Inputs (STEP, DIR)*

The -S drives include two high speed inputs labeled STEP and DIR. They accept 5 volt single-ended or differential signals, up to 2 MHz.

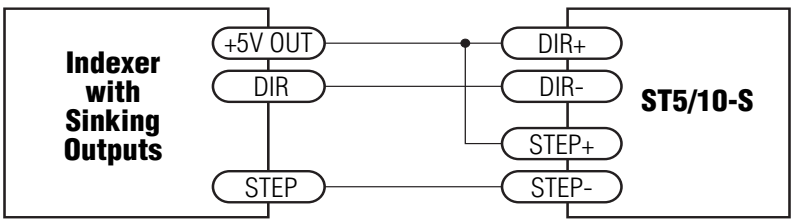
STEP and DIR Inputs are configured using the ST Configurator software.

The inputs can connect to an indexer, a master encoder or CNC handwheel for following applications, or they can be used for connecting sensors, switches and other electronic devices. They can be used as the run/stop and direction inputs for velocity (oscillator) mode.

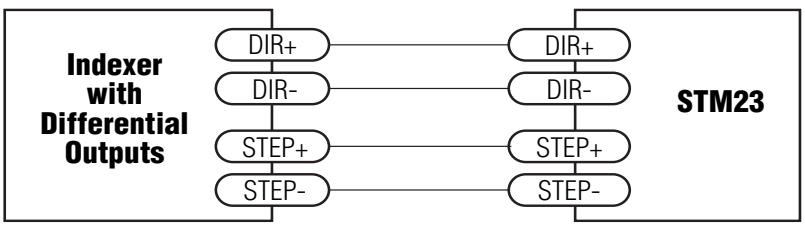
Connection diagrams follow.



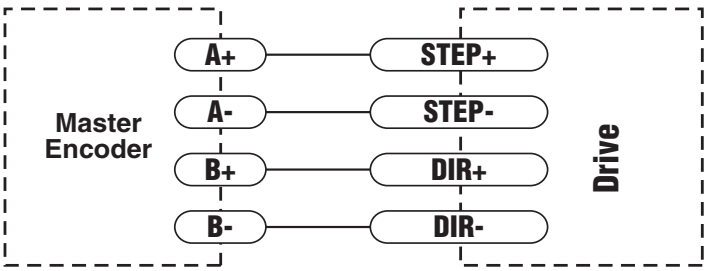

Connecting to indexer with Sourcing Outputs




Connecting to Indexer with Sinking Outputs




Connecting to Indexer with Differential Outputs
(Many High Speed Indexers have Differential Outputs)



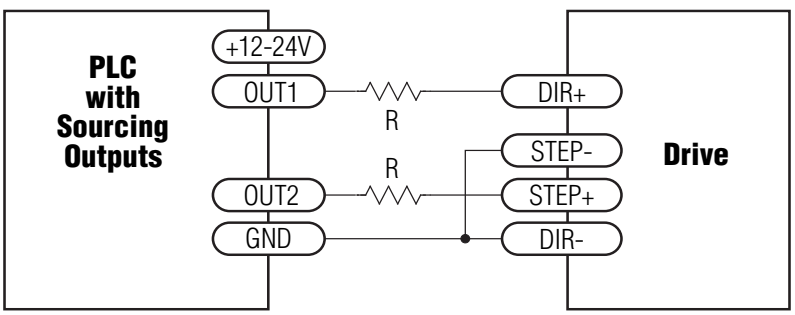

Wiring for Encoder Following

## *Using High Speed Inputs with 12-24 Volt Signals*

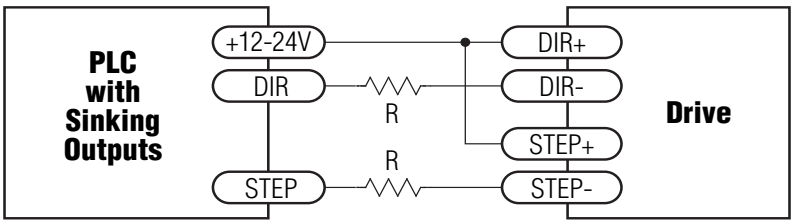
Most PLCs don't use 5 volt logic. You can connect signal levels as high as 24 volts to the STEP and DIR inputs if you add external dropping resistors, as shown below.

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

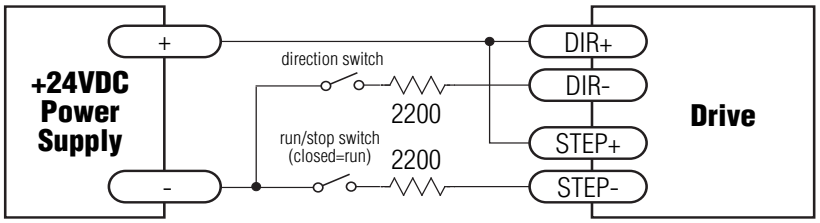
**The maximum voltage that can be applied to an input terminal is 24 volts DC. Never apply AC voltage to an input terminal.**




Connecting to PLC with Sourcing (PNP) Outputs
(Most PLC's use 24 volt logic)



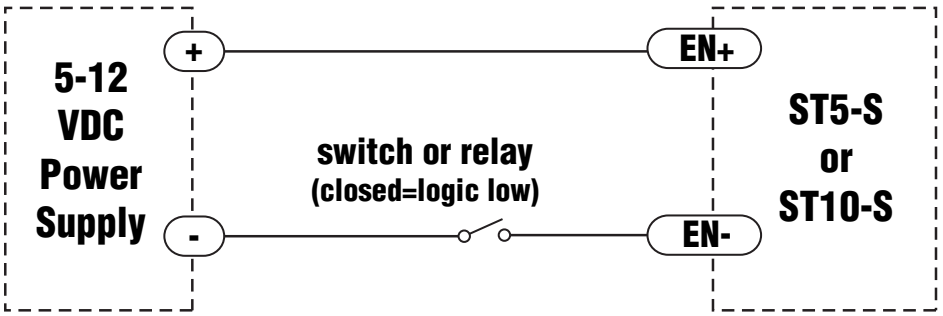

Connecting to PLC with Sinking (NPN) Outputs
(Most PLC's use 24 volt logic)

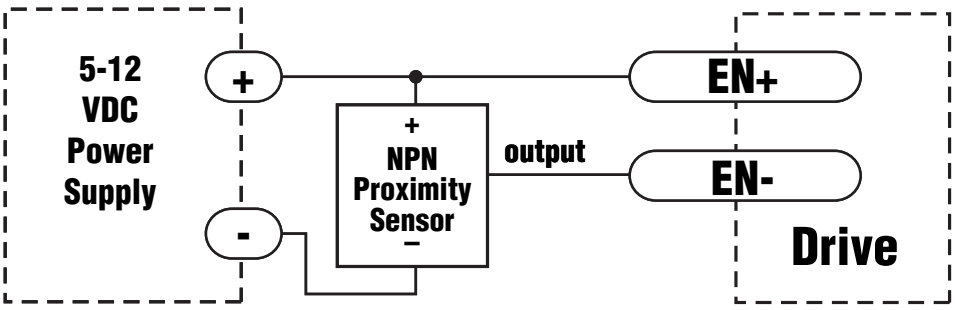


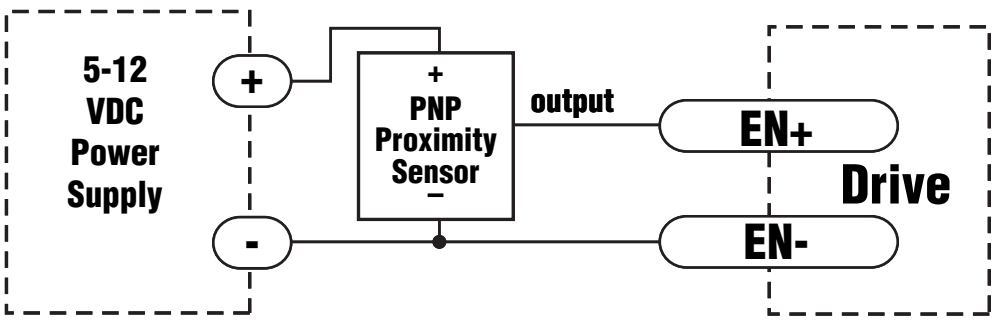

Using Mechanical Switches at 24 Volts

## *Other Digital Input*

As previously noted, the high speed STEP and DIR inputs are configured for 5V logic. EN is designed for operation between 5 and 12 volts DC. Add 1500 ohms to EN for 24V operation.



## Connecting Limit Switches

For point to point SCL and HUB applications, the STEP input can be used as a clockwise end of travel limit and the DIR input can be used as the counterclockwise end of travel limit. If using SCL, you activate the limits using the SCL "DL" command, as described in the Host Command Reference manual.

These inputs are differential, which allows you to use signals that are sinking (NPN), sourcing (PNP) or differential (line driver). The limit inputs are optically isolated.
Input signals must not exceed 5 volts DC unless external current limiting resistors are used in series with STEP+ and DIR+.

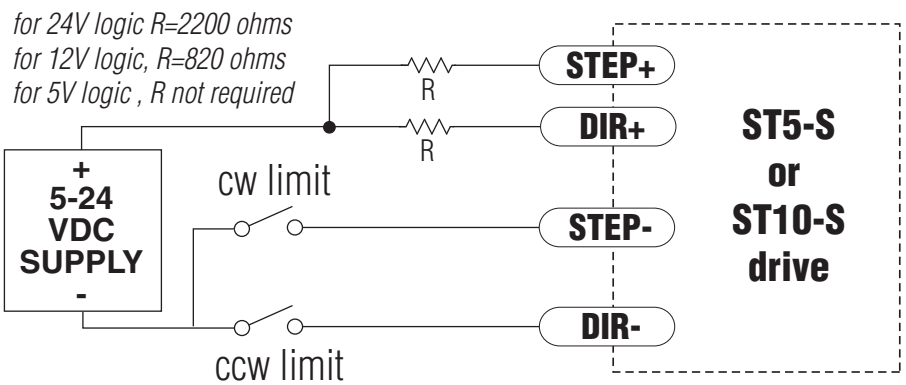
For 12 volt logic, add 820 ohm, 1/4 watt resistors

For 24 volt logic, use 2200 ohm, 1/4 watt resistors

Because these inputs can accept high frequency signals, care must be taken in locating the signal wires and dropping resistors. Shielded cables are recommended. Separate any limit sensor wires from the motor wires by at least 4 inches. If false triggering of a limit occurs, increase the value of the internal digital filter using the EI150 command. This will limit the bandwidth of the STEP and DIR inputs to 100 kHz.

## Wiring a Mechanical Limit Switch

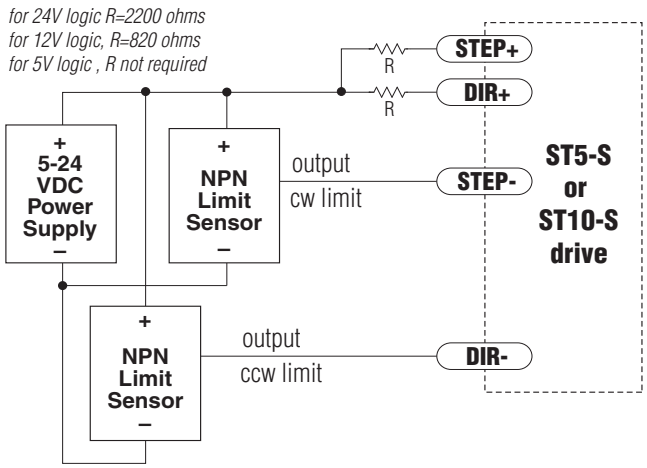
You can use normally open or normally closed limit switches. Either way, wire them as shown here.



## *Wiring a Limit Sensor*

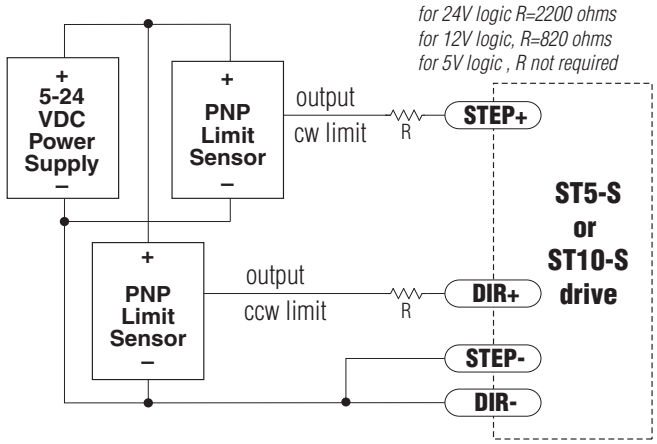
Some systems use active limit sensors that produce a voltage output rather than a switch or relay closure. These devices must be wired differently than switches.

If your sensor has an open collector output or a sinking output, wire it like this:

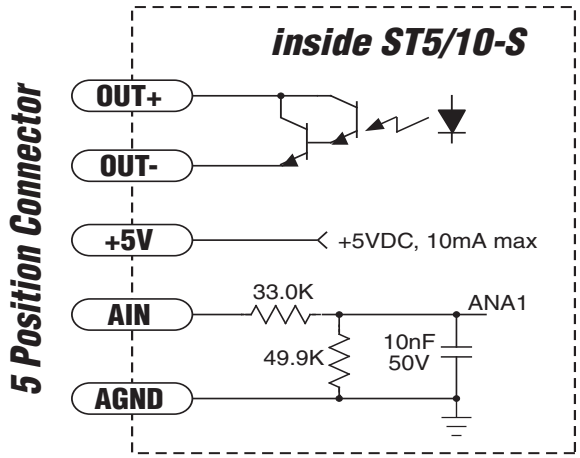



If the sensor output goes low at the limit, select the option ”closed” (DL1). If the output is open, or high voltage, choose ”open” (DL2).

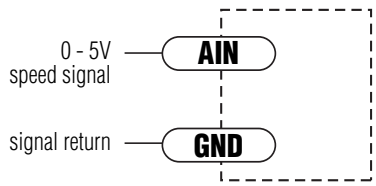
Other sensors have sourcing outputs. That means that current can flow out of the sensor output, but not into it. In that case, wire the sensor this way:



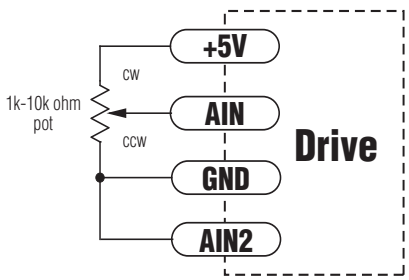
## Analog Inputs




The ST5-S and ST10-S have one 0 to 5 volt analog input that can be used by the drive for controlling the motor speed in velocity mode. This input can also be used to read a voltage using the SCL "IA" or "RA" commands.



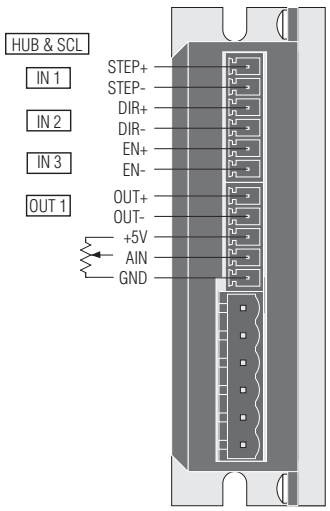

Connecting to an Analog Signal

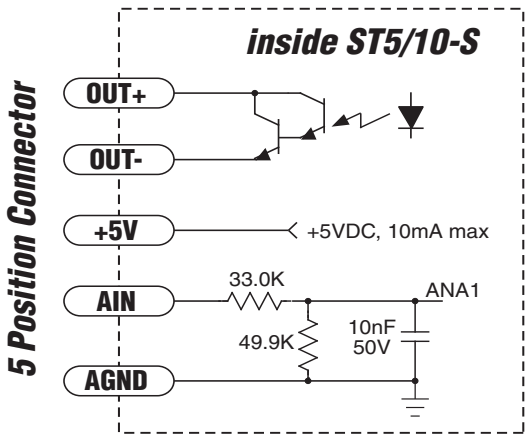



Connecting the Analog Signal to a Potentiometer or Joystick

**WARNING - Analog input must be used with care. It is not optically isolated and may operate improperly or could be damaged when system grounds are not compatible.**

## Connecting the Digital Output




The ST5-S and ST10-S drives include one digital output that can be used in one of five ways:

**Brake**: output can be configured to control an electric brake relay, automatically releasing and engaging as the drive requires.

**Motion**: indicates when the motor is moving.

**Fault**: closes when a drive fault or alarm condition occurs. The red and green LEDs will flash an error code.

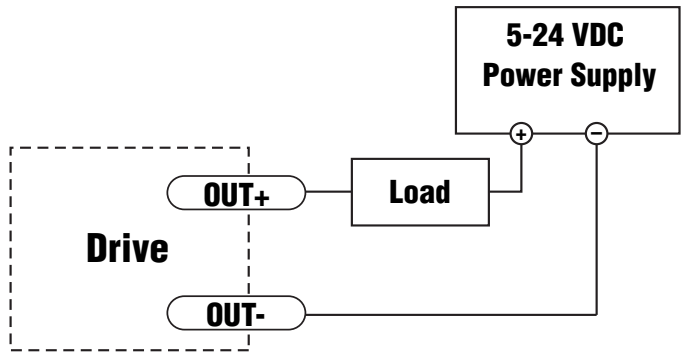
**Tach**: produces pulses proportional to the distance traveled (and thereby a frequency that is proportional to motor speed.)

**General purpose digital output**, controlled by the SCL SO, FO, IL and IH commands.

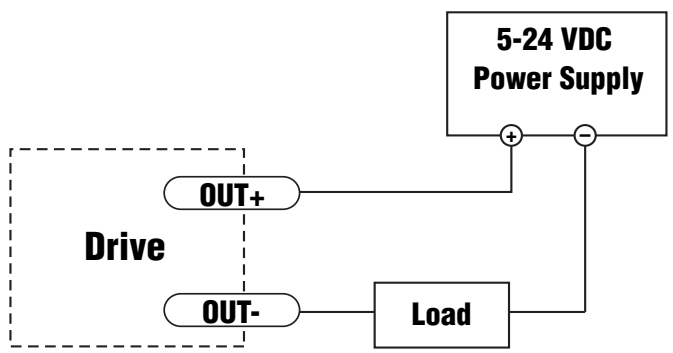
The output features separate + and - terminals and can be used to sink or source current.

Diagrams of each type of connection follow.

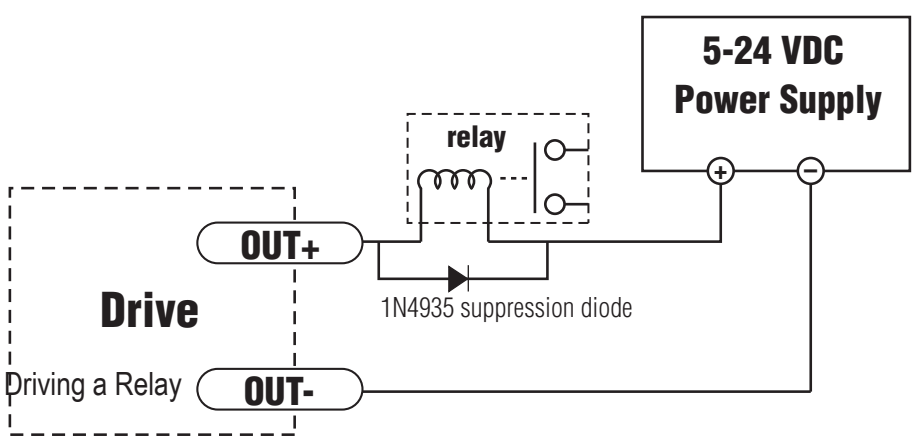
***Do not connect the output to more than 30VDC.***
***The current through the output terminals must not exceed 10 mA.***




Sinking Output




Sourcing Output



## *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 ST 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 Power Supplies*

Applied Motion Products offers two Power Supplies recommended for use with the ST drives. These are switching power supplies offering 24V and 48V, and an overload current capability making them ideal for use with drive applications.

| Model | Power | Output Voltage |
|---|---|---|
| PS150A24 | 150W | 24VDC |
| PS320A48 | 320W | 48VDC |

## Recommended Motors

| Part Number | Holding Torque oz-in | Holding Torque kg-cm | Drive Current Setting amps | Resistance ohms | Inductance mH | Rotor Inertia g-cm$^2$ |
|---|---|---|---|---|---|---|
| HT11-012/212 | 7.0 | 0.50 | 1.2 | 1.4 | 1.4 | 8 |
| HT11-013/213 | 15.0 | 1.08 | 1.2 | 2.0 | 2.6 | 18 |
| 5014-042/842 | 26.0 | 1.87 | 1.2 | 4.3 | 5.5 | 20 |
| HT17-068/268 # | 31.4 | 2.26 | 1.6 | 2.1 | 2.8 | 35 |
| HT17-071/271 # | 51.0 | 3.67 | 2.0 | 1.7 | 3.6 | 54 |
| HT17-075/275 # | 62.8 | 4.52 | 2.0 | 1.7 | 3.0 | 68 |
| HT23-394/594 # | 76.6 | 5.52 | 3.4 | 0.7 | 1.4 | 120 |
| HT23-398/598 # | 177 | 12.7 | 5.0 | 0.4 | 1.2 | 300 |
| HT23-401/601 # | 264 | 19.0 | 5.0 | 0.5 | 1.6 | 480 |
| HT23-603 | 354 | 25.48 | 6.0 | 0.5 | 2.2 | 750 |
| HT24-100 | 123.2 | 8.87 | 3.36 | 0.73 | 1.6 | 260 |
| HT24-105 | 177 | 12.74 | 4.8 | 0.43 | 1.1 | 450 |
| HT24-108 | 354 | 25.48 | 4.8 | 0.65 | 2.4 | 900 |
| HT34-485 # | 650 | 46.8 | 10.0 | 0.19 | 1.3 | 1400 |
| HT34-486 # | 1200 | 86.4 | 9.7 | 0.27 | 2.2 | 2680 |
| HT34-487 # | 1845 | 133 | 10.0 | 0.27 | 2.4 | 4000 |
| HT34-504 | 396.5 | 28.55 | 7.56 | 0.24 | 1.7 | 1100 |
| HT34-505 | 849.6 | 61.18 | 7.56 | 0.33 | 2.7 | 1850 |
| HT34-506 | 1260 | 90.75 | 6.72 | 0.63 | 5.4 | 2750 |

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.

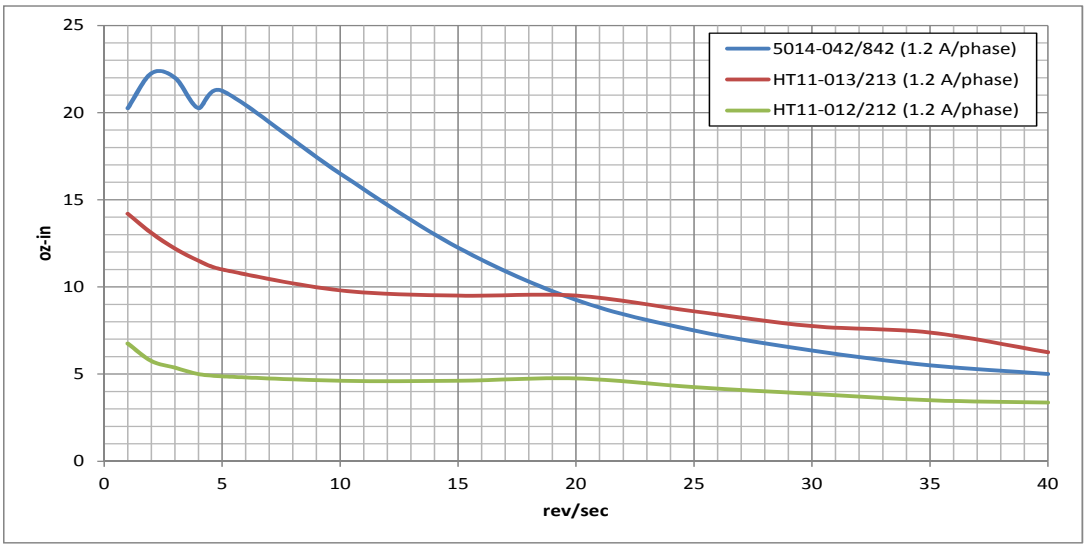
# Indicates values are with motor connected in Parallel.

## *Torque-Speed Curves*

Note: all torque curves were measured at 20,000 steps/rev.

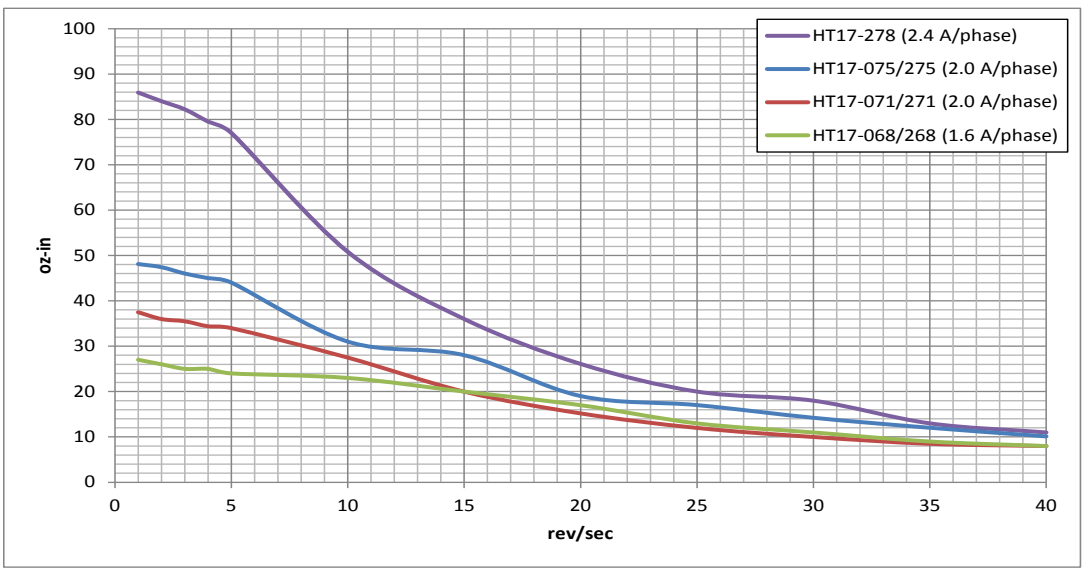
### HT11-012/212, HT11-013/213, 5014-042/842

24 VDC power supply, 20000 steps/rev



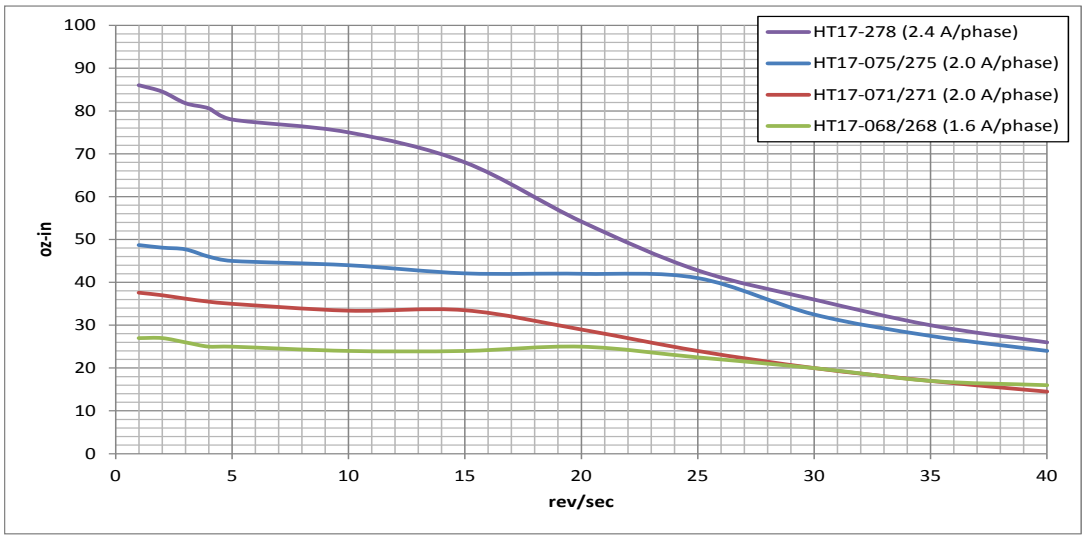

### HT17

24 VDC power supply, 20000 steps/rev, all motors connected in parallel



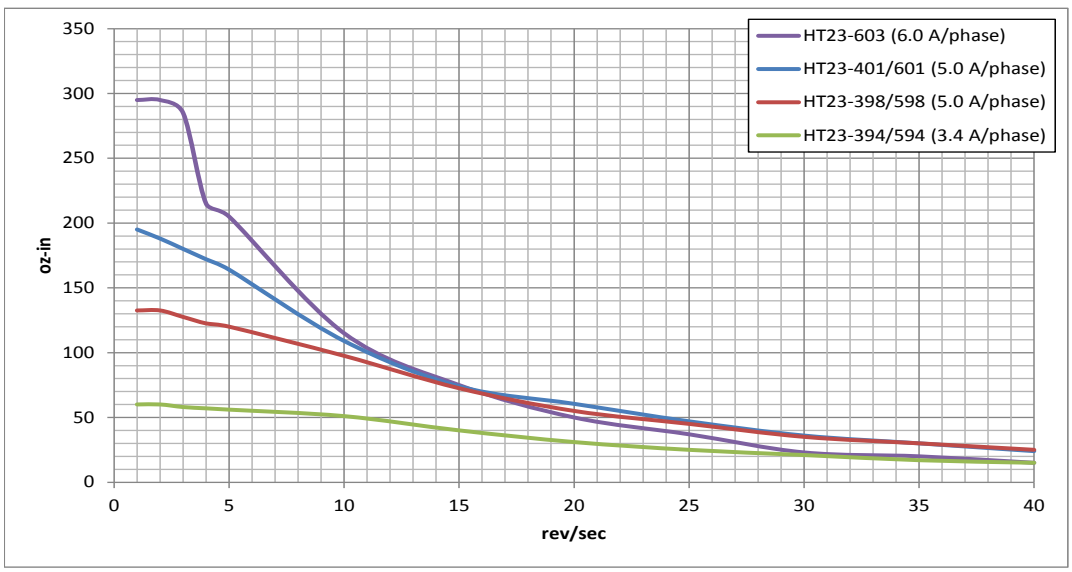
## HT17

48 VDC power supply, 20000 steps/rev, all motors connected in parallel



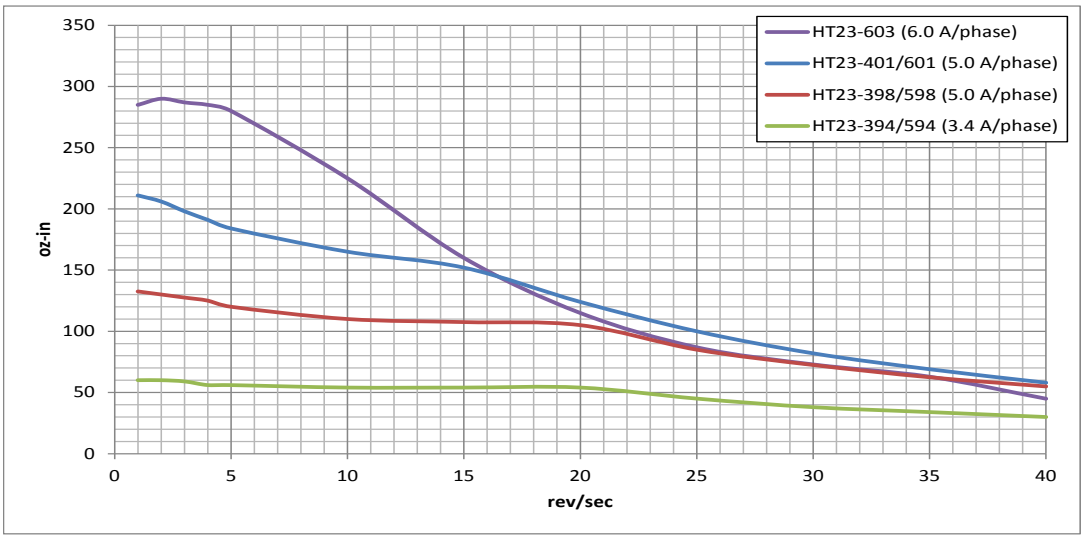

## HT23

24 VDC power supply, 20000 steps/rev, all motors connected in parallel



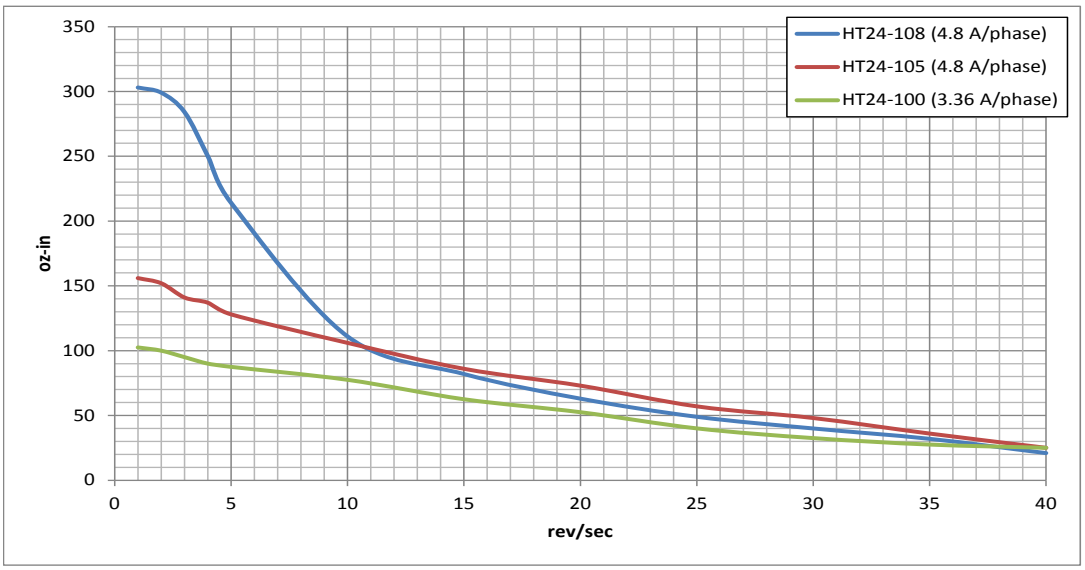
## HT23

48 VDC power supply, 20000 steps/rev, all motors connected in parallel



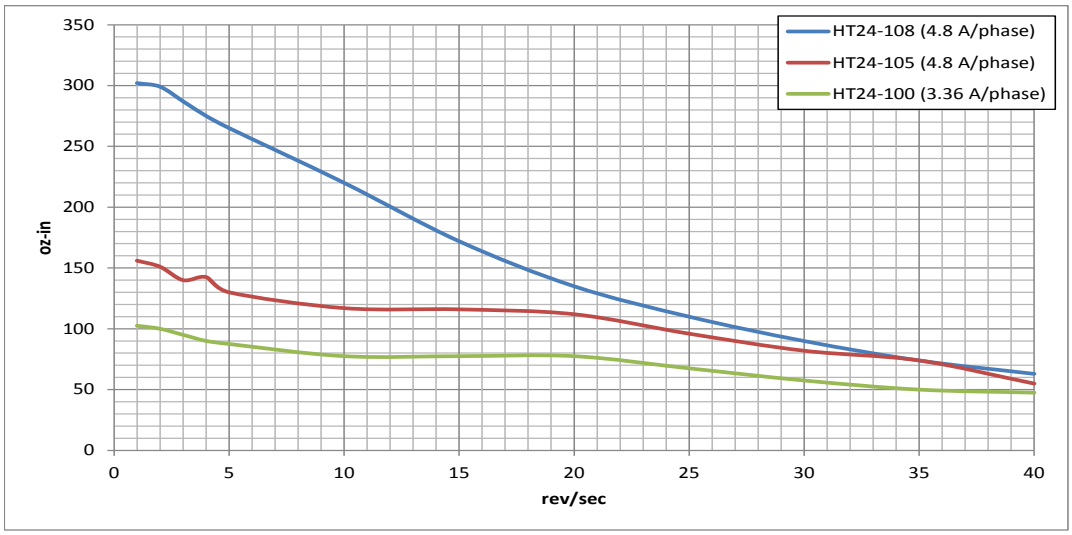

## HT24

24 VDC power supply, 20000 steps/rev



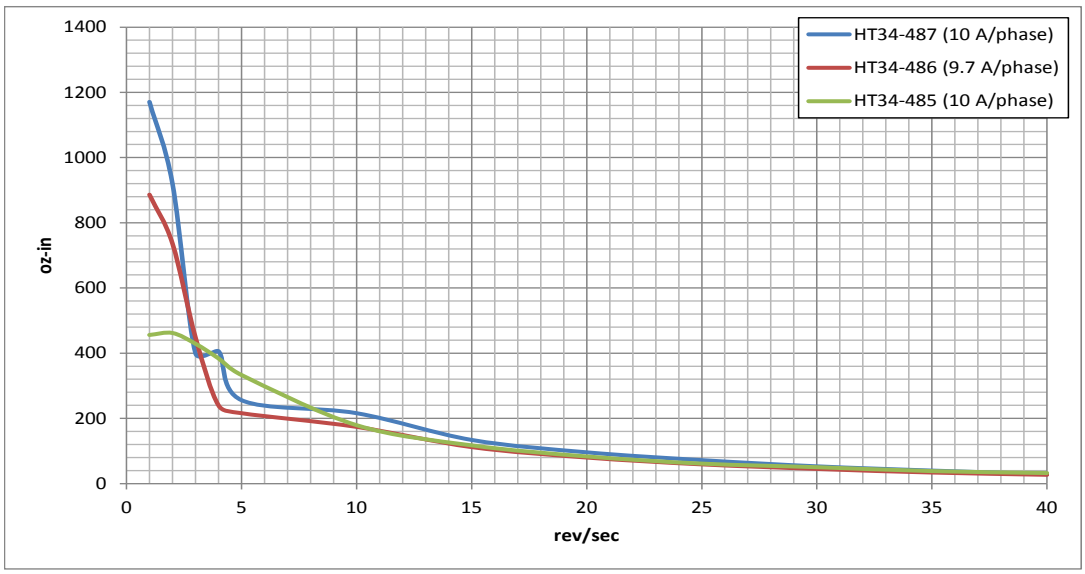
### HT24

48 VDC power supply, 20000 steps/rev



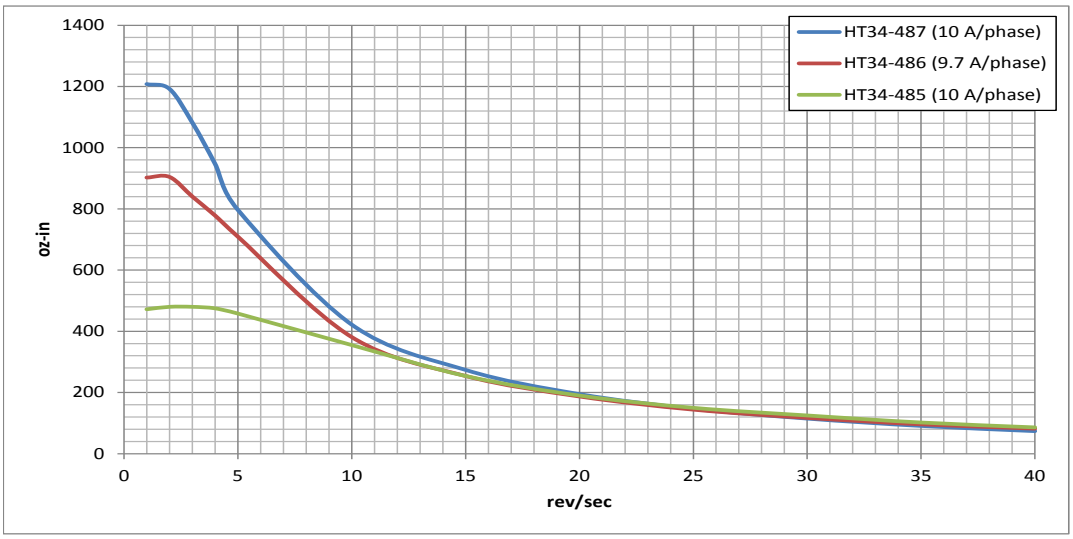

### HT34-485/486/487 with ST10

24 VDC power supply, 20000 steps/rev, all motors connected in parallel



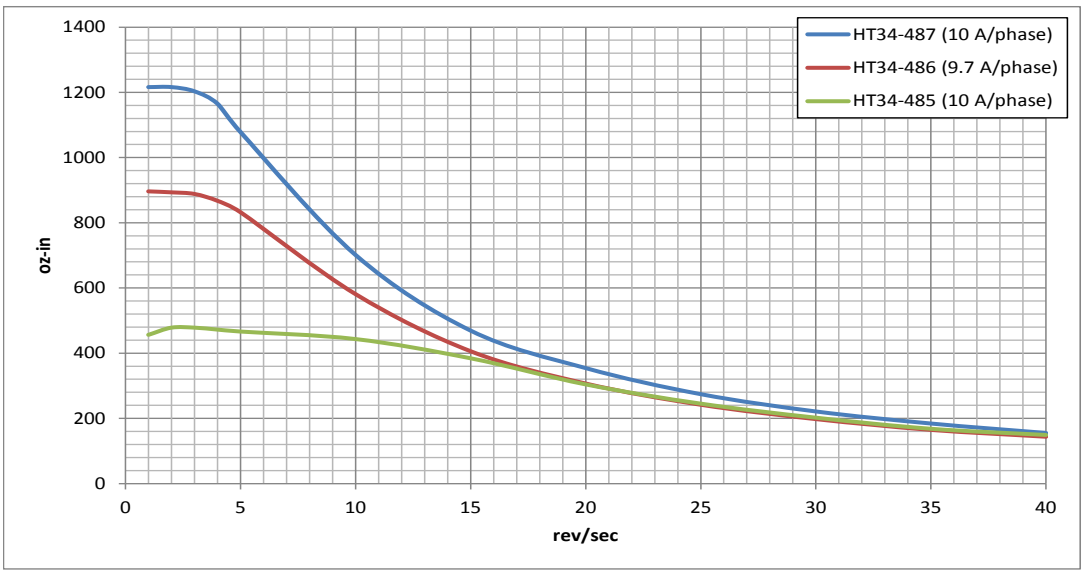
### HT34-485/486/487 with ST10

48 VDC power supply, 20000 steps/rev, all motors connected in parallel



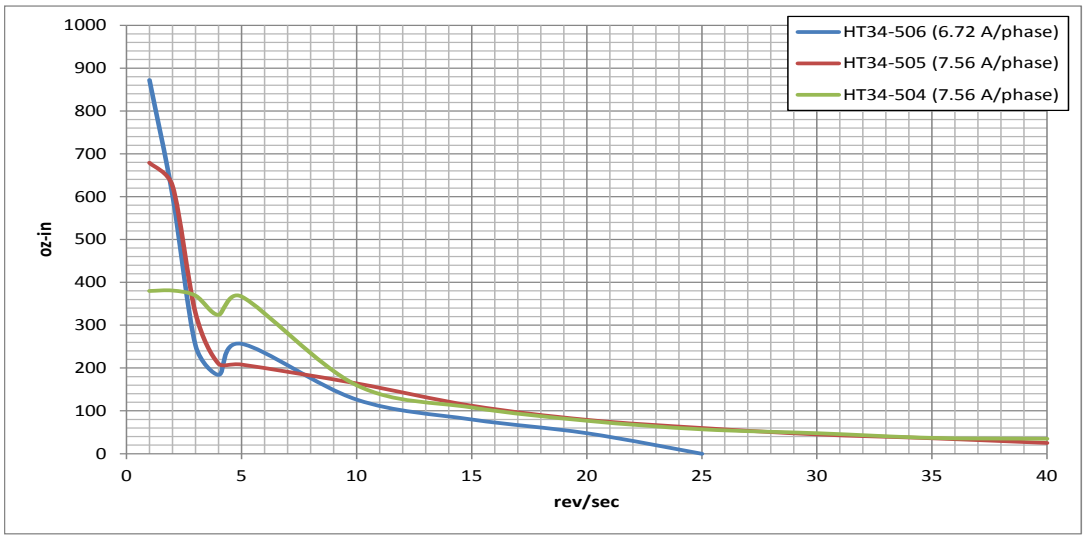

### HT34-485/486/487 with ST10

80 VDC power supply, 20000 steps/rev, all motors connected in parallel



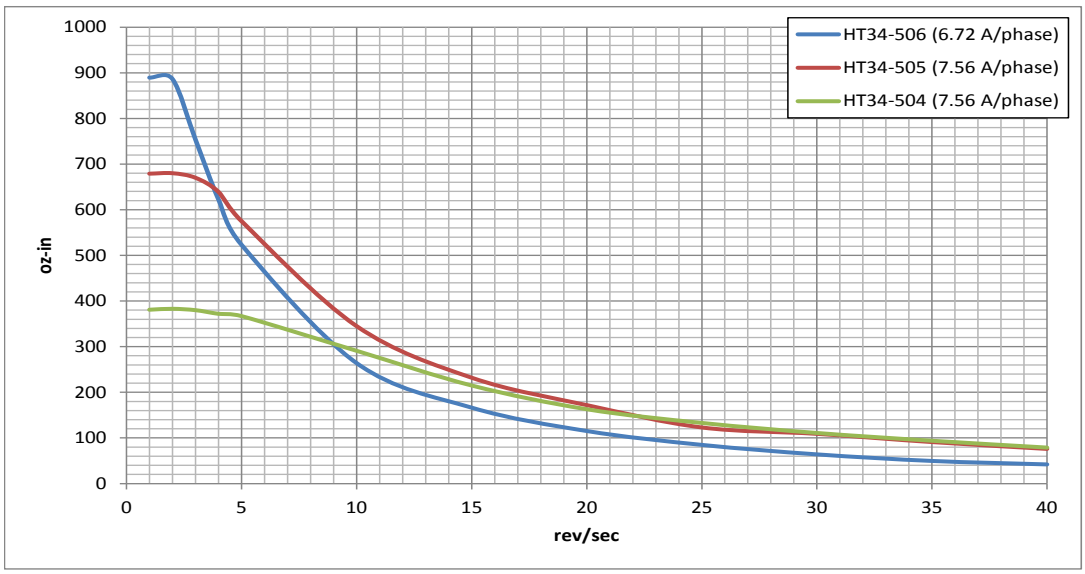
### HT34-504/505/506 with ST10

24 VDC power supply, 20000 steps/rev, all motors connected in parallel



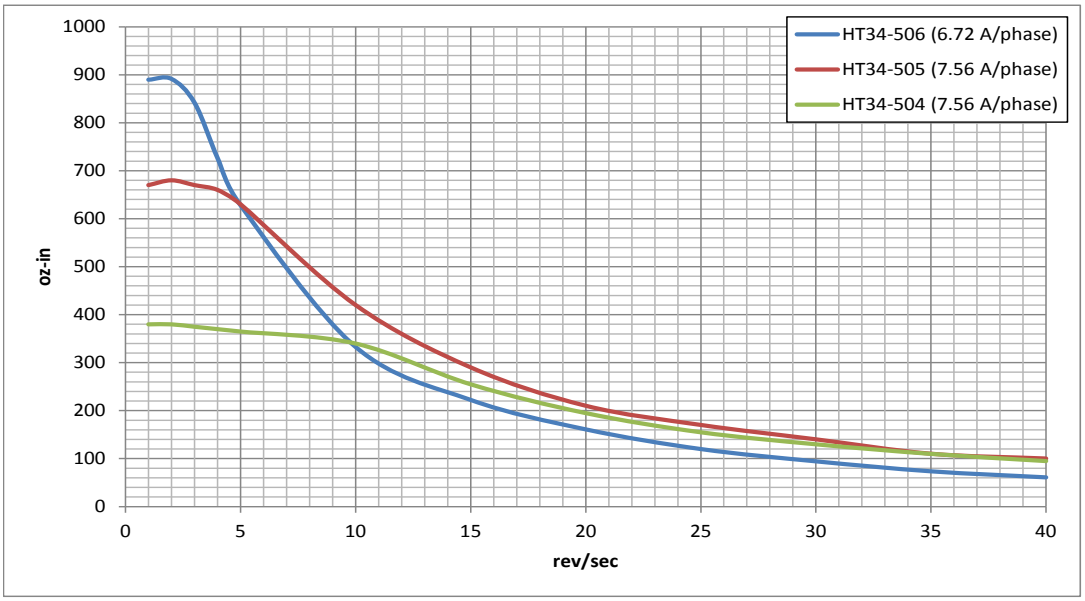

### HT34-504/505/506 with ST10

48 VDC power supply, 20000 steps/rev, all motors connected in parallel



**HT34-504/505/506 with ST10**

60 VDC power supply, 20000 steps/rev, all motors connected in parallel



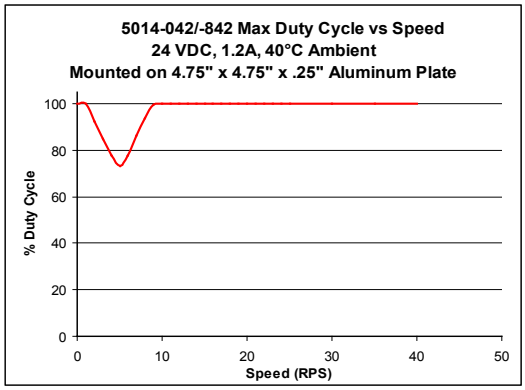

## *Motor Heating*

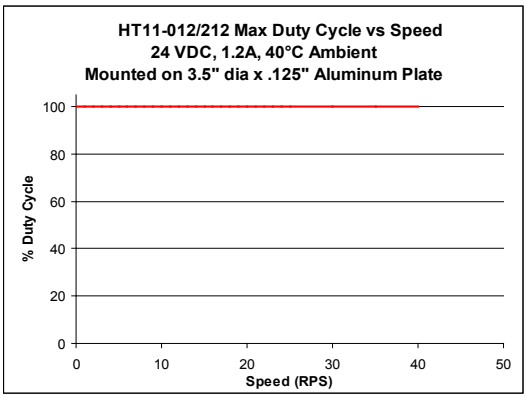
Step motors convert electrical power from the driver into mechanical power to move a load. Because step motors are not perfectly efficient, some of the electrical power turns into heat on its way through the motor. This heating is not so much dependent on the load being driven but rather the motor speed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

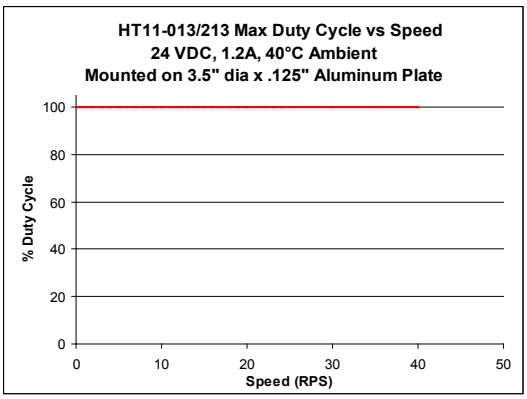
We have characterized the recommended motors in our lab and provided curves showing the maximum duty cycle versus speed for each motor at commonly used power supply voltages. Please refer to these curves when planning your application.

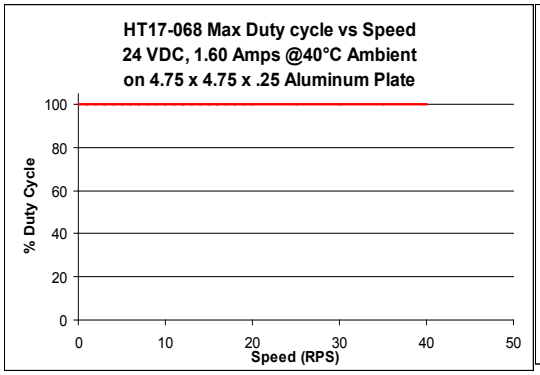
Please also keep in mind that a step motor typically reaches maximum temperature after 30 to 45 minutes of operation. If you run the motor for one minute then let it sit idle for one minute, that is a 50% duty cycle. Five minutes on and five minutes off is also 50% duty. However, one hour on and one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

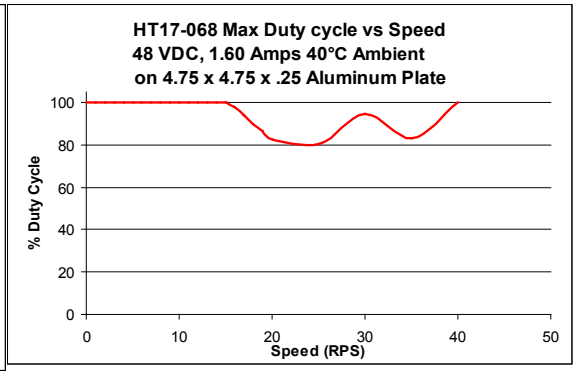
The actual temperature of the motor depends on how much heat is conducted, convected or radiated out of it. Our measurements were made in a 40°C (104°F) environment with the motor mounted to an aluminum plate sized to provide a surface area consistent with the motor power dissipation. Your results may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

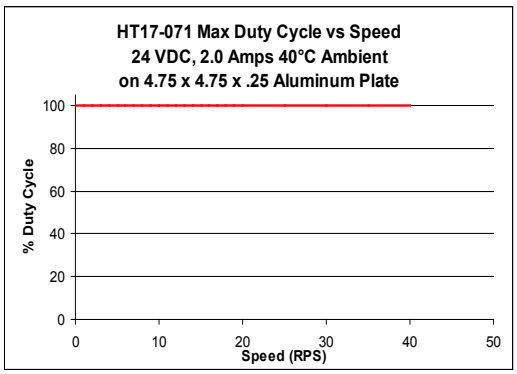

5014-042/-842 Max Duty Cycle vs Speed
24 VDC, 1.2A, 40°C Ambient
Mounted on 4.75" x 4.75" x .25" Aluminum Plate
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)

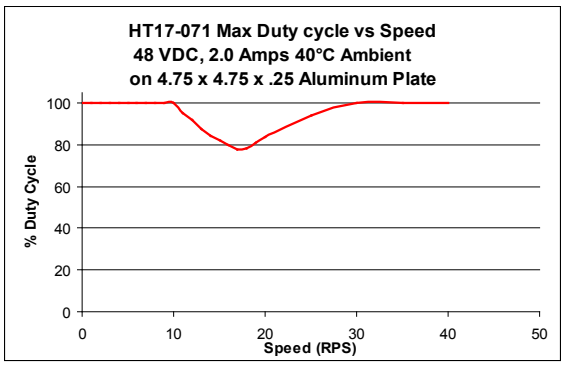

HT11-012/212 Max Duty Cycle vs Speed
24 VDC, 1.2A, 40°C Ambient
Mounted on 3.5" dia x .125" Aluminum Plate
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)

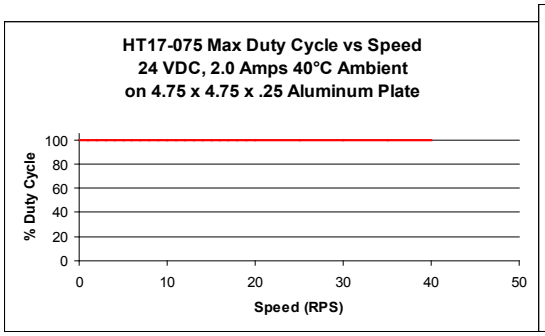

HT11-013/213 Max Duty Cycle vs Speed
24 VDC, 1.2A, 40°C Ambient
Mounted on 3.5" dia x .125" Aluminum Plate
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)

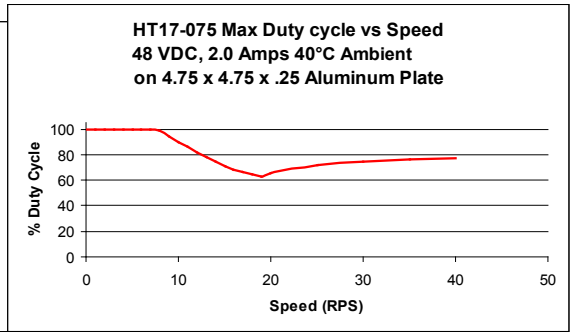

HT17-068 Max Duty cycle vs Speed
24 VDC, 1.60 Amps @40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

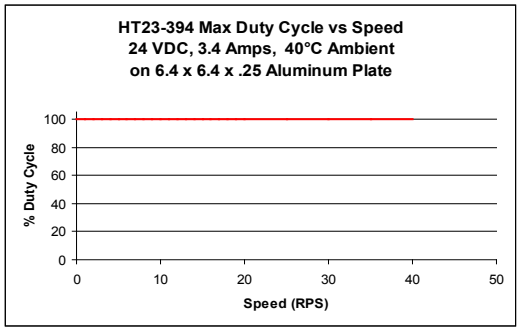

HT17-068 Max Duty cycle vs Speed
48 VDC, 1.60 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

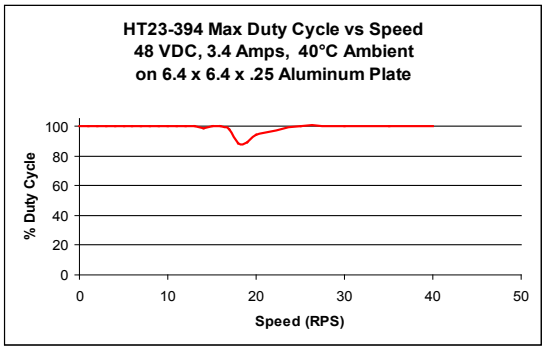

HT17-071 Max Duty Cycle vs Speed
24 VDC, 2.0 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

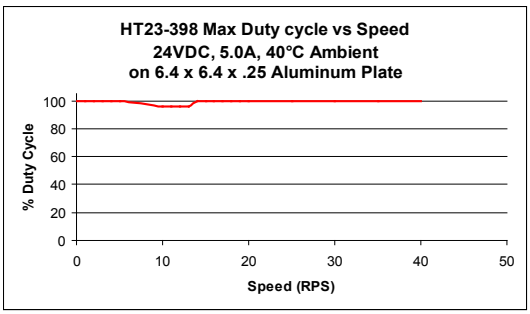

HT17-071 Max Duty cycle vs Speed
48 VDC, 2.0 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

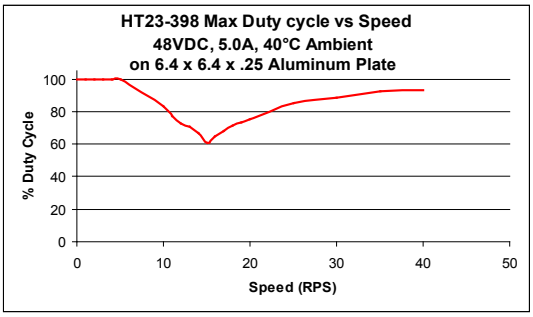

HT17-075 Max Duty Cycle vs Speed
24 VDC, 2.0 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

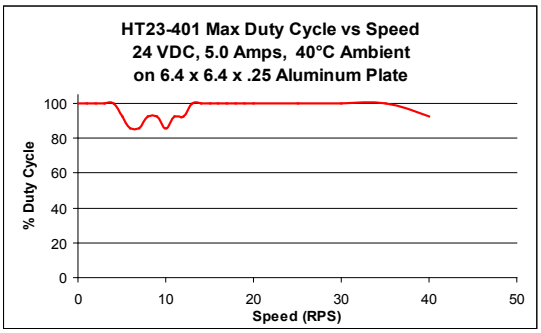

HT17-075 Max Duty cycle vs Speed
48 VDC, 2.0 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

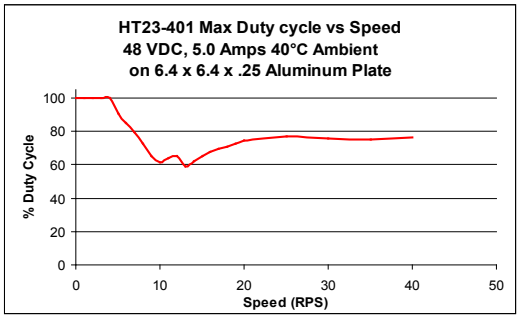

HT23-394 Max Duty Cycle vs Speed
24 VDC, 3.4 Amps, 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)

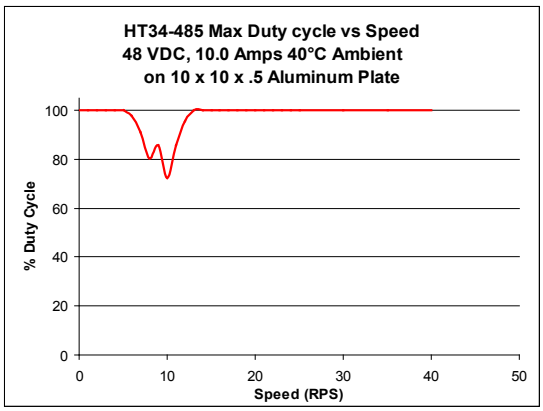

HT23-394 Max Duty Cycle vs Speed
48 VDC, 3.4 Amps, 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)

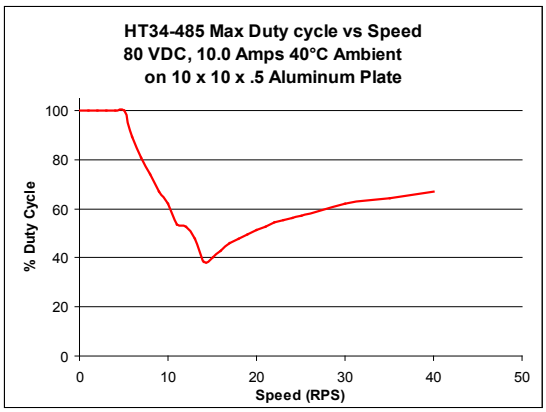

HT23-398 Max Duty cycle vs Speed
24VDC, 5.0A, 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)

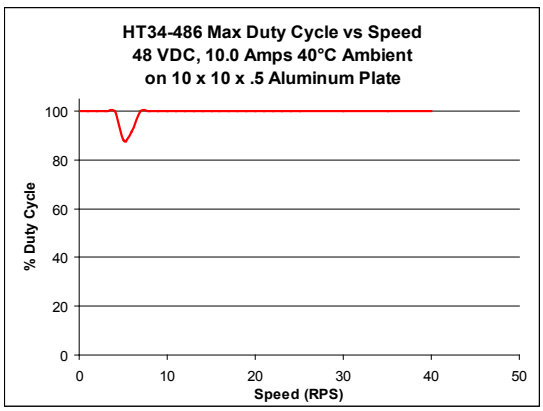

HT23-398 Max Duty cycle vs Speed
48VDC, 5.0A, 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)

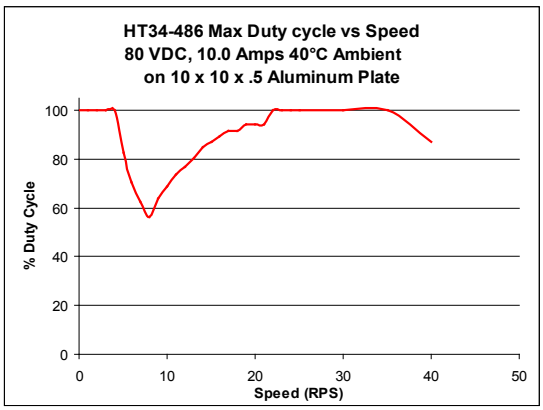

HT23-401 Max Duty Cycle vs Speed
24 VDC, 5.0 Amps, 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)

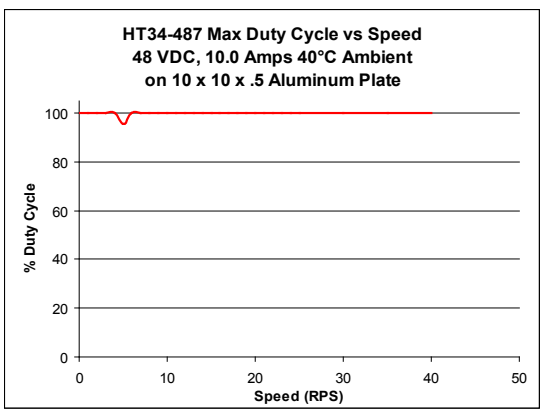

HT23-401 Max Duty cycle vs Speed
48 VDC, 5.0 Amps 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)

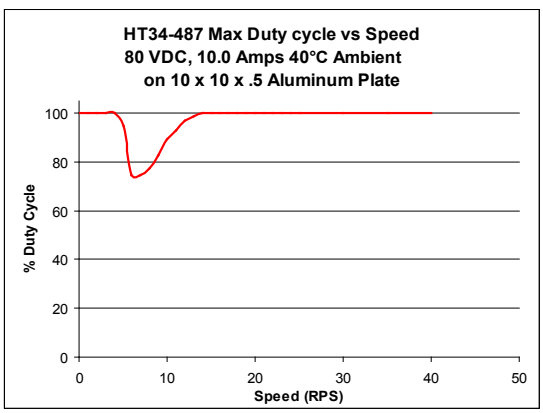

HT34-485 Max Duty cycle vs Speed
48 VDC, 10.0 Amps 40°C Ambient
on 10 x 10 x .5 Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50


HT34-485 Max Duty cycle vs Speed
80 VDC, 10.0 Amps 40°C Ambient
on 10 x 10 x .5 Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50


HT34-486 Max Duty Cycle vs Speed
48 VDC, 10.0 Amps 40°C Ambient
on 10 x 10 x .5 Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50


HT34-486 Max Duty cycle vs Speed
80 VDC, 10.0 Amps 40°C Ambient
on 10 x 10 x .5 Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50


HT34-487 Max Duty Cycle vs Speed
48 VDC, 10.0 Amps 40°C Ambient
on 10 x 10 x .5 Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50

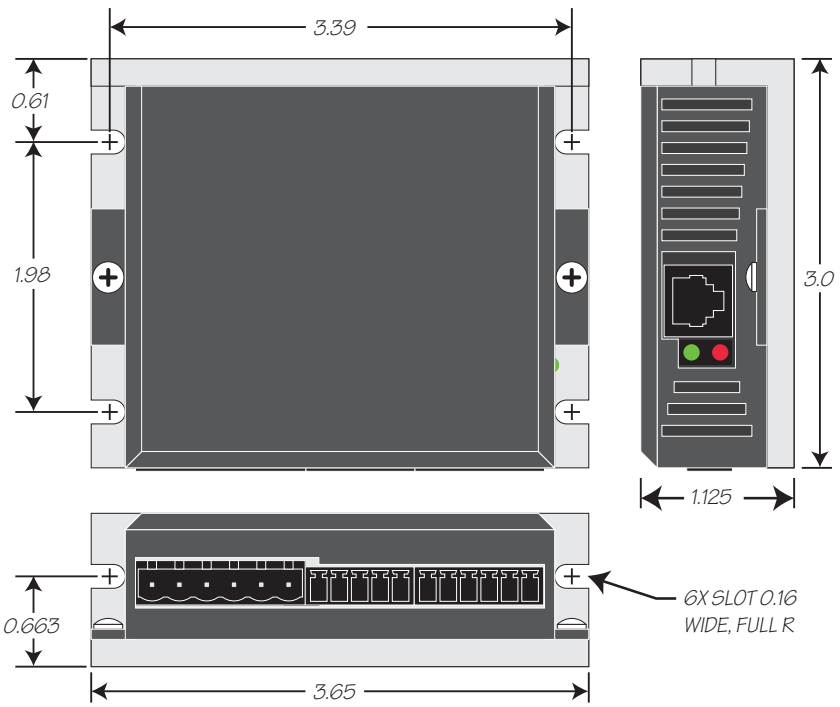

HT34-487 Max Duty cycle vs Speed
80 VDC, 10.0 Amps 40°C Ambient
on 10 x 10 x .5 Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50

## 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 ST drives near each other, maintain at least one half inch of space between drives.**

## Mechanical Outline



# Technical Specifications

## POWER AMPLIFIER: **All Models**

| | |
|---|---|
| AMPLIFIER TYPE | Dual H-Bridge, 4 Quadrant |
| CURRENT CONTROL | 4 state PWM at 20 Khz |
| OUTPUT CURRENT | **ST5 Series** 0.1 — 5.0 amps/phase in 0.01 amp increments<br>**ST10 Series** 0.1 — 10.0 amps/phase in 0.01 amp increments |
| POWER SUPPLY | **ST5 Series** External 24 - 48 VDCPower Supply Required<br>**ST10 Series** External 24 - 80 VDC Power Supply Required |
| INPUT VOLTAGE RANGE | **ST5 Series** 18 - 53 VDC<br>**ST10 Series** 18 - 88 VDC |
| PROTECTION | Over-Voltage, Under-voltage, Over-Temp, Motor/wiring shorts (Phase-to-Phase, Phase-to-Ground). |
| IDLE CURRENT REDUCTION | Reduction range of "0 – 90%" of "Running Current" after delay selectable in milliseconds. |
| AMBIENT TEMPERATURE | 0 to 55°C (32 - 158°F) (ST10 must be mounted to suitable heatsink) |
| HUMIDITY | 90% non-condensing. |

## CONTROLLER: **All Models**

| | |
|---|---|
| MICROSTEP RESOLUTION | Software selectable from 200 to 51200 steps/rev in increments of 2 steps/rev. |
| ANTI-RESONANCE (Electronic Damping) | Raises the system damping ratio to eliminate midrange instability and allow stable operation throughout the speed range and improves settling time. |
| TORQUE RIPPLE SMOOTHING | Allows for fine adjustment of phase current waveform harmonic content to reduce low-speed torque ripple in the range 0.25 to 1.5 rps |
| AUTO SETUP | Measures motor parameters and configures motor current control and anti-resonance gain settings |
| SELF TEST | Checks Internal & External Power supply voltages. Diagnoses open motor phases and motor resistance changes >40%. Detects encoder wiring and signal faults (differential encoder only). |
| MICROSTEP EMULATION | Performs high resolution stepping by synthesizing fine microsteps from coarse steps (Step & Direction Mode Only) . |
| COMMAND SIGNAL SMOOTHING | Software configurable filtering reduces jerk and excitation of extraneous system resonances (Step & Direction Mode Only). |

CONTROLLER: **S Models**

| | |
|---|---|
| NON-VOLATILE STORAGE | Configurations are saved in FLASH memory on-board the DSP. |
| MODE OF OPERATION | Step & Direction, CW/CCW, A/B Quadrature, Oscillator, Joystick, SCL, Hub. |
| STEP AND DIRECTION INPUTS | Optically Isolated, Differential, 5 Volt. Minimum pulse width = 250 ns. Maximum pulse frequency = 2 MHz<br>Function: Step & Direction, CW/CCW Step, A/B Quadrature, Run/Stop & Direction, Jog CW & CCW or CW & CCW Limits / Adjustable bandwidth digital noise rejection filter. |
| ENABLE INPUT | Optically Isolated, 5-12 Volt<br>Function: Motor Enable, Alarm Reset or Speed Select (Oscillator Mode). |
| OUTPUT | Optically Isolated, 24V, 10mA MAX.<br>Function: Fault, Motion, Tach. |
| ANALOG INPUT | 0 to 5VDC, 83k ohms input impedance |
| ANALOG INPUT RESOLUTION | 12 bits |
| COMMUNICATION INTERFACE | RS-232 |

## *Mating Connectors and Accessories*

### Mating Connectors

Motor/power supply: PCD P/N ELFP06210, included with drive.
Signal Connectors: 5 way = PCD P/N ELVP05100 , 6 way = PCD ELVP06100, included with drive.

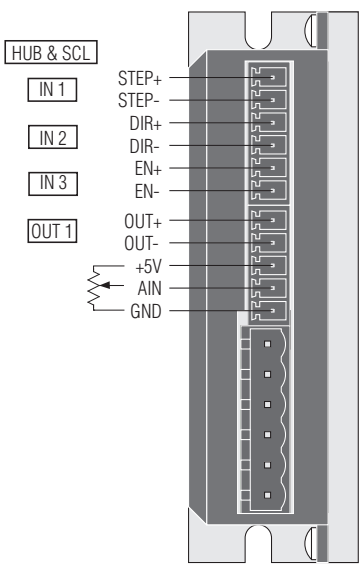
Regeneration Clamp:
Applied Motion Products RC050.

## *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.

| Code | Error |
|---|---|
| solid green | no alarm, motor disabled |
| flashing green | no alarm, motor enabled |
| 1 red, 2 green | move attempted while drive disabled |
| 2 red, 1 green | ccw limit |
| 2 red, 2 green | cw limit |
| 3 red, 1 green | drive overheating |
| 3 red, 2 green | internal voltage out of range - prior to 1.01R |
| 4 red, 1 green | power supply overvoltage |
| 4 red, 2 green | power supply undervoltage |
| 5 red, 1 green | over current / short circuit |
| 5 red, 2 green | motor resistance out of range |
| 6 red, 1 green | open motor winding |
| 7 red, 1 green | serial communication error |
| 7 red, 2 green | flash memory error |
| 8 red, 1 green | internal voltage out of range - after 1.01R |

## *Connector Diagrams*





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