STF-EC

Stepper Motor Drive
Hardware Manual

STF03-EC STF05-EC

EtherCAT®
Conformance tested

Applied Motion Products

920-0139 Rev. A
6/5/2018

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The Information in this manual applies to the following products:

Model	Communication
STF03-EC	EtherCAT
STF06-EC	EtherCAT
STF06-EC	EtherCAT
STF06-EC	EtherCAT

1 Introduction

Thank you for selecting the Applied Motion Products STF series stepper drive. The STF series are high performance fieldbus control stepper drive which also integrates with built-in motion controller. The STF EtherCAT drive can operate as a standard EtherCAT slave using CANopen over EtherCAT (CoE).

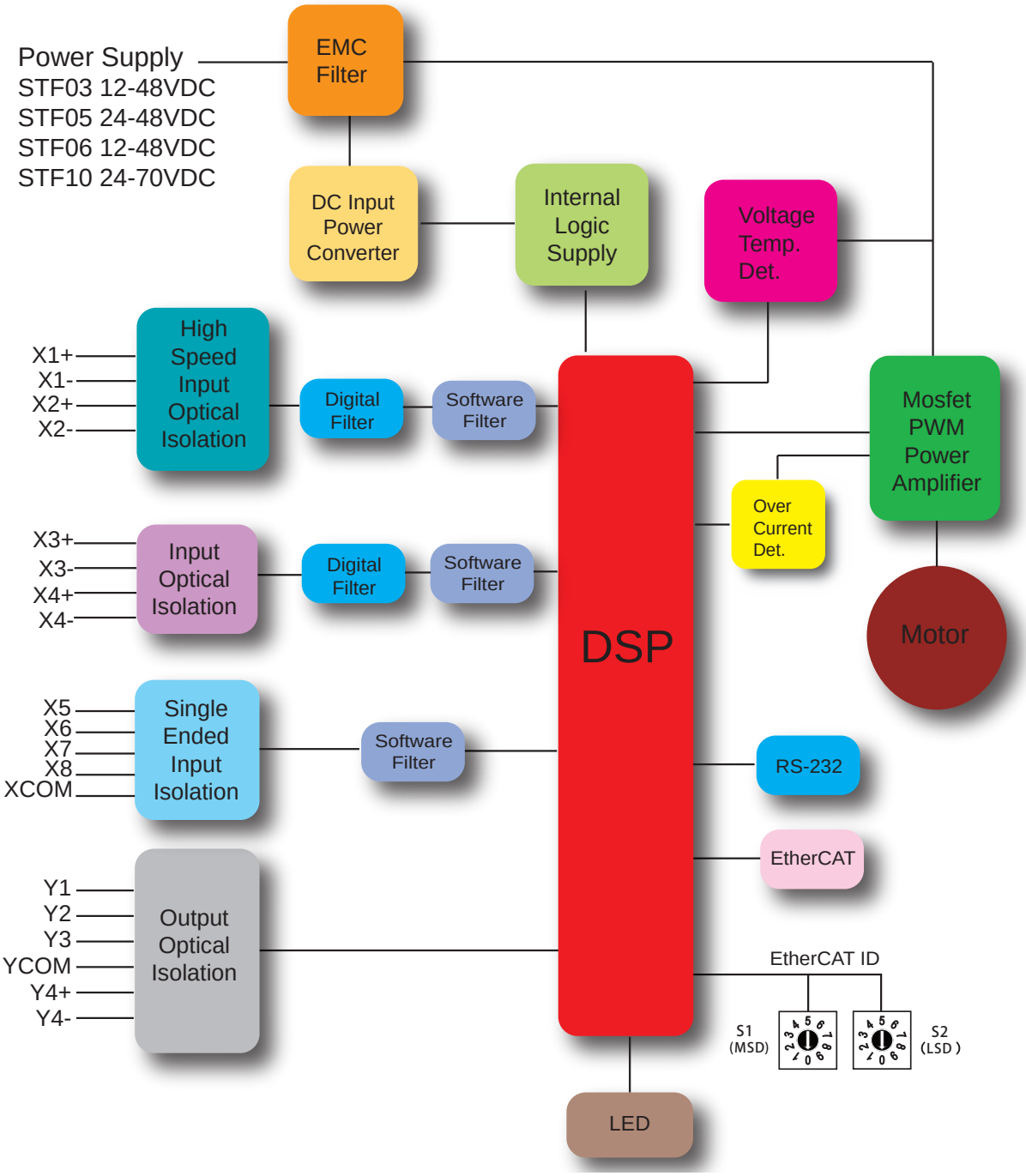
EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1.1 Features

- Programmable, filed bus controlled stepper motor drive in compact package
- Operating DC voltage range:
  - STF03 12-48V
  - STF05 24-48V
  - STF06 12-48V
  - STF10 24-70V
- Based on the widely used 100BASE-TX cabling system and with a baud rate of 100Mbps full-duplex, EtherCAT enables high speed and highly reliable communication
- CANopen over EtherCAT (CoE) with full support of CiA402.
- Supported modes: Profile Position, Profile Velocity, Cyclic Synchronous Position and Homing; as well as Applied Motion Products Q program mode
- Dual port RJ45 connector for EtherCAT communication
- RS-232 port for drive configuration
- STF03 output current: max 3A/phase (peak-of-sine)
- STF05 output current: max 5A/phase (peak-of-sine)
- STF06 output current: max 6A/phase (peak-of-sine)
- STF10 output current: max 10A/phase (peak-of-sine)
- I/O
  - 8 optically isolated digital inputs, 5-24VDC high level voltage
  - 4 optically isolated digital outputs, max 30V/100mA sink or source current

1.2 Block Diagram

STF EtherCAT Block Diagram



1.3 Safety Instructions

Only qualified personnel should transport, assemble, install, operate, or maintain this equipment. Properly qualified personnel are persons who are familiar with the transport, assembly, installation, operation, and maintenance of motors, and who meet the appropriate qualifications for their jobs.

To minimize the risk of potential safety problems, all applicable local and national codes regulating the installation and operation of equipment should be followed. These codes may vary from area to area and it is the responsibility of the operating personnel to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

- Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. Applied Motion Products does not guarantee the products described in this publication are suitable for a particular application, nor do they assume any responsibility for product design, installation, or operation.
- Read all available documentation before assembly and operation. Incorrect handling of the products referenced in this manual can result in injury and damage to persons and machinery. All technical information concerning the installation requirements must be strictly adhered to.
- It is vital to ensure that all system components are connected to earth ground. Electrical safety is impossible without a low-resistance earth connection.
- This product contains electrostatically sensitive components that can be damaged by incorrect handling. Follow qualified anti-static procedures before touching the product.
- During operation keep all covers and cabinet doors shut to avoid any hazards that could possibly cause severe damage to the product or personal health.
- During operation, the product may have components that are live or have hot surfaces.
- Never plug in or unplug the Integrated Motor while the system is live. The possibility of electric arcing can cause damage.

Be alert to the potential for personal injury. Follow recommended precautions and safe operating practices emphasized with alert symbols. Safety notices in this manual provide important information. Read and be familiar with these instructions before attempting installation, operation, or maintenance. The purpose of this section is to alert users to the possible safety hazards associated with this equipment and the precautions necessary to reduce the risk of personal injury and damage to equipment. Failure to observe these precautions could result in serious bodily injury, damage to the equipment, or operational difficulty.

2 Getting Started

The following items are needed:

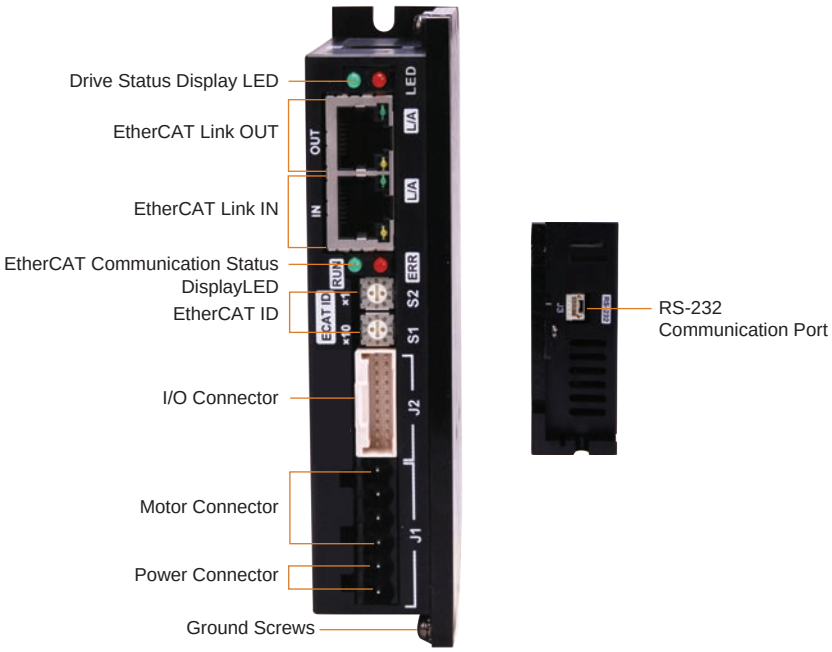
- An appropriate power supply, see the section below entitled“Choose a Power Supply”for help in choosing the right one.
- A compatible stepper motor, please see the section below entitled “Recommended Motor”
- A small flat blade screwdriver for tightening the connectors screw(included)
- A PC running Microsoft Windows XP / Vista / Windows 7 / Windows 8 / Windows 10(32-bit or 64-bit)operation system
- A CAT5 cable for EtherCAT daisy chain connection (included)
- A RS-232 cable for configuration (included)
- Optional I/O cable 3004-348 (Sold seperately)

Install STF Configurator software (Available from Applied Motion Products website)

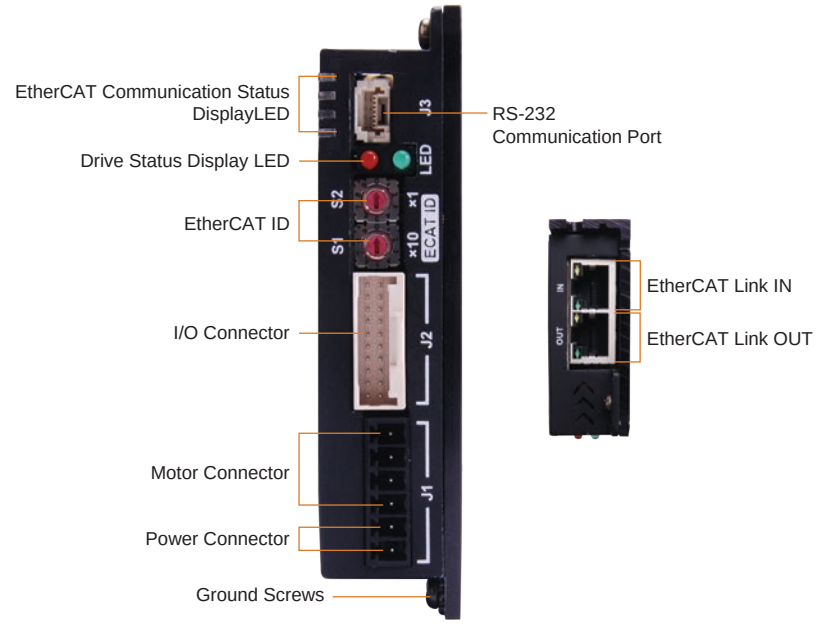
2.1 Installing Software

- Download the STF Configurator Software from the Applied Motion Products website and install it.
- Launch the software by clicking Start...Programs...Applied Motion Products...STF Configurator
- Connect the drive to the RS-232 port of the PC . Select right COM port in the software. See Section “Choosing the Right COM Port”
- If the PC does not have an RS-232 serial port, a USB to RS-232 Serial, Converter will be needed. we recommend using a USB-serial adapter, model 3004-235 from Applied Motion Products.
- Connect the drive to the power supply.
- Connect the motor to the drive.
- Apply power to the drive.
- The software will recognize the drive & display the model & firmware version.

The connectors and other points of interest are illustrated below:



Model
STF05-EC
STF10-EC



Model
STF03-EC
STF06-EC

2.2 Connect the drive to the PC with the RS-232 communication Cable

Connector J3 is an RS-232 interface for connecting the drive to PC. Use the STF Configurator software to configure drive parameters, monitor the status of the drive, and perform motor motion test.

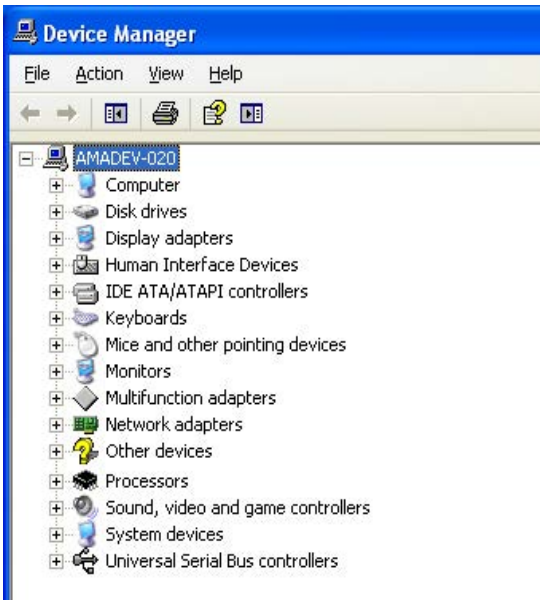
STF05/10-EC

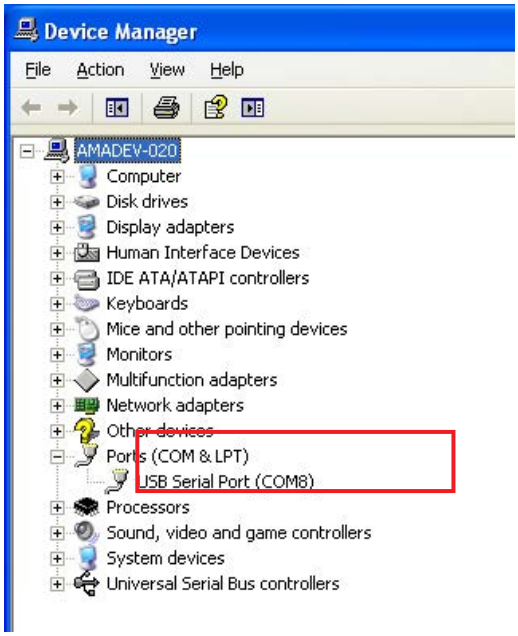
STF03/06-EC

2.3 Choosing the Right COM Port

Open the “Device Manager” on the PC. There may or may not be a “Ports” selection. Connect the RS-232 communication cable to the PC. The connected COM port should then be displayed. Choose this new COM(n) port in the STF Configurator software.

If the PC does not have an RS-232 serial port, a USB to RS-232 Serial, Converter will be needed. we recommend using a USB-serial adapter, model 3004-235 from Applied Motion Products.



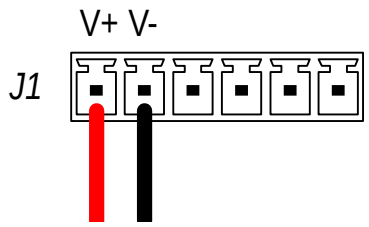


2.4 Connecting the Power Supply

- Connect power supply "+" terminal to the drive terminal labeled "V+".
- Connect power supply "-" terminal to the drive terminal labeled "V-".
- STF03 accepts DC voltage range from 12 – 48VDC
- STF05 accepts DC voltage range from 24 – 48VDC
- STF06 accepts DC voltage range from 12 – 48VDC
- STF10 accepts DC voltage range from 24 – 70VDC

Warning: DO NOT reverse the wires

NOTE: DO NOT apply power until all connections to the drive have been made



Power Connector

Ensure a proper earth ground connection by using the screw on the left side of the chassis.

Please read "choosing a power supply" for more details.

2.5 Choosing A Power Supply

The main considerations when choosing a power supply are the voltage and current requirements of the application.

2.5.1 Voltage

The STF drive and motor is designed to give optimum performance between 24~48 Volts DC. Choosing the voltage depends on the performance needed and diver/motor heating that acceptable and/or does not cause a drive over-temperature. Higher voltage will give higher speed performance,but will cause the drive to produce higher temperatures. Using power supplies with voltage outputs that are near the drive maximum may significantly reduce the operational duty- cycle.

STF03/06

The STF03/06 drive extended range of operation voltage can be as low as 11VDC minimum to as high as 53VDC maximum. When operation below 11VDC, the STF03/06 series will work unstable. The supply input cannot go blow 11VDC for reliable operation, otherwise under voltage alarm will be triggered. STF03/06 drive will stop working when this alarm is triggered.

If a regulated power supply is used, and that is near the driver maximum voltage of 53VDC ,a voltage clamp may be required to prevent the voltage over 53VDC which will occurs a overvoltage fault. When using an unregulated power supply, make sure the no-load voltage of the supply does not exceed the maximum input voltage 53VDC.

STF05/10

The STF05/10 drive extended range of operation voltage can be as low as 18VDC minimum to as high as 75VDC maximum for STF10 and 53VDC maximum for STF05. When operation below 18VDC, the STF05/10 series will work unstable. The supply input cannot go blow 18VDC for reliable operation, otherwise under voltage alarm will be triggered. STF05/10 drive will stop working when this alarm is triggered.

For STF10 drives, If a regulated power supply is used, and that is near the driver maximum voltage of 75VDC, a voltage clamp may be required to prevent the voltage over 75VDC which will occurs a overvoltage fault. When using an unregulated power supply, make sure the no-load voltage of the supply does not exceed the maximum input voltage 75VDC.

For STF05 drives, If a regulated power supply is used, and that is near the driver maximum voltage of 53VDC ,a voltage clamp may be required to prevent the voltage over 53VDC which will occurs a overvoltage fault. When using an unregulated power supply, make sure the no-load voltage of the supply does not exceed the maximum input voltage 53VDC.

2.5.2 Current

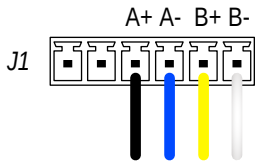
The maximum supply current you could ever need is the sum of the two phase currents. However, you will generally need a lot less than that, depending on the motor type, voltage, speed and load conditions. That's because the STF drives use switching amplifiers, converting a high voltage and low current 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.

2.6 Connecting the motor

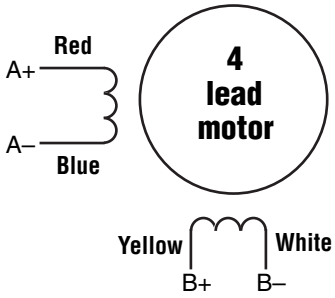
For Applied Motion Products'stepper motor, please connect black, green, red, blue wires to drive's A+, A-, B+ and B- correspondingly.



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

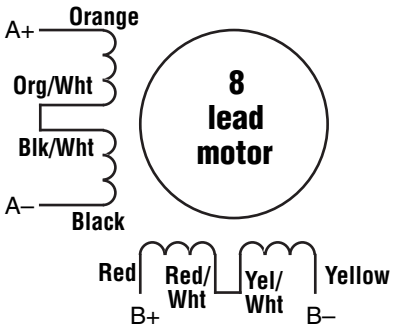
If using a non-Applied Motion Products motor, please refer to your motor specs for wiring information. Do not connect it until you have configured the drive for that motor.

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

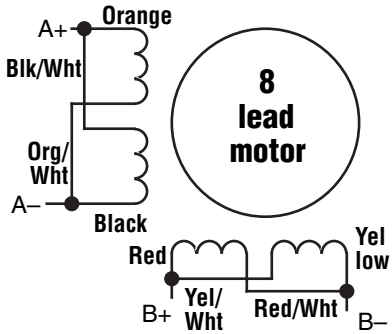


4 Leads

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

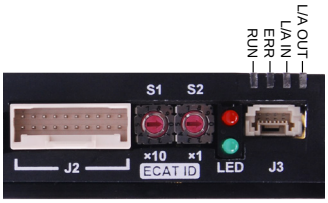
2.7 Connecting the EtherCAT

Dual RJ-45 connectors accept standard Ethernet cables and are categorized as 100BASE-TX (100 Mb/sec) ports. CAT5 or CAT5e (or higher) cables should be used. The IN port connects to a master, or to the OUT port of an upstream node. The OUT port connects to a downstream node. If the drive is the last node on a network, only the IN port is used. No terminator is required on the OUT port.

2.7.1 EtherCAT Status Indicator LEDs

The LEDs are used for indicating status of the EtherCAT. STF05/10-EC have two Link/Activity LEDs (one for each RJ-45 Ethernet connector) and two status LEDs (RUN and ERR). STF03/06-EC's four EtherCAT indicator LEDs are above the connector J3.

STF05/10-EC



STF03/06-EC

LED	Color	Status	Description
Link/Activity	Green	OFF	No Ethernet connection
		ON	Ethernet is connected
		Flickering	Activity on line
RUN	Green	OFF	Initialization state
		Blinking	Pre-operational state
		Single Flash	Safe-operational state
		ON	Operational state
ERR	Red	OFF	No error
		Blinking	General error
		Single Flash	Sync error
		Double Flash	Watch dog error

Notes:

- Flickering: Rapid flashing with a period of approximately 50ms (10Hz)
- Blinking: Flashing with equal on and off periods of 200ms (2.5Hz)
- Single Flash: Repeating on for 200ms and off for 1s

Double Flash: Two flashes with a period of 200ms followed by off for 1s

2.8 Setting the EtherCAT Node ID

STF-EC support three methods to set and read the EtherCAT Node ID(Alias ID):

2.8.1 Set by rotary switches

When the drive's ID is configured to be set by rotary switches in STF Configrator software, two decimal rotary switches on the drive are used to set a nonzero value (range 1~99) as the EtherCAT node Alias ID.

For example, if switch S1 is 1 and switch S2 is 2, then the drive's EtherCAT node Alias ID is set to 12.

ID value set by rotary switches takes effect when power of drive turns on.

2.8.2 Assigned by master controller

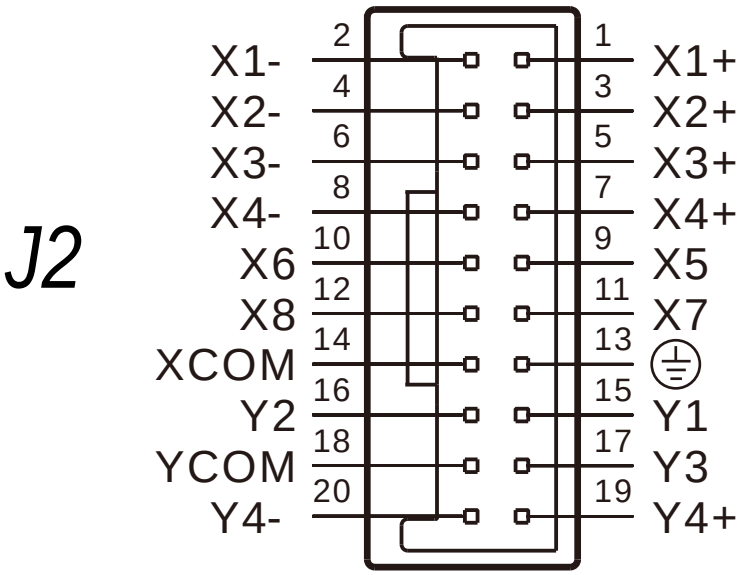
When the drive's ID is configured to be assigned by master controller in STF Configrator software, the master controller can set the EtherCAT node Alias ID to address 0004h of SII (Slave Information Interface) EEPROM. The drive can get this ID value from SII EEPROM address 0004h after power up.

2.8.3 Read rotary switches setting by AL Status Code

3 Inputs and Outputs

STF series drive inputs and outputs include:

- 8 optically isolated digital inputs, 5-24VDC for high level voltage
- 4 optically isolated digital outputs, maximum voltage 30V, maximum sinking or sourcing current 100mA



I/O Connector Diagram

3.1 Digital Inputs

3.1.1 X1, X2, X3 and X4 Digital Inputs

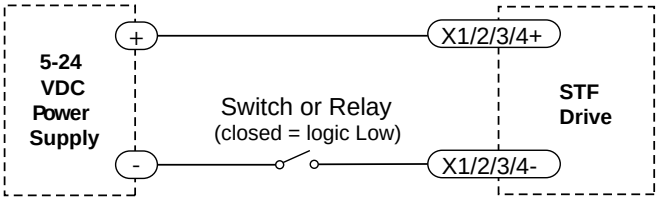
X1, X2: optically isolated, differential, 5-24VDC for high level voltage, minimum pulse width 250ns, maximum pulse frequency 2MHz

X3, X4: optically isolated, differential, 5-24VDC for high level voltage, minimum pulse width 100μs, maximum pulse frequency 5KHz

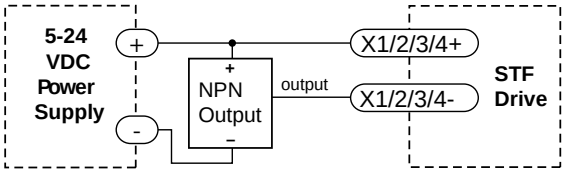
- X1 can be used as general purpose input.
- X2 can be used as general purpose input.
- X3 can be used as CW limit input or general purpose input.
- X4 can be used as CCW limit input or general purpose input.

Please use STF Configurator software for X1,X2,X3 and X4 function configuration.

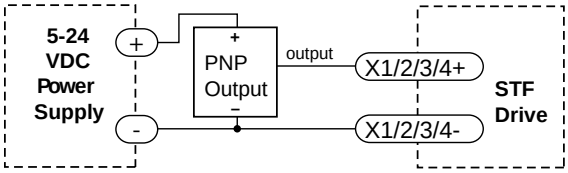
Following graphs shows some common connection methods for the inputs:



Connecting the inputs to a Switch or Relay



Connecting the inputs to a NPN type output



Connecting the inputs to a PNP type output

3.1.2 X5, X6, X7 and X8 Digital Inputs

X5, X6, X7 and X8: optically isolated, single-ended, 5-24VDC for high level voltage, minimum pulse width 100μs, maximum pulse frequency 5KHz

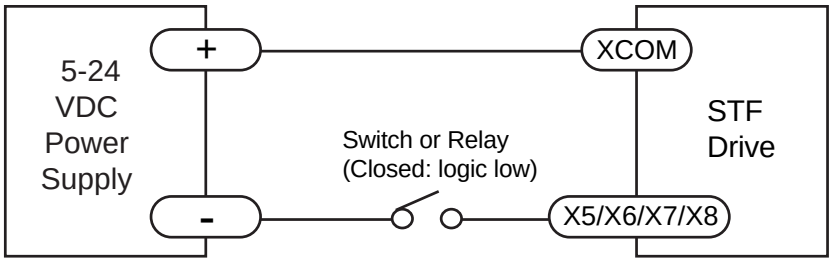
- X5 can be used as motor enable input or general purpose input.
- X6 can be used as alarm reset input or general purpose input.
- X7 can be used as general purpose input or touch Probe 1 trigger input.
- X8 can be used as general purpose input or touch Probe 2 trigger input.

Because the input is an optically isolated circuit, a 5-24V power supply is needed. For example, you can use the power supply of the PLC when you are using a PLC control system, but if you want to connect a relay or mechanical switch to the input , you must need a power supply.

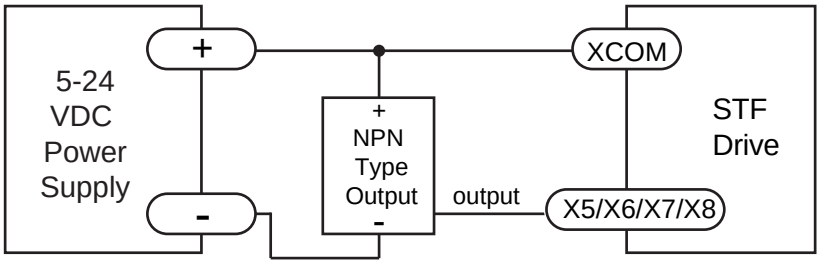
XCOM is an electronics term for a single-ended signal connection to a common voltage. If you are using a sourcing (PNP) input signals, you need to connect XCOM to the ground (power supply -), if you are using a sinking(NPN) input signals ,the XCOM need to be connected to the power supply +.

Use ***STF Configurator*** software for X5, X6, X7 and X8 function configuration.

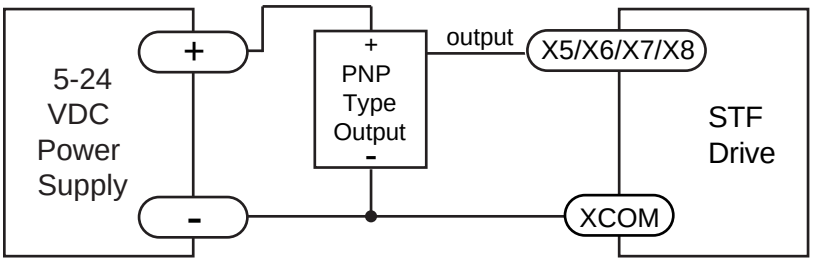
The following graphs show some common connection methods for the inputs:



Connecting to a switch or relay



Connecting an NPN type output to an input



Connecting a PNP type output to an input

3.2 Digital Outputs

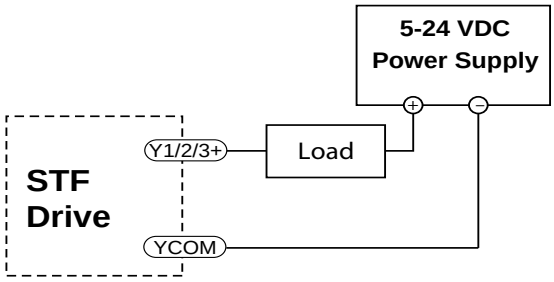
3.2.1 Y1, Y2, Y3 Digital Outputs

- Y1 can be used as alarm output, motion status output or general purpose output.
- Y2 can be used as brake output, motion status output or general purpose output.
- Y3 cab be used as tach-out, timing signal output(50pulse/rev), motion status output or general purpose output.

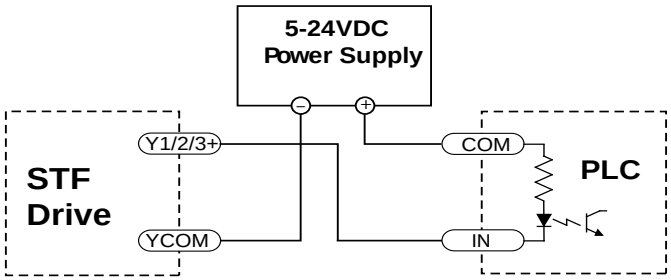
Please use ***STF Configurator*** software for Y1,Y2 and Y3 function configuration.

Following graphs shows some common connection methods for the outputs:

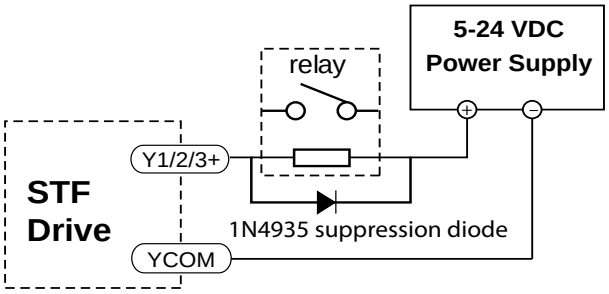
NOTE: Do not connect the outputs to more than 30VDC power supply. And the current of each output terminal must not exceed 100mA!



Connecting a sinking output



Connecting a sinking output with PLC's input



Driving a relay

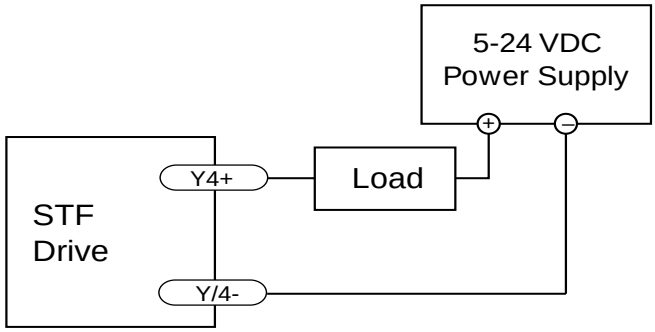
3.2.2 Y4 Digital Output

Y4 can be used as motion status output or general purpose output.

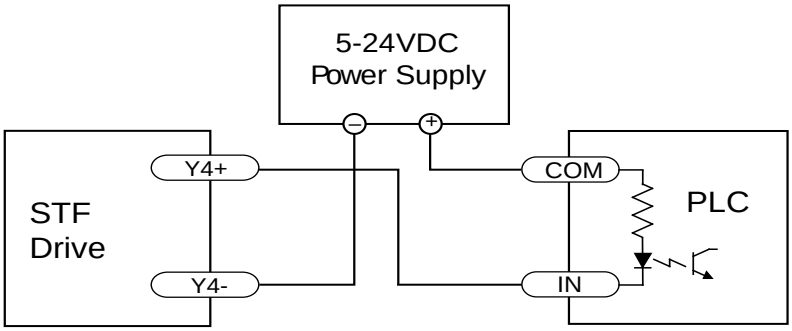
Please use ***STF Configurator*** software for Y4 function configuration.

Following graphs shows some common connection methods for the outputs:

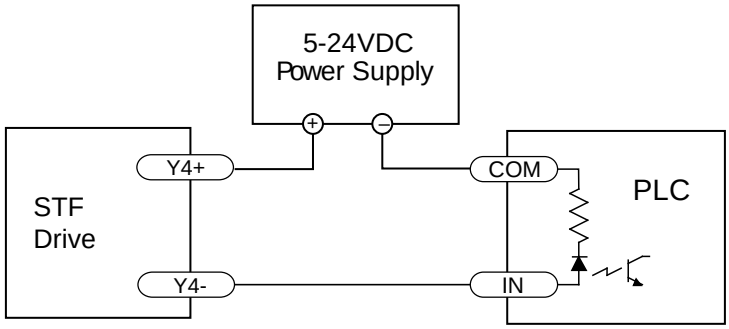
NOTE: Do not connect the outputs to more than 30VDC power supply. And the current of each output terminal must not exceed 100mA.



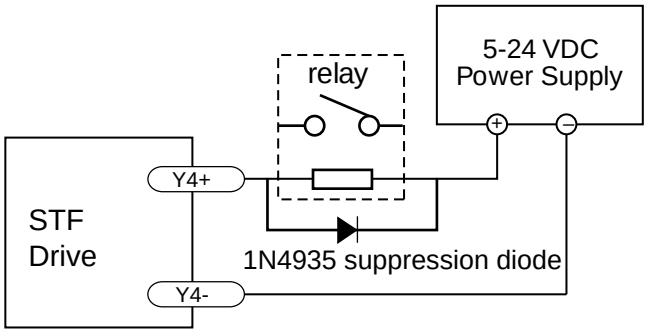
Connecting a sinking output



Connecting a sinking output to a PLC's input



Connecting a sourcing output to a PLC's input



Driving a relay

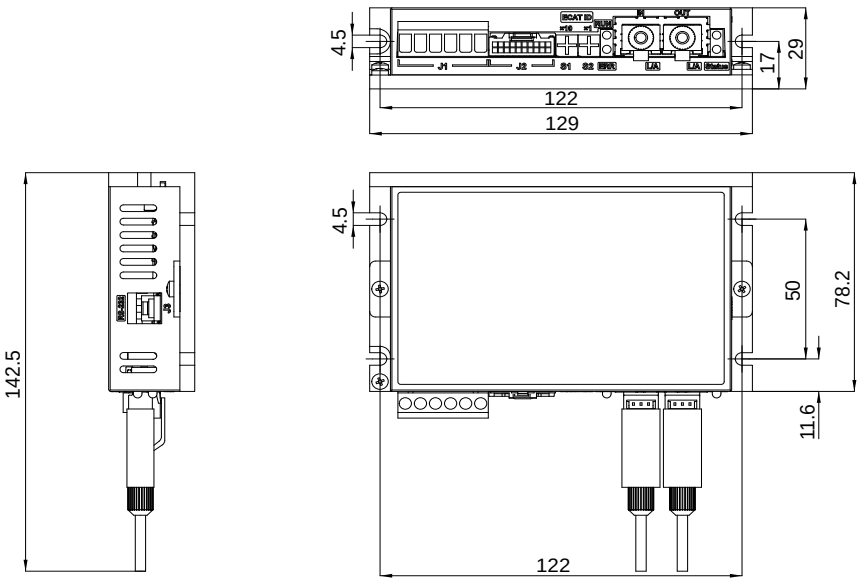
4 Mounting the Drive

Use the M3 or M4 screw to mount the STF series drive .The drive should be securely fastened to a smooth, flat metal surface the will help conduct heat away from the chassis. If this is not possible, forced airflow from a fan maybe required to prevent the drive from overheating.

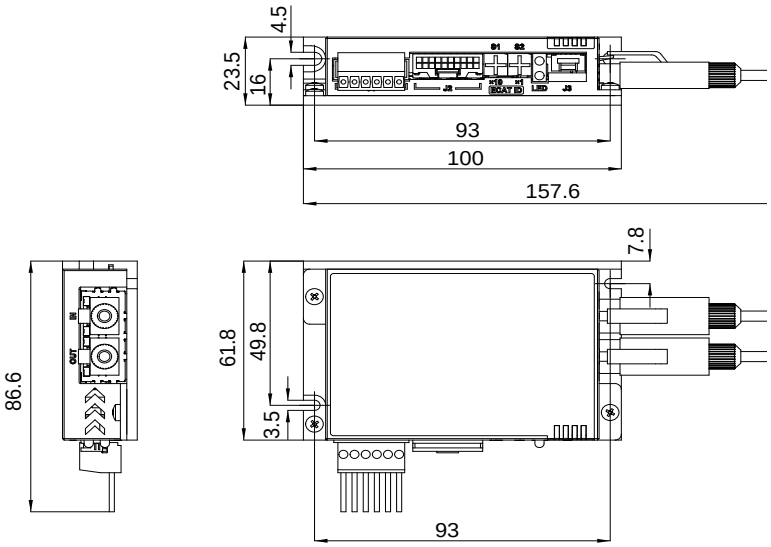
- Never use the drive in a place where there is no air flow or the surrounding air is more than 40°C.
- Never put the drive where it can get wet or where metal or other electrically conductive particle particles can get on the circuity.
- Always provide air flow around the drive. When mounting multiple STF drives near each other, maintain at least 2cm of space between drives.

5 Reference Materials

5.1 Drive Mechanical Outlines (unit mm)



Model
STF05-EC
STF10-EC



Model
STF03-EC
STF06-EC

5.2 Technical Specifications

Power Amplifier	
Amplifier Type	Dual H-Bridge, 4 Quadrant
Current Control	4 state PWM at 20 KHz
Output Current	STF03: 0.1 - 3.0A/phase (peak-of-sine) in 0.01 Amp increments
	STF05: 0.1 - 5.0A/phase (peak-of-sine) in 0.01 Amp increments
	STF06: 0.1 - 6.0A/phase (peak-of-sine) in 0.01 Amp increments
	STF10: 0.1 - 10.0A/phase (peak-of-sine) in 0.01 amp increments
Rated input voltage range	STF03: 12 - 48VDC
	STF05: 24 - 48VDC
	STF06: 12 - 48VDC
	STF10: 24 - 70VDC
Absolute maximum input voltage range	STF03: 10 - 53VDC
	STF05: 18 - 53VDC
	STF06: 10 - 53VDC
	STF10: 18 - 75VDC
Protection	Over voltage, under voltage, over temp, over current, open winding, communication cable disconnection
Idle Current Reduction	Reduction range of 0 - 90% of running current after a delay selectable in milliseconds
Controller	
Anti-Resonance	Raises the system-damping ratio to eliminate midrange instability and allow stable operation throughout the speed range of the motor
Torque Ripple Smoothing	Allows for fine adjustment of phase current waveform harmonic content to reduce low-speed torque ripple in the range of 0.25 to 1.5 rps
Auto Test & Auto Setup	Auto test and setup at power on (ie. motor resistance, and capacitance) to optimize your system performance.
Non-Volatile Storage	Configurations are saved in FLASH memory on-board the DSP
Operation Mode	EtherCAT (CoE) with full support of CiA402, Support PP, PV, CSP&HM mode,and Applied Motion Products own Q mode
Digital Input	8 digital inputs
	X1, X2: Optically isolated, differential, 5-24VDC for high level voltage, minimum pulse width = 250ns, maximum pulse frequency = 2MHz
	X3, X4: Optically isolated, differential, 5-24VDC for high level voltage, minimum pulse width = 100µs, maximum pulse frequency = 5KHz
	X5 ~ X8: Optically isolated, single-ended, 5-24VDC for high level voltage, minimum pulse width = 100µs, maximum pulse frequency = 5KHz
Digital Output	4 digital outputs Y1 ~ Y4: Optically isolated, maximum voltage 30V, maximum sinking or sourcing current 100mA
Communication Port	Dual port Ethernet(RJ45 connector)and RS-232(RS-232 serial port for configuration)
Physical	
Ambient Temperature	0-40°C (32-104°F)(when mounted to a suitable heat sink)
Humidity	90% non-condensing

5.3 Recommended Motor

Part Number	Holding Torque		Current Setting	Resistance	Inductance	Inertia
Number	oz-in	kg-cm	amps	ohms	mH	g-cm2
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
HT34-486 #	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

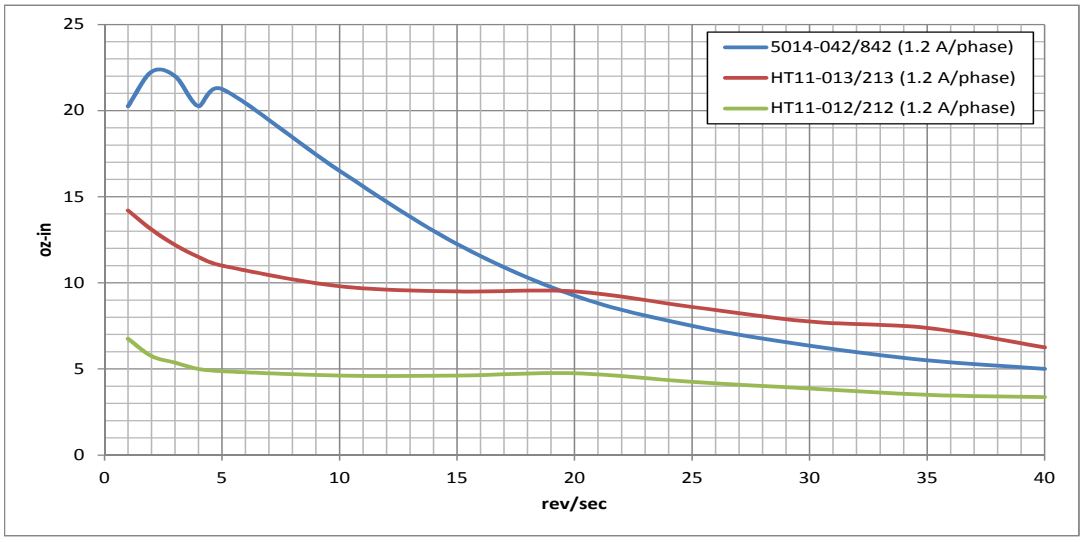
Note: The “Drive Current Setting” shown here differs from the rated current of each motor because the rated current is RMS and the drive current setting is peak sine. If you are using a motor not listed here, for best results set the drive current at the motor’s rated current x 1.2.

# Indicates values are with motor connected in Parallel.

5.4 Torque Speed curves

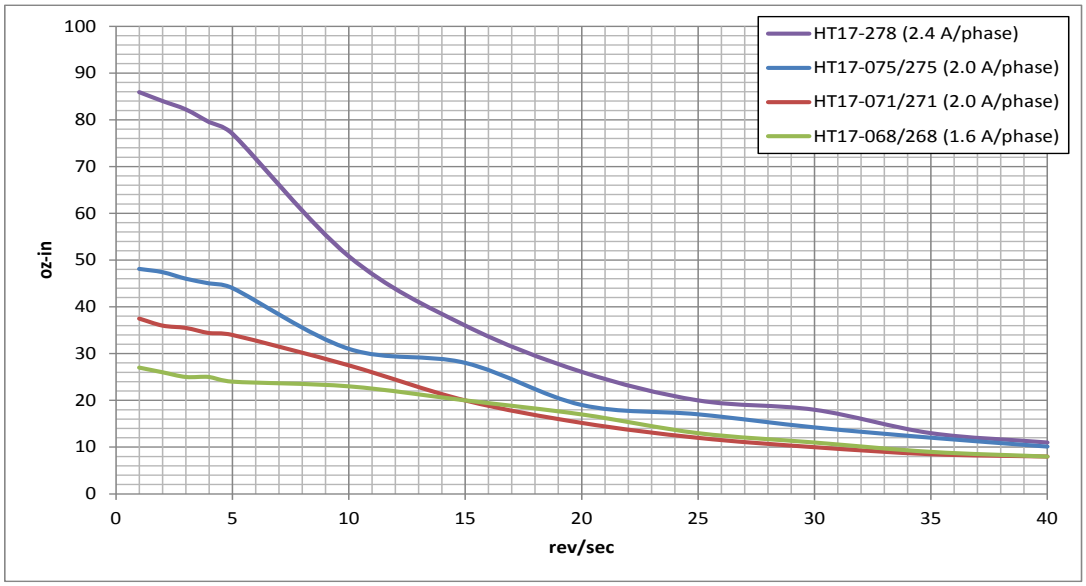
HT11-012/212, HT11-013/213, 5014-042/842

24 VDC power supply, 20000 steps/rev



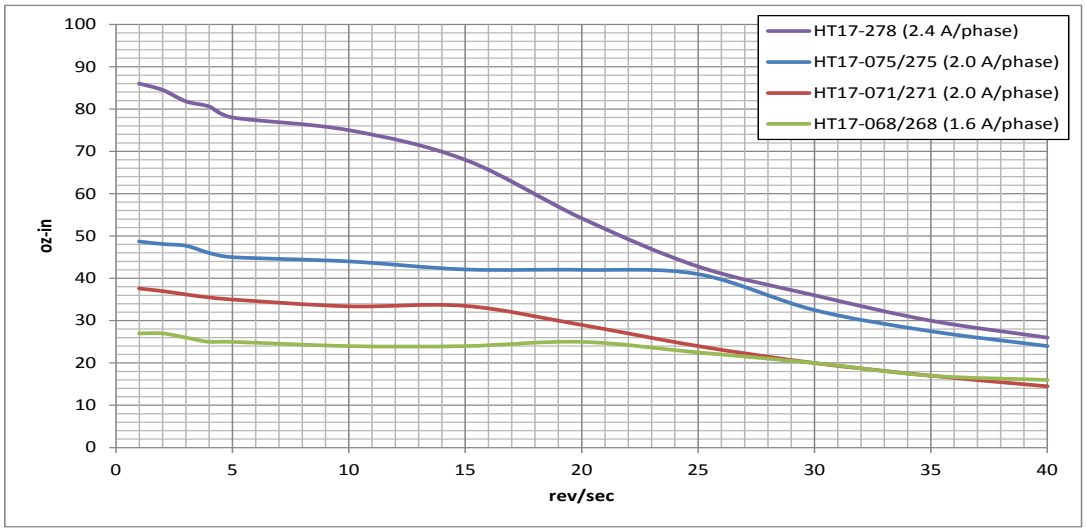
HT17

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



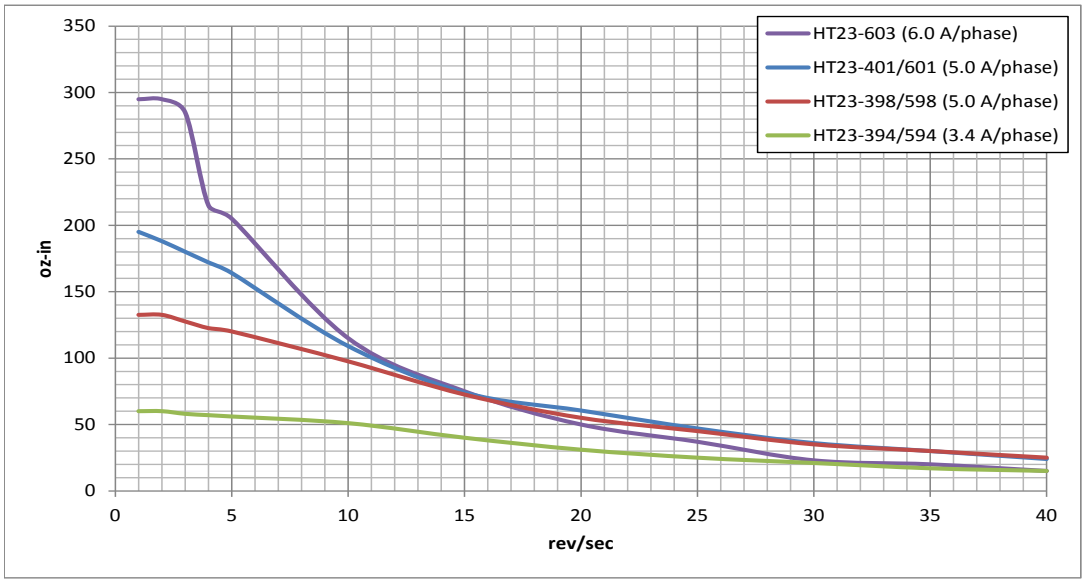
HT17

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



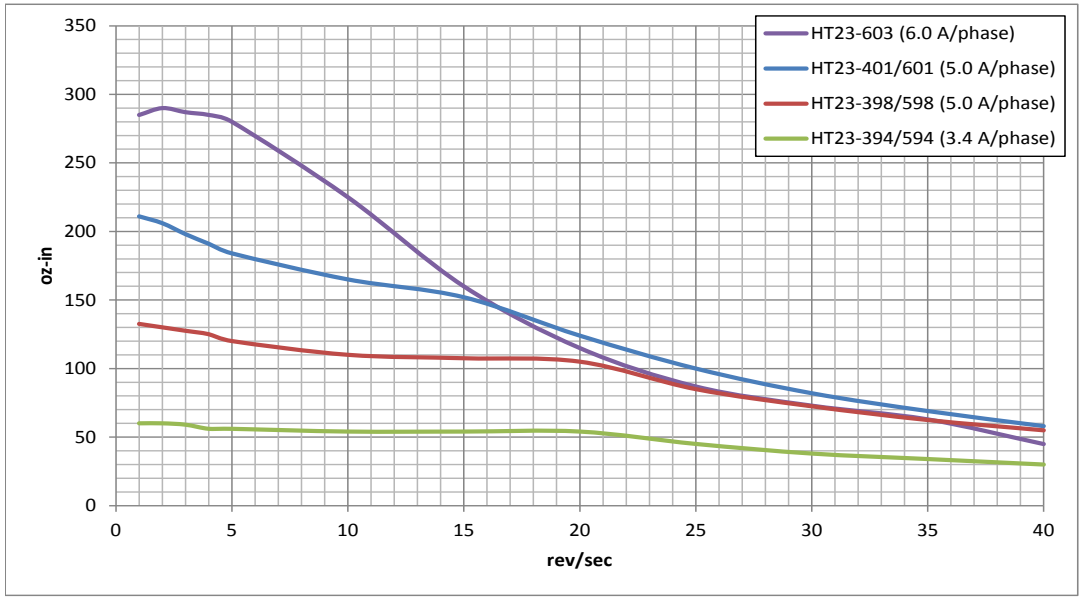
HT23

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



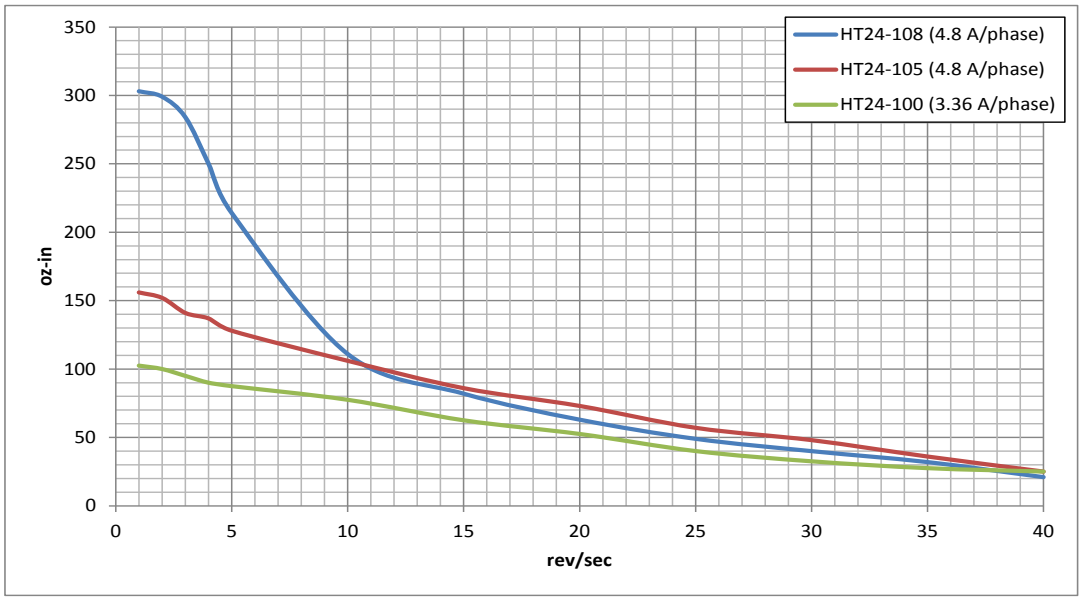
HT23

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



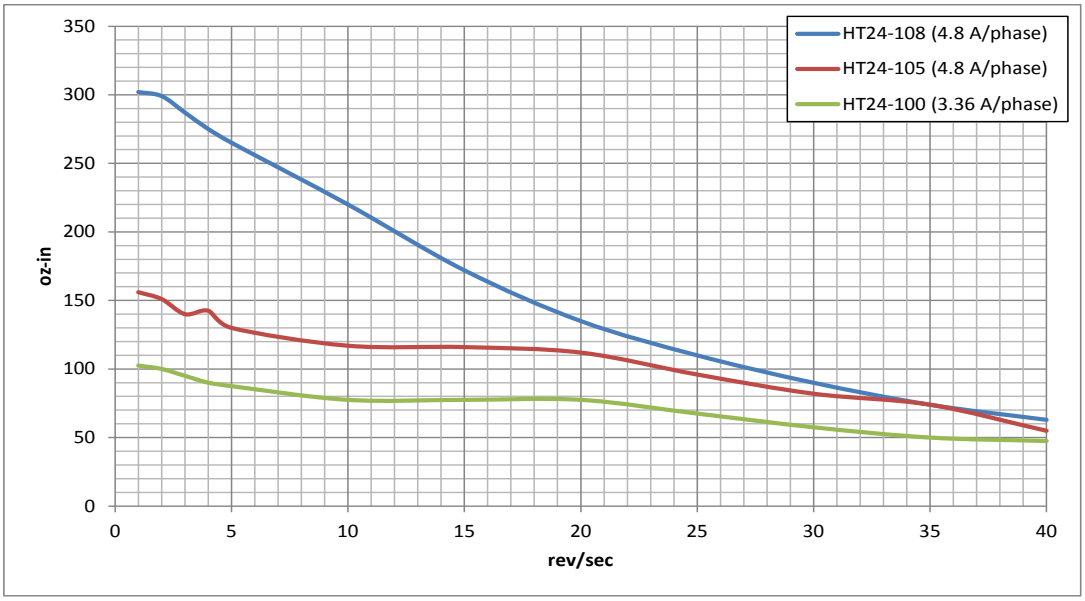
HT24

24 VDC power supply, 20000 steps/rev



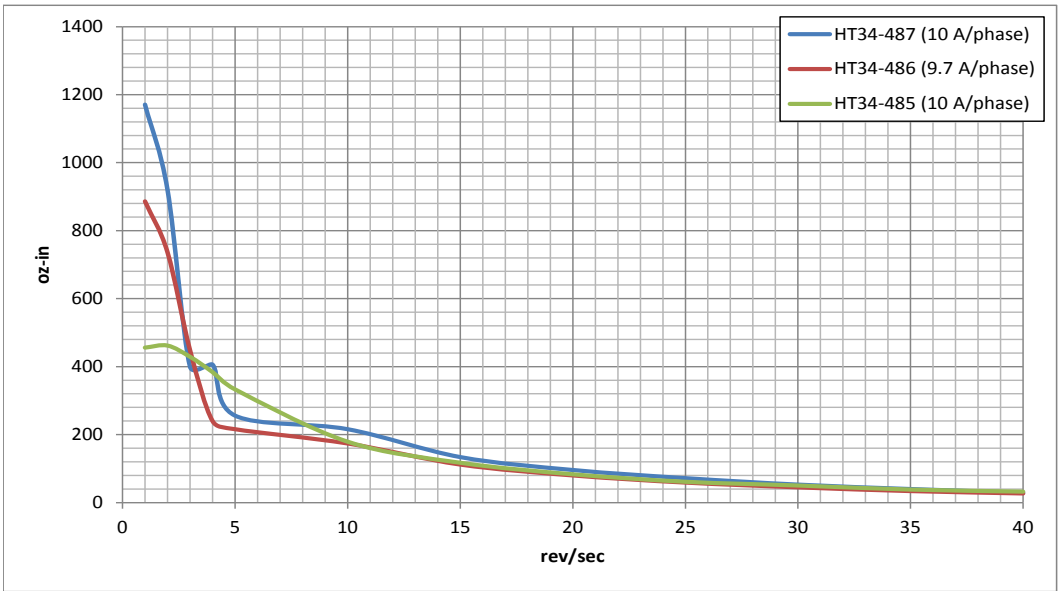
HT24

48 VDC power supply, 20000 steps/rev



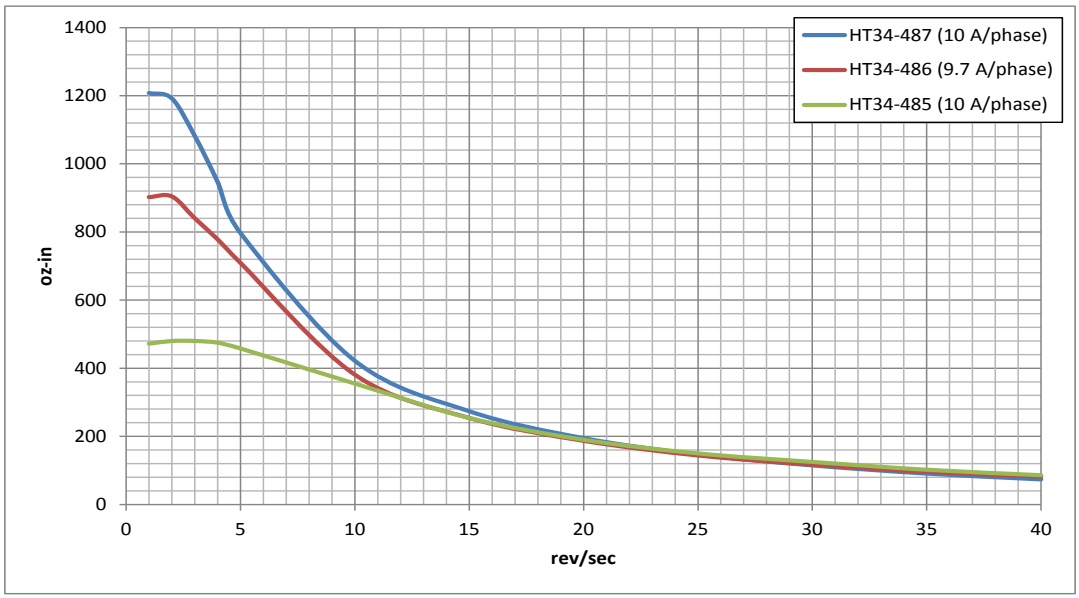
HT34-485/486/487

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



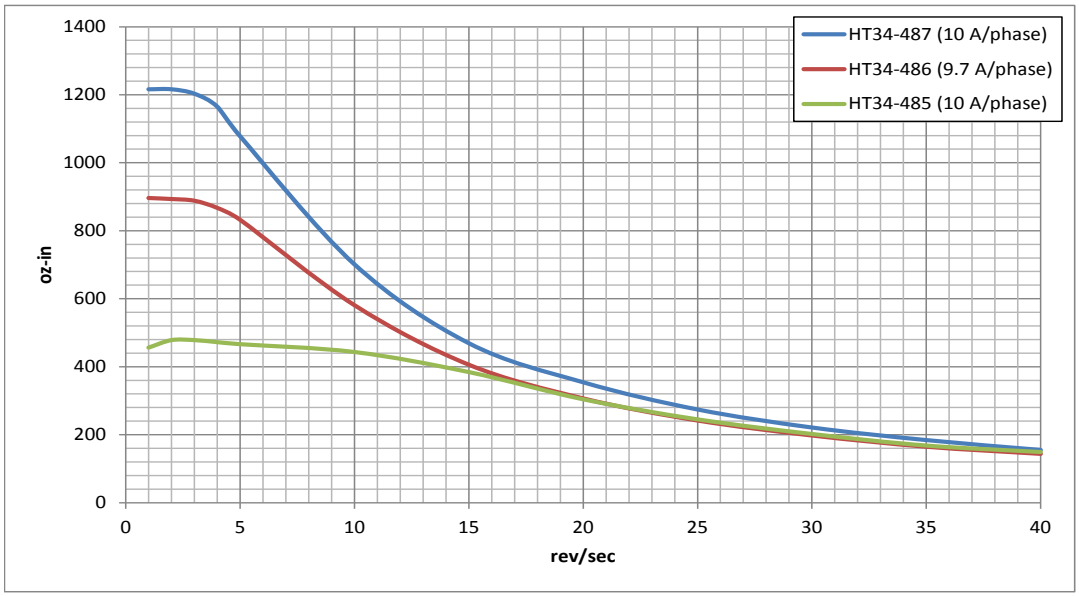
HT34-485/486/487

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



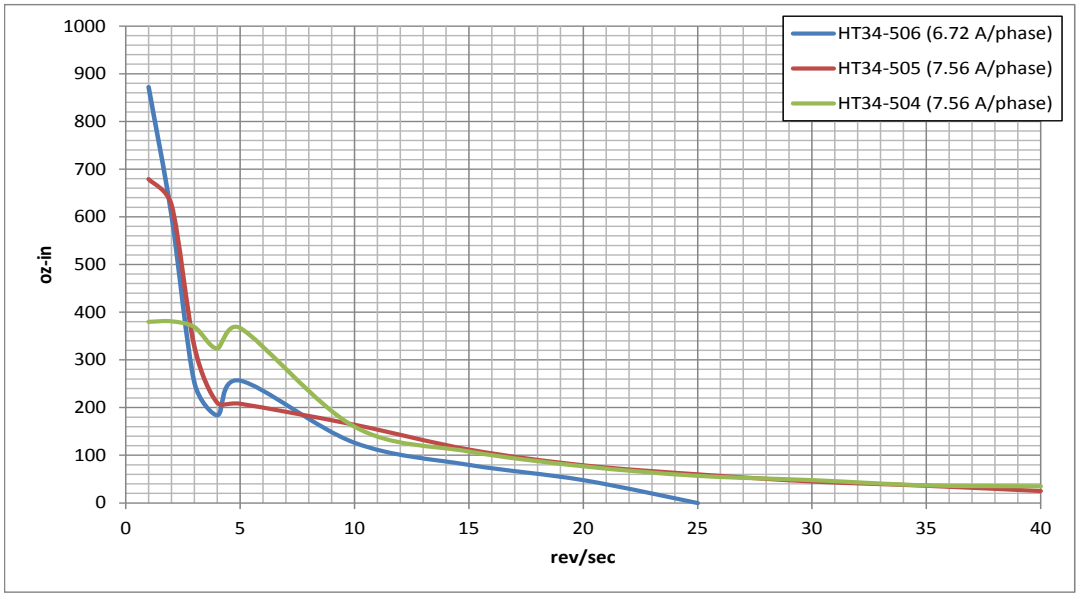
HT34-485/486/487

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



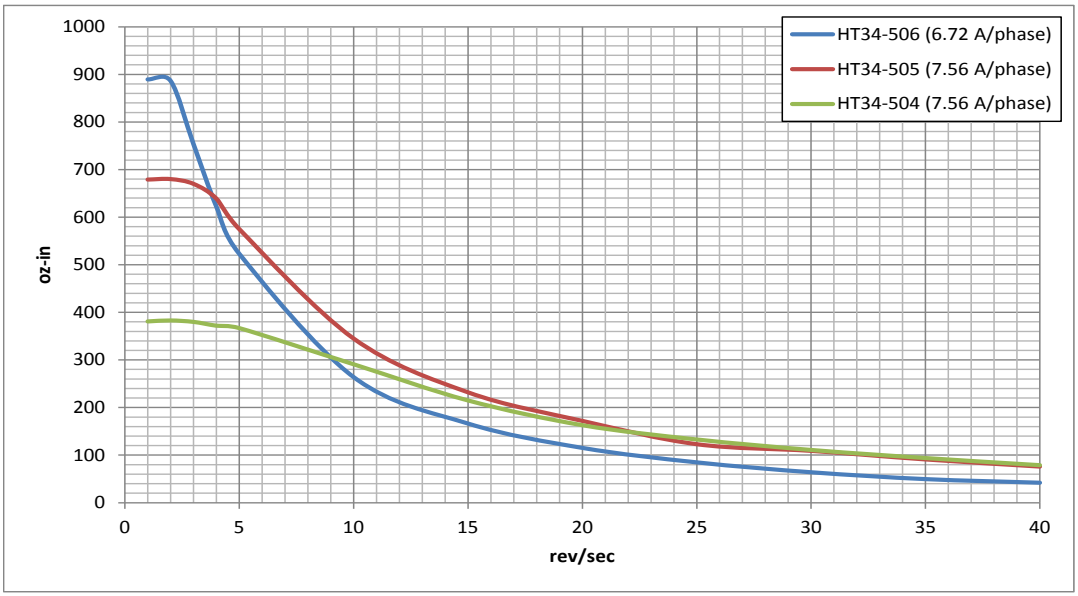
HT34-504/505/506

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



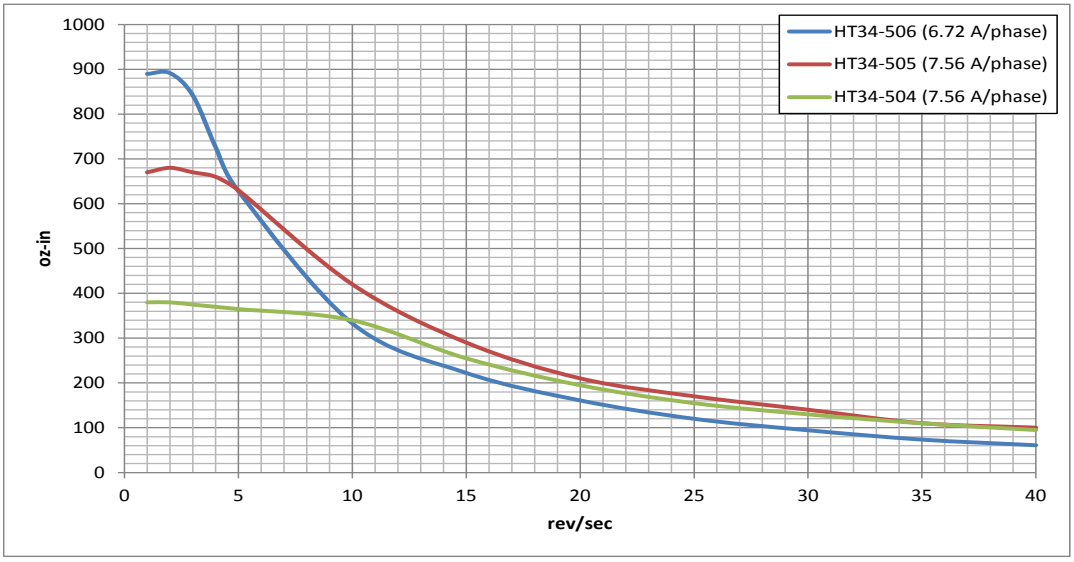
HT34-504/505/506

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



HT34-504/505/506

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



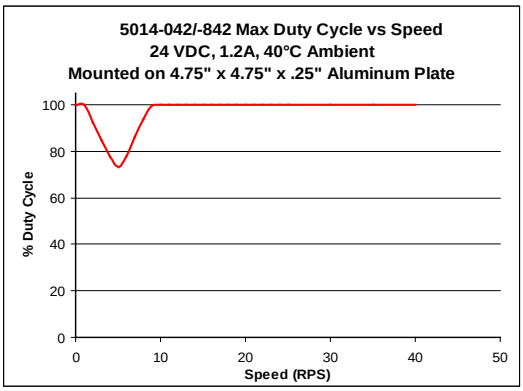
5.5 Motor Heating

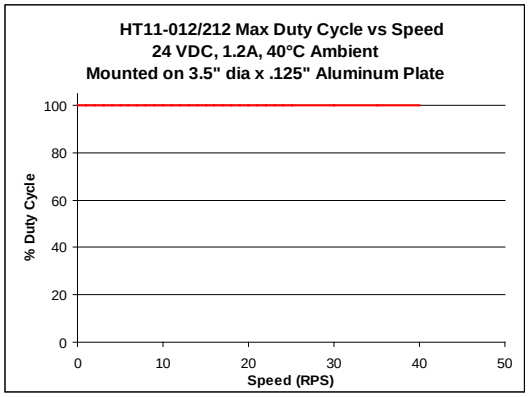
Step motors convert electrical power from the driver into mechanical power to move a load. Because step motors are not perfectly efficient, some of the electrical power turns into heat on its way through the motor. This heating is not so much dependent on the load being driven but rather the motor speed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

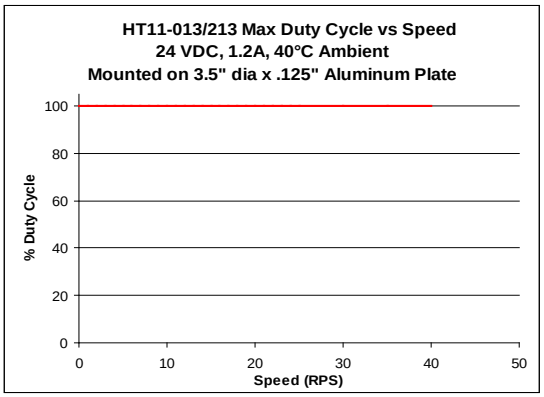
We have characterized the recommended motors in our lab and provided curves showing the maximum duty cycle versus speed for each motor at commonly used power supply voltages. Please refer to these curves when planning your application.

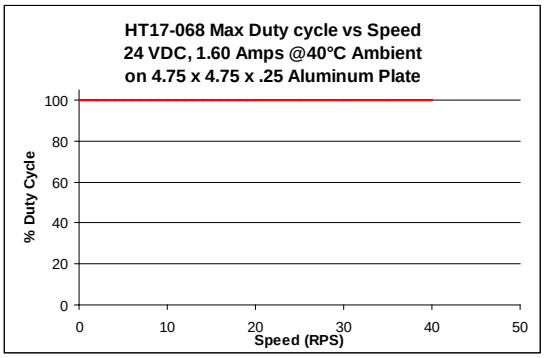
Please also keep in mind that a step motor typically reaches maximum temperature after 30 to 45 minutes of operation. If you run the motor for one minute then let it sit idle for one minute, that is a 50% duty cycle. Five minutes on and five minutes off is also 50% duty. However, one hour on and one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

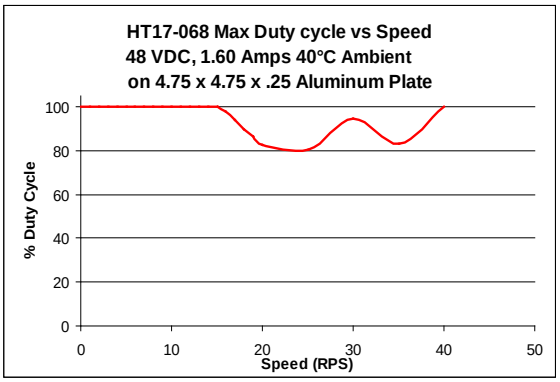
The actual temperature of the motor depends on how much heat is conducted, convected or radiated out of it. Our measurements were made in a 40°C (104°F) environment with the motor mounted to an aluminum plate sized to provide a surface area consistent with the motor power dissipation. Your results may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

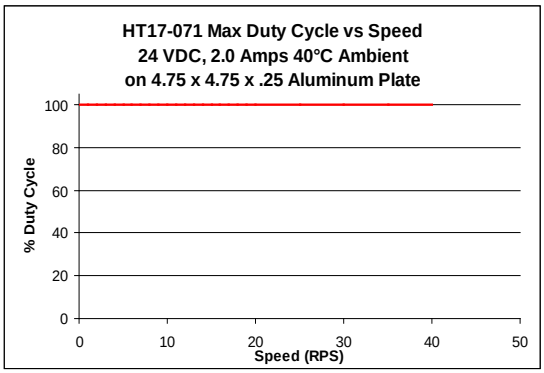


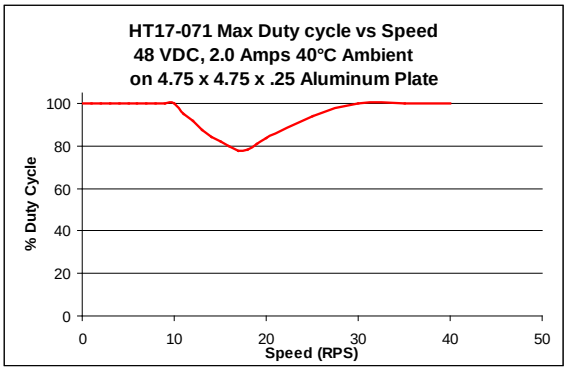


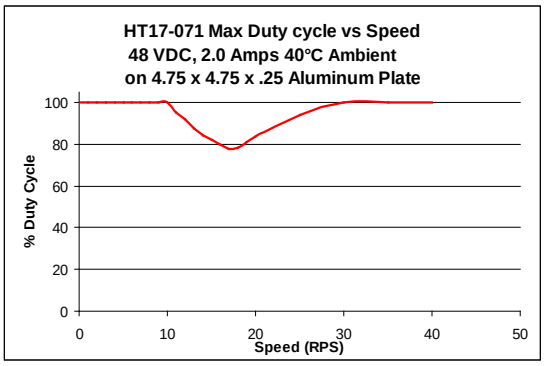

HT11-013/213 Max Duty Cycle vs Speed
24 VDC, 1.2A, 40°C Ambient
Mounted on 3.5" dia x .125" Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50

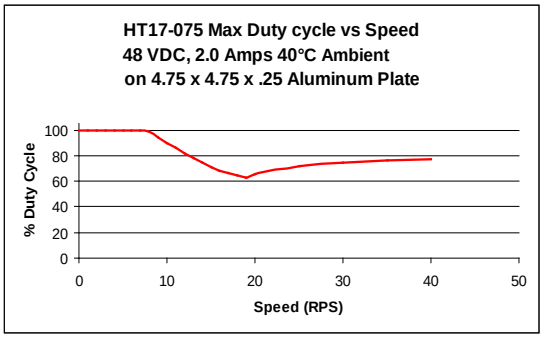

HT17-068 Max Duty cycle vs Speed
24 VDC, 1.60 Amps @40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50

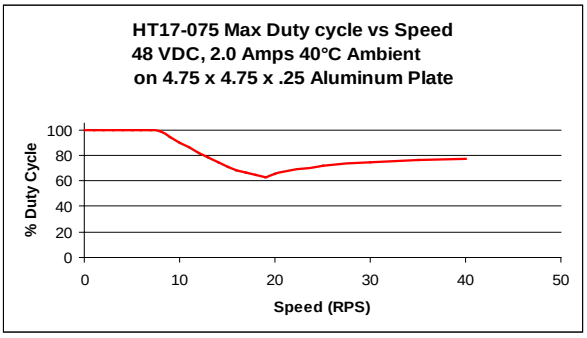

HT17-068 Max Duty cycle vs Speed
48 VDC, 1.60 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50

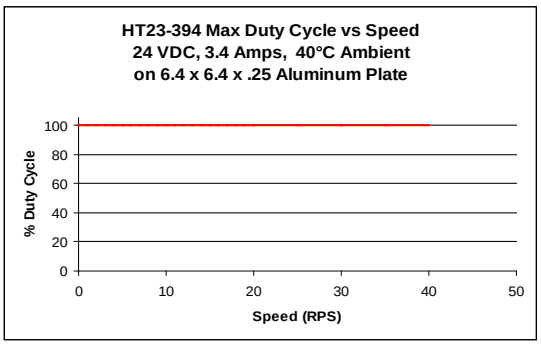

HT17-071 Max Duty Cycle vs Speed
24 VDC, 2.0 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50

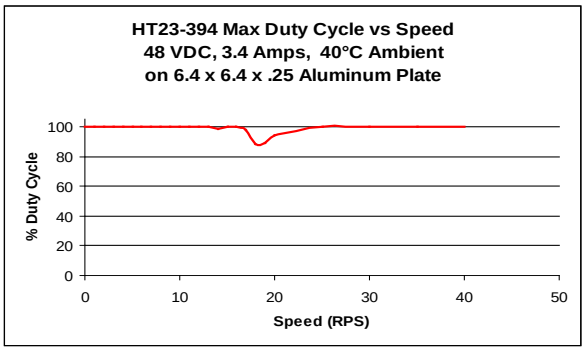

HT17-071 Max Duty cycle vs Speed
48 VDC, 2.0 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)
0
20
40
60
80
100
0
10
20
30
40
50

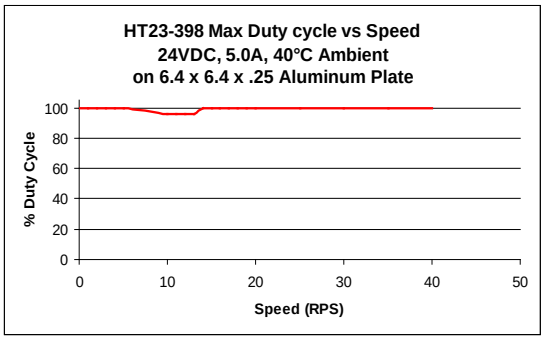

HT17-071 Max Duty cycle vs Speed
48 VDC, 2.0 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

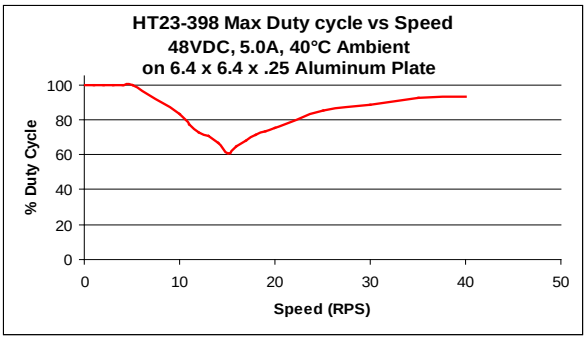

HT17-075 Max Duty cycle vs Speed
48 VDC, 2.0 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

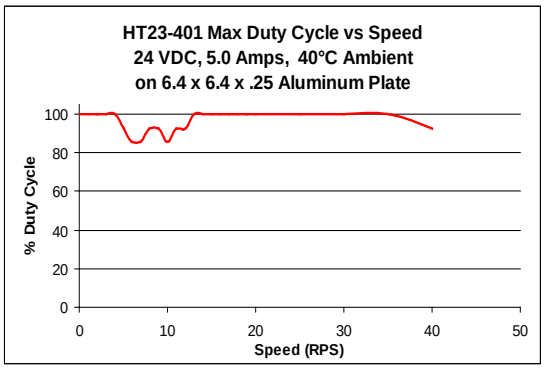

HT17-075 Max Duty cycle vs Speed
48 VDC, 2.0 Amps 40°C Ambient
on 4.75 x 4.75 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

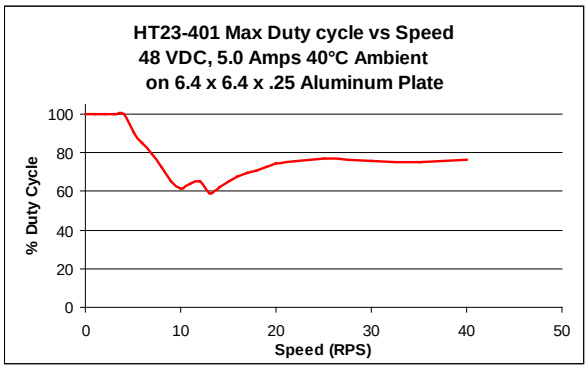

HT23-394 Max Duty Cycle vs Speed
24 VDC, 3.4 Amps, 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

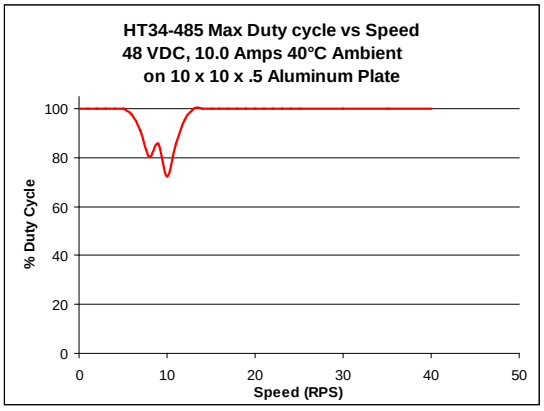

HT23-394 Max Duty Cycle vs Speed
48 VDC, 3.4 Amps, 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

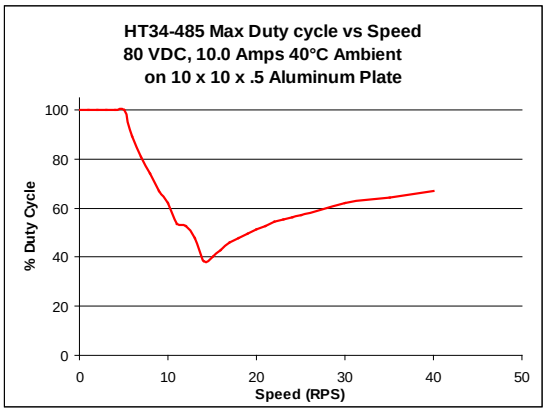

HT23-398 Max Duty cycle vs Speed
24VDC, 5.0A, 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

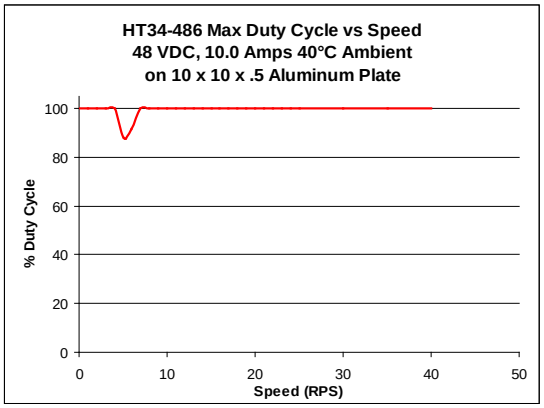

HT23-398 Max Duty cycle vs Speed
48VDC, 5.0A, 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

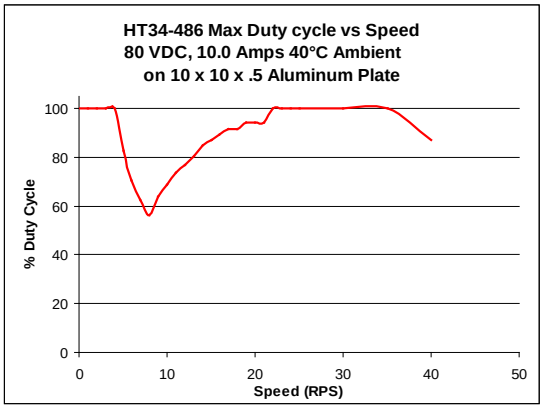

HT23-401 Max Duty Cycle vs Speed
24 VDC, 5.0 Amps, 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

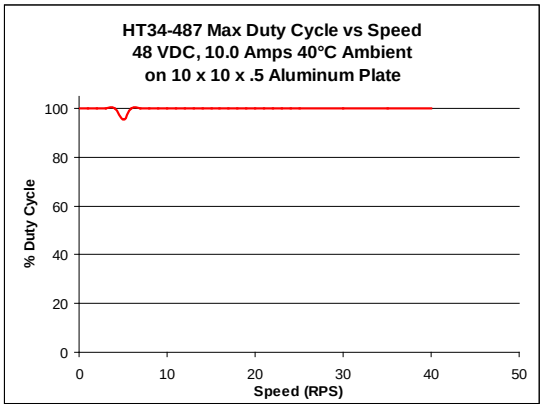

HT23-401 Max Duty cycle vs Speed
48 VDC, 5.0 Amps 40°C Ambient
on 6.4 x 6.4 x .25 Aluminum Plate
% Duty Cycle
Speed (RPS)

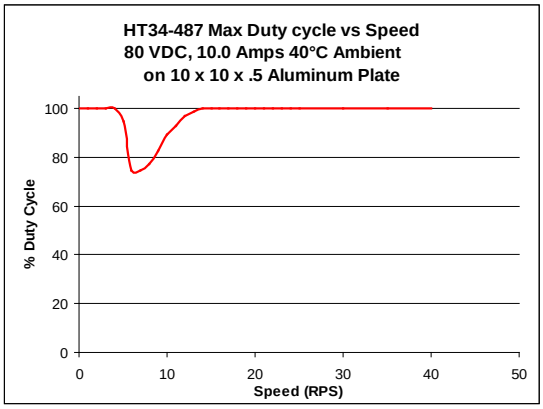

HT34-485 Max Duty cycle vs Speed
48 VDC, 10.0 Amps 40°C Ambient
on 10 x 10 x .5 Aluminum Plate
% Duty Cycle
Speed (RPS)


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)


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)


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)


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)


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)

5.6 Alarm Code

Code		Error
🟢	**solid green**	**no alarm,motor disabled**
🟢🟢	**flashing green**	**no alarm,motor enabled**
🔴🟢🟢	**1 red, 2 green**	**move while disabled**
🔴🔴🟢	**2 red, 1 green**	**CCW limit**
🔴🔴🟢🟢	**2 red, 2 green**	**CW limit**
🔴🔴🔴🟢	**3 red, 1 green**	**drive over temperature**
🔴🔴🔴🟢🟢	**3 red, 2 green**	**internal voltage bad**
🔴🔴🔴🟢🟢🟢	**3 red, 3 green**	**blank Q segment**
🔴🔴🔴🔴🟢	**4 red, 1 green**	**over voltage**
🔴🔴🔴🔴🟢🟢	**4 red, 2 green**	**under voltage**
🔴🔴🔴🔴🔴🟢	**5 red, 1 green**	**over current**
🔴🔴🔴🔴🔴🔴🟢	**6 red, 1 green**	**open motor winding**
🔴🔴🔴🔴🔴🔴🔴🟢	**7 red, 1 green**	**communication error**

NOTE: Items in bold italic represent Drive Faults, which automatically disable the motor.

6 Accessories (Sold Separately)

6.1 Mating Connector (included in drive package)

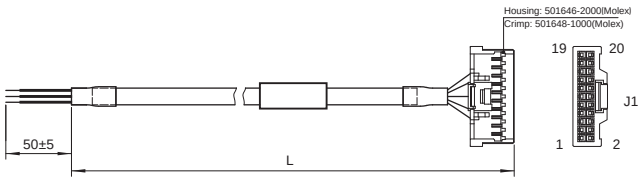
STF05/10

Part	Description	Part Number	Vendor	Qty
J1	Power & Motor Connector	2EDGK-5.08-06P-13-1000AH	DEGSON	1
J2	I/O Connector Housing	501646-2000	Molex	1
J2	I/O Connector Crimp	501648-1000	Molex	20

STF03/06

Part	Description	Part Number	Vendor	Qty
J1	Power & Motor Connector	BCP-381-6 BK	Phoenix	1
J2	I/O Connector Housing	501646-2000	Molex	1
J2	I/O Connector Crimp	501648-1000	Molex	20

6.2 I/O Cable (Sold separate)



P/N	Length
3004-348	0.3m, 1m, 2m,

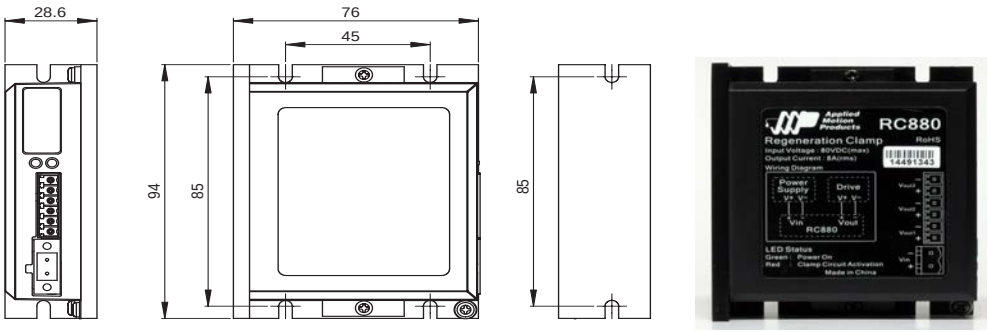
Pin No.	Assignment	Description	Color	Pin No.	Assignment	Description	Color
1	X1+	X1 Digital Input	Blue/White	11	X7	X7 Digital Input	Yellow
2	X1-		Blue/Black	12	X8	X8 Digital Input	Green
3	X2+	X2 Digital Input	Green/White	13	SHIELD	Shield	Shield
4	X2-		Green/Black	14	XCOM	X5-X8 Digital Input COM	Red
5	X3+	X3 Digital Input	Yellow/White	15	Y1	Y1 Digital Output	Brown
6	X3-		Yellow/Black	16	Y2	Y2 Digital Output	Gray
7	X4+	X4 Digital Input	Orange/White	17	Y3	Y3 Digital Output	White
8	X4-		Orange/Black	18	YCOM	Y1-Y3 Digital Output COM	Black
9	X5	X5 Digital Input	Blue	19	Y4+	Y4 Digital Output	Purple/ White
10	X6	X6 Digital Input	Purple	20	Y4-		Purple/ Black

6.3 Others

Power Supply

Regeneration Clamp

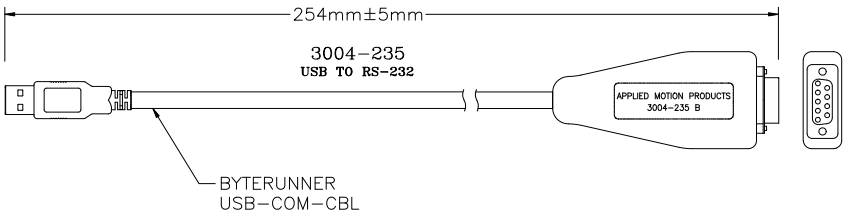
P/N: RC880



When using a regulated power supply you may encounter a problem with regeneration. The kinetic energy caused by regeneration is transferred back to the power supply. This can trip the overvoltage protection of a switching power supply, causing it to shut down. Applied Motion Products offers the RC880 “regeneration clamp” to solve this problem. If in doubt, use an RC880 for the first installation. If the “regen” LED on the RC880 never flashes, you don’t need the clamp.

USB Serial Adapter

P/N:3004-235



Power Supplies

P/N	Power	Voltage
PS150A24	150W	24VDC
PS320A48	320W	48VDC
PS480D72	480	72VDC

Applied Motion Products

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