



## High Performance Step Motor Drives with Multiple Control Options

- ✓ **Advanced Current Control**
- ✓ **Anti-Resonance**
- ✓ **Torque Ripple Smoothing**
- ✓ **Microstep Emulation**
- ✓ **Stall Detection/Prevention**

### Specifications

#### POWER SUPPLY:

- ST5 24-48 VDC
- ST10 24-80 VDC

#### OUTPUT CURRENT:

- ST5 0.1 - 5.0A
- ST10 0.1 - 10.0A

#### PROTECTION:

- Over-Voltage
- Under-Voltage
- Over-Temp
- Motor Shorts
- Motor Open Phase

### Control Options

**S**

- Pulse & direction, CW/CCW pulse, A/B quadrature
- Velocity (Oscillator) mode
- Host commands (SCL compatible)
- SiNet Hub compatible
- ST Configurator™ software for setup

**Plus**

- Same size and I/O as S model
- Execute stored Q programs like Q model

**Q**

- Executes stored Q programs
- Networking with RS-485 or Ethernet options
- Conditional processing & multi-tasking
- Math functions, register manipulation
- Encoder following
- Third-party HMI compatibility

**Si**

- Si Programmer™ with built-in Configurator
- Point-and-click indexing software
- User Friendly GUI
- I/O and motion programming
- MMI-01 compatibility

**C**

- CANopen protocols DS301 and DSP402
- Profile Position, Profile Velocity, and Homing Modes
- Up to 127 axes per channel
- Execute stored Q programs

**IP**

- EtherNet/IP industrial networking
- Same control modes as Q model

## SPECIFICATIONS

OUTPUT CURRENT	<b>ST5:</b> 0.1-5.0 amps/phase (peak-of-sine) in 0.01 amp increments <b>ST10:</b> 0.1-10.0 amps/phase (peak-of-sine) in 0.01 amp increments
POWER SUPPLY	<b>ST5:</b> External 24-48 VDC power supply required <b>ST10:</b> External 24-80 VDC power supply required
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
MICROSTEP RESOLUTION	Software selectable from 200 to 51200 steps/rev in increments of 2 steps/rev
MICROSTEP EMULATION	Performs high resolution stepping by synthesizing fine microsteps from coarse steps. Reduces jerk and extraneous system resonances. (Step & direction mode only)
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
MODES OF OPERATION	<b>ST-S:</b> Step & direction, CW/CCW pulse, A/B quadrature, velocity (oscillator, joystick), streaming serial commands (SCL), SiNet Hub compatible <b>ST-Plus, ST-Q:</b> Same as S models, plus Q programming <b>ST-Si:</b> Same as Q models, plus Si programming <b>ST-C:</b> CANopen slave node with Q programming <b>ST-IP:</b> Same as Q models, plus EtherNet/IP communications
INPUTS/OUTPUTS: ST-S, ST-Plus	<b>STEP, DIR inputs:</b> Optically isolated, differential, 5 VDC, minimum pulse width = 250 ns, maximum pulse frequency = 2 MHz <b>EN input:</b> Optically isolated, 5-12 VDC <b>OUT output:</b> Optically isolated, 24 VDC max, 10 mA max <b>AIN analog input:</b> Range = 0-5 VDC, resolution = 12 bits
INPUTS/OUTPUTS: ST-Q, ST-Si, ST-C, ST-IP	<b>X1, X2 inputs:</b> Optically isolated, differential, 5 VDC, minimum pulse width = 250 ns, maximum pulse frequency = 2 MHz <b>X3-X6 inputs:</b> Optically isolated, single-ended, shared common, sinking or sourcing, 12-24 VDC <b>X7, X8 inputs:</b> Optically isolated, differential, 12-24 VDC <b>Y1-Y3 outputs:</b> Optical darlington, single-ended, shared common, sinking, 30 VDC max, 100 mA max <b>Y4 output:</b> Optical darlington, sinking or sourcing, 30 VDC max, 100 mA max <b>Analog inputs IN1, IN2:</b> Can be used as two single-ended inputs or one differential input. Range = software selectable 0-5, +/-5, 0-10, or +/-10 VDC. Software configurable offset, deadband, and filtering. Resolution = 12 bits (+/-10 volt range), 11 bits (+/-5 or 0-10 volt range), or 10 bits (0-5 volt range). Note: Si programming mode does not support analog inputs.
COMMUNICATION INTERFACE	<b>ST-S, ST-Plus:</b> RS-232 for programming and serial communications <b>ST-Q-Nx, ST-Si-Nx:</b> RS-232 for programming and serial communications <b>ST-Q-Rx:</b> RS-232 for programming and serial communications, RS-485 for serial communications <b>ST-Q-Ex:</b> Ethernet for programming and serial communications <b>ST-C-Cx:</b> RS-232 for programming, CANopen for communications <b>ST-IP-Ex:</b> Ethernet for programming, EtherNet/IP for network communications
ENCODER INTERFACE	<b>ST-Q-xE, ST-Si-xE, ST-C-CE, ST-IP-EE:</b> For connecting to motor-mounted encoder. Used to provide stall detection and stall prevention with static position maintenance. Differential line receivers, up to 2 MHz.
AGENCY APPROVALS	RoHS CE: EN61800-3:2004, EN61800-5-1:2003 (CE pending on CANopen model)
AMBIENT TEMPERATURE	0 to 55 °C (32 to 131 °F). ST10 must be mounted to suitable heatsink.
HUMIDITY	90% max, non-condensing
WEIGHT	<b>ST-S, ST-Plus:</b> 7.1 oz <b>ST-Q, ST-Si, ST-C, ST-IP:</b> 10.4 oz

## Software



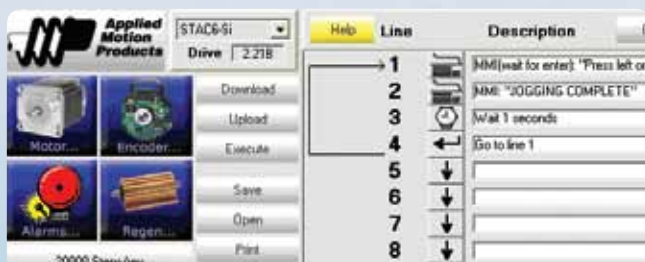
### ST Configurator™

Used for setup and configuration of the drive. For more information about the ST Configurator™ visit the Applied Motion Products website.



### Q Programmer™

Q Programmer™ is used to create and edit stand-alone programs for Q drives. The functions of these drives include multi-tasking, math, register manipulation, encoder following, and more.



### Si Programmer™

Intended for use in stand-alone applications, Si Programmer™ provides a user friendly, point-and-click, graphical interface that doesn't require any previous programming experience.



### Help Manuals

ST Configurator™ incorporates context sensitive help. All the technical data, application information and advice on setting up the drive is just a mouse click away.

All software applications run on Windows 7 (32-bit & 64-bit), Vista, XP, 2000, NT, ME, 98.

## Accessories

### Power Supplies

Applied Motion offers two matched power supplies for use with the ST Drives. A 24VDC, 150W supply (part number PS150A24) and a 48VDC, 320W supply (part number PS320A48). These power supplies have current overload capability making them ideal for use with stepper drives.

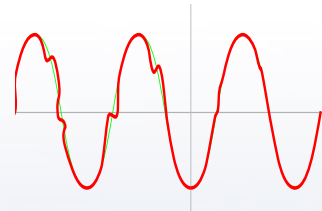


### RC-050 Regeneration Clamp

The RC-050 regeneration clamp is for use where regeneration from the motor may cause an over-voltage condition at the power supply. In these cases the RC-050 is connected between the drive and power supply and absorbs regenerated energy.

### Anti-Resonance/Electronic Damping

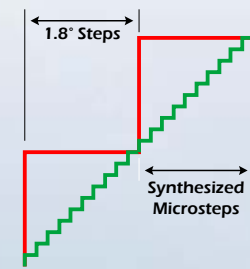
Step motor systems have a natural tendency to resonate at certain speeds. The ST drives automatically calculate the system's natural frequency and apply damping to the control algorithm. This greatly improves midrange stability, allows higher speeds and greater torque utilization, and also improves settling times.



**Benefit: Delivers better motor performance and higher speeds**

### Microstep Emulation

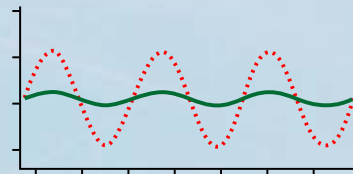
With Microstep Emulation, low resolution systems can still provide smooth motion. The drive can take low-resolution step pulses and create fine resolution micro-step motion.



**Benefit: Delivers smoother motion in any application**

### Torque Ripple Smoothing

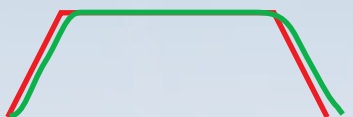
All step motors have an inherent low speed torque ripple that can affect the motion of the motor. By analyzing this torque ripple the system can apply a negative harmonic to negate this effect, which gives the motor much smoother motion at low speed.



**Benefit: Delivers smoother motion at lower speeds**

### Command Signal Smoothing

Command signal smoothing can soften the effect of immediate changes in velocity and direction, making the motion of the motor less jerky. An added advantage is that it can reduce the wear on mechanical components.



**Benefit: Delivers smoother system performance**

### Self Test & Auto Setup

At start-up the drive measures motor parameters, including the resistance and inductance, then uses this information to optimize the system performance. The drive can also detect open and short circuits.

### Inputs & Outputs

<b>S</b>	<b>Plus</b>	<b>Q</b>	<b>Si</b>	<b>C</b>	<b>IP</b>
3 digital inputs 1 digital output 1 analog input	3 digital inputs 1 digital output 1 analog input	8 digital inputs 4 digital outputs 2 analog inputs	8 digital inputs 4 digital outputs	8 digital inputs 4 digital outputs 2 analog inputs	8 digital inputs 4 digital outputs 2 analog inputs

## Option Boards

The following option boards are available with the ST drives (depending on control option)

### Encoder Feedback

(Q, Si, C and IP control options)

Example: ST5-Si-NE

The Encoder Feedback option board provides Stall Detection and Stall Prevention functionality to the drive. Stall Detection detects the moment the motor has stalled and triggers a drive fault. Stall Prevention automatically senses rotor lag (just before stalling) and reduces motor speed to avoid stalling. Stall Prevention includes Position Maintenance, which maintains shaft position when the motor is stopped.



### RS-485

(Q control option)

Example: ST10-Q-RN

The RS-485 option board enhances the ability to stream serial commands (SCL) by allowing you to connect to up to 32 drives in a serial communications network.



### Ethernet & EtherNet/IP

(Q control option for Ethernet TCP/UDP)

(IP control option for EtherNet/IP)

Examples: ST5-Q-EN, ST5-IP-EN

ST-Q drives with the Ethernet option can accept streaming serial commands (SCL) and Q serial commands over a high throughput, high-reliability 100Mbit network. The drives can also execute Q programs stored in built-in, non-volatile memory. IP models communicate with PLCs and other industrial devices supporting the EtherNet/IP standard. They can also be commanded to execute stored Q programs.

The drives can also execute Q programs stored in built-in, non-volatile memory. IP models communicate with PLCs and other industrial devices supporting the EtherNet/IP standard. They can also be commanded to execute stored Q programs.

### CANopen

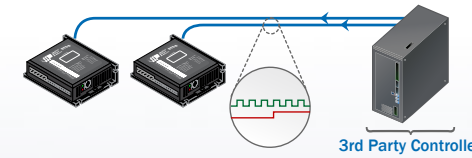
(C control option)

Example: ST5-C-CN

The CANopen option board used with ST-C drives allows the drive to be connected to a CANopen network along with other CANopen devices. Drives can be controlled and interrogated over the network.



### Step & Direction



- Step & Direction
- CW & CCW Pulse
- A/B Quadrature (Master Encoder)

### Oscillator / Run-Stop

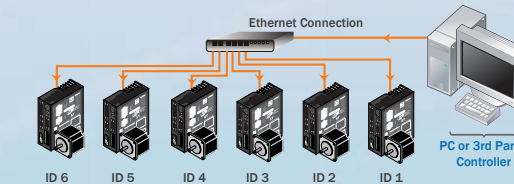


- Software Configuration
- Two speeds
- Vary speed with analog input
- Joystick compatible

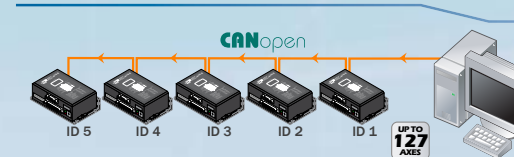
### Host Control



- Accepts streaming commands from host PC or PLC

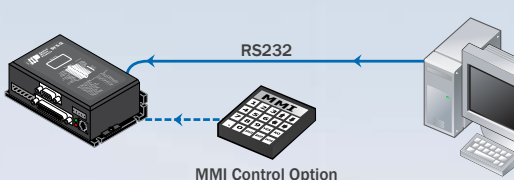


- Accepts streaming commands from host PC or PLC
- Up to 32 axes with RS-485 option
- 1000's of axes with Ethernet and EtherNet/IP

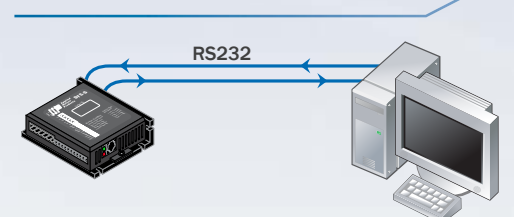


- Connect to CANopen network
- DS301 and DSP402 protocols
- Up to 127 axes

### Stand-Alone Programmable

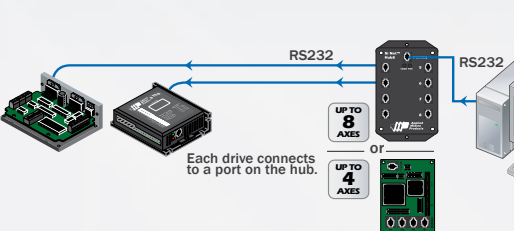


- Point & click graphical interface
- MMI option
- Download, store & execute programs



- Comprehensive text based language
- Download, store & execute programs
- High level features: multi-tasking, conditional programming, & math functions
- Host interface while executing internal programs

### Multi-Axis Systems



Use SiNet Hub Programmer software to develop your sequence of events, then download them to a SiNet Hub for a stand-alone system or stream serial commands to the drives from a PC, PLC, HMI, or other host controller.

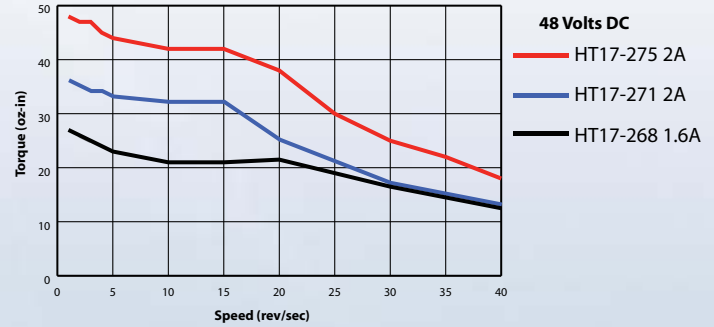
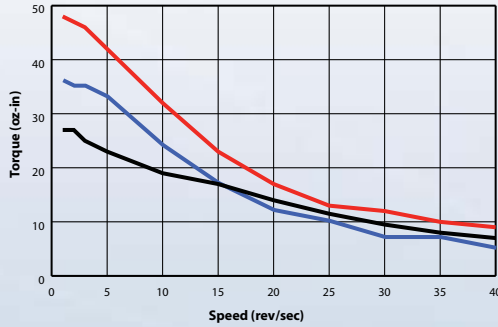
# Recommended Motors - a selection of motors suitable for use with the ST Drives

## NEMA 17 - HIGH TORQUE



Part #	Motor Length (inch)	Min-Holding Torque (oz-in)	Amps*	Ohms	mH	Rotor Inertia (oz-in-sec <sup>2</sup> )	Motor Weight (lbs)
HT17-268	1.31	31.2	1.34	2.1	2.5	5.38E-04	0.46
HT17-271	1.57	52.4	1.7	1.7	3.0	8.07E-04	0.60
HT17-275	1.90	77.9	1.7	1.7	3.2	1.16E-03	0.80

\* Motor only rating. Optimal current setting in ST drive may differ.  
All ratings are for bipolar parallel connection.  
Step angle 1.8 degrees for all motors.



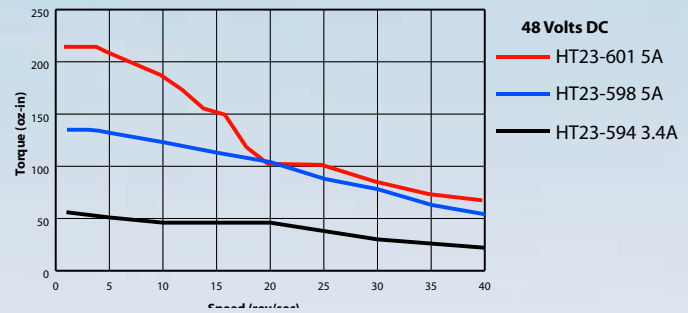
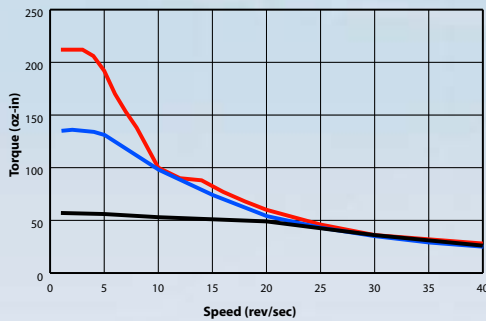
All curves run at 20,000 steps per rev.

## NEMA 23 - HIGH TORQUE



Part #	Motor Length (inch)	Min-Holding Torque (oz-in)	Amps*	Ohms	mH	Rotor Inertia (oz-in-sec <sup>2</sup> )	Motor Weight (lbs.)
HT23-594	1.61	76.5	2.83	0.7	1.4	1.91E-03	0.9
HT23-598	2.13	159	4.24	0.4	1.4	3.68E-03	1.3
HT23-601	2.99	269	4.24	0.5	1.7	6.51E-03	2.2

\* Motor only rating. Optimal current setting in ST drive may differ.  
All ratings are for bipolar parallel connection.  
Step angle 1.8 degrees for all motors.



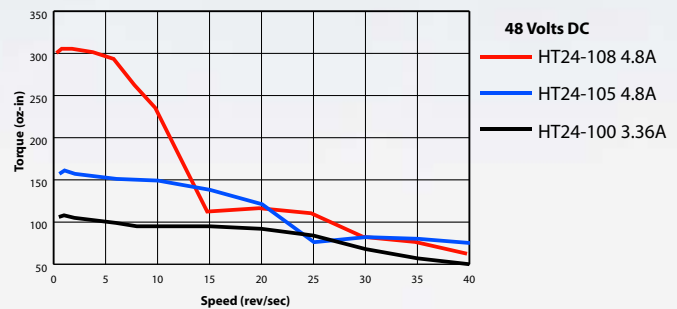
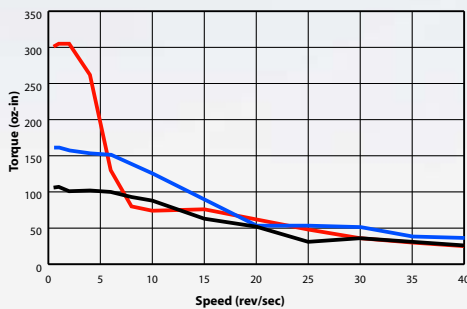
All curves run at 20,000 steps per rev.

## NEMA 24 - HIGH TORQUE



Part #	Motor Length (inch)	Min-Holding Torque (oz-in)	Amps*	Ohms	mH	Rotor Inertia (oz-in-sec <sup>2</sup> )	Motor Weight lbs.
HT24-100	1.73	123	2.8	0.73	1.6	3.68E-03	1.3
HT24-105	2.13	177	4.0	0.43	1.1	6.37E-03	1.8
HT24-108	3.35	354	4.0	0.65	2.4	1.27E-02	3.0

\* Motor only rating. Optimal current setting in ST drive may differ.  
Step angle 1.8 degrees for all motors.



All curves run at 20,000 steps per rev.

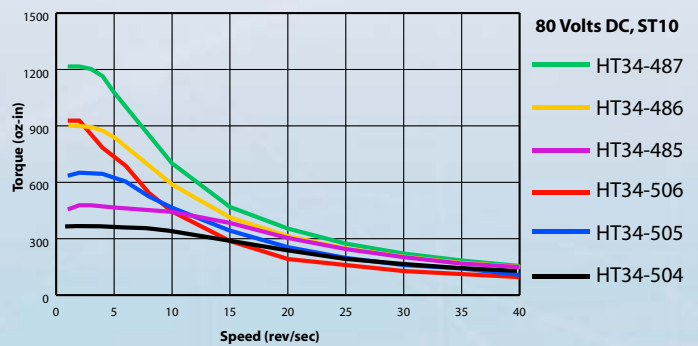
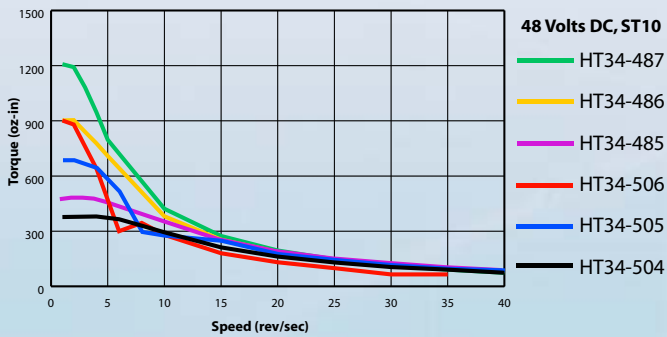
# Recommended Motors Continued

## NEMA 34 - HIGH TORQUE



Part #	Motor Length (inch)	Min-Holding Torque (oz-in)	Amps*	Ohms	mH	Rotor Inertia (oz-in-sec <sup>2</sup> )	Motor Weight lbs.
HT34-485	3.11	650	8.5	0.18	1.5	2.27E-02	4.6
HT34-486	4.63	1202	8.1	0.26	2.7	4.53E-02	7.7
HT34-487	6.14	1768	8.9	0.26	2.8	6.80E-02	11.0
HT34-504	2.62	397	6.3	0.24	1.7	1.56E-02	3.5
HT34-505	3.78	850	6.3	0.33	2.7	2.62E-02	5.9
HT34-506	4.94	1260	5.6	0.48	5.4	3.89E-02	8.4

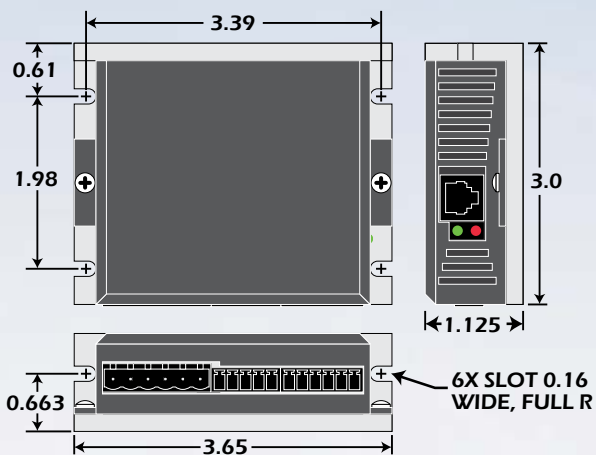
\* Motor only rating. Optimal current setting in ST drive may differ.  
All ratings are for bipolar parallel connection.  
Step angle 1.8 degrees for all motors.



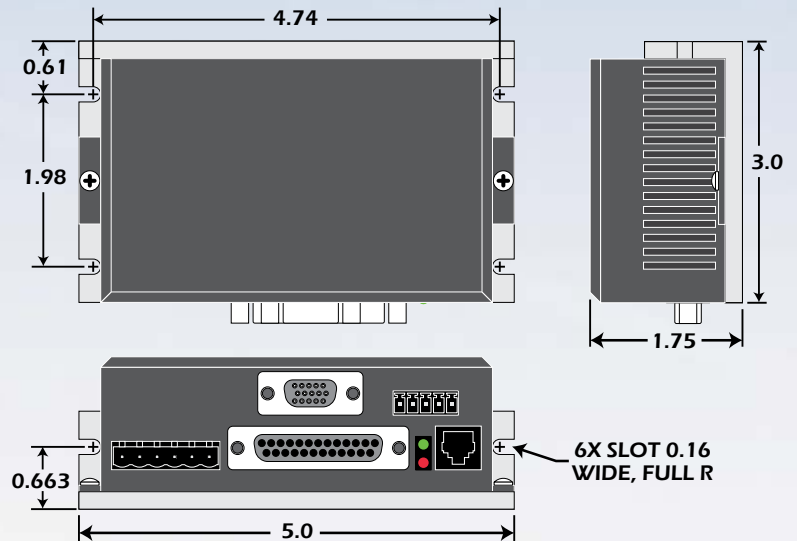
All curves run at 20,000 steps per rev.

## DIMENSIONS

### S AND Plus MODELS



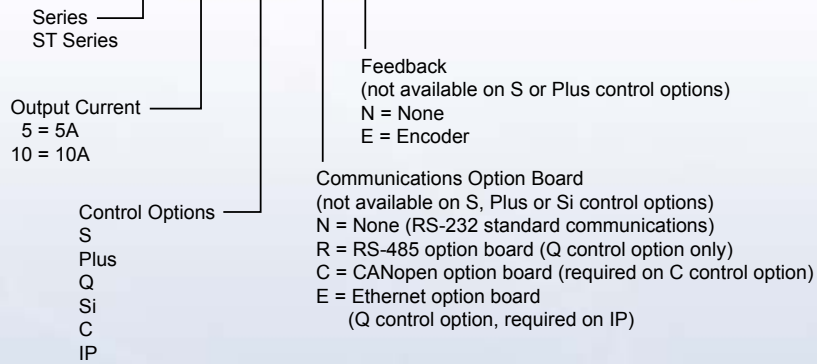
### Q, Si, C AND IP MODELS



Dimensions in inches, not to scale

# ST Drive Model Numbers

## ST5-Si-NE



Model Numbers	Q Program	Si Program	RS-232	RS-422/485	Ethernet	EtherNet/IP	CANopen	Encoder
ST5-S			X					
ST5-Plus	X		X					
ST5-Q-NN	X		X					
ST5-Q-NE	X		X					X
ST5-Q-RN	X		X	X				
ST5-Q-RE	X		X	X				X
ST5-Q-EN	X				X			
ST5-Q-EE	X				X			X
ST5-Si-NN		X	X					
ST5-Si-NE		X	X					X
ST5-C-CN	X*		X				X	
ST5-C-CE	X*		X				X	X
ST5-IP-EN	X				X	X		
ST5-IP-EE	X				X	X		X

Model Numbers	Q Program	Si Program	RS-232	RS-422/485	Ethernet	EtherNet/IP	CANopen	Encoder
ST10-S			X					
ST10-Plus	X		X					
ST10-Q-NN	X		X					
ST10-Q-NE	X		X					X
ST10-Q-RN	X		X	X				
ST10-Q-RE	X		X	X				X
ST10-Q-EN	X				X			
ST10-Q-EE	X				X			X
ST10-Si-NN		X	X					
ST10-Si-NE		X	X					X
ST10-C-CN	X*		X				X	
ST10-C-CE	X*		X				X	X
ST10-IP-EN	X				X	X		
ST10-IP-EE	X				X	X		X

\*CANopen drives cannot run Q Programs stand-alone at power-up.



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