### Specifications

<table>
<thead>
<tr>
<th>POWER SUPPLY</th>
<th>PROTECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST5 24-48 VDC</td>
<td>Over-Voltage</td>
</tr>
<tr>
<td>ST10 24-80 VDC</td>
<td>Under-Voltage</td>
</tr>
<tr>
<td>OUTPUT CURRENT:</td>
<td>Over-Temp</td>
</tr>
<tr>
<td>ST5 0.1 - 5.0A</td>
<td>Motor Shorts</td>
</tr>
<tr>
<td>ST10 0.1 - 10.0A</td>
<td>Motor Open Phase</td>
</tr>
</tbody>
</table>

### Control Options

- Pulse & direction, CW/CCW pulse, A/B quadrature
- Velocity (Oscillator) mode
- Host commands (SCL compatible)
- STNet Hub compatible
- ST Configurator™ software for setup
- Same size and I/O as S model
- Execute stored Q programs like Q model
- 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
- EtherNet/IP industrial networking
- Same control modes as Q model
- Same size and I/O as S model
- Same control modes as Q model
- EtherNet/IP industrial networking
- Same control modes as Q model

For more information, visit: [www.applied-motion.com/ST](http://www.applied-motion.com/ST)
### SPECIFICATIONS

#### OUTPUT CURRENT

<table>
<thead>
<tr>
<th>Model</th>
<th>Nominal DC Current (amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST, ST-Plus</td>
<td>0.1-5.0, peak-increase to 0.01 increments</td>
</tr>
<tr>
<td>STL</td>
<td>0.1-10.0, peak-increase to 0.01 increments</td>
</tr>
</tbody>
</table>

#### POWER SUPPLY

<table>
<thead>
<tr>
<th>Model</th>
<th>DC Power (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST, ST-Plus</td>
<td>24-48</td>
</tr>
<tr>
<td>STL</td>
<td>24-80</td>
</tr>
</tbody>
</table>

#### PROTECTION

- Over-voltage, under-voltage, over-temperature, motor/wiring shorts (phase-to-phase, phase-to-ground)
- Reduction of 0-90% of turn-on current after delay selectable in milliseconds

#### IDLE CURRENT REDUCTION

Reduction range of 0-90% of running current after delay selectable in milliseconds

#### MICROSTEP RESOLUTION

Microstep resolution from 200 to 51200 steps/rev in increments of 2 steps/rev

#### MICROSTEP EMULATION

Microstep resolution from 200 to 51200 steps/rev in increments of 2 steps/rev

#### AGENCY APPROVALS

- RoHS

#### ENCORDER INTERFACE

<table>
<thead>
<tr>
<th>Model</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST-Q-xE, ST-Si-xE, ST-C-CE, ST-IP-EE</td>
<td>Ethernet for programming, EtherCAT for network communications</td>
</tr>
</tbody>
</table>

#### COMMUNICATION INTERFACE

<table>
<thead>
<tr>
<th>Model</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST-Q, ST-Si, ST-C, ST-IP</td>
<td>RS-232 for programming and serial communications, CANopen for communications</td>
</tr>
</tbody>
</table>

#### ENCODER INTERFACE

<table>
<thead>
<tr>
<th>Model</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST-Q-xE, ST-Si-xE, ST-C-CE, ST-IP-EE</td>
<td>For connecting to motor-mounted encoder, to provide stall detection and stall prevention with static position maintenance. Differential line receivers, up to 2 MHz</td>
</tr>
</tbody>
</table>

#### AGENCY APPROVALS


#### AMBIENT TEMPERATURE

- 0 to 55 °C (32 to 131 °F)

#### HUMIDITY

- 90% max, non-condensing

#### WEIGHT

<table>
<thead>
<tr>
<th>Model</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST, ST-Plus</td>
<td>7.1</td>
</tr>
<tr>
<td>ST-Q, ST-Si, ST-C, ST-IP</td>
<td>10.4</td>
</tr>
</tbody>
</table>
### Software

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

#### 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.

#### 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.

#### 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.

---

### NEMA 23 - High Torque

<table>
<thead>
<tr>
<th>Part #</th>
<th>Motor</th>
<th>Length (inch)</th>
<th>Min-Holding Torque (oz-in)</th>
<th>Current</th>
<th>Rotor Inertia (oz-in-sec²)</th>
<th>Motor Weight (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT23-594</td>
<td>1.61</td>
<td>76.5</td>
<td>2.83</td>
<td>0.7</td>
<td>1.4</td>
<td>1.91E-03</td>
</tr>
<tr>
<td>HT23-598</td>
<td>2.13</td>
<td>159</td>
<td>4.24</td>
<td>0.4</td>
<td>1.4</td>
<td>3.68E-03</td>
</tr>
<tr>
<td>HT23-601</td>
<td>2.99</td>
<td>269</td>
<td>4.24</td>
<td>0.5</td>
<td>1.7</td>
<td>6.51E-03</td>
</tr>
</tbody>
</table>

* 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.

---

### NEMA 24 - High Torque

<table>
<thead>
<tr>
<th>Part #</th>
<th>Motor</th>
<th>Length (inch)</th>
<th>Min-Holding Torque (oz-in)</th>
<th>Current</th>
<th>Rotor Inertia (oz-in-sec²)</th>
<th>Motor Weight (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT24-100</td>
<td>1.73</td>
<td>123</td>
<td>2.8</td>
<td>0.73</td>
<td>1.6</td>
<td>3.68E-03</td>
</tr>
<tr>
<td>HT24-105</td>
<td>2.13</td>
<td>177</td>
<td>4.0</td>
<td>0.43</td>
<td>1.1</td>
<td>6.37E-03</td>
</tr>
<tr>
<td>HT24-108</td>
<td>3.35</td>
<td>354</td>
<td>4.0</td>
<td>0.65</td>
<td>2.4</td>
<td>1.27E-02</td>
</tr>
</tbody>
</table>

* 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.

---

### NEMA 17 - High Torque

<table>
<thead>
<tr>
<th>Part #</th>
<th>Motor</th>
<th>Length (inch)</th>
<th>Min-Holding Torque (oz-in)</th>
<th>Current</th>
<th>Rotor Inertia (oz-in-sec²)</th>
<th>Motor Weight (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT17-268</td>
<td>1.31</td>
<td>31.2</td>
<td>1.34</td>
<td>2.1</td>
<td>2.5</td>
<td>5.38E-04</td>
</tr>
<tr>
<td>HT17-271</td>
<td>1.57</td>
<td>52.4</td>
<td>1.7</td>
<td>1.7</td>
<td>3.0</td>
<td>8.07E-04</td>
</tr>
<tr>
<td>HT17-275</td>
<td>1.90</td>
<td>77.9</td>
<td>1.7</td>
<td>1.7</td>
<td>3.2</td>
<td>1.16E-03</td>
</tr>
</tbody>
</table>

* 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.

---

#### 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.

**Software**

- **ST Configurator™**
- **Si Programmer™**
- **Q Programmer™**
- **Help Manuals**

**Accessories**

- **Power Supplies**
- **RC-050 Regeneration Clamp**

**Software**

- **ST Configurator™**
- **Si Programmer™**
- **Q Programmer™**
- **Help Manuals**

**Accessories**

- **Power Supplies**
- **RC-050 Regeneration Clamp**
**Feature: 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 higher motor performance and longer drive life.

**Feature: 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.

**Feature: 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.

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

**Benefit:** Delivers smoother system performance.

**Feature: 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.

**Feature: Inputs & Outputs**
- 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
  - 2 analog inputs
- 8 digital inputs
  - 4 digital outputs
  - 2 analog inputs
- 8 digital inputs
  - 4 digital outputs
  - 2 analog inputs

**Feature: Oscillator / Run-Stop**
- Software Configuration
- Two speeds
- Very speed with analog input
- Joystick compatible

**Feature: Host Control**
- Accepts streaming commands from host PC or PLC
- Connect to CANopen network
- Up to 1000’s of axes with Ethernet and EtherNet/IP

**Feature: Stand-Alone Programmable**
- Point & click graphical interface
- MMI option
- Download, store & execute programs
- High level features: multi-tasking, conditional programming & math functions
- Host interface while executing internal programs

**Feature: 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, MMI, or other host controller.

**Option Boards**
The following option boards are available with the ST drives (depending on control option):

- **Encoder Feedback**
  - Q, S, C and IP control options
  - Example: STS-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: STS-10-Q-RS
  - The RS-485 option board enhances the ability to stream serial commands (SCL) by allowing you to connect up to 32 drives in a serial communications network.

- **Ethernet & EtherNet/IP**
  - Q control option for Ethernet TOP / UDP (IP control option for EtherNet/IP)
  - Example: STS-Q-EN, STS-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.

- **CANopen**
  - Q control option
  - Example: STS-C-CN
  - The CANopen option board used with ST-Q 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.

**Control Options**

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

- **3rd Party Controller**
  - Up to 127 axes with Ethernet and EtherNet/IP

- **Oscillator / Run-Stop**
  - Software Configuration
  - Two speeds
  - Very speed with analog input
  - Joystick compatible

- **Host Control**
  - Accepts streaming commands from host PC or PLC
  - Connect to CANopen network
  - Up to 32 axes with RS-485 option
  - Up to 1000’s of axes with Ethernet and EtherNet/IP

- **Stand-Alone Programmable**
  - Point & click graphical interface
  - MMI option
  - 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, MMI, or other host controller.
## Recommended Motors

### NEMA 17 - High Torque

<table>
<thead>
<tr>
<th>Part #</th>
<th>Motor Length (in)</th>
<th>Min-Holding Torque (oz-in)</th>
<th>Amps</th>
<th>Ohms</th>
<th>RPM</th>
<th>Motor Inertia (oz-in-sec²)</th>
<th>Motor Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT17-268</td>
<td>1.31</td>
<td>31.2</td>
<td>1.34</td>
<td>0.21</td>
<td>2.5</td>
<td>1.58E-04</td>
<td>0.46</td>
</tr>
<tr>
<td>HT17-271</td>
<td>1.67</td>
<td>52.8</td>
<td>1.7</td>
<td>1.7</td>
<td>3.0</td>
<td>8.07E-04</td>
<td>0.80</td>
</tr>
<tr>
<td>HT17-275</td>
<td>1.85</td>
<td>77.4</td>
<td>1.7</td>
<td>1.7</td>
<td>3.2</td>
<td>1.58E-03</td>
<td>0.90</td>
</tr>
</tbody>
</table>

* 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.

### NEMA 23 - High Torque

<table>
<thead>
<tr>
<th>Part #</th>
<th>Motor Length (in)</th>
<th>Min-Holding Torque (oz-in)</th>
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<tr>
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<td>2.83</td>
<td>0.7</td>
<td>1.4</td>
<td>1.95E-03</td>
<td>0.90</td>
</tr>
<tr>
<td>HT23-271</td>
<td>2.13</td>
<td>139</td>
<td>4.24</td>
<td>0.4</td>
<td>1.4</td>
<td>3.88E-03</td>
<td>1.3</td>
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<tr>
<td>HT23-275</td>
<td>2.59</td>
<td>269</td>
<td>6.25</td>
<td>0.6</td>
<td>1.7</td>
<td>6.05E-03</td>
<td>2.2</td>
</tr>
</tbody>
</table>

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### NEMA 24 - High Torque

<table>
<thead>
<tr>
<th>Part #</th>
<th>Motor Length (in)</th>
<th>Min-Holding Torque (oz-in)</th>
<th>Amps</th>
<th>Ohms</th>
<th>RPM</th>
<th>Motor Inertia (oz-in-sec²)</th>
<th>Motor Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT24-268</td>
<td>1.73</td>
<td>123</td>
<td>2.8</td>
<td>0.13</td>
<td>1.6</td>
<td>3.68E-03</td>
<td>1.3</td>
</tr>
<tr>
<td>HT24-274</td>
<td>2.15</td>
<td>177</td>
<td>4.6</td>
<td>0.43</td>
<td>1.4</td>
<td>6.37E-03</td>
<td>1.9</td>
</tr>
<tr>
<td>HT24-278</td>
<td>2.54</td>
<td>354</td>
<td>4.6</td>
<td>0.65</td>
<td>2.4</td>
<td>1.27E-02</td>
<td>3.0</td>
</tr>
</tbody>
</table>

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

### NEMA 34 - HIGH TORQUE

**Dimensions in inches, not to scale**

#### S AND Plus MODELS

- 3.39 in (H)
- 4.74 in (W)
- 3.0 in (D)

#### Q, SI, C AND IP MODELS

- 4.125 in (H)
- 3.0 in (W)
- 1.75 in (D)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>HT34-486</td>
<td>4.03</td>
<td>1302</td>
<td>0.1</td>
<td>5.2</td>
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<td>3.6</td>
</tr>
<tr>
<td>HT34-487</td>
<td>4.14</td>
<td>1768</td>
<td>0.9</td>
<td>2.6</td>
<td>2.3</td>
<td>6.9E-02</td>
<td>5.0</td>
</tr>
<tr>
<td>HT34-504</td>
<td>3.62</td>
<td>567</td>
<td>0.3</td>
<td>5.4</td>
<td>2.7</td>
<td>1.5E-02</td>
<td>3.0</td>
</tr>
<tr>
<td>HT34-505</td>
<td>3.76</td>
<td>650</td>
<td>0.3</td>
<td>4.0</td>
<td>2.8</td>
<td>3.0E-02</td>
<td>4.0</td>
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<tr>
<td>HT34-506</td>
<td>4.04</td>
<td>1200</td>
<td>0.3</td>
<td>1.2</td>
<td>3.0</td>
<td>3.0E-02</td>
<td>4.0</td>
</tr>
</tbody>
</table>

* Motor only rating. Optimal current setting in ST drive may differ.

**NEMA 34 - HIGH TORQUE**

- 48 Volts DC, ST10
- 80 Volts DC, ST10

---

**INPUTS/OUTPUTS:**

**ST-S, ST-Plus:**

- STEP, DIR inputs:

**MODES OF OPERATION**

**ST-S:**

- TORQUE RIPPLE SMOOTHING: Allows for fine adjustment of phase current waveform harmonic content to reduce low-speed torque ripple (Electronic Damping)

- MICROSTEP EMULATION: Performs high resolution stepping by synthesizing fine microsteps from coarse steps. Reduces jerk and

- MICROSTEP RESOLUTION: Software selectable from 200 to 51200 steps/rev in increments of 2 steps/rev

**ST-Q-xE, ST-Si-xE, ST-C-CE, ST-IP-EE:**

- COMMUNICATION INTERFACE

**ST-S, ST-Plus:**

- ST-Q, ST-Si, ST-C, ST-IP

**ENCODER INTERFACE**

- 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.

**STEP & DIRECTION MODES:**

- ST5:
  - OUTPUT CURRENT: 0-10.4 oz
  - IDLE CURRENT REDUCTION: Reduction range of 0-90% of running current after delay selectable in milliseconds
  - PROTECTION: Over-voltage, under-voltage, over-temp, motor/wiring shorts (phase-to-phase, phase-to-ground)

**ST-Q, ST-Si, ST-C, ST-IP:**

- POWER SUPPLY: External 24-48 VDC power supply required

**ST-Q-Rx:**

- RS-232 for programming and serial communications

**ST-Q-Nx, ST-Si-Nx:**

- RS-232 for programming and serial communications

Si programming mode does not support analog inputs.

**ANALOG INPUTS:**

- Resolution = 12 bits (+/-10 volt range), 11 bits (+/-5 or 0-10 volt range), or 10 bits (0-5 volt range). Note:
  - software selectable 0-5, +/-5, 0-10, or +/-10 VDC
  - Software configurable offset, deadband, and filtering.

**ANALOG INPUTS IN1, IN2:**

- Optical darlington, sinking or sourcing, 30 VDC max, 100 mA max

**Y4 OUTPUT:**

- Optical darlington, single-ended, shared common, sinking, 30 VDC max, 100 mA max

**Y1-Y3 OUTPUTS:**

- Optical darlington, single-ended, shared common, sinking, 30 VDC max, 100 mA max

**X7, X8 INPUTS:**

- Optically isolated, differential, 5 VDC, minimum pulse width = 250 ns, maximum pulse frequency = 2 MHz

**X1, X2 INPUTS:**

- Optically isolated, differential, 5 VDC, minimum pulse width = 250 ns, maximum pulse frequency = 2 MHz

**AIN ANALOG INPUT:**

- Optically isolated, 24 VDC max, 10 mA max

**OUT OUTPUT:**

- Optically isolated, 5-12 VDC

**EN INPUT:**

- Optically isolated, 5-12 VDC

**ST-Q, ST-Si, ST-C, ST-IP:**

- Same as Q models, plus Si programming

**ST-Plus, ST-Q:**

- Same as S models, plus Q programming

**ST10:**

- External 24-48 VDC power supply required

**ST-IP:**

- Same as Q models, plus EtherNet/IP communications

**ST-C:**

- Same as Q models, plus SiNet Hub compatible

**DIMENSIONS**

- Dimensions run at 20,000 steps per rev.
### Specifications

**High Performance Step Motor Drives with Multiple Control Options**

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

**Si Programmer™ with built-in Configurator**

- Point-and-click indexing software
- User Friendly GUI
- I/O and motion programming
- MMI-01 compatibility
- Pulse & direction, CW/CCW pulse, A/B quadrature
- Velocity (Oscillator) mode
- Host commands (SCL compatible)
- SiNet Hub compatible
- ST Configurator™ software for setup
- 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

### Control Options

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

### 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

**For more information, visit:** www.applied-motion.com/ST

### Different Models

<table>
<thead>
<tr>
<th>Model Numbers</th>
<th>Q Program</th>
<th>RS-232</th>
<th>RS-422/485</th>
<th>Ethernet</th>
<th>EtherNet/IP</th>
<th>CANopen</th>
<th>Encoder</th>
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</table>

**Feedback (not available on S or Plus control options)**

- N = None
- E = Encoder

**Communications Option Board (not available on S, Plus or Si control options)**

- N = None (RS-232 standard communications)
- R = RS-485 option board (Q control option only)
- C = CANopen option board (required on C control option)
- E = Ethernet option board (Q control option, required on IP)

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