SureStep Stepping System Overview

Stepping System Overview

SureStep stepping systems provide simple and accurate control of position and speed where open-loop control and cost are considerations. Pulses (or “step” and “direction” signals) from the DirectLOGIC family of PLCs or other indexers and motion controllers are “translated” by the microstepping drive into precise movement of the stepping motor shaft. The SureStep stepping motors use 2-phase technology with 200 full steps per revolution or 1.8° per full step. Older type stepping motor drives, which operate stepping motors in full step mode, can result in stalling or lost motion due to potential problems with low speed mechanical vibration (usually between 100 to 200 RPM). To minimize this vibration problem, the SureStep microstepping drives use advanced microstepping technology to smooth the motor motion and stepping response.

Standards and Agency Approvals

How fast can my system go?

SureStep Pro configuration software is available that makes setting parameters a snap for the advanced drives [STP-DRV-4850 & STP-DRV-80100]! Download free from our website:

http://support.automationdirect.com/products/surestep.html

FREE configuration software!

High-performance microstepping drives with high-torque stepping motors

The STP-DRV-4035 has selectable microstep resolutions of 400 (half-step); 1,000 (each full step ÷ 5 microsteps); 2,000 (÷10); or 10,000 (÷50).

The STP-DRV-6575 has selectable resolutions of 200 (full-step); 400 (half-step); 2,000; 5,000; 12,800; or 20,000 steps per revolution.

The advanced drives (STP-DRV-4805, STP-DRV-80100) have software-selectable resolutions ranging from 200 (full step) to 51,200 (÷256) steps per revolution.

The advanced drives can operate with traditional high-speed inputs, but can also be commanded via 0–5V analog input. They have an internal indexer that can accomplish point-to-point moves controlled via ASCII communication.

Stepping Motor RPM = (A÷B) x (60 seconds/minute)
Where: A = PLC output frequency (pulses per second)
B = microstepping resolution selection (steps/revolution)

<table>
<thead>
<tr>
<th>Maximum Potential Speed Chart (rpm) *</th>
<th>PLC</th>
<th>SureStep Drive Steps/Rev Selection **</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL05, DL105</td>
<td>7kHz</td>
<td>1,050</td>
</tr>
<tr>
<td>DL06</td>
<td>10 kHz</td>
<td>1,500</td>
</tr>
<tr>
<td>H0/Hx/H4/T1/Hx-CTRIO</td>
<td>25 kHz</td>
<td>3,750</td>
</tr>
<tr>
<td>H2-CTRIO2</td>
<td>250 kHz</td>
<td>37,500</td>
</tr>
<tr>
<td>P3-HSO</td>
<td>1MHz</td>
<td>150,000</td>
</tr>
</tbody>
</table>

* These speeds are theoretical maximums. See torque curves of specific motors for their rpm limits.
** Full step (200 steps/rev) will allow higher top speed. Full stepping, however, can create vibration at low speed.

Maximum RPM = Steps/Sec A ÷ Steps/Rev B x Sec/Min

Example 1: 1,500 =

DL06 with 10 kHz Built-in Pulse Output

Example 2: 3,750 =

Hx-CTRIO with 25 kHz Pulse Output

Four components to make a complete system

Microstepping Drives
NEMA Step Motors

Step Motor Extension Cables
Step Motor Power Supplies

Choose a drive, motor, motor extension cable and power supply
SureStep® Stepping System Overview

High-torque stepping motors with 1-ft. cable and 4-wire locking connector

The SureStep stepping family has twenty high-torque motors to handle a wide range of automation applications such as woodworking, assembly, and test machines. The motors are available in both single-shaft and dual-shaft configurations. Our square frame or “high-torque” style stepping motors are available in both single-shaft and dual-shaft configurations. Our latest technology, resulting in the best torque to volume. We have NEMA 17, 23, and 34 mounting flanges and holding torque ranges from 61 to 1288 oz·in. Optional 20-foot extension cables with locking connectors are available to interface any of the stepping motors to the microstepping drive. The extension cables can be easily cut to length, if desired.

High-performance microstepping drive

SureStep microstepping drives
(STP-DRV-4035 & STP-DRV-6575)

- Two models available
- Standard high-speed pulse input (pulse and direction)
- On-board or removable screw terminals for easy hook-up
- Optically-isolated inputs ready for 4.5VDC logic from DirectLOGIC PLCs, or 5–24 VDC (depending on model).
- No software or add-on resistors required for drive configuration; dipswitch and/or rotary-dial set-up
- Dipswitch used for built-in self-test, microstep resolution selection, current level selection, and optional idle current reduction.

SureStep advanced microstepping drives
(STP-DRV-4850 & STP-DRV-80100)

All the features of the high-performance drive, plus:
- Software configurable
- 200 - 51,200 microsteps (software selectable)
- High-speed pulse input
  (Quadrature, cw/ccw, pulse/direction)
- Analog velocity mode (0-5v or potentiometer)
- Internal indexer (point-to-point moves via ASCII command)

Linear power supplies

- 32V @ 4A, 48V @ 5A, 48V @ 10A, 70V @ 5A
- Input and output fuses included on power supplies
- Includes 5 VDC Logic supply for all low voltage signals

www.automationdirect.com/stepper-systems

Stepper System: Head to Head

Hey - I can do the math! - AutomationDirect

A complete 2-axis SureStep™ Stepping System for less than just the competition’s stepping drives.

SureStep™ NEMA 23 System Long Stack

$421

Complete 2-Axis System

Parker

E-DC

$654

for 2 drives

All prices are U.S. published prices. AutomationDirect prices as of 5/14/2015.

Prices as of October 21, 2015. Check Web site for most current prices.

Company

Information

Drives

Soft Starters

Motors

Power

Transmission

Motion: Sensors and Steppers

Motor Controls

Sensors:

Proximity

Sensors:

Photoelectric

Sensors:

Encoders

Sensors:

Limit Switches

Sensors:

Current

Sensors:

Pressure

Sensors:

Temperature

Sensors:

Level

Sensors:

Flow

Pushbuttons and Lights

Steadlights

Signal Devices

Process

Relays and Timers

Pneumatics:

Air Prep

Pneumatics:

Directional Control Valves

Pneumatics:

Cylinders

Pneumatics:

Tubing

Pneumatics:

Air Fittings

Appendix

Book 2

Terms and Conditions

eMC-3
Choose your SureStep System

1. Choose a motor

Determine the torque and speed required by your application. Then look at the motor speed-torque curves in the “SureStep Stepping System Motors” section of this catalog chapter. Choose a motor that can run your application with plenty of speed and torque reserve (most stepper systems should have a 100% safety margin for torque).

2. Choose a motor extension cable

Our 20-ft motor extension cables have a locking connector that mates up to the motor cable. The extension cables allow you to quickly connect the motor to the drive without having to splice wires or cut any cables.

If you chose an STP-MTR-xxxx motor, select an STP-EXT-020 cable.
If you chose an STP-MTRH-xxxx motor, select an STP-EXTH-020 cable.
(The “H” motors and cable can handle higher motor current)

3. Choose a drive

This chart is a quick selection guide. For a full list of features, check out the Technical Info later in this chapter.

<table>
<thead>
<tr>
<th>What you need</th>
<th>STP-DRV-4035</th>
<th>STP-DRV-4850</th>
<th>STP-DRV-6575</th>
<th>STP-DRV-80100</th>
</tr>
</thead>
<tbody>
<tr>
<td>32V Speed-Torque Curve (from Step 1)</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>48V Speed-Torque Curve (from Step 1)</td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>70V Speed-Torque Curve (from Step 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse &amp; Direction Input</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>More than 3.5A/motor phase</td>
<td>–</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>More than 5A/motor phase (“H” motors)</td>
<td>–</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Internal Indexing (Drive can move from Point A to Point B with a serial communication command)</td>
<td>–</td>
<td>√</td>
<td>–</td>
<td>√</td>
</tr>
<tr>
<td>Analog Velocity Input</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prices as of October 21, 2015. Check Web site for most current prices.
...in 4 easy steps

4. Choose a power supply

Since all SureStep motors can operate at 32V, 48V, and 70V, the selection of a power supply is dependent on the selected speed-torque curve of the motor and on the selection of drive. Choose a power supply that matches the desired speed-torque curve and stays within the voltage limit of the selected drive. Each power supply has incoming AC and outgoing DC fusing. There is also an electronically overload protected 5V supply for all your logic needs.

**Permissible Drive/Power Supply Combinations**

<table>
<thead>
<tr>
<th>Drive</th>
<th>STP-PWR-3204</th>
<th>STP-PWR-4805</th>
<th>STP-PWR-4810</th>
<th>STP-PWR-7005</th>
</tr>
</thead>
<tbody>
<tr>
<td>STP-DRV-4035</td>
<td>✔</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>STP-DRV-4850</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>-</td>
</tr>
<tr>
<td>STP-DRV-6575</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>-</td>
</tr>
<tr>
<td>STP-DRV-80100</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

For systems that use multiple drives and only one power supply, please read our SureStep User Manual (under “Product Documentation”) to properly size multiple systems.

120 or 240 VAC, 50/60 Hz power input (switch selectable)

32V, 48V and 70V linear supplies

Unregulated linear supplies perfect for stepper systems

Power ON LEDs

Input and output fusing included

Screw terminal AC input and DC output connections

5 VDC ±5% at 500 mA regulated logic power

2-Phase Microstepping Drive

Motor Extension Cable

Typical System

Step Motor Power Supply

NEMA Step Motor

www.automationdirect.com/stepper-systems
SureStep® System

SureStep stepping system includes:
- Four step motor power supplies
- Two DIP-switch configurable microstepping drives
- Two software configurable advanced microstepping drives
- Two motor extension cables
- Twenty step motors (NEMA 17, 23, 34 frame sizes; single & dual shaft)

Standard stepper drive features (STP-DRV-4035 & STP-DRV-6575)
- Low cost, digital step motor driver in compact package
- Operates from Step & Direction signals, or Step CW & Step CCW (jumper selectable)
- Fault output (-6575 only) & Enable input
- Optically isolated I/O
- Digital filters prevent position error from electrical noise on command signals: jumper selectable: 150 kHz or 2MHz (-6575 only)
- Rotary or DIP switch easily selects from many popular motors
- Electronic damping and anti-resonance (-6575 only)
- Automatic idle current reduction to reduce heat when motor is not moving: switch selectable: 50% or 90% of running current
- Switch selectable step resolution: (-DRV-4035) 400–10,000 steps per revolution; (-DRV-6575) 200–20,000 steps per revolution
- Switch selectable microstep emulation provides smoother, more reliable motion in full and half step modes
- Automatic self test (swich selectable)
- Operates from a 24–65 VDC or 12–40 VDC power supply, depending upon model
- Running current from 0.5–7.5A

Advanced stepper drive features (STP-DRV-4850 & STP-DRV-80100)
- Max 5A, 48V and max 10A, 80V models available
- Software configurable
- Programmable microsteps
- Internal indexer (via ASCII commands)
- Self test feature
- Idle current reduction
- Anti-resonance
- Torque ripple smoothing
- Step, analog, & serial communication inputs
- Serial communications allow point-to-point positioning

Motor features
- High torque, 2 phase, bipolar, 1.8° per step, 4-lead
- Available in single-shaft and dual-shaft models
- Connectorized
- (6) NEMA 17 motors
- (6) NEMA 23 motors
- (8) NEMA 34 motors

Power supply features
- Linear, unregulated DC power supplies
- 120/240 VAC selectable input
- 32V, 48V, 70V DC output models available
- All models have additional 5VDC, 500mA regulated logic supply
- Fusing included for both incoming AC and outgoing DC
- 5V supply has electronic overload protection

SureStep Drive / Motor Compatibility

SureStep Power Supply / Drive Compatibility

<table>
<thead>
<tr>
<th>Drive(1)(2)</th>
<th>STP-PWR-3204</th>
<th>STP-PWR-4805</th>
<th>STP-PWR-4810</th>
<th>STP-PWR-7005</th>
</tr>
</thead>
<tbody>
<tr>
<td>STP-DRV-4035</td>
<td>✓</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>STP-DRV-4850</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>No</td>
</tr>
<tr>
<td>STP-DRV-6575</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>No</td>
</tr>
<tr>
<td>STP-DRV-80100</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

1) Do NOT use a power supply that exceeds the drive’s input voltage range. If using a non-STP linear power supply, ensure that the unloaded voltage does not float above the drive’s maximum input range.

2) For best performance, use the lowest voltage power supply that supplies the required speed and torque.

SureStep Drive / Motor Compatibility

<table>
<thead>
<tr>
<th>Motor(1)(2)</th>
<th>Rated Extension Endurance (1)</th>
<th>STP-DRV-4035(1)</th>
<th>STP-DRV-4850(1)</th>
<th>STP-DRV-6575(1)</th>
<th>STP-DRV-80100(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STP-MTR-17040(D)</td>
<td>1.7</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>STP-MTR-17048(D)</td>
<td>2.0</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>STP-MTR-17060(D)</td>
<td>2.0</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>STP-MTR-23055(D)</td>
<td>2.8</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>STP-MTR-23079(D)</td>
<td>2.8</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>STP-MTR-34066(D)</td>
<td>2.8</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>STP-MTRH-23079(D)</td>
<td>5.6</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>STP-MTRH-34066(D)</td>
<td>6.3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>STP-MTRH-34097(D)</td>
<td>6.3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>STP-MTRH-34127(D)</td>
<td>6.3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

1) The combinations above will perform according to the published speed/torque curves. However, any STP motor can be used with any STP drive. Using a motor with a current rating higher than the drive’s output rating will proportionally limit the motor torque.

2) MTR motors have connectors compatible with the EXT extension cables. MTRH motors have connectors compatible with the EXTH extension cables.
SureStep® Microstepping Drives Overview

<table>
<thead>
<tr>
<th>Drive Model</th>
<th>Standard Microstepping Drives</th>
<th>Advanced Microstepping Drives</th>
</tr>
</thead>
<tbody>
<tr>
<td>STP-DRV-6575</td>
<td>$89.00</td>
<td>$230.00</td>
</tr>
<tr>
<td>STP-DRV-4035</td>
<td>$165.00</td>
<td>$275.00</td>
</tr>
<tr>
<td>STP-DRV-4850</td>
<td>$230.00</td>
<td></td>
</tr>
<tr>
<td>STP-DRV-80100</td>
<td>$275.00</td>
<td></td>
</tr>
</tbody>
</table>

- **Price**
  - STP-DRV-6575: $89.00
  - STP-DRV-4035: $165.00
  - STP-DRV-4850: $230.00
  - STP-DRV-80100: $275.00

- **Drive Type**
  - Microstepping drive with pulse input
  - Advanced microstepping drive with pulse or analog input, serial communication; includes programming/communication cable STP-232RJ11-CBL

- **Output Current**
  - 1.0–7.5 A/phase
  - 0.4–3.5 A/phase
  - 0.1–5 A/phase
  - 0.1–10 A/phase

- **Input Voltage**
  - nominal: 24–65 VDC
  - range: 20–75 VDC
  - nominal: 12–32 VDC
  - range: 12–42 VDC
  - nominal: 24–48 VDC
  - range: 18–53 VDC
  - nominal: 24–80 VDC
  - range: 18–88 VDC

- **Configuration Method**
  - rotary dial, dip switches, jumpers
  - dip switches
  - SureStep Pro software (included)

- **Amplifier Type**
  - MOSFET, dual H-bridge, 4-quadrant
  - MOSFET, dual H-bridge, bipolar chopper
  - MOSFET, dual H-bridge, 4-quadrant

- **Current Control**
  - 4-state PWM @ 20 kHz
  - 4-state PWM 20 kHz
  - 4-state PWM @ 20 kHz
  - 4-state PWM @ 20 kHz

- **Microstep Resolution**
  - dipswitch selectable
  - dipswitch selectable
  - software selectable
  - software selectable

- **Modes of Operation**
  - Step & Dir
  - CW/CCW
  - A/B Quad
  - Oscillator
  - Serial Indexing

- **Digital Input Signals**
  - Step/Pulse Direction
  - Enable

- **Analog Input**
  - n/a
  - n/a
  - speed control

- **Output Signal**
  - fault
  - fault, motion, tach

- **Communication Interface**
  - n/a
  - n/a
  - YES (programming/communication cable included)

- **Non-volatile Memory Storage**
  - n/a
  - n/a
  - YES

- **Idle Current Reduction**
  - YES
  - YES
  - YES

- **Self Test**
  - YES
  - YES
  - YES

- **Additional Features**
  - Load inertia (anti-resonance & damping feature to improve motor performance)
  - Step pulse noise filter
  - Anti-resonance (Electronic Damping)
  - Auto setup
  - Microstep emulation
  - Torque ripple smoothing (allows for fine adjustment of phase in the range 0.25 to 1.5 rps)
  - Waveform (command signal) smoothing

Refer to Specifications Tables for detailed specifications.

Prices as of October 21, 2015. Check Web site for most current prices.

www.automationdirect.com/stepper-systems
<table>
<thead>
<tr>
<th>Feature</th>
<th>STP-DRV-6575</th>
<th>STP-DRV-4035</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Microstepping Drive</strong></td>
<td>STP-DRV-6575</td>
<td>STP-DRV-4035</td>
</tr>
<tr>
<td><strong>Drive Type</strong></td>
<td>Microstepping drive with pulse input</td>
<td>Microstepping drive with pulse input</td>
</tr>
<tr>
<td><strong>Output Current</strong></td>
<td>Selectable from 1.0-7.5 A/phase (peak of sine)</td>
<td>Selectable from 0.4 to 3.5 A/phase (maximum output power is 140W)</td>
</tr>
<tr>
<td><strong>Input Voltage (external p/s required)</strong></td>
<td>Nominal: 24-65 VDC, Range: 20-75 VDC</td>
<td>Nominal: 12-32 VDC, Range: 12-42 VDC (including ripple voltage)</td>
</tr>
<tr>
<td><strong>Configuration Method</strong></td>
<td>Rotary dial, DIP switches, jumpers</td>
<td>DIP switches</td>
</tr>
<tr>
<td><strong>Amplifier Type</strong></td>
<td>MOSFET, dual H-bridge, 4-quadrant</td>
<td>MOSFET, dual H-bridge, bipolar chopper</td>
</tr>
<tr>
<td><strong>Current Control</strong></td>
<td>4-state PWM @ 20 kHz</td>
<td>4-state PWM @ 20 kHz</td>
</tr>
<tr>
<td><strong>Protection</strong></td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Recommended Input Fusing</strong></td>
<td>Fuse: 7A fast-acting, ADC #ACG7; Holder: ADC # DN-F6L11D</td>
<td>Fuse: 4A fast-acting, ADC # AC6A; Holder: ADC # DN-F6L11D</td>
</tr>
<tr>
<td><strong>Input Signals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Input Circuit</strong></td>
<td>5-24 VDC nominal (range: 4-30 VDC); optically isolated, differential</td>
<td>Opto-coupler input with 440Ω resistance (5 to 15 mA input current). Logic Low is input 0.8 VDC or less; Logic High is input 4VDC or higher.</td>
</tr>
<tr>
<td><strong>Step/Pulse</strong></td>
<td>Minimum pulse width = 0.25 µs. Maximum pulse frequency = 150kHz or 2MHz (user selectable).</td>
<td>Motor steps on falling edge of pulse and minimum pulse width is 0.5 µs (1MHz).</td>
</tr>
<tr>
<td><strong>Direction</strong></td>
<td>FUNCTIONS: step &amp; direction, CW/CCW step</td>
<td>Needs to change at least 2 microseconds before a step pulse is sent</td>
</tr>
<tr>
<td><strong>Enable</strong></td>
<td>FUNCTION: disable motor when closed</td>
<td>Logic 1 will disable current to the motor (current is enabled with no hook-up or logic 0)</td>
</tr>
<tr>
<td><strong>Analog</strong></td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Output Signal</strong></td>
<td>30 VDC/80 mA max, optically isolated photodarlington, sinking or sourcing.</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Current Reduction</strong></td>
<td>Reduce power consumption and heat generation by limiting motor running current to 100%, 90%, or 80% of maximum. Current should be increased to 120% if microstepping. (Torque is reduced/increased by the same %.)</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Idle Current Reduction</strong></td>
<td>90% or 50% of running current. (Holding torque is reduced by the same %.)</td>
<td>0% or 50% reduction (idle current setting is active if motor is at rest for 1 second or more).</td>
</tr>
<tr>
<td><strong>Microstep Resolution</strong></td>
<td>20000, 12800, 5000, 2000, 400 smooth, 400, 200 smooth, or 200 steps/rev.</td>
<td>400 (200x2), 1,000 (200x5), 2,000 (200x10), or 10,000 (200x50) steps/rev.</td>
</tr>
<tr>
<td><strong>Phase Current Setting</strong></td>
<td>(1.3–6.3) x 80%–120% DIP switch selectable</td>
<td>0.4 to 3.5 A/phase with 32 selectable levels</td>
</tr>
<tr>
<td><strong>Self Test</strong></td>
<td>Automatically rotates the motor back and forth two turns in each direction in order to confirm that the motor is operational. Uses half-step to rotate 1/2 revolution in each direction at 100 steps/second</td>
<td></td>
</tr>
<tr>
<td><strong>Step Pulse Noise Filter</strong></td>
<td>Select 150 kHz or 2MHz</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Load Inertia</strong></td>
<td>Set motor and load inertia range to 0-4x or 5-10x.</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Connectors</strong></td>
<td>Removable screw terminal blocks, Motor &amp; Power Supply: 30–12 AWG, Signals: 30–14 AWG</td>
<td>Screw terminal blocks with AWG 18 maximum wire size</td>
</tr>
<tr>
<td><strong>Maximum Humidity</strong></td>
<td>90% non-condensing</td>
<td>90% non-condensing</td>
</tr>
<tr>
<td><strong>Storage/Ambient Temperature</strong></td>
<td>0 to 50 °C [32 to 122 °F] (mount to suitable heat sink)</td>
<td>-20 to 80 °C [-4 to 176 °F]</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>0 to 85 °C [32 to 185 °F] (interior of electronics section)</td>
<td>0 to 55 °C [32 to 131 °F] recommended; 70 °C [158 °F] maximum</td>
</tr>
<tr>
<td><strong>Drive Cooling Method</strong></td>
<td>Natural convection (mount drive to metal surface)</td>
<td>Natural convection (mount drive to metal surface to dissipate heat)</td>
</tr>
<tr>
<td><strong>Mounting</strong></td>
<td>(2) #4 screws to mount wide or narrow side to metal surface</td>
<td>(4) #4 screws to mount on wide side; (2) #4 screws to mount on narrow side</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>10.8 oz [306g] – (including mating connectors)</td>
<td>9.3 oz. [264 g]</td>
</tr>
<tr>
<td><strong>Agency Approvals</strong></td>
<td>CE (EMC &amp; LVD); RoHS</td>
<td>CE (complies with EN55011A &amp; EN50082-1 (1992)), RoHS</td>
</tr>
</tbody>
</table>

Prices as of October 21, 2015. Check Web site for most current prices.