



# Integrated Microstepping Motors and Drives

## SureStep® Integrated Motors System

### General integrated motor/drive features

- DC power supply required (12-48 VDC or 12-70 VDC)
- Pulse/Direction or CW Pulse/CCW Pulse
- Digital input filtering
- "E" models include an encoder
- Three optically isolated digital inputs, 5 to 24 volts
- Step input signal smoothing (microstep emulation), performs high resolution stepping by synthesizing coarse steps into fine microsteps
- Dynamic smoothing, software-configurable filtering for use in removing spectral components from command sequence, reduces jerk, limiting excitation of system resonance
- Anti-resonance (electronic damping): raises the system-damping ratio to eliminate midrange instability and allow stable operation throughout the speed range of the motor
- Idle current reduction range of 0-90% of running current after a delay selectable in milliseconds (Standard models = 50/90%, DIP switch selectable)
- Configurable hardware digital noise filter, software noise filter
- Non-volatile storage, configurations are saved in FLASH memory on-board the DSP
- Dynamic current control, software configurable for running current, accel current, idle current, to make motion smoother and the motor run cooler



Standard NEMA 17 and 23 motor/drives

### Standard integrated motor/drive features

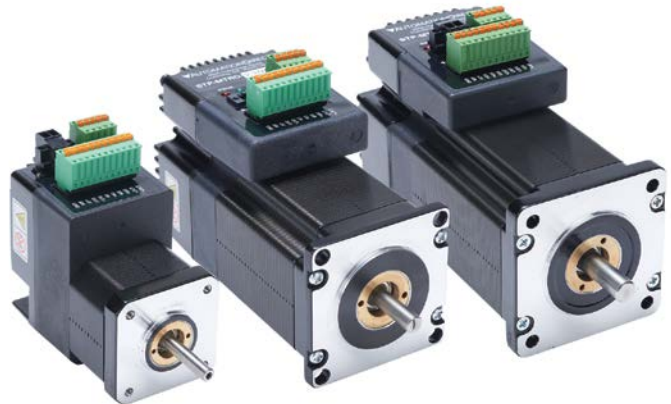
#### (STP-MTRD-x)

- "E" models have an externally wireable encoder which can provide feedback to an external controller
- Configurable via DIP switches
- Available torque from 68 to 210 oz-in

### Advanced integrated motor/drive features

#### (STP-MTRD-xR)

- Step and Direction, CW/CCW, and AB Quadrature/Encoder following
- Velocity (Oscillator) and position mode
- Control via streaming SCL commands
- RS-485 ASCII (2- or 4-wire) communications
- On "E" models, the internal encoder provides improved position and speed control
- Four "Variable I/O" points, 5 to 24 volts (NEMA 24 models)
- Analog input for speed and position, 0 to 5 VDC
- Configurable via SureMotion Pro software
- Available torque from 54 to 340 oz-in



Advanced NEMA 17, 23, and 24 motor/drives

| SureStep Series Part Numbers<br>Standard Integrated Motor/Drives |           |          |                     |
|--|-----------|----------|---------------------|
| Integrated Motor/Drive   | NEMA Size | Price    | Drawing             |
| <a href="#">STP-MTRD-17038</a>                                   | 17        | \$115.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-17038E</a>                                  | 17        | \$202.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-23042</a>                                   | 23        | \$178.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-23042E</a>                                  | 23        | \$265.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-23065</a>                                   | 23        | \$187.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-23065E</a>                                  | 23        | \$272.00 | <a href="#">PDF</a> |

Note: Standard Integrated motor/drives with an "E" have an external encoder that can be wired to an external controller.

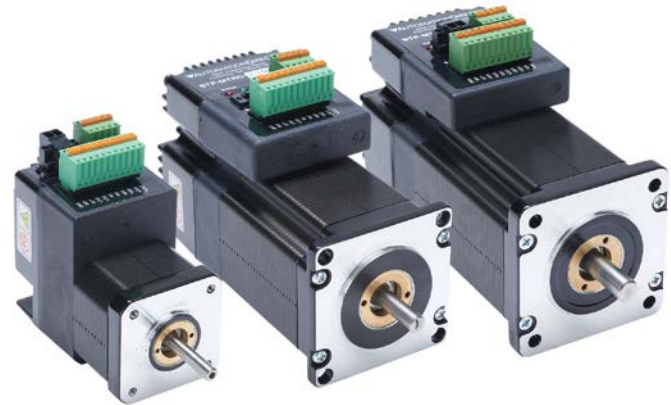
| SureStep Series Part Numbers<br>Advanced Integrated Motor/Drives |           |          |                     |
|--|-----------|----------|---------------------|
| Integrated Motor/Drive   | NEMA Size | Price    | Drawing             |
| <a href="#">STP-MTRD-17030R</a>                                  | 17        | \$274.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-17030RE</a>                                 | 17        | \$352.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-17038R</a>                                  | 17        | \$287.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-17038RE</a>                                 | 17        | \$384.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-23042R</a>                                  | 23        | \$295.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-23042RE</a>                                 | 23        | \$409.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-23065R</a>                                  | 23        | \$307.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-23065RE</a>                                 | 23        | \$415.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-24075RV</a>                                 | 24        | \$415.00 | <a href="#">PDF</a> |
| <a href="#">STP-MTRD-24075RVE</a>                                | 24        | \$493.00 | <a href="#">PDF</a> |

Note: Advanced Integrated motor/drives with an "E" have an internal encoder used for stall prevention (cannot be wired to an external PLC or controller).



# Integrated Microstepping Motors and Drives

## SureStep® Advanced Integrated Motor/Drives



### SureStep Integrated Series Specifications – Advanced

| Integrated Motor/Drive                       |                               | <u><i>STP-MTRD-17030RSTP-MTRD-17030RE</i></u><br><i>STP-MTRD-17030RE</i>  | <u><i>STP-MTRD-17038RSTP-MTRD-17038RE</i></u><br><i>STP-MTRD-17038RE</i> | <u><i>STP-MTRD-23042R</i></u><br><u><i>STP-MTRD-23042RE</i></u> | <u><i>STP-MTRD-23065R</i></u><br><u><i>STP-MTRD-23065RE</i></u> |
|--|-------------------------------|---|--|---|---|
| <b>Input Voltage (external p/s required)</b> |                               | 12-48 VDC   |  | 12-70 VDC   |   |
| <b>Configuration Method</b>                  |                               | SureMotion Pro software (SM-PRO: free download)   |  |   |   |
| <b>Supply Output</b>                         |                               | +4.8 - 5 volts @ 50mA maximum   |  |   |   |
| <b>Current Controller</b>                    |                               | Dual H-Bridge, 4 Quadrant, 4 state PWM @ 16kHz  |  | Dual H-Bridge, 4 Quadrant, 4 state PWM @ 20kHz                  |   |
| <b>Encoder Feedback</b>                      |                               | "E" models only. Encoder is internal and provides position verification and stall prevention control by default.  |  |   |   |
| <b>Motor/Drive Protection</b>                |                               | Short circuit, over-voltage, under-voltage, over-temp   |  |   |   |
| <b>Input Signals</b>                         | <b>Step/Pulse</b>             | 5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 3 MHz). Maximum pulse frequency = 3MHz, max current draw = 12mA<br>Function = Step Input, Jog CW, Limit CW, Start/Stop, General Purpose                         |  |   |   |
|  | <b>Direction</b>              | 5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 3 MHz). Maximum pulse frequency = 3MHz, max current draw = 12mA<br>Function = Direction Input, Jog CCW, Limit CCW, General Purpose                              |  |   |   |
|  | <b>Enable</b>                 | 5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 3 MHz). Maximum pulse frequency = 3MHz, max current draw = 12mA<br>Function = Enable Input, Reset Input, Change Speed, General Purpose                          |  |   |   |
|  | <b>Analog</b>                 | 0-5 VDC nominal (AIN referenced to GND). Input impedance: 30K ohms minimum, resolution = 12 bits<br>Function = analog control modes and general purpose analog usage; programmable for signal range, offset, dead band, and filtering |  |   |   |
| <b>Output Signal</b>                         |                               | 30VDC, 40mA maximum. Optically isolated, open collector. Maximum pulse frequency 10kHz.<br>Functions = Brake Output, Alarm Output, Motion Output, Tach Output, General Purpose  |  |   |   |
| <b>Communication Interface</b>               |                               | RS-485 ASCII  |  |   |   |
| <b>Non-volatile Memory Storage</b>           |                               | Configurations are saved in FLASH memory on-board the DSP   |  |   |   |
| <b>Features</b>                              | <b>Current Reduction</b>      | Selectable in SureMotion Pro software   |  |   |   |
|  | <b>Idle Current Reduction</b> | Reduction range of 0-90% of running current after delay selectable in ms  |  |   |   |
|  | <b>Microstep Resolution</b>   | Software selectable from 200 to 51200 steps/rev in increments of 2 steps/rev  |  |   |   |
|  | <b>Modes of Operation</b>     | Pulse (step) & direction, CW/CCW, A/B quadrature, velocity (oscillator), SCL streaming commands   |  |   |   |
|  | <b>Self Test</b>              | Checks internal and external power supply voltages. Diagnoses open motor phases and motor resistance changes > 40%  |  |   |   |
| <b>Connectors</b>                            | <b>DC Power</b>               | 2-position screw terminal: Weidmuller 1615780000  |  |   |   |
|  | <b>I/O</b>                    | 11-position spring cage: Phoenix 1881419  |  |   |   |
|  | <b>Comm</b>                   | 5-position spring cage: Phoenix 1881354   |  |   |   |
| <b>Drive Cooling Method</b>                  |                               | Natural convection (mount to suitable heat sink)  |  |   |   |
| <b>Status LEDs</b>                           |                               | 1 red, 1 green  |  |   |   |
| <b>Mounting</b>                              |                               | Four M3 screws  |  | Four #6 screws  |   |



# Integrated Microstepping Motors and Drives

## SureStep<sup>®</sup> Advanced Integrated Motor/Drives

| <b>SureStep Integrated Series Specifications – Advanced Variable I/O</b> |   |  |
|--|---|--|
| <b>Integrated Motor/Drive</b>  | <b><i>STP-MTRD-24075RV / STP-MTRD-24075RVE</i></b>  |  |
| <b>Input Voltage<br/>(external p/s required)</b>                         | 12-70 VDC   |  |
| <b>Configuration Method</b>  | SureMotion Pro software ( <a href="#">SM-PRO</a> : free download)   |  |
| <b>Supply Output</b>   | +4.8 - 5 volts @ 50mA maximum   |  |
| <b>Current Controller</b>  | Dual H-Bridge, 4 Quadrant, 4 state PWM @ 20kHz  |  |
| <b>Encoder Feedback</b>  | "E" models only. Encoder is internal and provides position verification and stall prevention control by default.  |  |
| <b>Motor/Drive Protection</b>  | Short circuit, over-voltage, under-voltage, over-temp   |  |
| <b>Variable I/O</b>  | <b>I/O 1 (Step/Pulse)</b><br>INPUT: 5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 3MHz). Maximum pulse frequency = 3MHz, max current draw = 12mA, Function = Step Input, Jog CW, Enable Input, Start/Stop, General Purpose<br>OUTPUT: 30VDC, 40mA maximum. Optically isolated, open collector. Maximum pulse frequency 10kHz. Functions = Brake Output, Fault Output, Motion Output, Tach Output, General Purpose |  |
|  | <b>I/O 2 (Direction)</b><br>INPUT: 5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 3MHz). Maximum pulse frequency = 3MHz, max current draw = 12mA, Function = Direction Input, Jog CCW, Alarm Reset Input, General Purpose<br>OUTPUT: 30VDC, 40mA maximum. Optically isolated, open collector. Maximum pulse frequency 10kHz. Functions = Brake Output, Fault Output, Motion Output, Tach Output, General Purpose   |  |
|  | <b>I/O 3</b><br>INPUT: 5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 3MHz). Maximum pulse frequency = 3MHz, max current draw = 12mA, Function = Limit CW Input, Enable Input, Change Speed Input, General Purpose<br>OUTPUT: 30VDC, 40mA maximum. Optically isolated, open collector. Maximum pulse frequency 10kHz. Functions = Brake Output, Fault Output, Motion Output, Tach Output, General Purpose          |  |
|  | <b>I/O 4</b><br>INPUT: 5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 3 MHz). Maximum pulse frequency = 3MHz, max current draw = 12mA, Function = Limit CCW Input, Alarm Reset Input, General Purpose<br>OUTPUT: 30VDC, 40mA maximum. Optically isolated, open collector. Maximum pulse frequency 10kHz. Functions = Brake Output, Fault Output, Motion Output, Tach Output, General Purpose                       |  |
| <b>Analog</b>  | 0-5 VDC nominal (AIN referenced to GND). Input impedance: 30k ohms minimum, resolution = 12 bits, Function = analog control modes and general purpose analog usage; programmable for signal range, offset, dead band, and filtering   |  |
| <b>Communication Interface</b>   | RS-485 ASCII (2- or 4-wire)   |  |
| <b>Non-volatile Memory Storage</b>                                       | Configurations are saved in FLASH memory on-board the DSP   |  |
| <b>Features</b>  | <b>Current Reduction</b>  | Selectable in SureMotion Pro software  |
|  | <b>Idle Current Reduction</b>   | Reduction range of 0–90% of running current after delay selectable in ms   |
|  | <b>Microstep Resolution</b>   | Software selectable from 200 to 51200 steps/rev in increments of 2 steps/rev                                       |
|  | <b>Modes of Operation</b>   | Pulse (step) & direction, CW/CCW, A/B quadrature, velocity (oscillator), SCL streaming commands                    |
|  | <b>Self Test</b>  | Checks internal and external power supply voltages. Diagnoses open motor phases and motor resistance changes > 40% |
| <b>Connectors</b>  | <b>DC Power</b>   | 2-position screw terminal: Weidmuller 1615780000   |
|  | <b>I/O</b>  | 11-position spring cage: Phoenix 1881419   |
|  | <b>Comm</b>   | 5-position spring cage: Phoenix 1881354  |
| <b>Drive Cooling Method</b>  | Natural convection (mount to suitable heat sink)  |  |
| <b>Status LEDs</b>   | 1 red, 1 green  |  |
| <b>Mounting</b>  | Four #6 screws  |  |



# Integrated Microstepping Motors and Drives

## SureStep® Advanced Integrated Motor/Drives

| SureStep Integrated Series Specifications – Advanced |   |                                     |                                     |                                     |                                       |          |
|--|---|-------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------|----------|
| Integrated Motor/Drive                               | STP-MTRD-17030R<br>STP-MTRD-17030RE   | STP-MTRD-17038R<br>STP-MTRD-17038RE | STP-MTRD-23042R<br>STP-MTRD-23042RE | STP-MTRD-23065R<br>STP-MTRD-23065RE | STP-MTRD-24075RV<br>STP-MTRD-24075RVE |          |
| <b>NEMA Frame Size</b>                               | NEMA 17   | NEMA 17                             | NEMA 23                             | NEMA 23                             | NEMA 24                               |          |
| <b>* Maximum Holding Torque</b>                      | (lb-in)   | 3.375                               | 4.25                                | 7.8125                              | 13.125                                | 21.25    |
|  | (oz-in)   | 54                                  | 68                                  | 125                                 | 210                                   | 340      |
|  | (N-m)   | 0.381326                            | 0.480189                            | 0.8827                              | 1.482936                              | 2.400944 |
| <b>Rotor Inertia</b>                                 | (oz-in <sup>2</sup> )   | 0.310                               | 0.448                               | 1.420                               | 2.515                                 | 4.900    |
|  | (kg-cm <sup>2</sup> )   | 0.057                               | 0.082                               | 0.260                               | 0.460                                 | 0.897    |
| <b>Insulation Class</b>                              | Class B (130°C)   |                                     |                                     |                                     |                                       |          |
| <b>Basic Step Angle</b>                              | 1.8 degrees   |                                     |                                     |                                     |                                       |          |
| <b>Shaft Runout (in)</b>                             | 0.03  |                                     | 0.05                                |                                     |                                       |          |
| <b>Max Shaft Radial Play @ 1lb load</b>              | 0.02  |                                     |                                     |                                     |                                       |          |
| <b>Perpendicularity (mm)</b>                         | 0.08  |                                     |                                     |                                     |                                       |          |
| <b>Concentricity (mm)</b>                            | 0.05  |                                     |                                     |                                     |                                       |          |
| <b>* Maximum Radial Load (lb [kg])</b>               | 6.7   |                                     | 13.9                                |                                     |                                       |          |
| <b>* Maximum Thrust Load (lb [kg])</b>               | 34  |                                     | 63                                  |                                     |                                       |          |
| <b>Storage Temperature Range</b>                     | 0-40°C (32-104°F)   |                                     |                                     |                                     |                                       |          |
| <b>Operating Temperature Range</b>                   | 0-85°C  |                                     |                                     | 0-70°C                              |                                       |          |
| <b>Operating Humidity Range</b>                      | 90% max, non-condensing   |                                     |                                     |                                     |                                       |          |
| <b>Product Material</b>                              | Aluminum, steel, plastic, FR4, etc.   |                                     |                                     |                                     |                                       |          |
| <b>Environmental Rating</b>                          | IP40  |                                     |                                     |                                     |                                       |          |
| <b>Weight (oz [g])</b>                               | 12.7 [360]  | 15.6 [441]                          | 30 [850]                            | 42 [1191]                           | 56 [1580]                             |          |
| <b>Agency Approvals</b>                              | CE*   |                                     |                                     |                                     |                                       |          |
| <b>Design Tips</b>                                   | <p>Allow sufficient time to accelerate the load and size the step motor with a 100% torque safety factor.<br/>           DO NOT disassemble step motors because motor performance will be reduced and the warranty will be voided.<br/>           DO NOT connect or disconnect the step motor during operation.<br/>           Mount the motor to a surface with good thermal conductivity, such as steel or aluminum, to allow heat dissipation.<br/>           Use a flexible coupling with "clamp-on" connections to both the motor shaft and the load shaft to prevent radial and thrust loading on bearings from minor misalignment and to prevent loosening due to vibration.</p> |                                     |                                     |                                     |                                       |          |

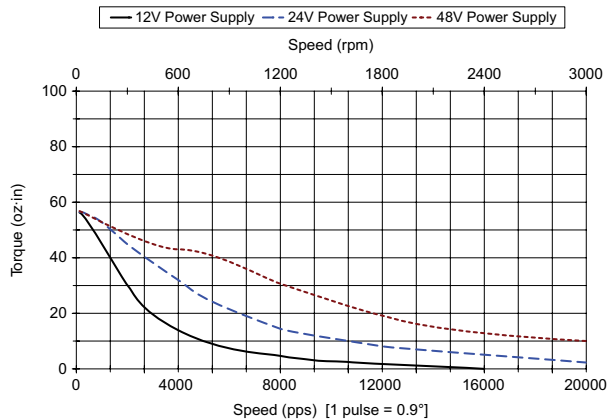
\* For NEMA 24 motors, an EMI filter (RES10F03) is needed on the power supply for CE compliance.



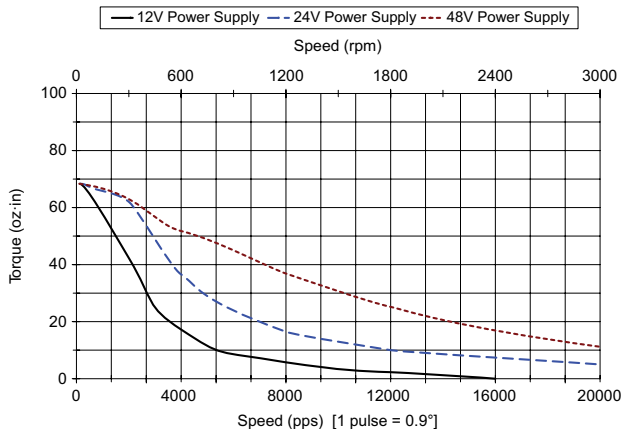
# Integrated Microstepping Motors and Drives

## SureStep® Integrated Motor/Drives Motor Torque vs. Speed

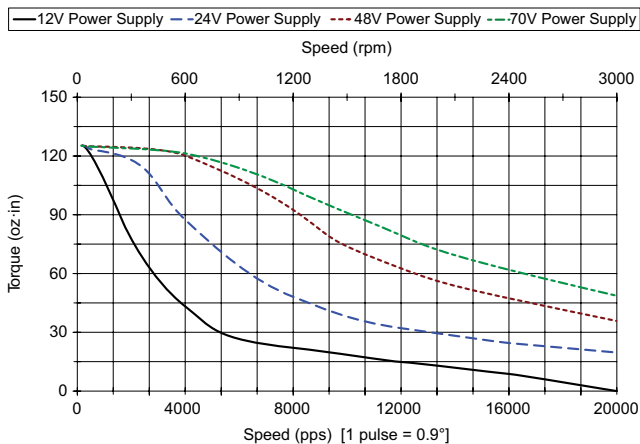
**STP-MTRD-17030 Torque vs Speed (1.8° step motor; 1/2 stepping)**



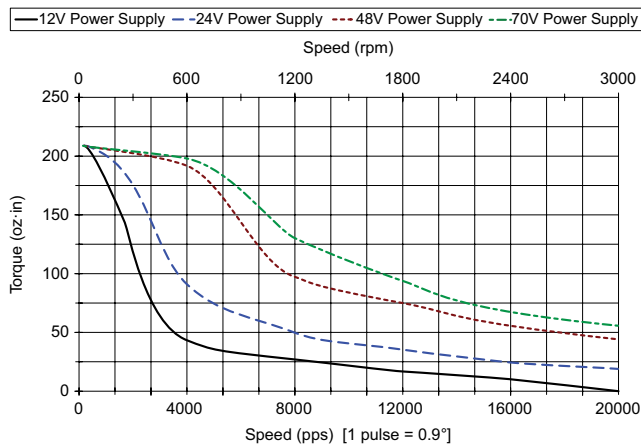
**STP-MTRD-17038 Torque vs Speed (1.8° step motor; 1/2 stepping)**



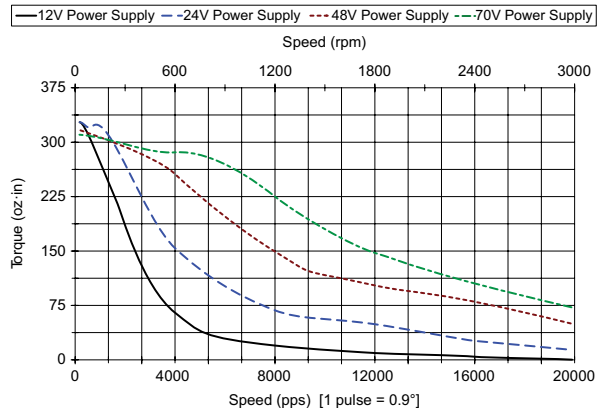
**STP-MTRD-23042 Torque vs Speed (1.8° step motor; 1/2 stepping)**



**STP-MTRD-23065 Torque vs Speed (1.8° step motor; 1/2 stepping)**



**STP-MTRD-24075 Torque vs Speed (1.8° step motor; 1/2 stepping)**



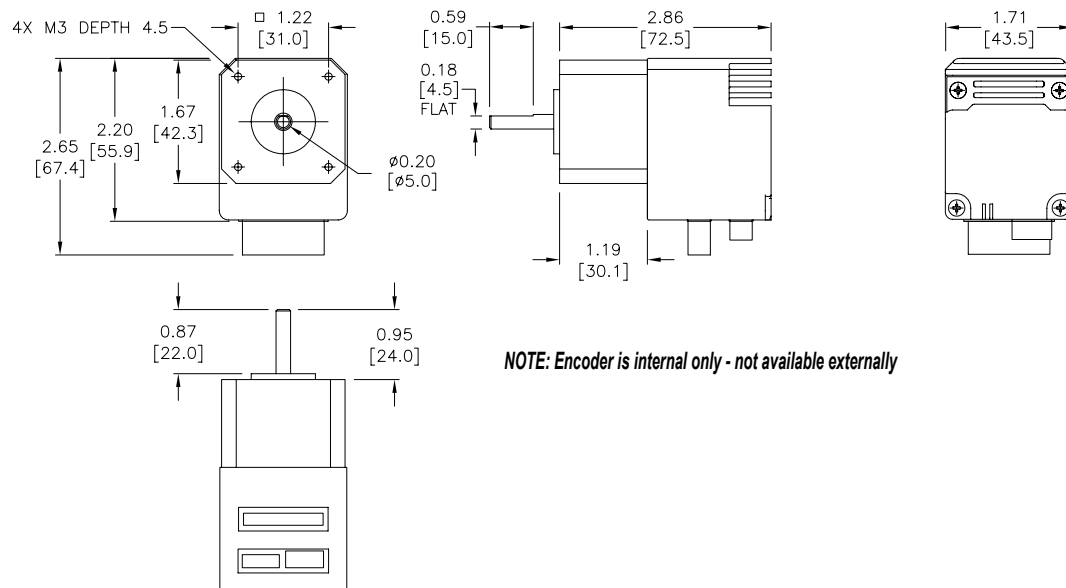


# Integrated Microstepping Motors and Drives

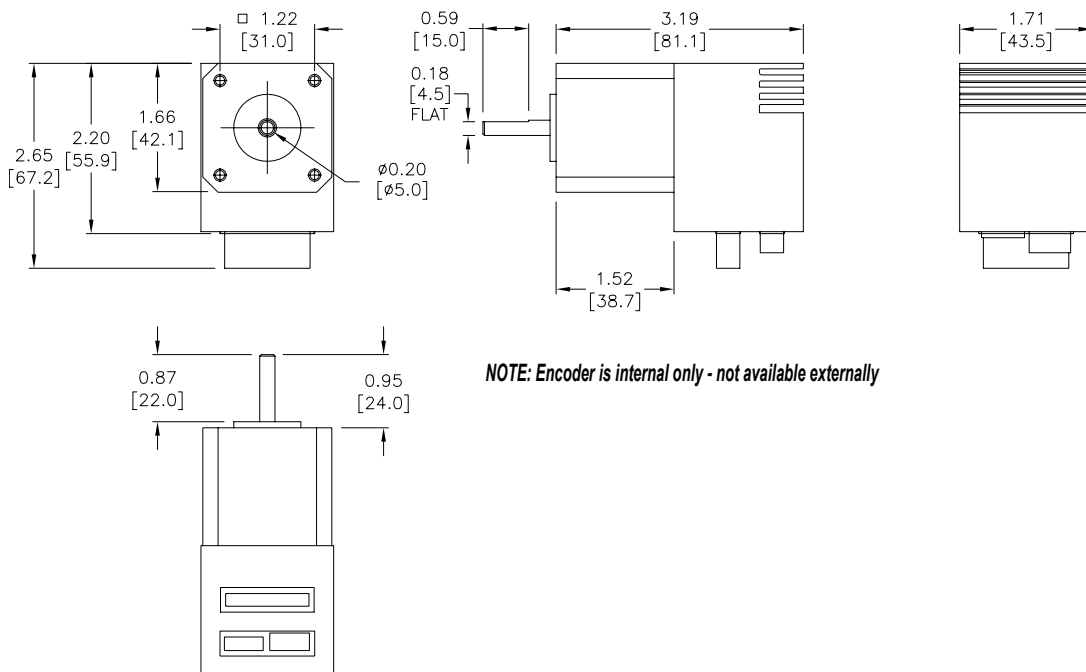
## SureStep® Advanced Integrated Motor/Drives Dimensions

**Dimensions = in [mm]**

### STP-MTRD-17030R / STP-MTRD-17030RE



### STP-MTRD-17038R / STP-MTRD-17038RE



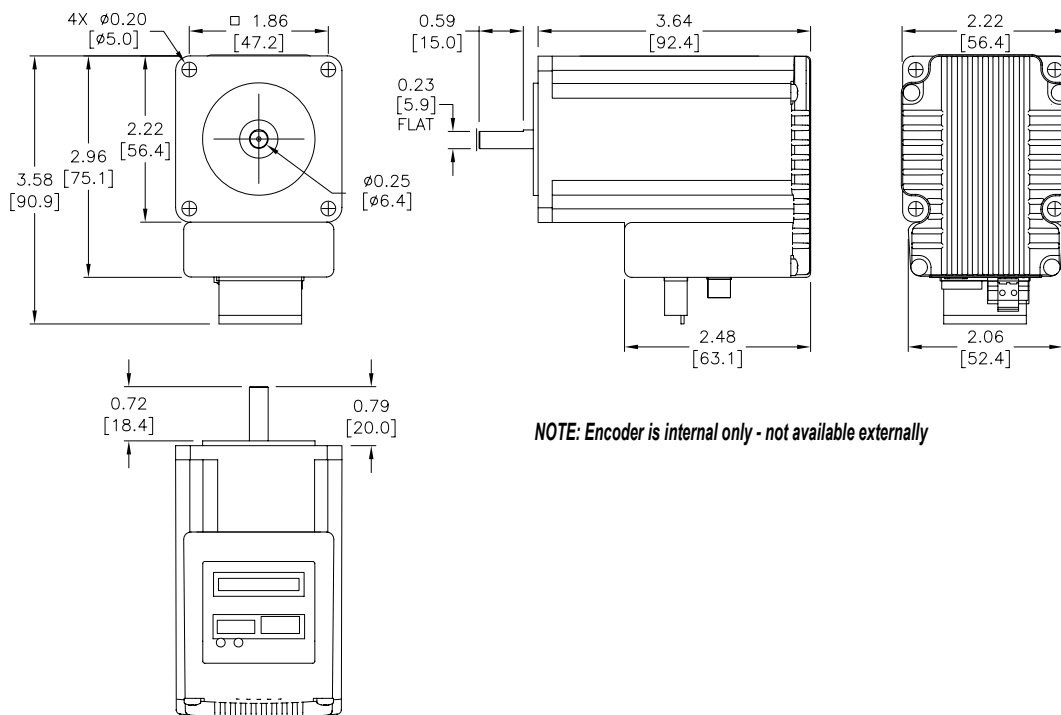


# Integrated Microstepping Motors and Drives

## SureStep® Advanced Integrated Motor/Drives Dimensions, continued

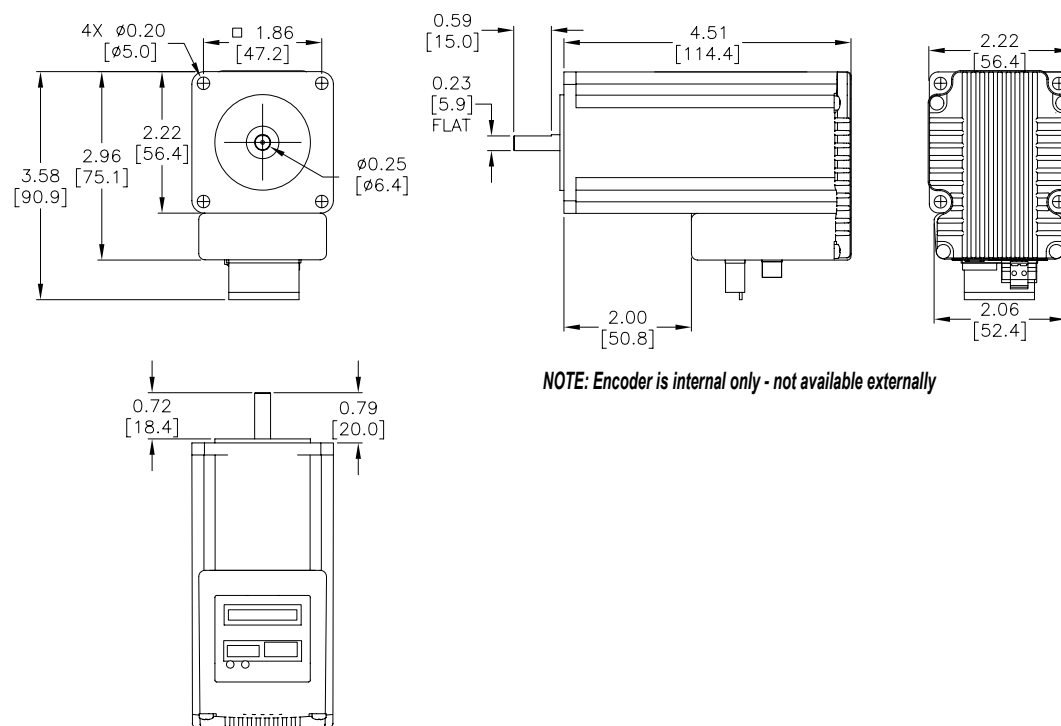
Dimensions = in [mm]

### STP-MTRD-23042R / STP-MTRD-23042RE



NOTE: Encoder is internal only - not available externally

### STP-MTRD-23065R / STP-MTRD-23065RE



NOTE: Encoder is internal only - not available externally

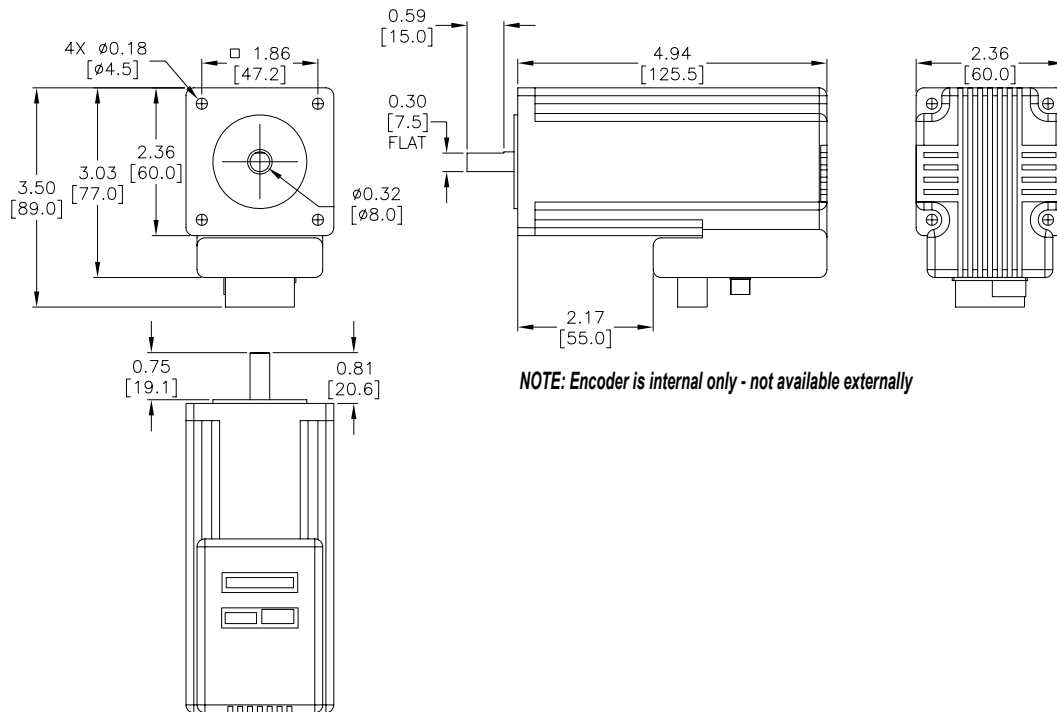


# Integrated Microstepping Motors and Drives

## SureStep® Advanced Integrated Motor/Drives Dimensions, continued

**Dimensions = in [mm]**

### STP-MTRD-24075RV / STP-MTRD-24075RVE







# Stepping System Accessories

## SureStep® Microstepping Drives Accessories

### Braking Accessories

As a load rapidly decelerates from a high speed, much of the kinetic energy of that load is transferred back to the motor. This energy is then pushed back to the drive and power supply, resulting in increased system voltage. If there is enough overhauling load on the motor, the DC voltage will go above the drive and/or power supply limits. In general, the more torque the motor is capable of producing then the more energy it can push back into the drive.

When using a regulated/switching power supply, this can trip the overvoltage protection of the power supply or drive, and cause it to shut down.

To solve this problem, AutomationDirect offers a regeneration clamp as an optional accessory. The regen clamp has a built-in 50W braking resistor. The STP-DRVA-RC-050A does not have the ability to use an external resistor.



**Regeneration Clamp STP-DRVA-RC-050A**

### Regeneration Clamp Features

#### STP-DRVA-RC-050A

- Built-in 50W power resistor for more continuous current handling
- Mounted on a heat sink
- Voltage range: 24–80 VDC; no user adjustments required
- Power: 50W continuous; 800W peak
- Indicators (LED):  
Green = power supply voltage is present  
Red = clamp is operating (usually when stepper is decelerating)
- Protection: The external power supply is internally connected to an “Input Diode” in the regen clamp that protects the power supply from high regeneration voltages. This diode protects the system from connecting the power supply in reverse. If the clamp circuit fails, the diode will continue to protect the power supply from over-voltage.
- Three drive connections, 7A max per channel, 15A total output current
- Removable terminal blocks (replacement kit STP-CON-4)
- Uses 18-20 AWG wire for connections

### SureStep Damper

A step motor inertia damper can smooth out steps in a typical step motor resulting in a quieter and smoother motion when rotating between steps. Reducing the resonance and possible micro oscillations when moving from step to step is the main purpose of a “hockey puck” style damper, but it can also be used as a hand wheel to directly rotate the position of the rotor when power is removed from the motor. The damper is a properly sized machined piece of aluminum encased in plastic. It is sized and weighted for general damping of the respective frame size motor.



**Damper**

| Sure Step Series Specifications – Microstepping Drives Optional Accessories |         |   |                     |
|---|---------|---|---------------------|
| Part Number   | Price   | Description   | Drawing             |
| <u><a href="#">STP-DRVA-RC-050A</a></u> *                                   | \$61.00 | Regen Clamp: 50W, for DC input stepper and servo drives, enclosed   | <a href="#">PDF</a> |
| <u><a href="#">STP-MTRA-17DMP</a></u>                                       | \$15.00 | SureStep damper, metal body. For use with NEMA 17 stepper motors with 5mm shafts. Mounting set screw included.      | <a href="#">PDF</a> |
| <u><a href="#">STP-MTRA-23DMP</a></u>                                       | \$34.50 | SureStep damper, metal body. For use with NEMA 23 stepper motors with 1/4 inch shafts. Mounting set screw included. | <a href="#">PDF</a> |

\* Do not use the regeneration clamp in an atmosphere containing corrosive gases.

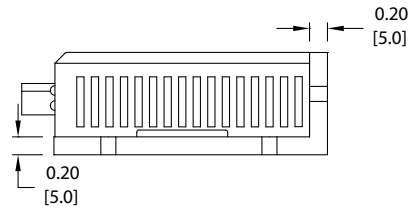
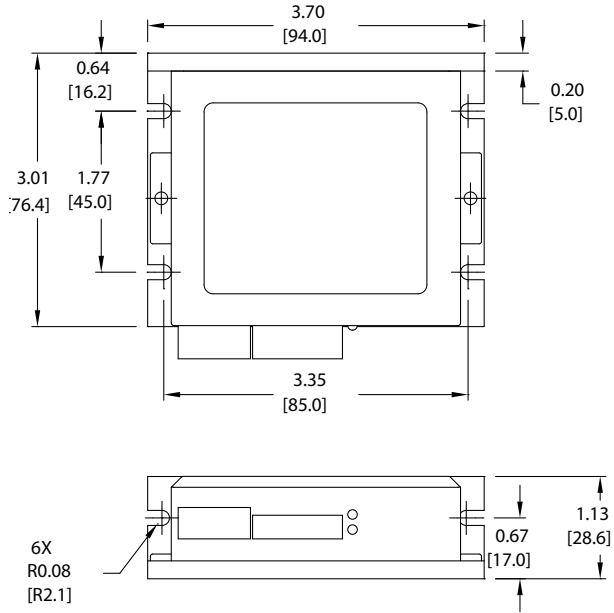


# Stepping System Accessories

## SureStep® Microstepping Drives Accessories

**Dimensions = in [mm]**

**STP-DRVA-RC-050A**





# Stepping System Accessories

## SureStep® Microstepping Drives Accessories

### USB to RS-485 Adapter

The STP-USB485-4W is a USB to RS-232/RS-485 converter that can be used in 2-wire or 4-wire serial networks. Serial communication can be wired up via the 9-pin D-sub connector or through the 6-screw terminals.

The STP-USB485-4W can be set for several different configurations. These modes are set up by the 4 DIP switches on the outside of the case (RS-232/RS-485, full/half duplex) and by the 7 jumpers located inside the case (termination/bias resistors).

SureStep Advanced Drives communicate via RS-232 (for control and for configuration via SureMotion Pro).

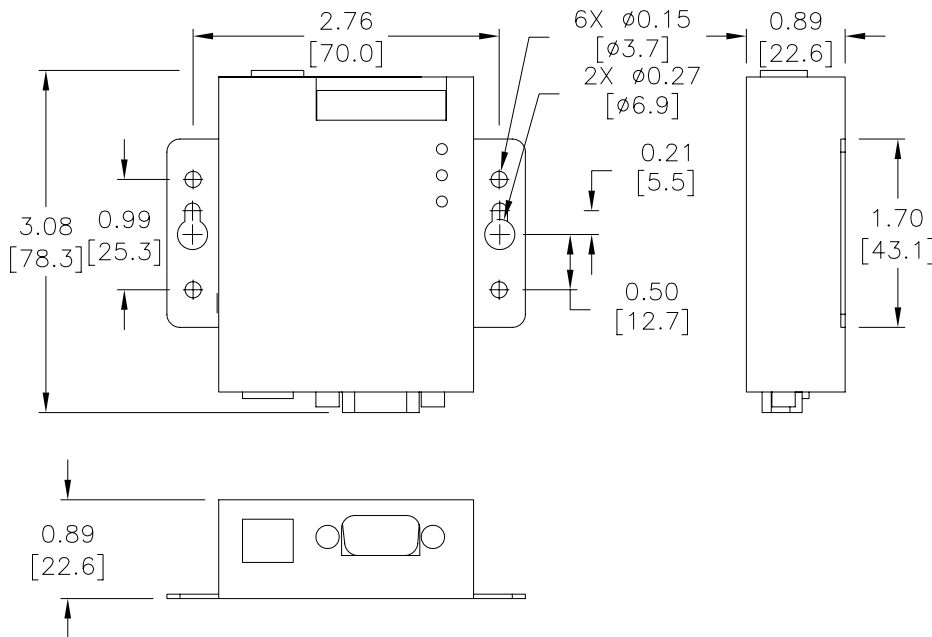
The Advanced Integrated motor/drives use RS-485. While the Advanced Integrated motor/drives can be wired for either 2- or 4-wire networks, 4-wire is require for use with SureMotion Pro due to the Firmware Download utility and the Status Monitor Screen.

Depending on the host controller's RS-485 implementation, either 2- or 4-wire RS-485 can be used for control. All RS-485 PLCs that have 2-wire capability (Productivity, BRX, Click, DirectLogic, etc.) can control the Advanced Integrated steppers.



| SureStep PC Adapter - STP-USB485-4W |  |
|-------------------------------------|--|
| <b>Price</b>                        | \$130.00                                   |
| <b>Drawing</b>                      | PDF  |
| <b>Communications</b>               | 2-wire RS-232<br>2- or 4-wire RS-485       |
| <b>Configure With</b>               | Internal jumpers and external DIP switches |
| <b>Compatible Cables</b>            | STP-232RJ11-CBL<br>STP-485DB9-CBL-2<br>USB |

**Dimensions = in [mm]**





# Stepping System Accessories

## SureStep® Stepping System Encoders

### Replacement Encoders

The [STP-MTRA-ENC1](#) is a replacement for the encoder that comes standard with the [STP-MTRD-17038E](#), [STP-MTRD-23042E](#), and [STP-MTRD-23065E](#) integrated motor/drives. Note that the encoder included with (E) model advanced integrated motor/drives is internal and cannot be replaced.

The [AMT112Q-V](#) is a replacement for the encoder that comes standard with the [STP-MTR\(x\)-xxxxE](#) stand alone step motors.

Installation tool and mounting hardware is included with all replacement encoders. For more information and details on how to wire the replacement encoders, please see the SureStep User Manual.

### Optional Encoders

Optional encoders can be purchased separately for standard integrated motor/drives and standalone dual-shaft motors in all NEMA 14, 17, and 23 sizes, and also for [STP-MTRAC-34xxxD](#) motors (currently not available for [STP-MTRx-34xxxD](#) motors). All (D) model (dual-shaft) step motors come with pre-drilled holes in the rear end cap for easy encoder mounting. Pre-installed encoders on standalone dual-shaft motors and standard integrated motor/drives can be retrofitted with an appropriate optional encoder if desired. Please see the chart on the following page for encoder compatibility.

#### Features:

- Fixed resolutions include 400ppr or 1000ppr
- Configurable models have up to 4096ppr (default = 400ppr)
- Choose line driver or push-pull (totem) output signals



**STP-MTRA-ENC2**



**AMT112Q-V**



**STP-MTRA-ENC11**

| Sure Step Series Specifications – Encoders |         |   |                     |
|--|---------|---|---------------------|
| Part Number                                | Price   | Description   | Drawing             |
| <a href="#">STP-MTRA-ENC1</a>              | \$91.00 | SureStep incremental (quadrature) modular encoder, 5VDC, line driver (differential) output, 1000 ppr. For use with SureStep stepper motors with 5mm rear shaft. Installation tool and mounting hardware included.               | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC2</a>              | \$79.00 | SureStep incremental (quadrature) modular encoder, 5VDC, Push-pull (totem) output, 1000 ppr. For use with SureStep stepper motors with 5mm rear shaft. Installation tool and mounting hardware included.                        | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC3</a>              | \$89.00 | SureStep incremental (quadrature) modular encoder, 5VDC, line driver (differential) output, 400 ppr. For use with SureStep stepper motors with 5mm rear shaft. Installation tool and mounting hardware included.                | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC4</a>              | \$76.00 | SureStep incremental (quadrature) modular encoder, 5VDC, Push-pull (totem) output, 400 ppr. For use with SureStep stepper motors with 5mm rear shaft. Installation tool and mounting hardware included.                         | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC5</a>              | \$91.00 | SureStep incremental (quadrature) modular encoder, 5VDC, line driver (differential) output, 1000 ppr. For use with SureStep stepper motors with 1/4 inch rear shaft. Installation tool and mounting hardware included.          | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC6</a>              | \$79.00 | SureStep incremental (quadrature) modular encoder, 5VDC, Push-pull (totem) output, 1000 ppr. For use with SureStep stepper motors with 1/4 inch rear shaft. Installation tool and mounting hardware included.                   | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC7</a>              | \$89.00 | SureStep incremental (quadrature) modular encoder, 5VDC, line driver (differential) output, 400 ppr. For use with SureStep stepper motors with 1/4 inch rear shaft. Installation tool and mounting hardware included.           | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC8</a>              | \$76.00 | SureStep incremental (quadrature) modular encoder, 5VDC, Push-pull (totem) output, 400 ppr. For use with SureStep stepper motors with 1/4 inch rear shaft. Installation tool and mounting hardware included.                    | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC11</a>             | \$72.00 | SureStep incremental (quadrature) modular encoder, 5 VDC, line driver (differential) output, 1000 ppr. For use with SureStep stepper motors with 3/8in rear shaft. Installation hardware included. Requires STP-CBL-EAxx cable. | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC12</a>             | \$60.00 | SureStep incremental (quadrature) modular encoder, 5 VDC, push-pull (totem) output, 1000 ppr. For use with SureStep stepper motors with 3/8in rear shaft. Installation hardware included. Requires STP-CBL-EDxx cable.          | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC13</a>             | \$61.00 | SureStep incremental (quadrature) modular encoder, 5 VDC, line driver (differential) output, 400 ppr. For use with SureStep stepper motors with 3/8in rear shaft. Installation hardware included. Requires STP-CBL-EAxx cable.  | <a href="#">PDF</a> |
| <a href="#">STP-MTRA-ENC14</a>             | \$52.00 | SureStep incremental (quadrature) modular encoder, 5 VDC, push-pull (totem) output, 400 ppr. For use with SureStep stepper motors with 3/8in rear shaft. Installation hardware included. Requires STP-CBL-EDxx cable.           | <a href="#">PDF</a> |



# Stepping System Accessories

## SureStep® Stepping System Encoders

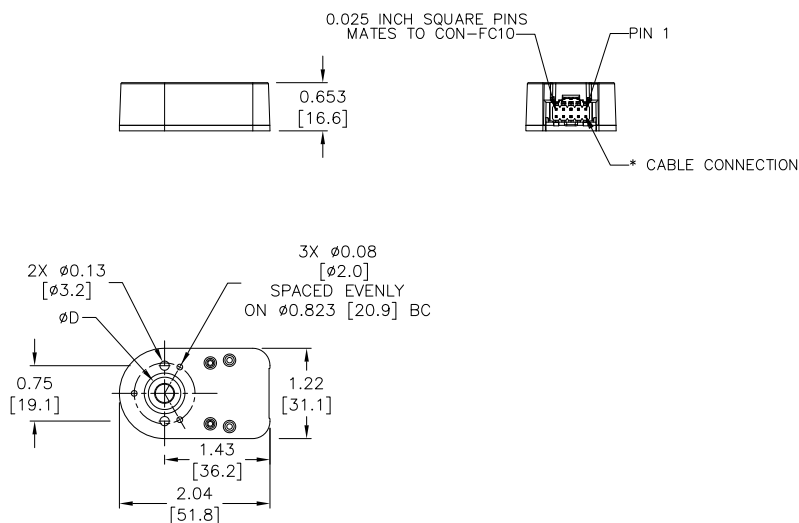
| Sure Step Series Encoder Compatibility |      |               |                   |               |   |   |
|--|------|---------------|-------------------|---------------|---|---|
| Part Number                            | PPR  | Bore Diameter | Output Type       | Encoder Cable | PLC Compatibility                       | Motor Compatibility   |
| <a href="#"><u>STP-MTRA-ENC1</u></a>   | 1000 | 5mm           | Line Driver       | STP-CBL-EAxx  | P2-HSI, P3-HSI, BRX*, CLICK C0-1xDxE-D* | STP-MTRx-14xxxD<br>STP-MTRx-14xxxE<br>STP-MTRx-17xxxD<br>STP-MTRx-17xxxE<br>Standard STP-MTRD-xxxxE |
| <a href="#"><u>STP-MTRA-ENC2</u></a>   |      |               | Push-pull (totem) | STP-CBL-EDxx  | BRX*, CLICK C0-1xDxE-D*                 |   |
| <a href="#"><u>STP-MTRA-ENC3</u></a>   | 400  |               | Line Driver       | STP-CBL-EAxx  | P2-HSI, P3-HSI, BRX*, CLICK C0-1xDxE-D* |   |
| <a href="#"><u>STP-MTRA-ENC4</u></a>   |      |               | Push-pull (totem) | STP-CBL-EDxx  | BRX*, CLICK C0-1xDxE-D*                 |   |
| <a href="#"><u>STP-MTRA-ENC5</u></a>   | 1000 | 0.25 inch     | Line Driver       | STP-CBL-EAxx  | P2-HSI, P3-HSI, BRX*, CLICK C0-1xDxE-D* | STP-MTRx-23xxxD<br>STP-MTRx-23xxxE<br>STP-MTRAC-23xxxD  |
| <a href="#"><u>STP-MTRA-ENC6</u></a>   |      |               | Push-pull (totem) | STP-CBL-EDxx  | BRX*, CLICK C0-1xDxE-D*                 |   |
| <a href="#"><u>STP-MTRA-ENC7</u></a>   | 400  |               | Line Driver       | STP-CBL-EAxx  | P2-HSI, P3-HSI, BRX*, CLICK C0-1xDxE-D* |   |
| <a href="#"><u>STP-MTRA-ENC8</u></a>   |      |               | Push-pull (totem) | STP-CBL-EDxx  | BRX*, CLICK C0-1xDxE-D*                 |   |
| <a href="#"><u>STP-MTRA-ENC11</u></a>  | 1000 | 0.375 inch    | Line Driver       | STP-CBL-EAxx  | P2-HSI, P3-HSI, BRX*, CLICK C0-1xDxE-D* | STP-MTRAC-34xxxD  |
| <a href="#"><u>STP-MTRA-ENC12</u></a>  |      |               | Push-pull (totem) | STP-CBL-EDxx  | BRX*, CLICK C0-1xDxE-D*                 |   |
| <a href="#"><u>STP-MTRA-ENC13</u></a>  | 400  |               | Line Driver       | STP-CBL-EAxx  | P2-HSI, P3-HSI, BRX*, CLICK C0-1xDxE-D* |   |
| <a href="#"><u>STP-MTRA-ENC14</u></a>  |      |               | Push-pull (totem) | STP-CBL-EDxx  | BRX*, CLICK C0-1xDxE-D*                 |   |

\* Requires FC-ISO-C

## SureStep® Stepping System Encoders

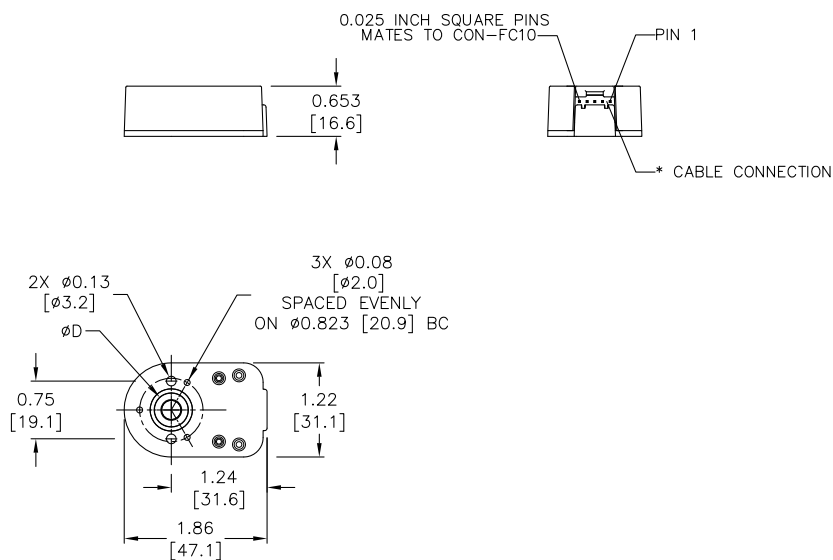
Dimensions = in [mm]

### STP-MTRA-ENC1, 3, 5, 7



| Bolt Hole Circles for Mounting                          |  |
|---|--|
| Encoder   | Holes  |
| ENC1, ENC2,<br>ENC3, ENC4,<br>ENC5, ENC6,<br>ENC7, ENC8 | 2 holes @ 19.05mm (.75")<br>3 holes @ 20.9mm (.823") |

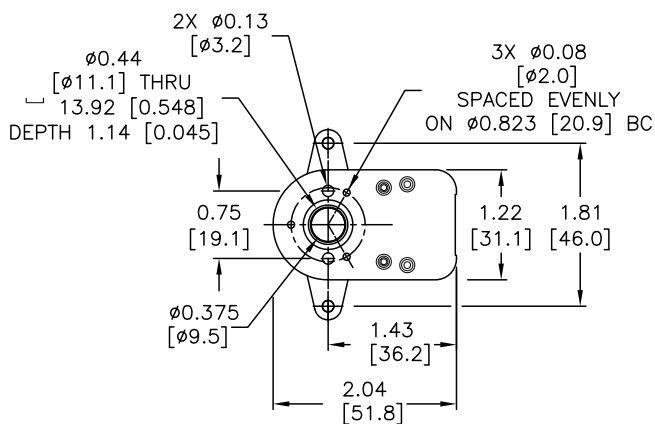
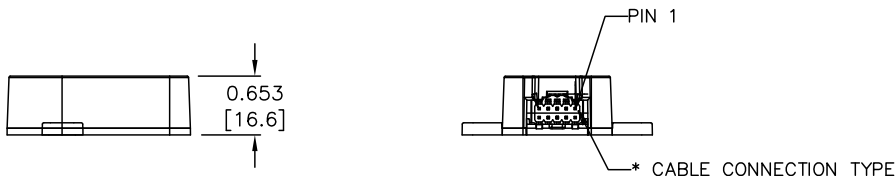
### STP-MTRA-ENC2, 4, 6, 8



## SureStep® Stepping System Encoders

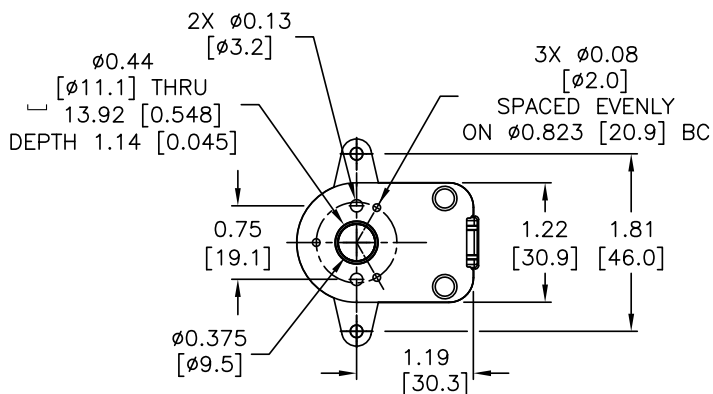
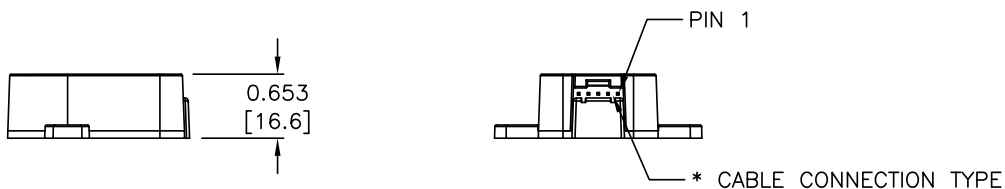
Dimensions = in [mm]

### STP-MTRA-ENC11, 13



| Bolt Hole Circles for Mounting    |                            |
|-----------------------------------|----------------------------|
| Encoder                           | Holes                      |
| <b>ENC11, ENC12, ENC13, ENC14</b> | 2 holes @ 19.05mm (.75")   |
|                                   | 3 holes @ 20.9mm (.823")   |
|                                   | 2 holes @ 46.02mm (1.812") |

### STP-MTRA-ENC12, 14





# Stepping System Cables

## SureStep® Cables

| SureStep Series – Stepping System Cables |          |                           |                  |  |  |                     |
|--|----------|---------------------------|------------------|--|--|---------------------|
| Cable                                    | Price    | Purpose                   | Length           | Use With   | Cable End Connectors                   | Drawing             |
| <a href="#">STP-EXT-006</a>              | \$13.00  | motor to drive extension  | 6 ft             | STP-MTR-xxxx(x)  | pigtail / Molex 43020-0401 connector   | <a href="#">PDF</a> |
| <a href="#">STP-EXT-010</a>              | \$14.50  |                           | 10 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXT-020</a>              | \$18.50  |                           | 20 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXTH-006</a>             | \$26.50  |                           | 6 ft             | STP-MTRH-xxxx(x)   | pigtail / Molex 39-01-2041 connector   | <a href="#">PDF</a> |
| <a href="#">STP-EXTH-010</a>             | \$31.50  |                           | 10 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXTH-020</a>             | \$38.00  |                           | 20 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXTHW-006</a>            | \$52.00  |                           | 6 ft             | STP-MTRHW-xxxx(x)  | Bulgin # PXP4011/06P/6065              | <a href="#">PDF</a> |
| <a href="#">STP-EXTHW-010</a>            | \$63.00  |                           | 10 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXTHW-020</a>            | \$95.00  |                           | 20 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXTL-006</a>             | \$11.50  |                           | 6 ft             | STP-MTRL-xxxx(x)   | pigtail / Molex 105308-22004 connector | <a href="#">PDF</a> |
| <a href="#">STP-EXTL-010</a>             | \$14.50  |                           | 10 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXTL-020</a>             | \$18.00  |                           | 20 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXTW-006</a>             | \$51.00  | 6 ft                      | STP-MTRW-xxxx(x) | Bulgin # PXP4011/06P/6065  | <a href="#">PDF</a>                    |                     |
| <a href="#">STP-EXTW-010</a>             | \$62.00  | 10 ft                     |                  |  | <a href="#">PDF</a>                    |                     |
| <a href="#">STP-EXTW-020</a>             | \$90.00  | 20 ft                     |                  |  | <a href="#">PDF</a>                    |                     |
| <a href="#">STP-EXT42-006</a>            | \$26.00  | motor to drive extension  | 6 ft             | STP-MTRAC-42xxxx   | 10-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-EXT42-010</a>            | \$31.00  |                           | 10 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXT42-020</a>            | \$44.50  |                           | 20 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXT42H-006</a>           | \$26.00  |                           | 6 ft             | STP-MTRACH-42xxxx  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXT42H-010</a>           | \$31.00  |                           | 10 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-EXT42H-020</a>           | \$44.50  |                           | 20 ft            |  |  | <a href="#">PDF</a> |
| <a href="#">STP-232RJ11-CBL*</a>         | \$11.00  | programming/communication | 10 ft            | STP-DRV-4850, STP-DRV-80100  | DB9 female / RJ11(6P4C)                | <a href="#">PDF</a> |
| <a href="#">STP-232HD15-CBL-2**</a>      | \$17.00  | communication             | 6.6 ft           | STP-DRV-4850, STP-DRV-80100<br>DL06, D2-250-1, D2-260  | HD 15-pin male / RJ12 6-pin plug       | n/a                 |
| <a href="#">STP-232RJ12-CBL-2**</a>      | \$10.50  | communication             | 6.6 ft           | STP-DRV-4850, STP-DRV-80100<br>DL05, CLICK   | RJ11 (6P4C) plug / RJ12 6-pin plug     | n/a                 |
| <a href="#">STP-CBL-CA6</a>              | \$19.00  | control cable             | 6 ft             | STP-MTRD-17038<br>STP-MTRD-17038E  | 11-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-CBL-CA10</a>             | \$23.00  | control cable             | 10 ft            |  | 11-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-CBL-CA20</a>             | \$33.50  | control cable             | 20 ft            |  | 11-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-CBL-EA6</a>              | \$19.00  | encoder cable             | 6 ft             | STP-MTRD-xxxxE<br>STP-MTRA-ENC1, STP-MTRA-ENC3<br>STP-MTRA-ENC5, STP-MTRA-ENC7<br>STP-MTRA-ENC11, STP-MTRA-ENC13<br>(for line driver encoders) | 10-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-CBL-EA10</a>             | \$23.00  | encoder cable             | 10 ft            |  | 10-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-CBL-EA20</a>             | \$33.50  | encoder cable             | 20 ft            |  | 10-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-CBL-EB3</a>              | \$60.00  | encoder cable             | 3 ft             | AMT112Q-V<br>AMT112S-V<br>(for both line driver and push-pull (totem) encoders)  | 17-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-CBL-EB6</a>              | \$83.00  | encoder cable             | 6 ft             |  | 17-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-CBL-EB10</a>             | \$113.00 | encoder cable             | 10 ft            |  | 17-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-CBL-EB20</a>             | \$187.00 | encoder cable             | 20 ft            |  | 17-pin / pigtail                       | <a href="#">PDF</a> |
| <a href="#">STP-CBL-ED6</a>              | \$34.00  | encoder cable             | 6 ft             | STP-MTRA-ENC2, STP-MTRA-ENC4<br>STP-MTRA-ENC6, STP-MTRA-ENC8<br>STP-MTRA-ENC12, STP-MTRA-ENC14<br>(for push-pull (totem) encoders)             | 5-pin / pigtail                        | <a href="#">PDF</a> |
| <a href="#">STP-CBL-ED10</a>             | \$46.00  | encoder cable             | 10 ft            |  | 5-pin / pigtail                        | <a href="#">PDF</a> |
| <a href="#">STP-CBL-ED20</a>             | \$55.00  | encoder cable             | 20 ft            |  | 5-pin / pigtail                        | <a href="#">PDF</a> |
| <a href="#">STP-CON-1</a>                | \$18.00  | replacement connector kit | n/a              | STP-DRV-4845 & -6575   | -                                      | n/a                 |
| <a href="#">STP-CON-2</a>                | \$18.00  | replacement connector kit | n/a              | STP-DRV-4850 & 80100   | -                                      | n/a                 |

\* Programming/communication cable [STP-232RJ11-CBL](#) is available for spare or replacement purposes.  
(One cable is included with each software programmable drive.)

\*\* Refer to the [ZIPLinks Wiring Solutions](#) section for complete information regarding cables [STP-232HD15-CBL-2](#) and [STP-232RJ12-CBL-2](#).



## SureStep® Cables, *continued*

| SureStep Series – Stepping System Cables |         |                           |        |                  |                                |                     |
|--|---------|---------------------------|--------|------------------|--------------------------------|---------------------|
| Cable                                    | Price   | Purpose                   | Length | Use With         | Cable End Connectors           | Drawing             |
| <b>STP-CON-3</b>                         | \$36.50 | replacement connector kit | n/a    | STP-MTRD-xxxxR   | -                              | n/a                 |
| <b>STP-CON-4</b>                         | \$18.00 | replacement connector kit | n/a    | STP-DRVA-RC-050A | -                              | n/a                 |
| <b>STP-CON-5</b>                         | \$18.00 | replacement connector kit | n/a    | STP-DRV-4830     | -                              | <a href="#">PDF</a> |
| <b>STP-CON-6</b>                         | \$23.50 | replacement connector kit | n/a    | STP-DRVAC-24025  | -                              | n/a                 |
| <b>STP-485DB9-CBL-2</b>                  | \$42.00 | 4-wire programming cable  | 6.5 ft | STP-MTRD-xxxxR   | DB9 / Phoenix 5-conductor plug | <a href="#">PDF</a> |

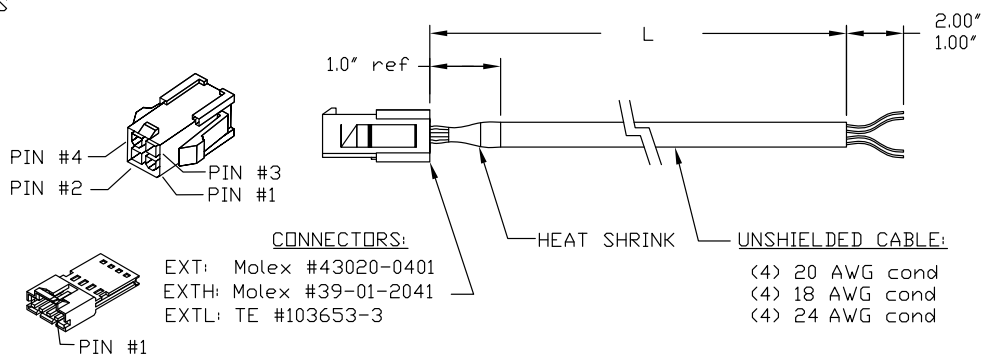
### STP-EXT(x)-0xx Extension Cable Wiring Diagram

EXT & EXTH CABLES

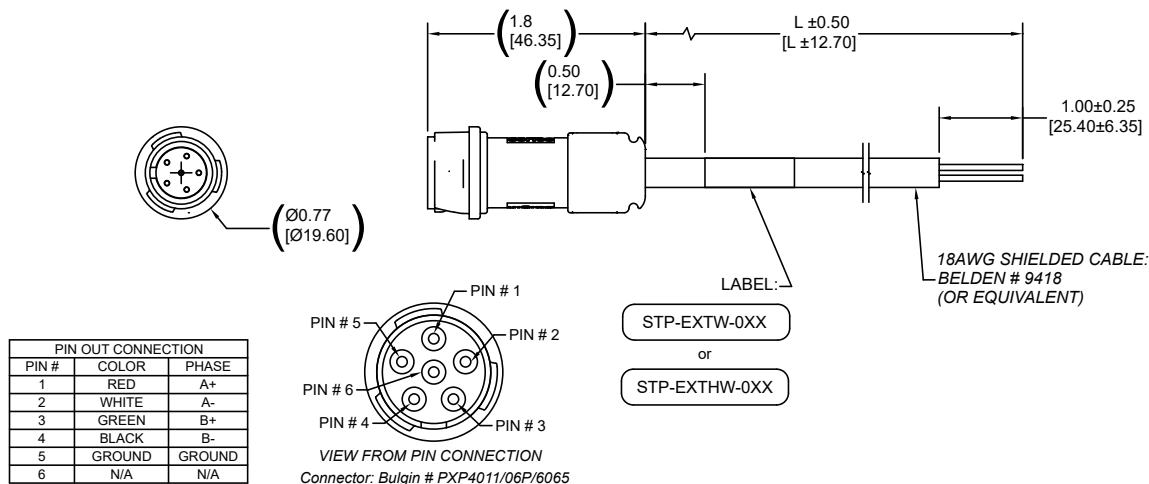
| PIN# | COLOR |
|------|-------|
| 1    | RED   |
| 2    | WHITE |
| 3    | GREEN |
| 4    | BLACK |

EXTL CABLES

| PIN# | COLOR |
|------|-------|
| 1    | RED   |
| 2    | WHITE |
| 3    | GREEN |
| 4    | BLACK |



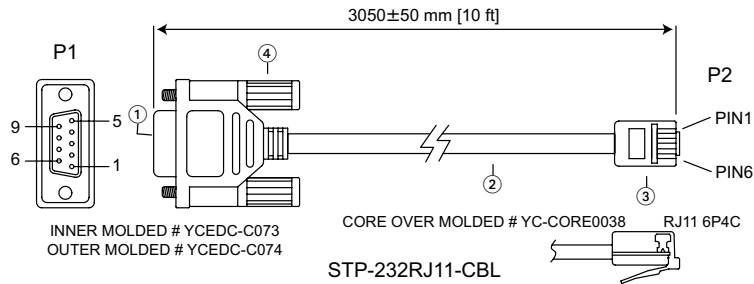
### STP-EXTW-0xx and STP-EXTHW-0xx Extension Cable Wiring Diagram



| PIN OUT CONNECTION |        |        |
|--------------------|--------|--------|
| PIN #              | COLOR  | PHASE  |
| 1                  | RED    | A+     |
| 2                  | WHITE  | A-     |
| 3                  | GREEN  | B+     |
| 4                  | BLACK  | B-     |
| 5                  | GROUND | GROUND |
| 6                  | N/A    | N/A    |

## SureStep® Cables, continued

### STP-232RJ11-CBL Programming Cable Wiring Diagram



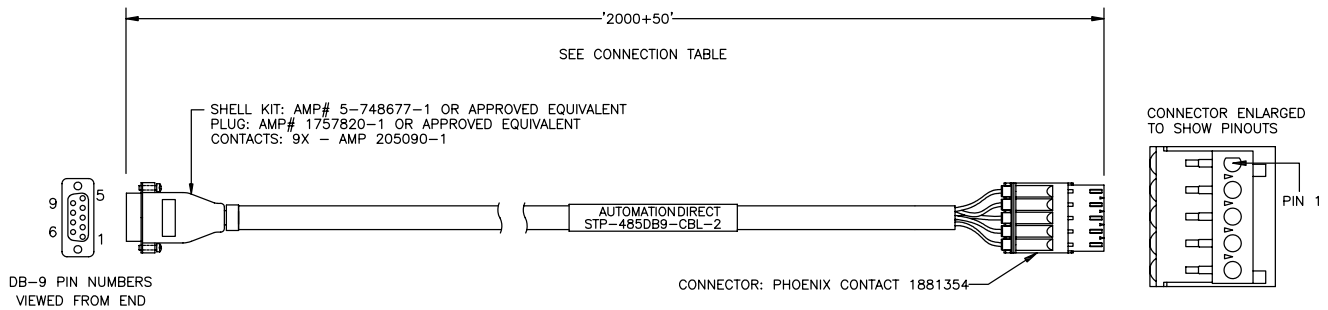
WIRE CONNECTION

| (DB9) P1 |     | P2 (RJ11 6P4C) |
|----------|-----|----------------|
| 2        | RX  | TX             |
| 3        | TX  | RX             |
| 4        | nc  | nc             |
| 5        | GND | GND            |

|   |   |
|---|---|
| ① | DB 9P FEMALE CONNECTOR SHELL: FRONT NICKEL BACK TIN<br>INSULATOR COLOR: BLACK |
| ② | CABLE: CAT-5 UTP 24AWG (7/0.203BA*2PR) 100MHz<br>COLOR: BLACK OD: 4.5mm       |
| ③ | RJ11 6P4C PLATED GOLD 3U"   |
| ④ | SCREW: #4-40UNC PD40*175TNP COLOR: BLACK                                      |

### STP-485DB9-CBL-2 4-wire Programming Cable Wiring Diagram

| CONNECTION CHART |            |            |             |                |
|------------------|------------|------------|-------------|----------------|
| DB-9 CONN PIN    | DB9 SIGNAL | WIRE COLOR | PHOENIX PIN | PHOENIX SIGNAL |
| 2                | TX+        | RED        | 5           | RX+            |
| 1                | TX-        | ORANGE     | 4           | RX-            |
| 3                | RX+        | BLACK      | 3           | TX+            |
| 4                | RX-        | BROWN      | 2           | TX-            |
| 5                | GND        | YELLOW     | 1           | GND            |
| METAL HOUSING    | SHIELD     | SHIELD     | N/C         | N/C            |

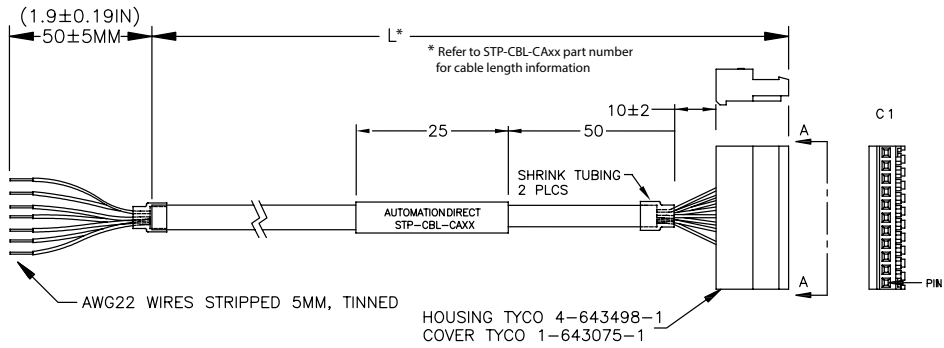


## SureStep® Cables, continued

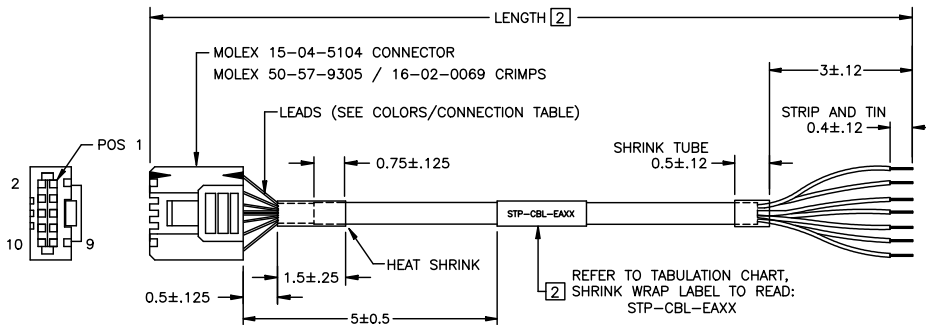
### STP-CBL-CAXx Control Cable Wiring Diagram

| C 1     |        |              |
|---------|--------|--------------|
| PIN NO. | SIGNAL | WIRE COLOR   |
| 1       | STEP+  | ORANGE       |
| 2       | STEP-  | BROWN        |
| 3       | DIR+   | YELLOW       |
| 4       | DIR-   | GREEN        |
| 5       | EN+    | BLUE         |
| 6       | EN-    | TAN          |
| 7       | OUT+   | GRAY         |
| 8       | OUT-   | WHITE        |
| 9       | N.C.   | PINK         |
| 10      | V-     | BLACK        |
| 11      | V+     | RED          |
| 12      | N/C    | PURPLE - CUT |

Note: For Rev A of this cable, STEP+ is Grey/Pink and EN- is Red/Blue



### STP-CBL-EAXx Encoder Cable Wiring Diagram



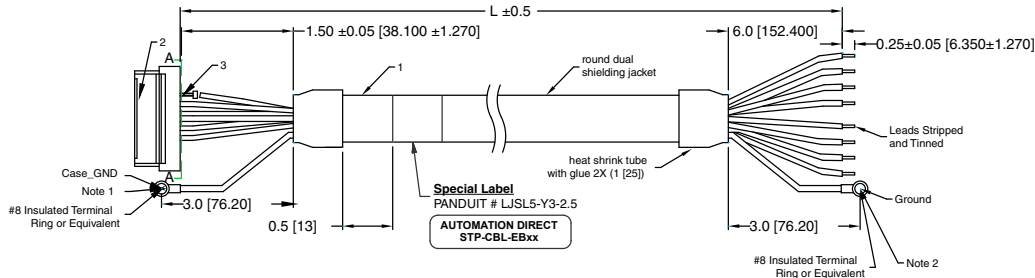
| CONN | CONNECTION TABLE |        |
|------|------------------|--------|
| PIN  | LEAD COLOR       | SIGNAL |
| 2    | GREEN/WHITE      | GROUND |
| 7    | GREEN            | POWER+ |
| 3    | ORANGE/WHITE     | Z-     |
| 4    | ORANGE           | Z+     |
| 5    | BLUE/WHITE       | A-     |
| 6    | BLUE             | A+     |
| 9    | BROWN/WHITE      | B-     |
| 10   | BROWN            | B+     |
| 1    | N/C              | N/A    |
| 8    | N/C              | N/A    |

WIRE: 24AWG, CABLE: UL2464.

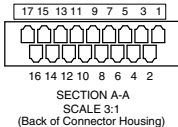
### STP-CBL-EBxx Encoder Cable Wiring Diagram

- NOTE:
- Case\_GND is connected internally to GND (BLACK/RED)
  - Ground connected internally to cable shielding-customer ref. only
  - Tolerance: ± 0.2" [5] unless otherwise specified
  - All materials must be ROHS compliant

| TABLE INFORMATION |                |
|-------------------|----------------|
| CABLE NUMBER      | CABLE LENGTH L |
| STP-CBL-EB3       | 3 Feet         |
| STP-CBL-EB6       | 6 Feet         |
| STP-CBL-EB10      | 10 Feet        |
| STP-CBL-EB20      | 20 Feet        |



| Connector Pinout |          |               |              |
|------------------|----------|---------------|--------------|
| #                | Function | Primary Color | Stripe Color |
| 4                | GND      | Black         | Red          |
| 6                | +5V      | Red           | Black        |
| 8                | B+       | Green         | Black        |
| 9                | B-       | Black         | Green        |
| 10               | A+       | White         | Black        |
| 11               | A-       | Black         | White        |
| 12               | Z+       | Blue          | Black        |
| 13               | Z-       | Black         | Blue         |



| PARTS LIST |            |                      |     |
|------------|------------|----------------------|-----|
| #          | PART       | DESCRIPTION          | QTY |
| 1          | CABLE      | 3M # 3600B/14        | 1   |
| 2          | CONNECTOR  | JAE # FI-W175        | 1   |
| 3          | CRIMP PINS | JAE # FI-C3-A1-15000 | 8   |