SureStep™ Integrated Motors/Drives

In This Chapter...

Features

General Features:

- NEMA 17, NEMA 23, and NEMA 24 frame sizes available
- DC power supply required: 12-48 VDC or 12-70 VDC
- Pulse/Direction or CW Pulse/CCW Pulse
- Digital input filtering
- Three optically isolated digital inputs, 5 to 24 volts
- One isolated digital input, 30V 100mA
- 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
- 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 Drive Features

- Optional, external encoder feedback
  Note: Please see Appendix A for more encoder output options
- Configurable via DIP switches
- Available torque from 60 oz-in to 210 oz-in

Advanced Drive Features

- AB Quadrature/Encoder Following
- Velocity (Oscillator) and position mode
- Streaming SCL commands
- RS-485 communications
- Optional, internal encoder feedback. Internal only (not customer accessible)
- Four “Variable I/O” points, 5 to 24 volts (available on NEMA 24 only)
- 12-bit analog input for speed and position, 0 to 5 VDC
- Configurable via SureMotion Pro software
- Available torque from 68 oz-in to 340 oz-in

Features Comparison

Features Comparison – Integrated Motor/Drives					
Motor/Drive Series	**STP-MTRD-17xxxxR(E)**	**STP-MTRD-23xxxxR(E)**	**STP-MTRD-24xxxxRV(E)**	**STP-MTRD-17xxxx(E)**	**STP-MTRD-23xxxx(E)**
Motor/Drive Type	**Advanced (w/RS-485 Serial/ASCII)**			**Standard (Pulse/Direction only)**	
DC Power Supply	12-48 VDC	12-70 VDC	12-70 VDC	12-48 VDC	12-70 VDC
Pulse/Direction or CW Pulse/CCW Pulse	✓	✓	✓	✓	✓
AB Quadrature/ Encoder Following	✓	✓	✓	-	-
Velocity (Oscillator) and Position Mode	✓	✓	✓	-	-
Serial ASCII (SCL) Commands	✓	✓	✓	-	-
RS-485 ASCII Communications	✓	✓	✓	-	-
Optional, Internal Encoder Feedback (Position Verification)	✓	✓	✓	-	-
Optional, External Encoder Feedback (Open Loop)	-	-	-	✓	✓
Available Torque	Up to 68 oz-in	Up to 210 oz-in	Up to 340 oz-in	Up to 68 oz-in	Up to 210 oz-in
Digital Input Filtering	✓	✓	✓	✓	✓
Three Optically Isolated Digital Inputs, 5-24 Volts	✓	✓	-	✓	✓
One Optically Isolated Digital Output, 30V 100mA	✓	✓	-	✓	✓
Four, 5-24 Volt digital "Variable I/O" points	-	-	✓	-	-
12-bit Analog Input	✓	✓	✓	-	-
Step Input Signal Smoothing (Microstep Emulation)	✓	✓	✓	✓	✓
Anti-resonance	✓	✓	✓	✓	✓
Electronic Damping	✓	✓	✓	✓	✓
Idle Current Reduction	✓	✓	✓	✓	✓
Configuration Method	SureMotion Pro software			Dip Switch	

Specifications

General Specifications – All Integrated Motor/Drives	
Drive Cooling Method	Natural convection (mount to suitable heat sink)
Step Resolution	Full, Half, Microstepping, Microstep Emulation
Step Angle	1.8 degrees
Shaft Runout	NEMA 17: 0.03 mm NEMA 23/24 : 0.05 mm
Max Shaft Radial Play @ 1lb load	0.02 mm
Perpendicularity	0.08 mm
Concentricity	0.05 mm
Maximum Radial Load	NEMA 17: 6.7 lb. NEMA 23/24: 13.9 lb.
Maximum Axial (Thrust) Load	NEMA 17: 34 lb. NEMA 23/24: 63 lb.
Supply Output	+4.8 - 5 volts @ 50mA maximum (**Note:** Not applicable to Pulse and Direction MTRD drives, only for advanced MTRD drives)
Circuit Protection	Short circuit, over-voltage, under-voltage, over-temp
Operating Temperature	0-85°C (32-185°F) 0-70°C (0-158°F) for NEMA 24 systems
Ambient Temperature	0-40°C (32-104°F)
Over-temp Shutdown	85°C (185°F)
Humidity	90% max, non-condensing
Insulation Class	Class B (130°C)
Environmental Rating	IP40
Product Material	Aluminum/steel/plastic case, stainless steel shaft
Agency Approvals	CE*

**For NEMA 24 motors, an EMI filter (RES10F06) is needed on the power supply for CE compliance.*

*Sure*Step™ Standard Integrated Motor/Drive Specifications				
Integrated Motor/ Drive		**STP-MTRD-17038 / STP-MTRD-17038E**	**STP-MTRD-23042 / STP-MTRD-23042E**	**STP-MTRD-23065 / STP-MTRD-23065E**
Frame Size		NEMA 17	NEMA 23	
Input Power		12-48 VDC (nominal) (Range: 11-52 VDC) (fuse at V+)	12-70 VDC (nominal) (Range: 11-74 VDC) (fuse at V+)	
Current Controller		Digital MOSFET, PWM at 16kHz		
Encoder Feedback		"E" models only. External encoder must be wired to external feedback device.		
Configuration Method		Dip Switches		
Input Signals	**Step**	5-24 VDC nominal (range 4-30VDC); (5mA @ 4V; 15 mA @ 30V); Optically isolated. Minimum pulse width = 3µs (at 2 MHz), 0.25µs (at 150kHZ) Maximum pulse frequency = 150kHz or 2MHz (switch selectable) Function = Step Input, Limit CW		
	Direction	5-24 VDC nominal (range 4-30VDC); (5mA @ 4V; 15 mA @ 30V); Optically isolated. Minimum pulse width = 3µs (at 2 MHz), 0.25µs (at 150kHZ) Maximum pulse frequency = 150kHz or 2MHz (switch selectable) Function = Direction Input, Limit CCW		
	Enable	5-24 VDC nominal (range 4-30VDC); (5mA @ 4V; 15 mA @ 30V); Optically isolated. Minimum pulse width = 3µs (at 2 MHz), 0.25µs (at 150kHZ) Maximum pulse frequency = 150kHz or 2MHz (switch selectable) Function = Enable Input		
Output Signal	**Output**	30 VDC / 100mA max, photodarlington, voltage drop = 1.2V max at 100mA Function = Alarm Output		
DIP Switch Selectable Functions	**Step Pulse Type**	Step and Direction: Step signal = step/pulse; Direction signal = direction. Step CW & CCW: Step signal = CW step; Direction signal = CCW step.		
	Step Pulse Noise Filter	Selectable 150 kHz or 2MHz		
	Current Reduction	This is the percentage of full current that the motor will use when the shaft is rotating. 100%, 90%, 70%, and 50% current selections.		
	Idle Current Reduction	Reduce power consumption and heat generation by limiting motor idle current to 90% or 50% of running current. (Holding torque is reduced by the same %.)		
	Load Inertia	Anti-resonance and damping feature improves motor performance. Set motor and load inertia range to 0–4x or 5–10x.		
	Step Resolution	200-25600 (dip switch selectable)		
	Self Test	Automatically rotate the motor back and forth two turns in each direction in order to confirm that the motor is operational.		
Max Holding Torque		4.25 lb·in / 68 oz·in / 0.480189 N·m	7.8125 lb·in / 125 oz·in / 0.8827 N·m	13.125 lb·in / 210 oz·in / 1.482936 N·m
Mounting		Four M3 screws	Four #6 screws	
Removable Connector	**Control**	Housing: Tyco 4-643498-1 Cover: Tyco 1-643075-1	Connector part number: Weidmuller 1610200000, included in STP-CON-3	
	Encoder	Two 5 pin inserts (Molex# 14-60-0058), one housing Molex# 15-04-5104		
Rotor Inertia		0.448 oz-in^2 (0.082 kg-cm^2)	1.420 oz-in^2 (0.260 kg-cm^2)	2.515 oz-in^2 (0.460 kg-cm^2)
Status LEDs		1 red/green		
Weight		14.7 oz	30 oz (850g)	42 oz (1200g)

*Sure*Step™ Advanced Integrated Motor/Drive Specifications			
Integrated Motor/Drive		**STP-MTRD-17030R / STP-MTRD-17030RE**	**STP-MTRD-17038R / STP-MTRD-17038RE**
Frame Size		NEMA 17	
Input Power		12-48 VDC (nominal) (Range: 11-52 VDC) (fuse at V+)	
Current Controller		Dual H-Bridge, 4 Quadrant, 4 state PWM @ 16kHz	
Encoder Feedback		"E" models only. Encoder is internal and provides position verification and stall prevention control by default. Internal only (not customer accessible).	
Configuration Method		SureMotion Pro software (SM-PRO: Free download)	
Input Signals	***Step/Pulse***	5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 3 MHz). Maximum pulse frequency = 3MHz, max current draw = 12mA Function = Step Input, Jog CW, Limit CW, Start/Stop, General Purpose	
	Direction	5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 3 MHz). Maximum pulse frequency = 3MHz, max current draw = 12mA Function = Direction Input, Jog CCW, Limit CCW, General Purpose	
	Enable	5-24 VDC nominal. Optically isolated. Minimum pulse width = 50µs, maximum pulse frequency = 10kHz, max current draw = 12mA Function = Enable Input, Reset Input, Change Speed, General Purpose	
	Analog	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	
Output Signal		30VDC, 40mA maximum. Optically isoalted, open collector. Maximum pulse frequency 10kHz. Functions = Brake Output, Alarm Output, Motion Output, Tach Output, General Purpose	
Communication Interface		RS-485 ASCII/SCL (2- or 4-wire network for PLC control; SureMotion Pro software requires 4-wire)	
Non-volatile Memory Storage		Configurations are saved in FLASH memory on-board the DSP	
Features	***Current Reduction***	Selectable in SureMotion Pro software	
	Idle Current Reduction	Reduction range of 0–90% of running current after delay selectable in ms	
	Microstep Resolution	Software selectable from 200 to 51200 steps/rev in increments of 2 steps/rev	
	Modes of Operation	Pulse (step) & direction, CW/CCW, A/B quadrature, velocity (oscillator), SCL streaming commands via RS-485 ASCII/SCL (2- or 4-wire)	
	Self Test	Checks internal and external power supply voltages, diagnoses open motor phases	
Max Holding Torque		3.375 lb·in / 54 oz·in / 0.381326 N·m	4.25 lb·in / 68 oz·in / 0.480189 N·m
Mounting		Four M3 screws	
Removable Connector (included in STP-CON-3)	**DC Power**	2-position screw terminal: Dinkle 0225-1602L (new models) or Weidmuller 1615780000 (old models)	
	I/O	11-position spring cage: Phoenix 1881419	
	Comm	5-position spring cage: Phoenix 1881354	
Rotor Inertia		0.310 oz-in^2 (0.057 kg-cm^2)	0.448 oz-in^2 (0.082 kg-cm^2)
Status LEDs		1 red, 1 green	
Weight		12.7 oz (360g)	15.6 oz (441g)

*Sure*Step™ Advanced Integrated Motor/Drive Specifications				
Integrated Motor/Drive			**STP-MTRD-23042R / STP-MTRD-23042RE**	**STP-MTRD-23065R / STP-MTRD-23065RE**
Frame Size			NEMA 23	
Input Power			12-70 VDC (nominal) (Range: 11-74 VDC) (fuse at V+)	
Current Controller			Dual H-Bridge, 4 Quadrant, 4 state PWM @ 20kHz	
Encoder Feedback			"E" models only. Encoder is internal and provides closed loop control by default. Internal only (not customer accessible).	
Configuration Method			SureMotion Pro software (SM-PRO: Free download)	
Input Signals	***Step/Pulse***		5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 2 MHz). Maximum pulse frequency = 2MHz, max current draw = 12mA Function = Step Input, Jog CW, Limit CW, Start/Stop, General Purpose	
	Direction		5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 2 MHz). Maximum pulse frequency = 2MHz, max current draw = 12mA Function = Direction Input, Jog CCW, Limit CCW, General Purpose	
	Enable		5-24 VDC nominal. Optically isolated. Minimum pulse width = 50µs, maximum pulse frequency = 10kHz, max current draw = 12mA Function = Enable Input, Reset Input, Change Speed, General Purpose	
	Analog		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	
Output Signal			30VDC, 40mA maximum. Optically isolated, open collector. Maximum pulse frequency 10kHz. Functions = Brake Output, Alarm Output, Motion Output, Tach Output, General Purpose	
Communication Interface			RS-485 ASCII/SCL (2- or 4-wire network for PLC control; SureMotion Pro software requires 4-wire)	
Non-volatile Memory Storage			Configurations are saved in FLASH memory on-board the DSP	
Features	***Current Reduction***		Selectable in SureMotion Pro software	
	Idle Current Reduction		Reduction range of 0–90% of running current after delay selectable in ms	
	Microstep Resolution		Software selectable from 200 to 51200 steps/rev in increments of 2 steps/rev	
	Modes of Operation		Pulse (step) & direction, CW/CCW, A/B quadrature, velocity (oscillator), SCL streaming commands	
	Self Test		Checks internal and external power supply voltages. Diagnoses open motor phases and motor resistance changes > 40%	
Max Holding Torque			7.8125 lb·in / 125 oz·in / 0.8827 N·m	13.125 lb·in / 210 oz·in / 1.482936 N·m
Mounting			Four #6 screws	
Removable Connector (included in STP-CON-3)	**DC Power**		2-position screw terminal: Weidmuller 1615780000	
	I/O		11-position spring cage: Phoenix 1881419	
	Comm		5-position spring cage: Phoenix 1881354	
Rotor Inertia			1.420 oz-in^2 (0.260 kg-cm^2)	2.515 oz-in^2 (0.460 kg-cm^2)
Status LEDs			1 red, 1 green	
Weight			30 oz (850g)	42 oz (1191g)

*Sure*Step™ Advanced Integrated Motor/Drive Specifications		
Integrated Motor/ Drive		**STP-MTRD-24075RV / STP-MTRD-24075RVE**
Frame Size		NEMA 24
Input Power		12-70* VDC (nominal) (Range: 11-74 VDC) (fuse at V+)
Current Controller		Dual H-Bridge, 4 Quadrant, 4 state PWM @ 20kHz
Encoder Feedback		"E" models only. Encoder is internal and provides position verification and stall prevention control by default. Internal only (not customer accessible).
Configuration Method		SureMotion Pro software (SM-PRO: free download)
Variable I/O	**I/O 1*(Step/Pulse)***	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 OUTPUT: 30VDC, 40mA maximum. Optically isolated, open collector. Maximum pulse frequency 10kHz. Functions = Brake Output, Fault Output, Motion Output, Tach Output, General Purpose
	I/O 2 *(Direction)*	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 OUTPUT: 30VDC, 40mA maximum. Optically isolated, open collector. Maximum pulse frequency 10kHz. Functions = Brake Output, Fault Output, Motion Output, Tach Output, General Purpose
	I/O 3	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 OUTPUT: 30VDC, 40mA maximum. Optically isolated, open collector. Maximum pulse frequency 10kHz. Functions = Brake Output, Fault Output, Motion Output, Tach Output, General Purpose
	I/O 4	INPUT: 5-24 VDC nominal. Optically isolated. Minimum pulse width = 250ns (at 2 MHz). Maximum pulse frequency = 2MHz, max current draw = 12mA, Function = Limit CCW Input, Alarm Reset Input, General Purpose OUTPUT: 30VDC, 40mA maximum. Optically isolated, open collector. Maximum pulse frequency 10kHz. Functions = Brake Output, Fault Output, Motion Output, Tach Output, General Purpose
Analog		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
Communication Interface		RS-485 ASCII/SCL (2- or 4-wire network for PLC control; SureMotion Pro software requires 4-wire)
Features	***Current Reduction***	Selectable in SureMotion Pro software
	Idle Current Reduction	Reduction range of 0–90% of running current after delay selectable in ms
	Microstep Resolution	Software selectable from 200 to 51200 steps/rev in increments of 2 steps/rev
	Modes of Operation	Pulse (step) & direction, CW/CCW, A/B quadrature, velocity (oscillator), SCL streaming commands
	Self Test	Checks internal and external power supply voltages. Diagnoses open motor phases and motor resistance changes > 40%.

** If using the STP-PWR-7005, the power supply (when unloaded) may float above the drive's maximum alowable DC voltage if the power supply is fed with greater than 120VAC input. Either ensure that the incoming AC voltage is less than 120V or supply a burden resistor to pull the unloaded DC voltage level down.*

*Sure*Step™ Advanced Integrated Motor/Drive Specifications (continued)		
Integrated Motor/ Drive		**STP-MTRD-24075RV / STP-MTRD-24075RVE**
Max Holding Torque		21.25 lb·in / 340 oz·in / 2.400944 N·m
Mounting		Four #6 screws
Removable Connector (included in STP-CON-3)	**DC Power**	2-position screw terminal: Dinkle 0225-1602L (new models) or Weidmuller 1615780000 (old models)
	I/O	11-position spring cage: Phoenix 1881419
	Comm	5-position spring cage: Phoenix 1881354
Rotor Inertia		4.900 oz-in^2 (0.897 kg-cm^2)
Status LEDs		1 red, 1 green
Weight		56 oz (1580g)

Getting Started

The following items are needed for the Standard and Advanced integrated motors/drives (STP-MTRD):

- DC power supply (see the Chapter 8, "Choosing a Power Supply") for help in choosing one.
- A small, flat blade screwdriver for inserting wires into the connector.
- A source of step signals, such as a PLC or motion controller.

Additional items needed for Advanced integrated motors/drives (STP-MTRD-xxxxR):

- A PC running Microsoft Windows software.
- A configuration cable and suitable USB to four wire RS-485 converter. ADC part numbers STP-USB485-4W and STP-485DB9-CLB-2 are recommended.

Installing Software

Before using the STP-MTRD-xxxxR Advanced integrated motor and SureMotion Pro software in an application, the following steps are necessary:

- Install the SureMotion Pro software.
- Launch the software by clicking Programs -> AutomationDirect -> SureMotion Pro
- Connect the drive to the PC using the programming cable. STP-USB485-4W in 4-wire configuration is recommended (see "Chapter 9: Communications" for detailed info).
- Connect the drive to the power supply.
- Apply power to the drive. (When first powered-up, the drive sends out a "power-up packet" to identify itself. See the SCL Manual for more details.)
- The software will recognize the drive and display the model and firmware version. At this point, it is ready for use.

Mounting

As with any step motor, the STP-MTRD must be mounted so as to provide maximum heat sinking and airflow. Keep enough space around the unit to allow for airflow.

Never use the drive where there is no airflow or where other devices cause the surrounding air to be more than 40°C (104°F). Never put the drive where it can get wet. Never use the drive where metal or other electrically conductive particles can infiltrate the drive. Always provide airflow around the STP-MTRD.

Use the following to mount the motors:

- STP-MTRD-17 series: four M3 screws
- STP-MTRD-23 and -24 series: four #6 or #8 screws

Additional Reading

To learn more about SureMotion Pro™, please refer to the software's built-in help.

To learn more about the SCL language, please read the Serial Command Language User Manual.

Mating Connectors and Accessories

Advanced Drive Mating Connectors & Accessories			
Mating Connector (Type)	**Part Number**	**Terminal Tightening Torque**	**Acceptable Wire AWG**
DC Power (new models) (2-position, spring cage)	Dinkle 0225-1602L	N/A	16-20 AWG, no ferrules allowed
DC Power (old models) (2-position, screw terminal)	Weidmuller 1615780000	0.25 Nm	16-20 AWG, ferrules allowed
I/O (11-position, spring cage)	Phoenix 1881419	N/A	20-22 AWG, no ferrules allowed
Comm (5-position, spring cage)	Phoenix 1881354		

Note: ADC's STP-CON-3 connector kit contains all three above parts.

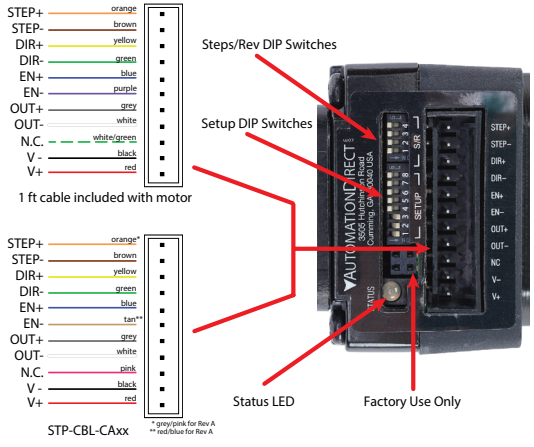
Standard Drive Mating Connectors & Accessories			
Mating Connector (Type)	**Part Number**	**Terminal Tightening Torque**	**Acceptable Wire AWG**
NEMA 17: 11-pin insulation displacement style connector	Housing: Tyco 4-643498-1 Cover: Tyco 1643075-1	N/A	22 AWG
NEMA 23: 11-pin screw terminal connector	Weidmuller 1610200000	0.25 Nm	18-20 AWG, ferrules allowed

Note: See STP-CON-3 connector kit and STP-CBL-CAxx for replacement options.

General Accessories	
Part	**Part Number**
USB to RS485 Adapter	STP-USB485-4W
Regeneration Clamp and/or breaking resistor for applications with high inertial loads	STP-DRVA-RC-050 STP-DRVA-BR-100
SureStep communication cable, 9-pin	STP-485DB9-CBL-2
Replacement SureStep incremental (quadrature) encoder for standard models	STP-MTRA-ENC1
Note: Multiple replacement encoder options are available in Appendix A.	

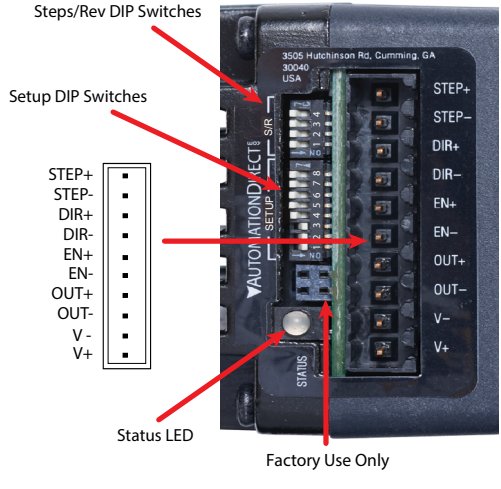
Installation and Connections

STP-MTRD-17 Standard Series

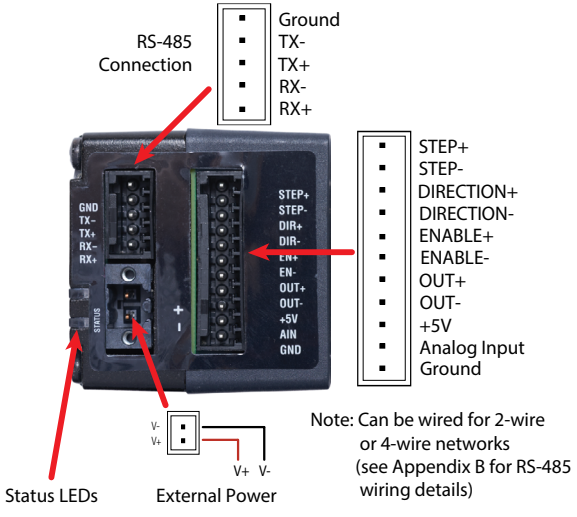


Includes a 12 inch control cable for accessing the terminals. STP-CBL-CAxx cable can be purchased separately if longer cable lengths are needed.

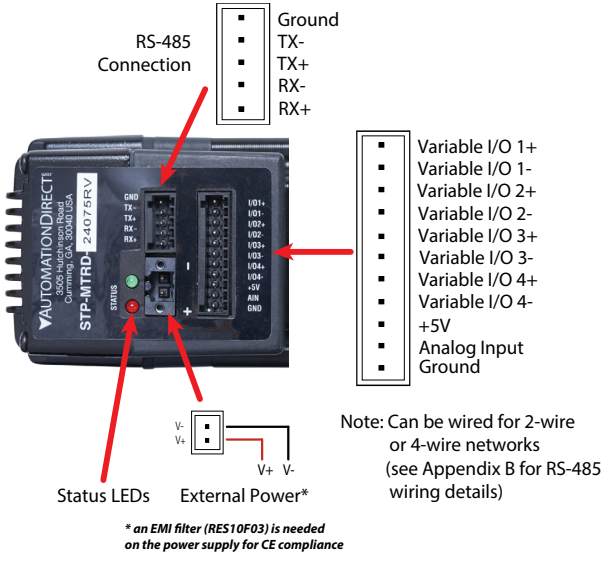
STP-MTRD-23 Standard Series



STP-MTRD-17 / STP-MTRD-23 Advanced Series



STP-MTRD-24 Advanced Series

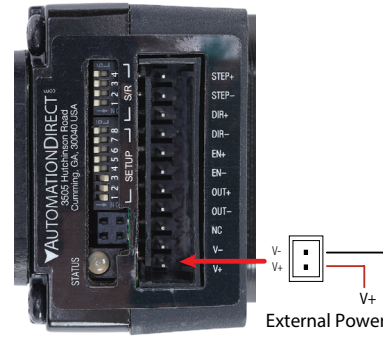


an EMI filter (RES10F03) is needed on the power supply for CE compliance

Connecting a Power Supply to the Standard STP-MTRD-17

For information on choosing a power supply, please see the "Choosing a Power Supply" section of Chapter 7, "SureStep System Power Supplies."

Connect the power supply "+" terminal to connector terminal V+, then connect power supply "-" to connector terminal V-. Use 22 gauge stranded wire if supplying your own connector and cable.



The STP-MTRD-17 contains an internal fuse that connects to the power supply + terminal. This fuse is not user replaceable. If you want to install a user serviceable fuse in your system, install a fast acting 2 amp fuse in line with the + power supply lead.

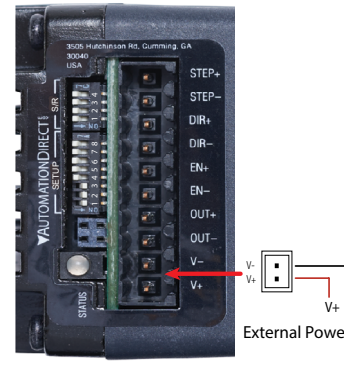
Be careful not to reverse the wires. Reverse connection will open the internal fuse on your drive and void your warranty. Fuse is not user-replaceable.

Connecting a Power Supply to the Standard STP-MTRD-23

For information on choosing a power supply, please see the "Choosing a Power Supply" section of Chapter 7, "SureStep System Power Supplies."

Connect the power supply "+" terminal to the connector terminal labeled "V+", then connect the power supply "-" to the connector terminal labeled "V-". Use 14-20 gauge stranded wire.

The STP-MTRD-23 contains an internal fuse that connects to the power supply + terminal. This fuse is not user replaceable. If you want to install a user serviceable fuse in your system, install a fast acting 4 amp fuse in line with the + power supply lead.

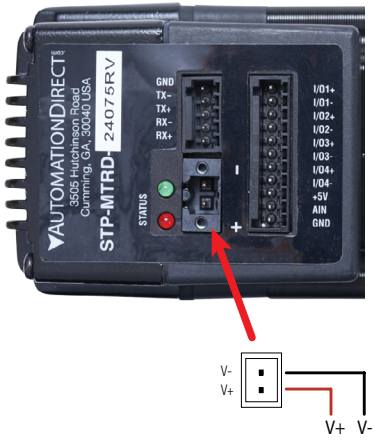


Be careful not to reverse the wires. Reverse connection will open the internal fuse on your drive and void your warranty. Fuse is not user-replaceable.

Connecting a Power Supply to the Advanced STP-MTRD-xxxxxR

For information on choosing a power supply, please see the "Choosing a Power Supply" section of Chapter 7, "SureStep System Power Supplies."

Connect the power supply "+" terminal to the drive "+" terminal and the power supply "-" terminal to the drive "-" terminal using 16 to 22 gauge wire. The STP-MTRD contains an internal fuse connected to the "+" terminal. This fuse is not user replaceable. If a user serviceable fuse is desired, install a fast acting fuse in line with the "+" power supply lead.



Suitable fuses are:

- STP-MTRD-17 series: 2 amp
- STP-MTRD-23 series: 4 amp
- STP-MTRD-24 series: 5 amp

It is important that the motor frame be electrically connected to ground. When the motor is mounted on an insulated surface, a ground wire is required. Also, in applications where multiple integrated motors are used on a machine, individual ground wires may reduce the overall electrical noise level.

Be careful not to reverse the wires. Reverse connection will open the internal fuse on your drive and void your warranty. Fuse is not user-replaceable.

To maintain CE compliance with the STP-MTRD-24, EMI filter RES10F06 must be wired in series with the V+ power supply to the motor/drive.

Using a Regulated Power Supply

If a regulated power supply is being used, there may be a problem with regeneration. When a load decelerates rapidly from a high speed, some of the kinetic energy of the load is transferred back to the power supply, possibly tripping the over-voltage protection of a regulated power supply, causing it to shut down. This problem can be solved with the use of an STP-DRVA-RC-050 regeneration clamp. It is recommended that an STP-DRVA-RC-050 initially be installed in an application. If the "regen" LED on the STP-DRVA-RC-050 never flashes, the clamp is not necessary. For additional regen clamping capacity, STP-DRVA-BR-100 resistor can be added to the regen clamp. See Appendix A: "SureStep Accessories."

STP-DRVA-RC-050 Regen Clamp

LED Error Codes

STP-MTRD Alarm Codes		
Alarm Code	***LED Sequence***	***Alarm Description***
SG	Solid green	No alarm, motor disabled
FG	Fast green	Factory use
01	Flashing green	No alarm, motor enabled
10	Flashing red	Configuration or memory error[1]
11	1 red, 1 green	Motor stall (optional encoder only)[4]
12	1 red, 2 green	Move attempted while drive disabled
21	2 red, 1 green	CCW limit
22	2 red, 2 green	CW limit
31	3 red, 1 green	Drive overheating
32	3 red, 2 green	Internal voltage out of range[2]
33	3 red, 3 green	Factory use
41	4 red, 1 green	Power supply overvoltage[2]
42	4 red, 2 green	Power supply undervoltage
43	4 red, 3 green	Flash memory backup error
51	5 red, 1 green	Over current / short circuit[2, 3]
61	6 red, 1 green	Open motor winding[2]
62	6 red, 2 green	Bad encoder signal (optional encoder only)[4]
71	7 red, 1 green	Serial communication error[5]
72	7 red, 2 green	Flash memory error

1 - Does not disable the motor.
The alarm will clear about 30 seconds after the fault is corrected.

2 - Disables the motor. Cannot be cleared until power is cycled.

3 - The over-current/short-circuit alarm typically indicates that an electrical fault exists somewhere in the system external to the drive. This alarm does not serve as motor overload protection.

4 - This alarm only occurs on STP-MTRD advanced integrated motor/drives

5 - This alarm does not occur on STP-DRV-6575 or standard integrated motor/drives

Alarm Code Definitions

Alarm Code	Error	Description	Corrective Action
SG	No alarm, motor disabled	No faults active, Circuit is closed between EN+ and EN-.	N/A

Alarm Code	Error	Description	Corrective Action
01	No alarm, motor enabled	No faults active, Circuit is open between EN+ and EN-.	N/A
10	Configuration or memory error	Memory error detected when trying to load config from flash on powerup.	Restart device. No fix if restart doesn't work.
11	Motor stall (optional encoder only)	Motor torque demand exceeded capability and the motor skipped steps. This is configured in SureMotion Pro.	Increase torque utilization if it's not already maxed out, otherwise decrease the torque demand by modifying the move profile, or put in a larger motor.
12	Move attempted while drive disabled	Drive is disabled and move attempted.	Reset alarm, enable motor, and move again.
21	CCW limit	CCW limit is reached. The digital input that has been assigned CCW limit has been activated.	Unblock the CCW sensor (open the circuit) or redifine the input with SureMotion Pro.
22	CW limit	CW limit is reached. The digital input that has been assigned CW limit has been activated.	Unblock the CCW sensor (open the circuit) or redefine the input with SureMotion Pro.
31	Drive overheating	The drive's internal temperature is too high.	If the drive is operating within its standard range (input voltage and output current are OK), more heat must be removed from the drive during operation. For Advanced drives (see "Mounting the Drive" on page 4-14), ensure the drive is mounted to a metal surface that can dissipate the drive's heat. For Integrated motor/drives, see "Mounting" on page 5-13. For both types of drives: If the mounting surface cannot pull enough heat away from the drive, forced airflow (from a fan) may be required to cool the drive.
32	Internal voltage out of range	Gate voltage, 5V rail, or 3V rail are out of spec.	Ensure adequate supply voltage (in very rare cases, low input voltages combined with fast accelerations can draw down the gate voltage) and try again. If persistant, RMA is required.

Alarm Code	Error	Description	Corrective Action
41	Power supply overvoltage	The DC voltage feeding the drive is above the allowable level.	Decrease the input voltage. Linear power supplies do not output a fixed voltage: the lighter the output current, the higher the output voltage will float. If a linear supply's voltage floats above the drive's max voltage, you can install a small power resistor across the linear power supply's output to provide some load that will help pull down the floating voltage. Consider using a switching power supply such as the Rhino PSB power supply series. Overvoltage can also be fed back into a system by regeneration (when an overhauling load pushes energy back into the motor). In an application with regen problems, install an STP-DRVA-RC-050 regen clamp to help dissipate the extra energy. (The regen clamp will not help with the floating linear power supply that floats too high, but it will help with excess voltage generated from an overhauling load.)
42	Power supply undervoltage	The DC voltage feeding the drive is below the allowable level.	Correct the power supply. If this error occurs during operation, the power supply is most likely undersized. A sudden high current demand can cause an undersized power supply to dip in output voltage.
43	Flash memory backup error	Memory error detected when trying to load config from flash on powerup.	Restart device. No fix if restart doesn't work.
51	Over current / short circuit	Motor leads shorted - only checked on powerup.	Check and fix motor wiring.
61	Open motor winding	Motor leads not connected - only checked on powerup.	Check and fix motor wiring.
62	Bad encoder signal (optional encoder only)	Noisy or otherwise incorrectly formatted encoder signal (lack of A or B, lack of differential signal).	Check encoder wiring, always use differential encoders (or use checkbox in SureMotion Pro to disable this error when using single ended).
71	Serial communication error	Catch-all error for something wrong with serial communications. See CE command in HCR for details.	If drive can communicate, CE can give a precise diagnosis. If not, refer to the Serial Communications part of the HCR for troubleshooting.

Alarm Code	Error	Description	Corrective Action
72	Flash memory error	Memory error detected when trying to load config from flash on powerup.	Restart device. No fix if restart doesn't work.

STP-MTRD Inputs and Outputs

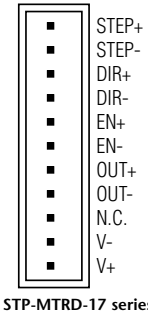
The standard drives (STP-MTRD-xxxx) have three inputs:

- STEP: a high speed digital input for step pulse commands, 5-24 volt logic
- DIR: a high speed digital input for the direction signal, 5-24 volt logic
- EN: a 5-24 volt input for commanding the removal of power from the motor

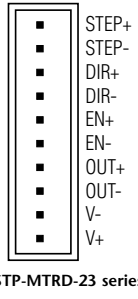
NOTE: STEP and DIR inputs can be converted to STEP CW and STEP CCW by moving switch #8 to the ON position.

The standard drives have a single digital output labeled OUT. This output closes to signal a fault condition. The output can be used to drive LEDs, relays, and the inputs of other electronic devices like PLCs. The "+" (collector) and "-" (emitter) terminals of the output are available at the connector - this allows you to configure the output for current sourcing or sinking. STP-MTRD-17038(E) includes a 12 inch control cable for accessing the terminals. STP-CBL-CAxx cable can be purchased separately if longer cable lengths are needed.

Connector Pin Diagrams

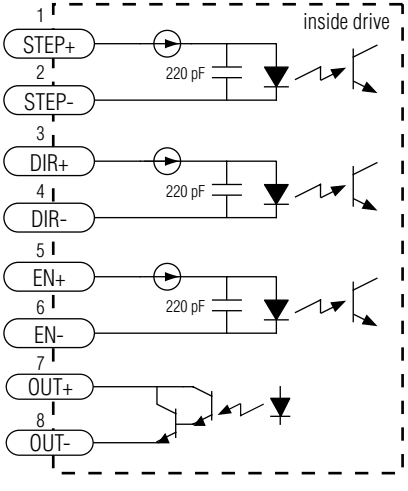


STP-MTRD-17 series

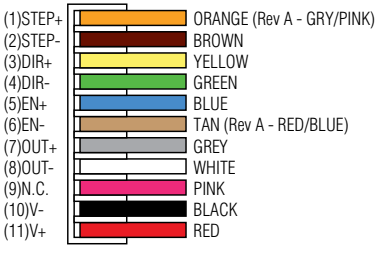


STP-MTRD-23 series

Internal Circuit Diagram



Control Cable STP-CBL-CAxx (for STP-MTRD-17038/17038E)



The advanced STP-MTRD-17xxxxxR and -23xxxxxR drives include 3 digital inputs and 1 analog input:

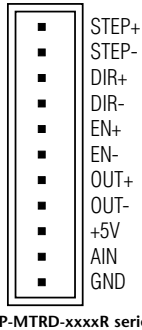
- Two high speed digital inputs, 5-24 volt logic, labeled STEP (or IN1) and DIR (or IN2), for commanding position. Pulse & direction, CW/CCW pulse, and A/B quadrature encoder signals can be used as position commands with these inputs. The STEP/IN1 and DIR/IN2 inputs can also be connected to sensors, switches and other devices for use with streaming SCL commands such as Wait Input (WI), Seek Home (SH), Feed to Sensor (FS), etc. When not being used for commanding position, these inputs can also be used for CW/CCW end-of-travel limits, CW/CCW jog inputs, or Run/stop & direction velocity-mode inputs.

NOTE: the available functionality of these inputs is determined by the STP-MTRD control option (R) as well as the motion control mode selected in SureMotion Pro.

- One digital input, 5-24 volt logic, labeled EN (or IN3), which can be used for motor enable/disable and/or alarm reset. It can also be connected to a sensor, switch or other device for use with streaming SCL commands such as Wait Input, Seek Home, Feed to Sensor, etc.
- One analog input, 0-5 volt logic, labeled AIN, which can be used as an analog velocity or position command. It can also be used with streaming SCL commands such as Wait Input, Seek Home, Feed to Sensor, etc.

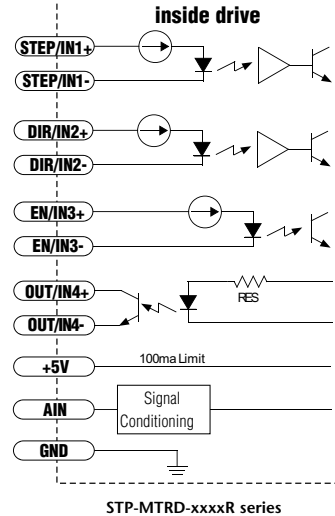
NOTE: On the advanced drives, the green 5 and 11 position spring clip terminal blocks do not accept ferrules, either use bare stranded copper or tinned leads.

Connector Pin Diagram



STP-MTRD-xxxxR series

I/O Connector

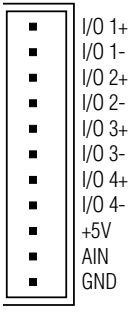


STP-MTRD-xxxxR series

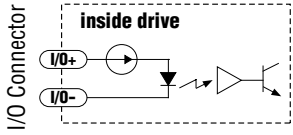
The STP-MTRD-24 models have four "Variable I/O" points. Each can be configured as a digital input or a digital output. In addition, pre-defined functions such as motor enable or fault output can be assigned, providing the flexibility to handle a diverse range of applications.

SureMotion Pro™ is used to set each Variable I/O point as an input or output. SureMotion Pro™ can also be used to assign functions to each I/O point, or functions can be assigned "on the fly" from SCL streaming commands.

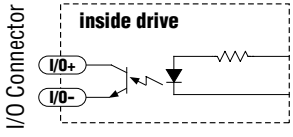
Connector Pin Diagram



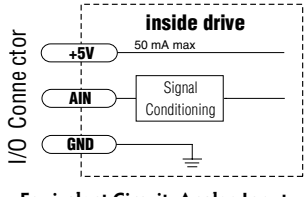
STP-MTRD-24xxR series



Equivalent Circuit: Variable I/O Point Set as Input



Equivalent Circuit: Variable I/O Point Set as Output



Equivalent Circuit: Analog Input

Input/Output Functions

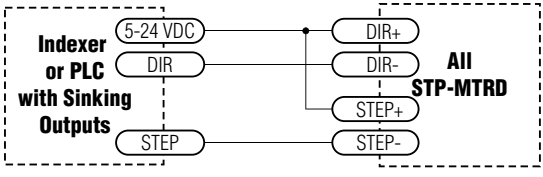
Basic STP-MTRD-x I/O Functions (configure with dip switches)				
Terminal	**STEP (5-24 Volts)**	**DIR (5-24 Volts)**	**EN (5-24 Volts)**	**OUT (30V, 80mA)**
Function	Step Input	Dir Input	Enable Input	Alarm Output
	Limit CW	Limit CCW	-	-
Advanced STP-MTRD-17xR (23xR) I/O Functions (configure in software)				
Terminal	**STEP (5-24 Volts)**	**DIR (5-24 Volts)**	**EN (5-24 Volts)**	**OUT (30V, 80mA)**
Function	Step Input	Dir Input	Enable Input	Brake Output
	Jog CW	Jog CCW	Reset Input	Alarm Output
	Limit CW	Limit CCW	Change Speed	Motion Output
	Start/Stop	General Purpose	General Purpose	Tach Output
	General Purpose	-	-	General Purpose
Advanced STP-MTRD-24xR I/O Functions (configure in software)				
Terminal	**I/O 1**	**I/O 2**	**I/O 3**	**I/O 4**
Input Function	Step/CW Pulse/AB Quad Input	DIR/CCW Pulse/AB Quad Input	Limit CW Input	Limit CCW Input
	Jog CW Input	Jog CCW Input	Enable Input	Alarm Reset Input
	Enable Input	Alarm Reset Input	Change Speed Input	General Purpose Input
	Start/Stop Input	General Purpose Input	General Purpose Input	-
	General Purpose Input	-	-	-
Output Function	Brake Output	Brake Output	Brake Output	Brake Output
	Fault Output	Fault Output	Fault Output	Fault Output
	Motion Output	Motion Output	Motion Output	Motion Output
	Tach Output	Tach Output	Tach Output	Tach Output
	General Purpose Output	-	General Purpose Output	General Purpose Output

The Step (STEP) and Direction (DIR) Inputs

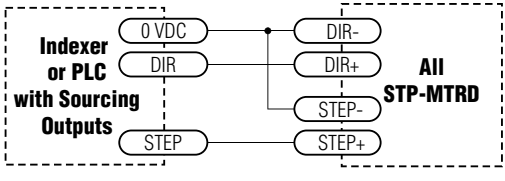
The STP-MTRD motor/drives include two high-speed inputs called STEP (or IN1) and DIR (or IN2). They accept 5 to 24 volt single-ended or differential signals, up to 2 MHz. Typically these inputs connect to an external controller that provides step and direction command signals. With the Advanced models you can also connect a master encoder to the high-speed inputs for "encoder following" applications. Or you can use these inputs with Wait Input, If Input, Feed to Sensor, Seek Home, and other SCL commands.

If the current is flowing into or out of an input, the logic state of that input is low or closed. If no current is flowing, or the input is not connected, the logic state is high or open.

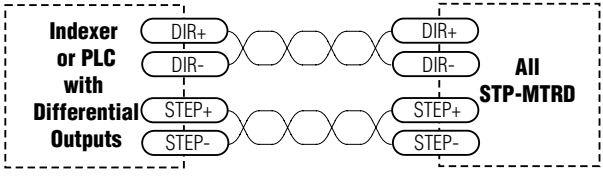
Example connection diagrams:



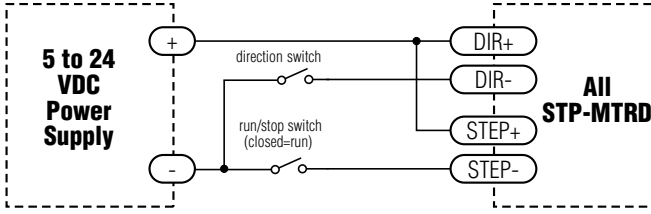
Connecting to indexer with Sinking Outputs



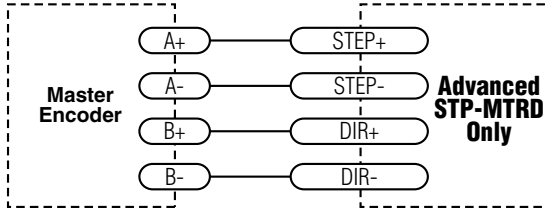
Connecting to indexer with Sourcing Outputs



Connecting to indexer with Differential Outputs



Using Mechanical Switches
(The switches can also be placed on the + line)



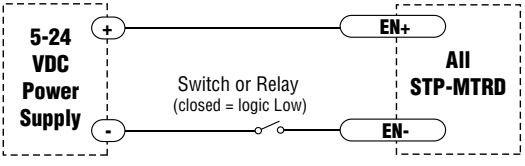
Wiring for Encoder Following

The Enable (EN/IN3) Digital Input

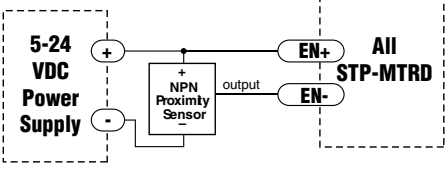
As mentioned in the previous section, the high-speed STEP and DIR inputs are designed for high speed operation. The Enable digital input is designed for low speed digital input operation between 5 and 24 volts DC.

If the current is flowing into or out of an input, the logic state of that input is low or closed (active). If no current is flowing, or the input is not connected, the logic state is high or open. Using a switch (see the first image below) to activate the "Enable" circuit will actually disable the drive. The switch in the image below could be considered a "Disable" switch.

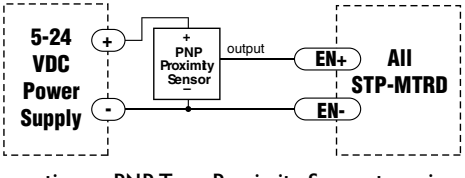
Example connection diagrams:



Connecting the Input to a Switch or Relay



Connecting an NPN Type Proximity Sensor to an input
(When proximity sensor activates, input goes low).

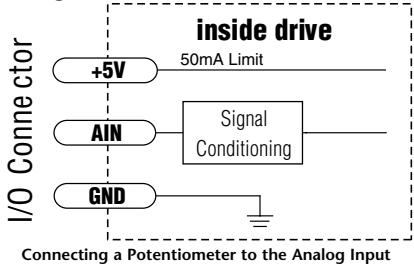


Connecting an PNP Type Proximity Sensor to an input
(When prox sensor activates, input goes low).

The Analog (AIN) Input

The Advanced STP-MTRD drives feature an analog input. The input can accept a signal range of 0 to 5 VDC. The drive can be configured to operate at a speed or position that is proportional to the analog signal. Use the SureMotion Pro software to set the signal range, offset, dead-band and filter frequency. For some SCL commands the analog input can be used as an emulated digital input by just using the full analog scale as the on/off condition. The Advanced STP-MTRD also provides a +5VDC 50mA output that can be used to power external devices such as potentiometers. It is not the most accurate supply for reference; for more precise readings use an external supply that can provide the desired accuracy.

Example connection diagram:



Connecting a Potentiometer to the Analog Input

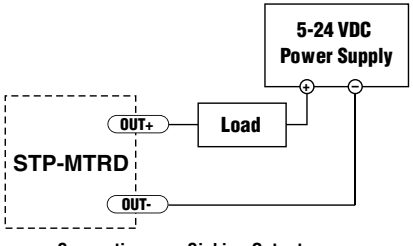
The Digital Output

The STP-MTRD drives feature one configurable optically isolated digital output. In the units with RS-485 communication this output can be set to automatically control a motor brake, to signal a fault condition, to indicate when the motor is moving, or to provide an output frequency proportional to motor speed (tach signal). The output can also be turned on and off by program instructions like Set Output. The output can be used to drive LEDs, relays, and the inputs of other electronic devices like PLCs and counters. The "OUT+" (collector) and "OUT-" (emitter) terminals of the transistor are available at the connector. This allows you to configure the output for current sourcing or sinking. The STP-MTRD-24 has four variable I/O points. Each one can be either an output or an input.

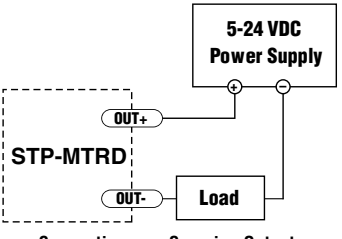
If current is flowing into or out of an output, the logic state of that output is low or closed (active). If no current is flowing, or the output is not connected, the logic state is high or open.

Do not connect the output to more than 30VDC.
The current through the output terminal must not exceed 40mA.

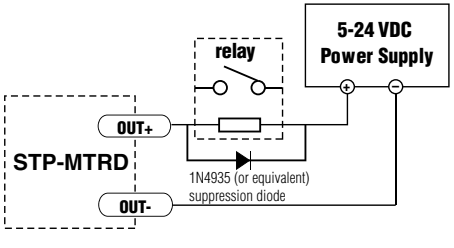
Example connection diagrams:



Connecting as a Sinking Output



Connecting as a Sourcing Output



Driving a Relay

Using the Optional Encoder

(STP-MTRD-17038E, 23042E, 23065E)

The optional encoder that is included with the standard E models is a differential line driver 1000 ppr incremental encoder assembled to the rear shaft of the unit. This is replacement part number STP-MTRA-ENC1. The A, B, and Index (Z) channel signals of this encoder can be connected back to the external controller for position verification and enhanced performance, depending on the features of the controller. To facilitate connecting the encoder signals to your external controller you should purchase cable part number STP-CBL-EAx.

For more information on the encoder, please see the Accessories appendix. Replacement encoder part number is STP-MTRA-ENC1.

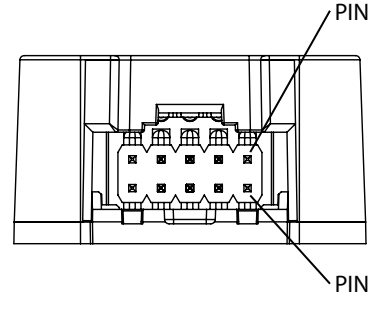
Incremental encoder specifications:

- 10-pin connector provides the following signals (pin assignments): Ground (1,2), Index- (3), Index+ (4), A- (5), A+ (6), +5VDC power (7,8), B- (9) and B+ (10).
- Power supply requirements: 5 VDC at 56mA typical, 59 mA max.
- The encoder's internal differential line driver can source and sink 20mA at TTL levels.
- Maximum noise immunity is achieved when the differential receiver is terminated with a 110-ohm resistor in series with a .0047 microfarad capacitor placed across each differential pair. The capacitor simply conserves power; otherwise power consumption would increase by approximately 20mA per pair, or 60mA for three pairs.
- If making your own cable to connect the encoder signals to your controller, we recommend using a shielded cable with four or five twisted pairs for improved noise immunity.
- Max encoder frequency is 100,000 pulses per second.

Other encoder configurations are available. Please see Appendix A for the full line of encoders compatible with the standard E series STP-MTRD integrated motor/drives.

Connection Table for STP-EA-EAx

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	GROUND
8	N/C	POWER+



Note: Pin 1 and Pin 2 are internally connected. Pin 7 and Pin 8 are internally connected inside the encoder.

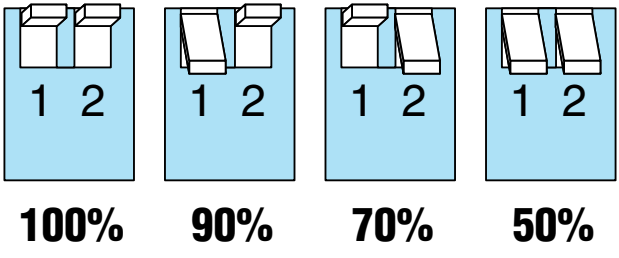
Configuring the Standard STP-MTRD

Step 1: Setting the Current

To achieve maximum torque, you should set the current to 100%. But under some conditions you may want to reduce the current to save power or lower motor temperature. This is important if the motor is not mounted to a surface that will help it dissipate heat or if the ambient temperature is expected to be high.

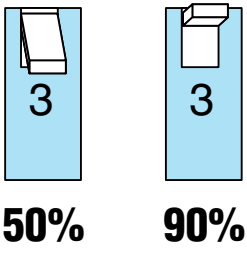
Step motors produce torque in direct proportion to current, but the amount of heat generated is roughly proportional to the square of the current. If you operate the motor at 90% of rated current, you'll get 90% of the rated torque. But the motor will produce approximately 81% as much heat. At 70% current, the torque is reduced to 70% and the heating to about 50%.

Two of the small switches on the front of the STP-MTRD are used to set the percent of rated current that will be applied to the motor: SW1 and SW2. Please set them according to the illustration below.



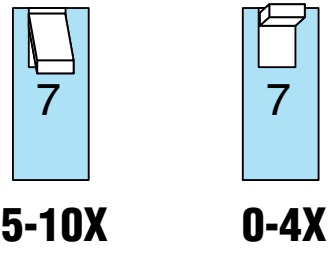
Step 2: Setting Idle Current

Motor heating and power consumption can also be reduced by lowering the motor current when it is not moving. The STP-MTRD will automatically lower the motor current when it is idle to either 50% or 90% of the running current. The 50% idle current setting will lower the holding torque to 50%, which is enough to prevent the load from moving in most applications. This reduces motor heating by 75%. In some applications, such as those supporting a vertical load, it is necessary to provide a high holding torque. In such cases, the idle current can be set to 90% as shown.



Step 3: Load Inertia

The Standard STP-MTRD includes anti-resonance and electronic damping features which greatly improve motor performance. To perform optimally, the drive must understand the electromechanical characteristics of the motor and load. Most of this is done automatically when the motor and drive are assembled at the factory. To further enhance performance, you must set a switch to indicate the approximate inertia ratio of the load and motor. The ranges are 0 to 4X and 5 to 10X. Please divide your load inertia by the STP-MTRD rotor inertia (82 g-cm2) to determine the ratio, then set switch 7 accordingly, as shown.

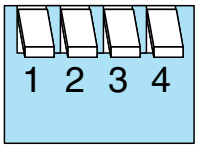


Step 4: Step Size

The Standard STP-MTRD requires a source of step pulses to command motion. This may be a PLC, an indexer, a motion controller or another type of device. The only requirement is that the device be able to produce step pulses whose frequency is in proportion to the desired motor speed, and be able to smoothly ramp the step speed up and down to produce smooth motor acceleration and deceleration.

Smaller step sizes result in smoother motion and more precise speed, but also require a higher step pulse frequency to achieve maximum speed. The smallest step size is 1/25,600th of a motor turn. To command a motor speed of 50 revolutions per second (3000 rpm) the step pulses frequency must be 50 x 25,600 = 1.28 MHz. Many motion devices, especially PLCs cannot provide step pulses at such a high speed. If so, the drive must be set for a lower number of steps per revolution. Sixteen different settings are provided, as shown in the diagrams on the next page.

Please choose the one that best matches the capability of your system.



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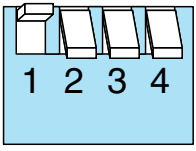

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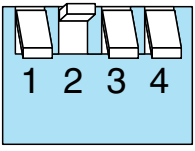

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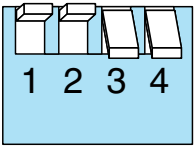

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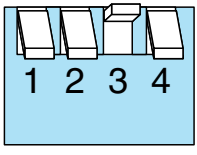

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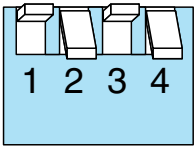

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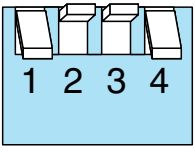

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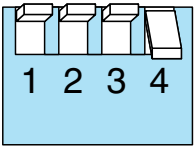

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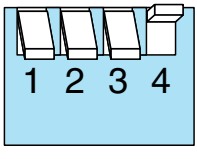

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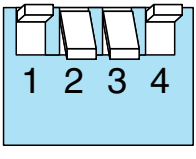

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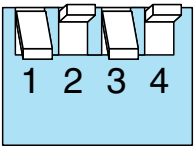

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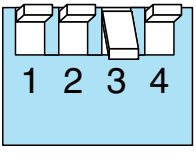

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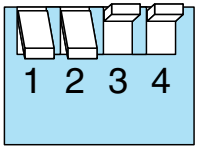

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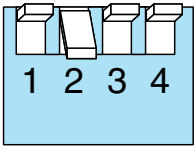

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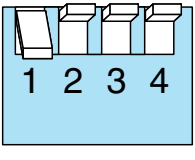
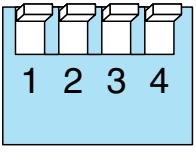
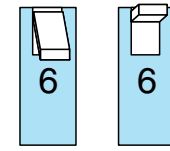


20000

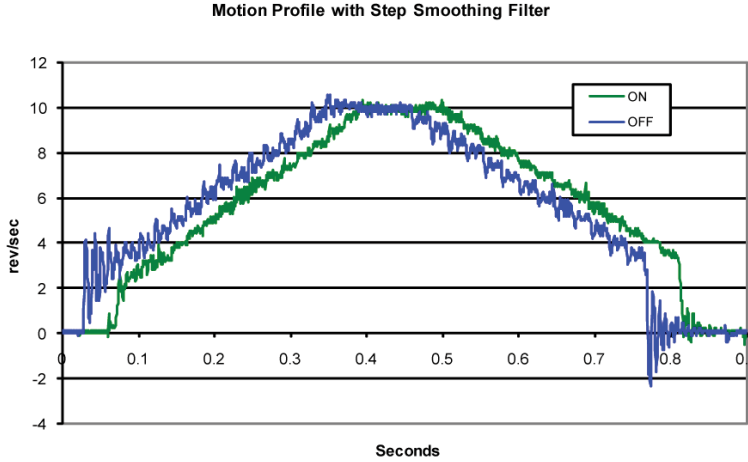


25000

At lower step resolutions such as 200 steps/rev (full step) and 400 steps/rev (half step), motors run a little rough and produce more audible noise than when they are microstepped. The STP-MTRD includes a feature called "microstep emulation", also called "step smoothing", that can provide smooth motion from coarse command signals. If you set switch 6 to the ON position, this feature is automatically employed to provide the smoothest possible motion from a less than ideal signal source.



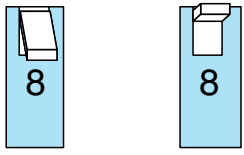
Because a command filter is used as part of the step smoothing process, there will be a slight delay, or "lag", in the motion. The graph below shows an example of the delay that can occur from using the step smoothing filter.



Step 5: Step Pulse Type

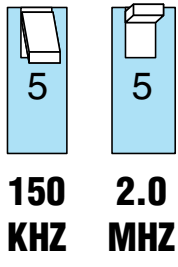
Most indexers and motion controllers provide motion commands in the "Step and Direction" format. The step signal pulses once for each motor step and the direction signal commands direction. However, a few PLCs use a different type of command signal: one signal pulses once for each desired step in the clockwise direction (called STEP CW), while a second signal pulses for counterclockwise motion (STEP CCW). The Standard STP-MTRD can accept this type of signal if you adjust switch 8 as shown in the diagram on the next page.

In STEP CW/STEP CCW mode, the CW signal should be connected to the STEP input and the CCW signal to the DIR input.



Step 6: Step Pulse Noise Filter

Electrical noise can affect the STEP signal in a negative way, causing the drive to think that one step pulse is two or more pulses. This results in extra motion and inaccurate motor and load positioning. To combat this problem, the Standard STP-MTRD includes a digital noise filter on the STEP and DIR inputs. The default factory setting of this filter is 150 kHz, which works well for most applications. This is set by moving switch 5 to the ON position.

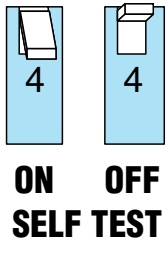


However, as discussed in Step 4, if you are operating the STP-MTRD at a high number of steps/rev and at high motor speeds, you will be commanding the drive at step rates above 150 kHz. In such cases, you should set switch 5 to the OFF position as shown.

Your maximum pulse rate will be the highest motor speed times the steps/rev. For example, 40 revs/second at 20,000 steps/rev is 40 x 20,000 = 800 kHz. Please consider this when deciding if you must increase the filter frequency.

Self Test

If you are having trouble getting your motor to turn, you may want to try the built-in self-test. Any time switch 4 is moved to the ON position, the drive will automatically rotate the motor back and forth, two and a half turns each direction. This feature can be used to confirm that the motor is correctly wired and otherwise operational.



Drive/Motor Heating

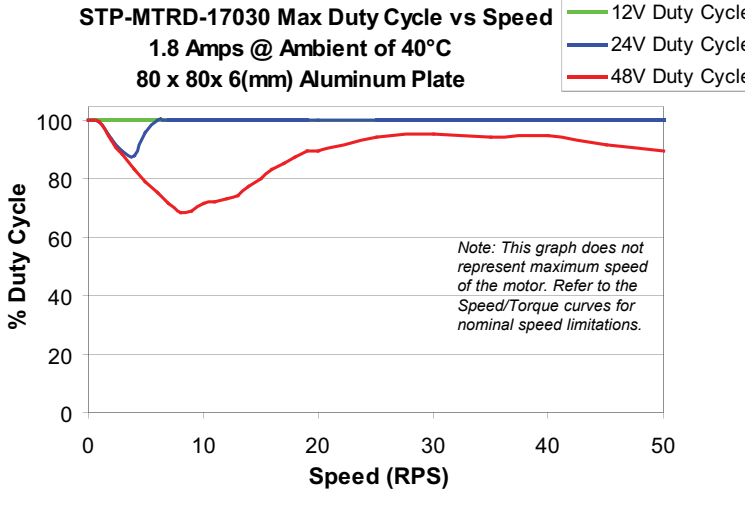
Step motors convert electrical power from the driver into mechanical power to move a load. Because step motors are not perfectly efficient, some of the electrical power turns into heat on its way through the motor. This heating is not dependent on the load being driven but rather the motor speed and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

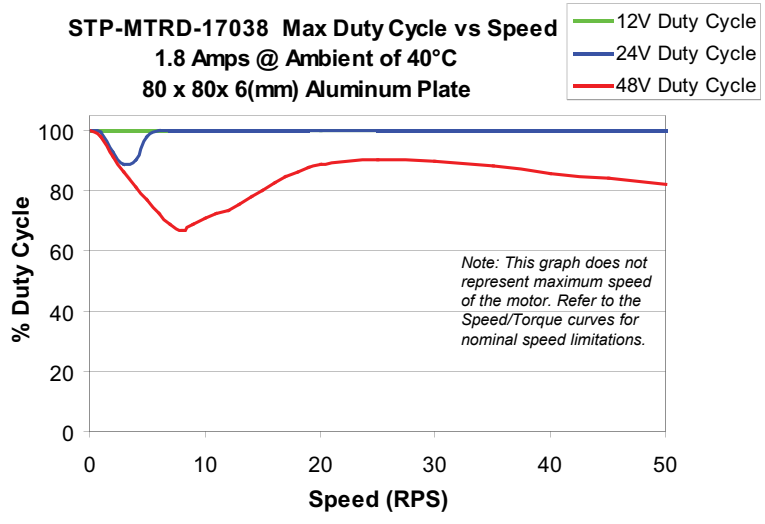
Provided below are curves showing the maximum duty cycle versus speed for each size at commonly used power supply voltages. Please refer to these curves when planning your application.

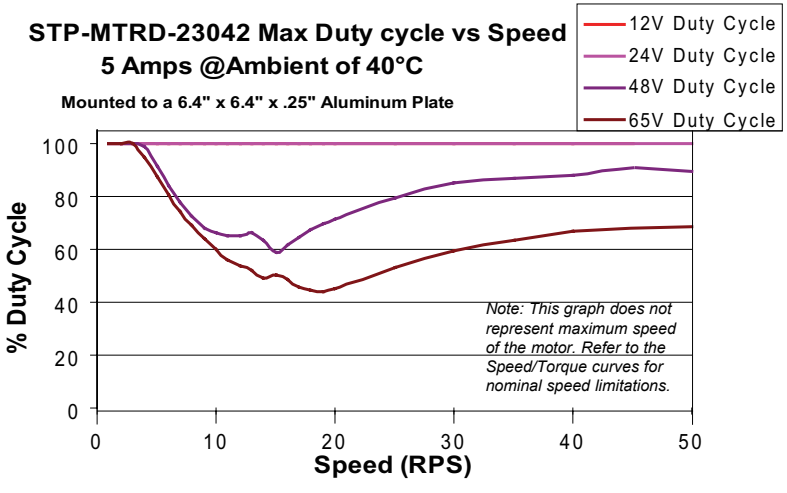
Also keep in mind that a step motor typically reaches maximum temperature after 30 to 45 minutes of operation. If you run the motor for one minute then let it sit idle for one minute, that is a 50% duty cycle. Five minutes on and five minutes off is also a 50% duty. However, one hour on and one hour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

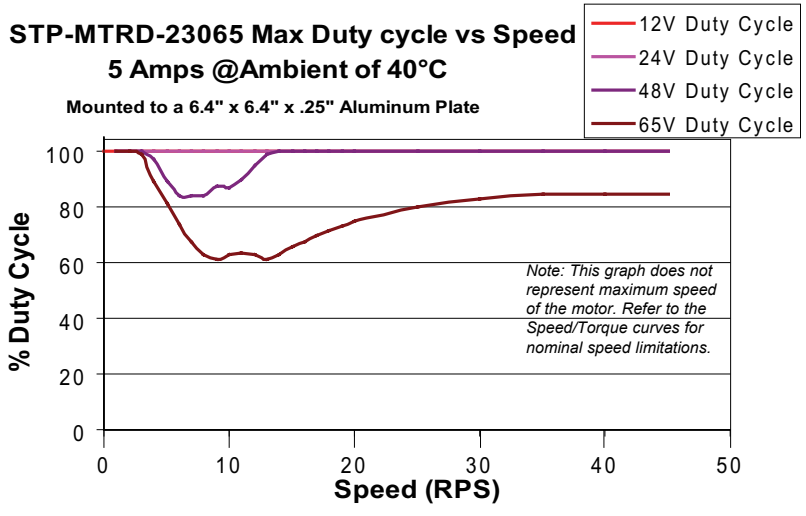
The actual temperature of the motor depends on how much heat is conducted, convected, or radiated out of it. The measurements below were made in a 40°C (104°F) environment with the motor mounted to an aluminum plate sized to provide a surface area consistent with the motor power dissipation. Your results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

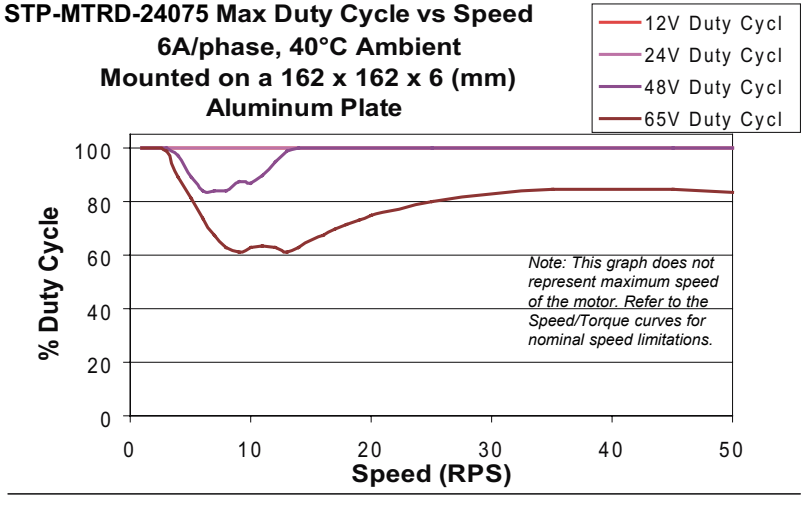
Please use the motor body temperature curves below to determine the maximum duty cycle of the drive/motor under various conditions.




STP-MTRD-17038 Max Duty Cycle vs Speed
1.8 Amps @ Ambient of 40°C
80 x 80x 6(mm) Aluminum Plate
12V Duty Cycle
24V Duty Cycle
48V Duty Cycle
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)
Note: This graph does not represent maximum speed of the motor. Refer to the Speed/Torque curves for nominal speed limitations.

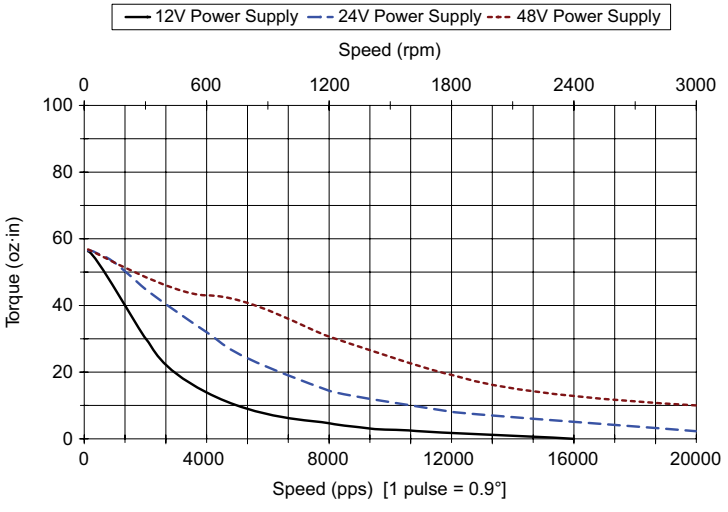

STP-MTRD-23042 Max Duty cycle vs Speed
5 Amps @Ambient of 40°C
Mounted to a 6.4" x 6.4" x .25" Aluminum Plate
12V Duty Cycle
24V Duty Cycle
48V Duty Cycle
65V Duty Cycle
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)
Note: This graph does not represent maximum speed of the motor. Refer to the Speed/Torque curves for nominal speed limitations.


STP-MTRD-23065 Max Duty cycle vs Speed
5 Amps @Ambient of 40°C
Mounted to a 6.4" x 6.4" x .25" Aluminum Plate
12V Duty Cycle
24V Duty Cycle
48V Duty Cycle
65V Duty Cycle
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)
Note: This graph does not represent maximum speed of the motor. Refer to the Speed/Torque curves for nominal speed limitations.

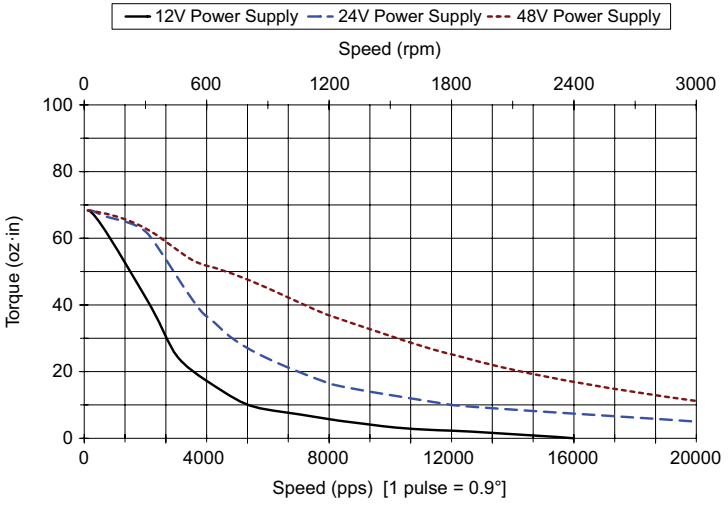

STP-MTRD-24075 Max Duty Cycle vs Speed
6A/phase, 40°C Ambient
Mounted on a 162 x 162 x 6 (mm)
Aluminum Plate
12V Duty Cycl
24V Duty Cycl
48V Duty Cycl
65V Duty Cycl
% Duty Cycle
100
80
60
40
20
0
0
10
20
30
40
50
Speed (RPS)
Note: This graph does not represent maximum speed of the motor. Refer to the Speed/Torque curves for nominal speed limitations.

Torque Speed Graphs

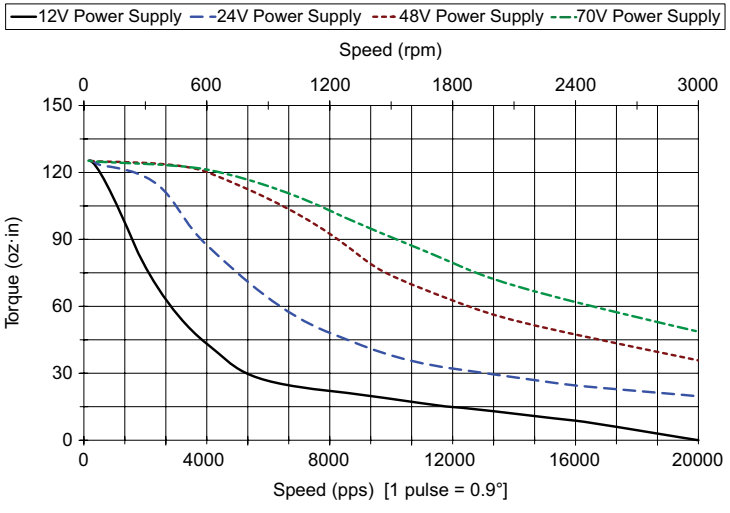
STP-MTRD-17030 Torque vs Speed (1.8° step motor; 1/2 stepping)



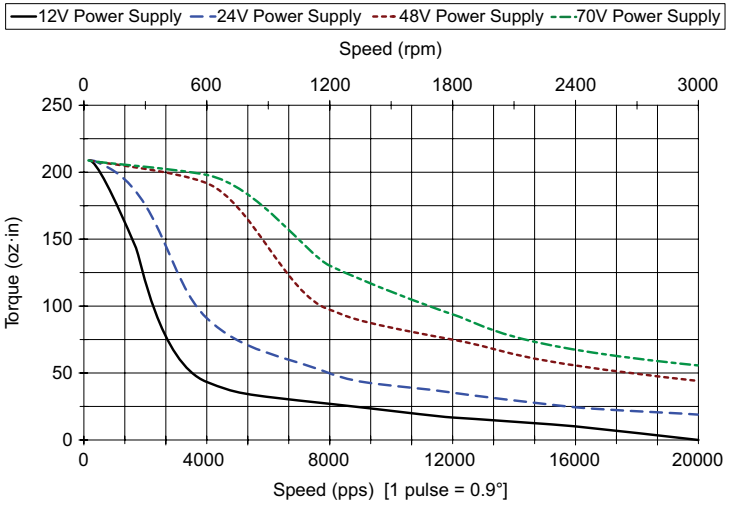
STP-MTRD-17038 Torque vs Speed (1.8° step motor; 1/2 stepping)



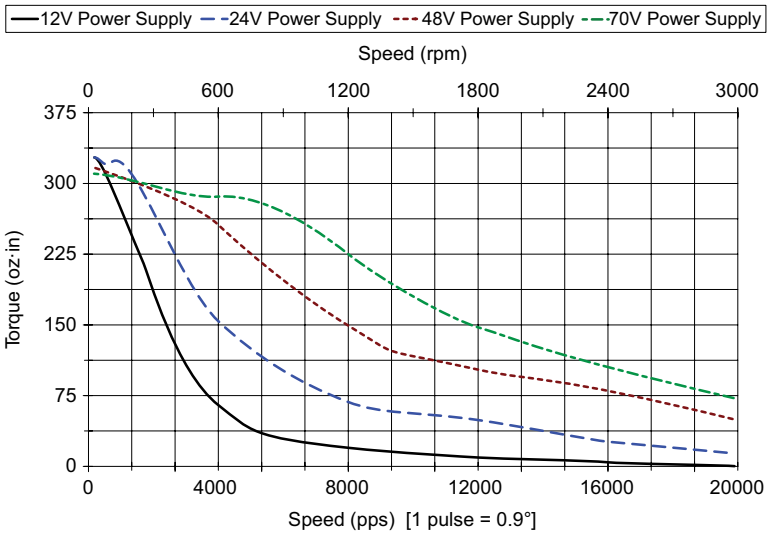
STP-MTRD-23042 Torque vs Speed (1.8° step motor; 1/2 stepping)



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



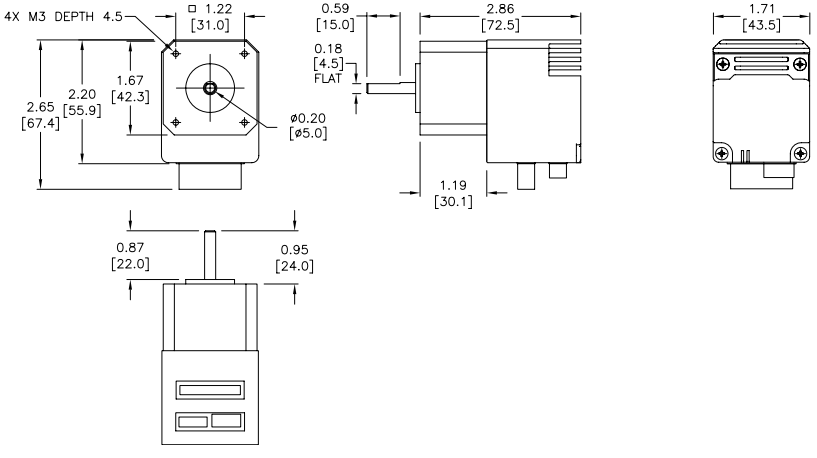
STP-MTRD-24075 Torque vs Speed (1.8° step motor; 1/2 stepping)



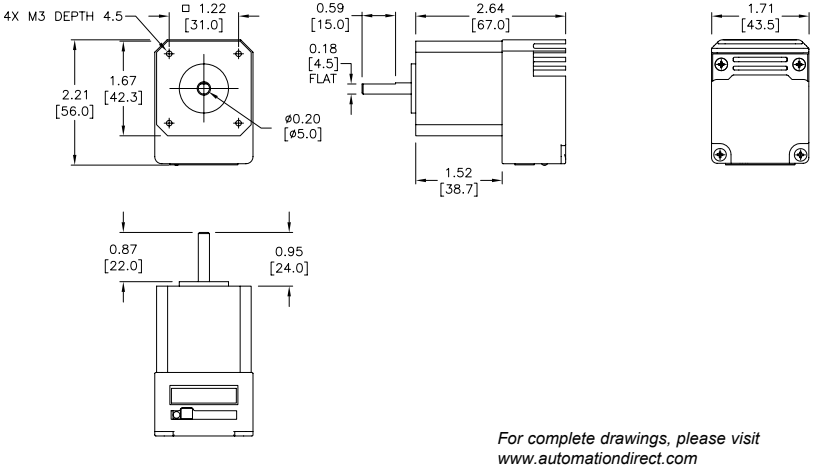
Dimensions and Mounting Slot Locations

Dimensions = inches [mm]

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

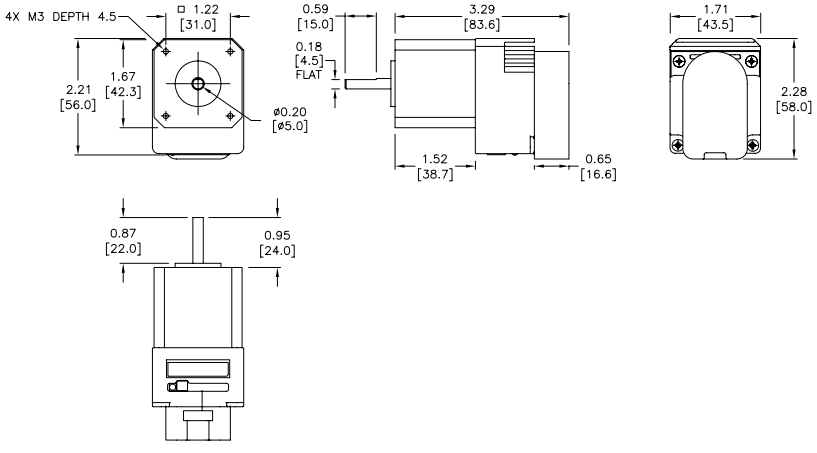


STP-MTRD-17038

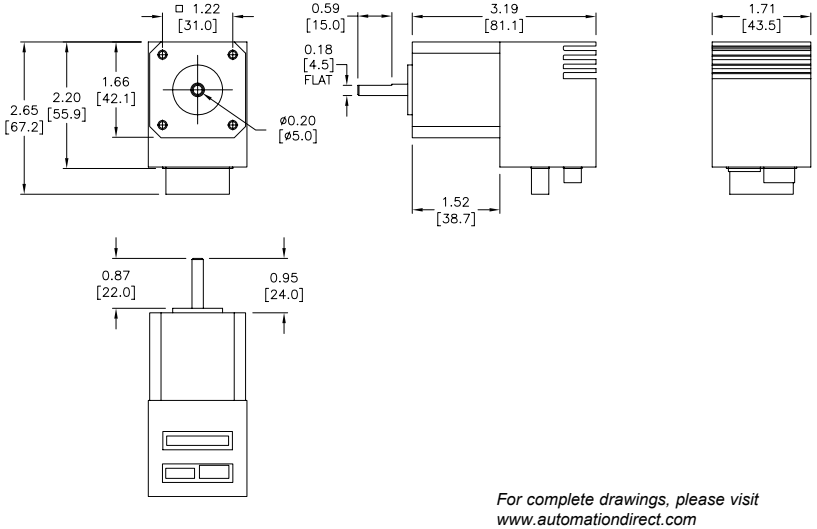


For complete drawings, please visit www.automationdirect.com

STP-MTRD-17038E

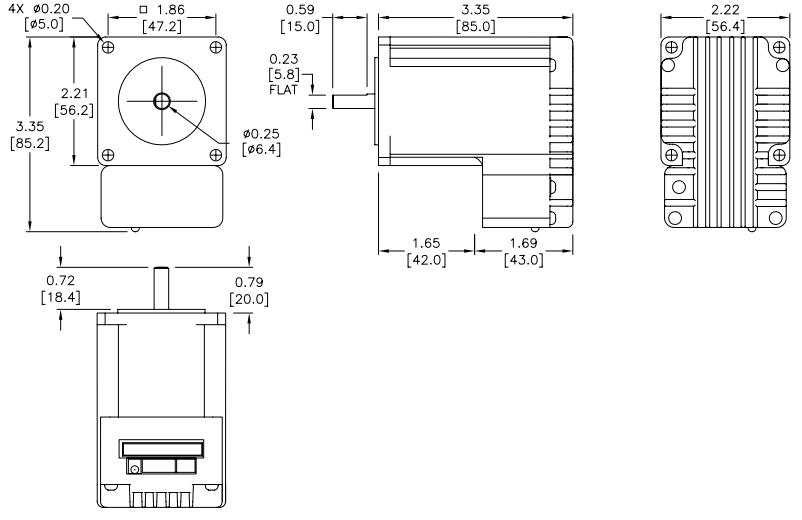


STP-MTRD-17038R / STP-MTRD-17038RE

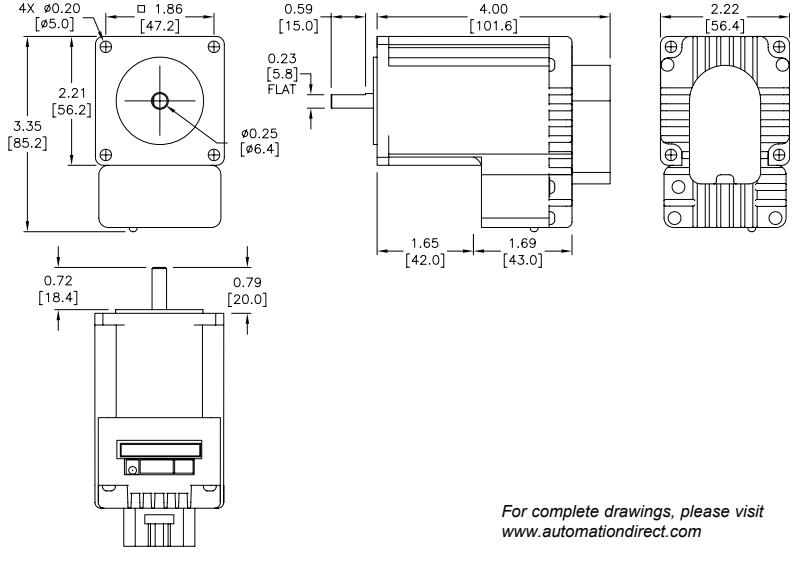


For complete drawings, please visit www.automationdirect.com

STP-MTRD-23042

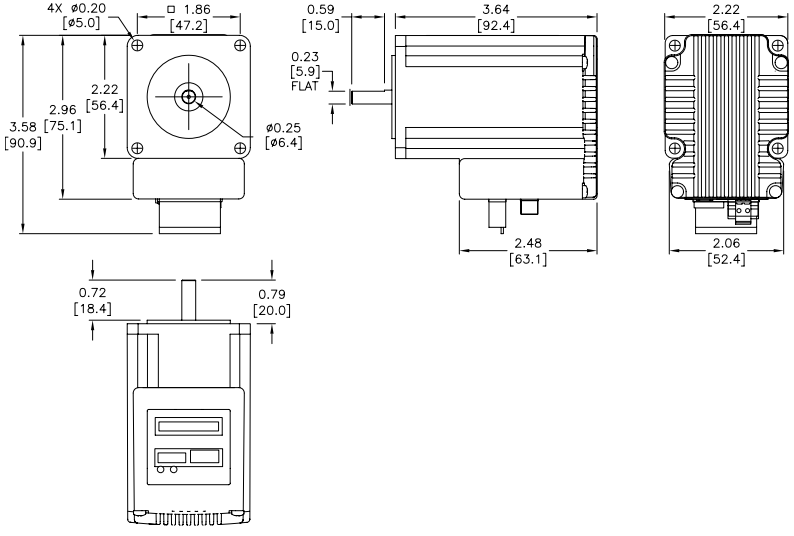


STP-MTRD-23042E

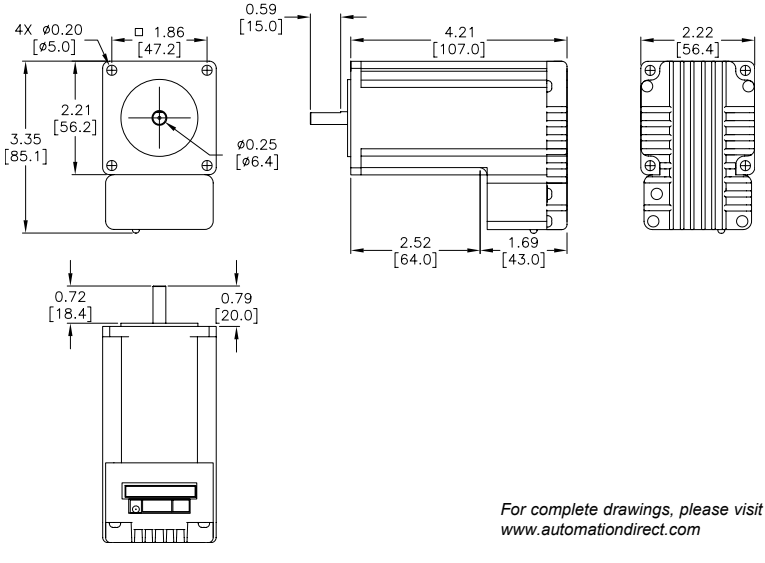


For complete drawings, please visit www.automationdirect.com

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

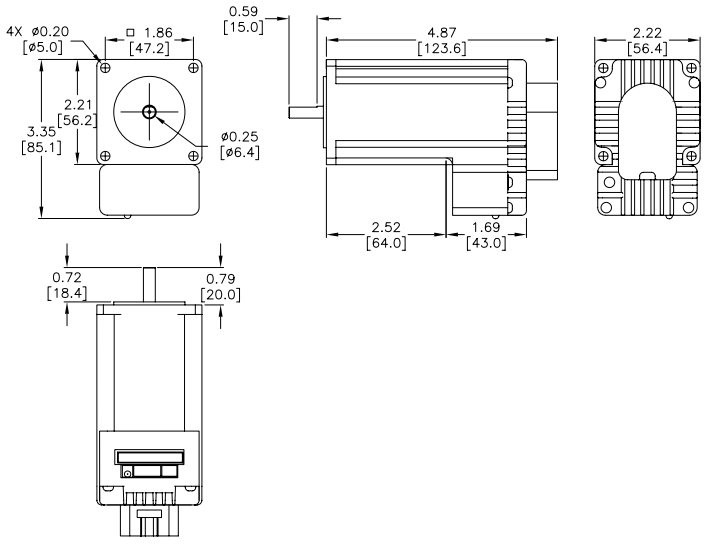


STP-MTRD-23065

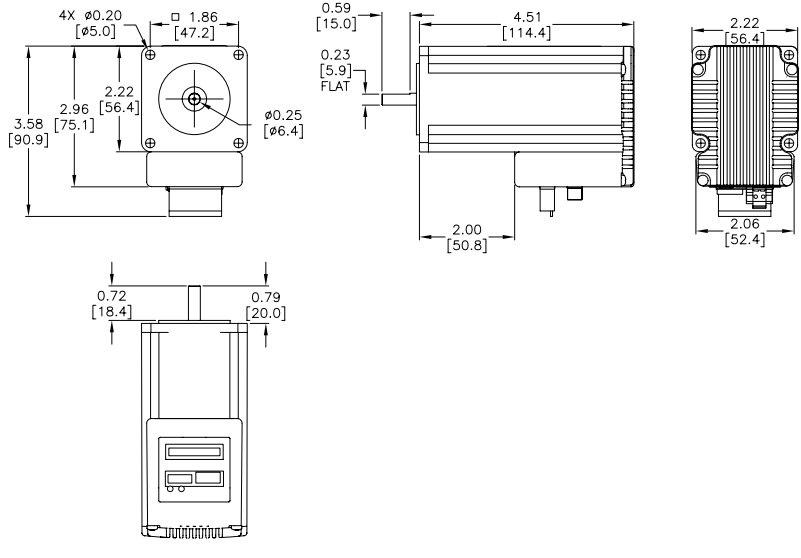


For complete drawings, please visit www.automationdirect.com

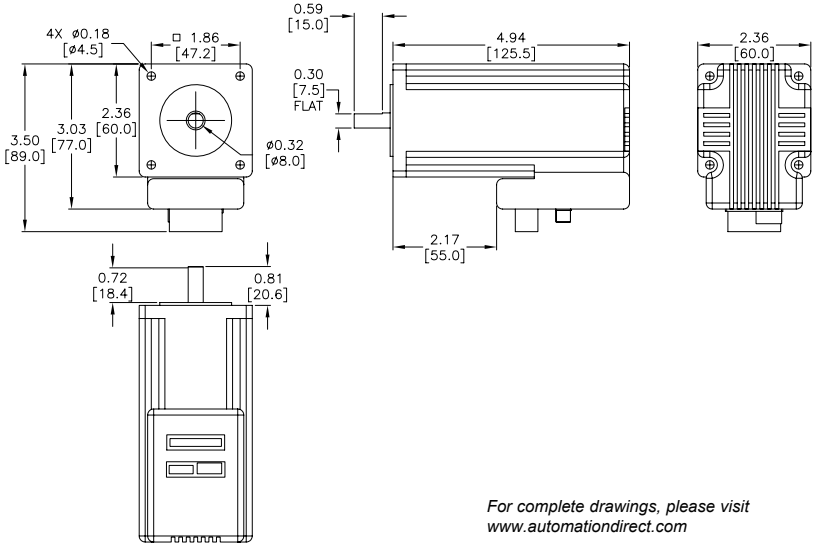
STP-MTRD-23065E



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



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



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